Project PLaY: Physical Literacy in the early Years

Examining the Effects and Relative Enjoyment of Structured and Play-based Fundamental Movement Skill Interventions in Preschool Children

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Abstract

Yearly reports emphasize low physical activity (PA) rates in preschool children and fundamental movement skill (FMS) development has been deemed an effective way to increase PA. While previous research suggests play alone is unable to improve FMS, methodological shortcomings led to the question of whether "free-play" groups were incorporating sufficient movement into their play to improve FMS. This study examined the effectiveness of an 8-week structured play-based intervention, a structured skill-based instructive technique and a free-play control of equal duration on FMS development in preschool aged children. Both interventions showed statistically significant improvements in FMS ability while no improvements were found in the free-play control group. The structured play approach was easier to implement, adapted well to altering participant numbers, and required less personnel to complete. These findings highlight the use of structured play programs as a beneficial and manageable approach to movement development in preschool children.

List of Abbreviations Used

AHKC	Active Healthy Kids Canada
ANOVA	Analysis of Variance
BMI	Body Mass Index
CAPL	Canadian Assessment of Physical Literacy
CHMS	Canadian Health Measures Survey
CS4L	Canadian Sport for Life
CSEP	Canadian Society for Exercise Physiology
FMS	Fundamental Movement Skills
GMQ	Gross Motor Quotient
HALO	Healthy Active Living and Obesity Research Group
HRM	Halifax Regional Municipality
IPLA	International Physical Literacy Association
LM	Locomotor
LTAD	Long-term Athlete Development
MABC	Movement Assessment Battery for Children
MVPA	Moderate-to-vigorous Physical Activity
NGOs	Non-government Organizations
OC	Object Control
PA	Physical Activity
PHE	Physical Health and Education
PI	Primary Investigator
PL	Physical Literacy
RA	Research Assistant
SKIP	Successful Kinaesthetic Instruction for Preschoolers
TGMD	Test of Gross Motor Development
TGMD-2	Test of Gross Motor Development 2nd Edition

Chapter 1 Introduction

1.1 Physical Activity in Canada

Physical inactivity is a growing concern for the health of the Canadian population. Despite increasing evidence demonstrating the association between healthy active lifestyles and benefits ranging from disease prevention to improved mental health, today's lifestyles are largely sedentary (Janssen & LeBlanc, 2010). Between 2007 and 2009, Statistics Canada completed the first Canadian Health Measures Survey (CHMS), which to date, is the most comprehensive assessment on the health of the Canadian population (Tremblay, 2012). The national analysis, currently accumulating its fourth cycle of surveys (Health Canada, 2015), collects data from both physical measurements and personalized questionnaires. The study covers various aspects of health and well-being, including sedentary behaviours and physical activity (PA) participation (Tremblay, 2012). While physical inactivity is a major concern for the population as a whole, higher PA rates in children and adolescents have been found to correlate with greater adult PA rates (Telama et al., 2005), underscoring the importance of investigating barriers to PA participation, and identifying successful PA interventions at a young age. The following section will focus on the barriers to PA and the effects of physical inactivity in children.

The CHMS was the first Canadian study to objectively measure PA through the use of accelerometers (Colley et al., 2011). Previously, population levels of PA had been based on self-reported data, which suggested that the bulk of Canadians were attaining seemingly adequate PA levels (Gilmour, 2007). With the use of more precise measurement tools such as accelerometers, however, results demonstrated the opposite: less than 10% of Canadian children and youth (aged 6-19) accumulate the recommended

60 minutes of moderate-to-vigorous physical activity (MVPA) per day for health benefits. Strikingly, this national study found that only 4% of girls were receiving the recommended 60 minutes of daily MVPA, and the boys were not fairing much better, with only 9% meeting recommended guidelines. On top of poor PA participation rates, children were sedentary an average of 8.6 hours per day, encompassing the bulk (62%) of their waking hours. These results provided some of the first objective data that have highlighted the low levels of PA participation by the vast majority of Canadian children (Colley et al., 2011).

1.2 Improvements through Awareness Campaigns

In response to the CHMS and the increased awareness of physical inactivity in Canadian children, several national initiatives have been launched (Tremblay, 2012). For example, ParticipACTION is a Canada-wide organization aiming to encourage PA participation and healthy living choices through mass media campaigns. The ultimate goal is to raise awareness on the increasing number of sedentary children and youth in our society (Tremblay & Craig, 2009).

Acknowledging that parental influence and involvement plays an important role in childhood health behaviours (Tremblay & Craig, 2009; Tremblay, 2012), ParticipACTION purposefully targets parents and caregivers by informing them of both the immediate and life-long risks associated with physical inactivity. While there remains room for substantial improvement, a survey of 1500 Canadian parents found that nearly 60% of those surveyed were able to recall specific messages related to the campaign. These results showed that the program has been successful at raising

awareness on the matter, however, the corresponding impact on levels of PA remains to be explored (Craig, Bauman, Gauvin, Robertson, & Murumets, 2009).

Another major national health initiative, also targeting parental involvement, is the Active Healthy Kids Canada (AHKC) report card[1]. This initiative provides evidence-based assessments of the overall PA-related health of children (aged 3-11) and youth (aged 12-17) in Canada. AHKC aims to increase awareness on the health of Canadian children through extensive media attention related to the publication of their yearly report. The report card provides clear "grades", highlighting the areas that are inadequate and suggests recommendations for improvement. The AHKC report card serves as a call for action, clearly displaying what areas are in need of attention and improvement, with the intention of allocating partial responsibility to the public (Tremblay, 2012). On top of observing the population's PA participation, the AHKC report card assesses the quality of school, community and home environments for facilitating PA, and gauges the effects of strategies for PA promotion. The 2014 report card marked the 10th anniversary of this PA advocacy tool, and although higher scores were received for implemented strategies and investments, particularly through Non-Government Organizations (NGOs), PA indicators including overall PA level, sport participation, and active transportation were extremely low. In particular, overall PA levels received a D-, indicating that only approximately 20% of Canadian children and youth were engaging in sufficient PA. Sedentary time received an F, meaning less than 20% of Canadian children and youth were adhering to the recommended daily allowances (see CSEP, 2012 for detailed sedentary behaviour guidelines). This is the 6th consecutive year that Canadian children

[1] This has recently been renamed the ParticipACTION Report Card on Physical Activity for Children and Youth.

failed in the sedentary time category. Furthermore, these values are based solely off reported screen time, comprising only a part of overall sedentary behaviours. If a more comprehensive assessment were in place, sedentary time would likely be much higher. This report further highlights that despite positive improvements in infrastructure and PA-promoting programs, children are failing to increase their activity levels (Gray et al., 2014). In the fall of 2014, AHKC joined forces with ParticipACTION, a long-time partner of the AHKC report card and renamed the yearly report the ParticipACTION Report Card on Physical Activity for Children and Youth. While all of the previous health indicators were still included, the new report added an assessment of Physical Literacy (PL) and reported the percent of children who meet the expected levels of PL achievement for their age range (ParticipACTION, 2015). In the most recent report, no improvements were noted in either overall PA participation (still scoring a D-) or sedentary behaviours, which remains with a score of F. That being said, the report stated that 70% of younger children (aged 3 to 4) are meeting the recommended 180 minutes of daily PA at any intensity while only 9% of children and youth aged 5-17 are attaining the 60 minutes of daily MVPA (ParticipACTION, 2016). Findings within the younger population are higher than other reported values documented previously (Pate et al., 2004; Williams et al., 2008; Goldfield et al., 2012) however the lack of specificity for intensity of PA in this case may have been related to these increased PA levels. For the newly-added PL assessments the most recent report has found that only 44% of children aged 8-12 are attaining an adequate level of PL, earning this category a grade of D+ (ParticipACTION, 2016).

While raising awareness through mass media campaigns is a good start to confronting the physical inactivity epidemic, it is undetermined whether these methods are truly able to provoke a sufficient and sustainable behavioural adaptation to support positive improvements in PA participation (Craig et al., 2009). It seems that a more direct, hands on approach to implementing behavioural changes is warranted leading us to the growing awareness of the concept of PL.

1.3 Physical Literacy

The concept of PL stems from philosophical views of the importance of assisting our bodies to encounter environments and experiences to our fullest potential. Although used loosely in the field of physical education for a number of years, Margaret Whitehead (2007), an expert in PL, has redefined the term as the motivation and physical competence required to utilize movement potential, and contribute significantly to one's quality of life. That is, individuals who are physically literate will have the ability to move with confidence and respond appropriately through various physically demanding situations and environments. PL encompasses the importance of motivation to move, and details how improved physical competence will have effects on both self-esteem and overall quality of life (Whitehead, 2007). In an effort to globally define the term, the International Physical Literacy Association now defines PL specifically as "the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engagement in physical activities for life" (IPLA, 2014, pg. 1). As with all other aspects of education, PL requires guidance and practice to enable children to thrive. Children who fail to attain adequate levels of PL will lack confidence in any

physically demanding challenges, consequently making them more likely to avoid PA throughout life (Whitehead, 2010).

In Canada, various organizations are contributing to the growth of PL (Tremblay, 2012), making it one of the leading countries in PL development (Corbin, 2016). One key player is Physical and Health Education (PHE) Canada, whose mission is to advance physical and health education to enable all children and youth to develop healthy and active lifestyles that will endure throughout life. According to PHE Canada, the first goal of physical literacy is to teach children the basics of movement, or fundamental movement skills (FMS), required to participate in PA. Mastering these skills early in childhood provides children with the confidence and ability required to not only participate in, but to enjoy PA. Failure to master these skills may become a barrier for later PA participation, making their early development crucial in both the short and long-term (PHE Canada, 2010). Another major contributor to the advancement of PL in Canada is Canadian Sport for Life (CS4L). CS4L is a PL champion focused on improving the quality of sport and PA education across the lifespan. The organization has developed a long-term athlete development-training program consisting of 7 varying stages of achievement. The first stage of development, "active start", aims to teach children from birth to 6 years of age the ABC's of movement (agility, balance, coordination and speed), providing the necessary foundation for future FMS development that occurs in stages two and three. All three early stages aim to successfully develop PL before puberty to provide children with the essential skills to remain active for life. The intermediate stages, 4-6, revolve around the development of sport excellence, providing elite training to athletes interested in high-level competition. The final stage, "active for

life", applies to all Canadians aged 12 and up. CS4L acknowledges that not all will attain "sport excellence", however the PL achieved in the earlier years through this structured program will provide the necessary skills to maintain a healthy active lifestyle throughout life (CS4L, 2011). Another more recent key player in the field of physical literacy is the non-profit social enterprise Active for Life. This initiative aims to help children become more active by providing useful resources for parents, educators and coaches to facilitate high quality PL development (AFL, 2016). Active for Life was created through another organization known as B2ten. Their original goal was to improve Canadian Olympian's success by supporting current athletes and setting the necessary building blocks to facilitate the development of future elite athletes. Initially, the program had anticipated that our Olympian's successes would be an adequate means of inspiring increased PA participation in the general population. Unfortunately, this result was not observed. These findings, coupled with a growing understanding of the importance of PL, led to the creation of Active for Life (B2ten, 2014). While there are other supporters assisting the growth of PL development in Canada, these major initiatives have contributed significantly and continue to push for change in our country.

1.4 Observing the Preschool Population

Research among school-aged children has long shown a decrease in fitness ability and PA rates, accompanied by increasing health concerns (e.g., mounting obesity rates) (Sirard & Pate, 2001). The need for PA recommendations for children aged 5-11 years of age was addressed and explored early on, with the first guidelines released in 2002 (LeBlanc et al., 2015). The development of recommendations for the preschool population (aged 3-5 years) however has lagged behind. It was not until 2012 that

guidelines for this age group were disseminated (Tremblay et al., 2012). This delay may have been due to a misconception that preschool-aged children were naturally more active and likely to engage in PA throughout the course of their day. Unfortunately, when assumptions were replaced by objectively measured PA data, the findings were yet again contradictory. Accelerometry data determined that 3-5 year olds are sedentary for a large majority of their day, with MVPA and VPA comprising less than 5% of their waking time. Although results did range between sites and individually, on average, children were found to participate in approximately 7 minutes of MVPA per hour, ranging from as small as 4.4 minutes/hour to 10.2 minutes (Pate, Pfeiffer, Trost, Ziegler, & Dowda, 2004). These low rates of PA are discouraging as Goldfield and colleagues (2012) have highlighted the preschool years as a critical period to implement positive health associations and habits. At this young age, parents, or daycare directors, are in complete control over the activities and environments children are exposed to. Therefore, by implementing positive health behaviours at this young age when attitudes and beliefs towards PA are still so malleable, it may prove more beneficial than attempting to create new habits later in life (Goldfield, Harvey, Grattan, & Adamo, 2012). Daycare attendance has already been deemed a major contributor to daytime activity. When comparing the results between preschools, large discrepancies in PA participation were observed. These were primarily dependent on the policies and procedures implemented, and whether PA participation was endorsed and promoted (Pate et al, 2004; Oleson, Kristensen, Korsholm, & Froberg, 2013). Vanderloo and colleagues (2015) completed a more recent review exploring PA levels in different types of early learning environments further highlights the importance of PA-promoting policies. Despite children displaying low

rates of MVPA overall, those attending full-day kindergarten did show significantly higher levels of MVPA as compared to home-based or center-based childcare facilities. While this may have been linked to the lack of a "nap time" in full-day kindergarten, researchers also attributed the increased PA rates to the inclusion of health and PA curriculum in these full-day centers. This newly revised curriculum aims to assist teachers with creating activities that encourage developmentally stimulating play (Vanderloo, Tucker, Johnson, Burke, & Irwin, 2015). On top of policies and specific curriculum, outdoor playtime has been strongly correlated with an increased amount of PA. Moreover, areas of play with more vegetation were found to reduce amount and intensity of PA while open spaces and circular tracks increased participation rates. Unfortunately, weather plays a large role in the accessibility to outdoor play, which is a significant concern in many Canadian provinces. The effects of this variable, however, were significantly reduced when large, open indoor spaces were also available (Oleson et al., 2013).

1.5 Previous Research in the Preschool Population

As aforementioned, the increased awareness of poor childhood PA participation rates has resulted in a myriad of public awareness campaigns. Regrettably, despite an increased awareness, children are continually failing to meet national guidelines (Gray et al., 2014). Acknowledging that additional strategies are needed to foster improvement, there has been an increased understanding of the importance of targeting the fundamental building blocks that underlie lifelong PA behaviours. While there has been a rapid growth in PL research over the past decade, the bulk of this work has focused on promoting PL in school-aged children and youth. Importantly, a growing body of evidence suggests that

there is also a need for improvements in the preschool population (Pate et al., 2004; Williams et al., 2008; Goldfield et al., 2012). Numerous studies have found associations within the preschool population between well-developed FMS and an increased participation in objectively measured PA. However, the cause and effect relationship between these two factors has been questioned. It is difficult to determine whether increased FMS are due to PA participation, or whether those with more developed FMS are more likely to engage in PA (Cliff, Okely, Smith, & McKeen, 2009; Cohen, Morgan, Plotnikoff, Callister, & Lubans, 2014; Fisher et al., 2005; Holfelder & Schott, 2014; Williams et al., 2008; Kreichauf et al., 2012). Regardless of the cause and effect relationship, improving FMS ability is correlated with an increased PA participation. Ultimately, improving either aspect, whether it be the process or the end-result, will have a positive influence on a child's overall health as both aspects are interrelated (Lloyd, Colley, & Tremblay, 2010). Therefore, researching ways to adequately improve FMS is an extremely beneficial area of study.

1.6 Tackling Physical Literacy: Structured Interventions and Free-Play

With growing knowledge in the field of PL, the importance of well-developed FMS at the preschool age has become increasingly evident. In an effort to ascertain the most efficient means to foster the development of FMS, several studies have explored the use of both structured interventions as well as less-structured, "free-play". The bulk of what has been explored to date appears to suggest that FMS need to be formally taught in order for children to improve. To date, PA in the form of unstructured free play has failed to show an increase in PA rates (Jones et al., 2011) and has consequently been touted as an inefficient means of FMS improvement (Goodway, Crowe, & Ward, 2003; Ignico,

1991; Goodway & Branta, 2003; Hamilton, Goodway, & Haubenstrick, 1999). However, in many of these studies, where a structured intervention was compared to a "free-play" control, the time allotted to PA was either of unequal duration (Goodway et al., 2003; Kelly, Dagger, & Walkley, 1989; Goodway & Branta, 2003) or unreported (Jones et al., 2011; Reilly et al., 2006). A thorough review of the literature has raised the question of whether the lack of improvements observed with unstructured free-play was truly a problem inherent to play or simply a lack of actual play time (i.e., PA). Based on a review of the evidence, the effectiveness of direct instruction on improving FMS ability is clear, however given the methodological limitations, the question that arises is whether play alone is truly unable to foster successful development of these skills. Furthermore, a review of qualitative research exploring reasons individuals participate in PA found enjoyment to be a leading motivator. When examining the younger population specifically, experimentation where activities enabled children to employ more creativity was found to be a powerful motivator while excess structure proved to be a barrier, discouraging PA participation (Allender, Cowburn, & Foster, 2006). The overarching goal of PL is to promote life-long PA and while previous work has demonstrated the short-term effectiveness of structured FMS interventions, no study to date has considered the impact of the intervention on overall participant enjoyment, which is an important factor for future PA adherence (Allender et al., 2006; Bremer & Cairney, 2016; Whitehead, 2010). Accordingly, the purpose of the current study was to examine the effectiveness of a structured play-based intervention, compared to a structured skill-based, instructive technique of equal duration. Both groups were compared to a free-play control that maintained the normal preschool curriculum. It was hypothesized that with

more structure provided in the play-based intervention, preschool children would demonstrate equal improvement in FMS ability, compared to a direct skill instruction approach. Furthermore, it was hypothesized that FMS ability improvements would be greater in both intervention groups compared to any improvements noted in the control group. Finally, it was believed that the overall enjoyment would be greater for those children who were involved with the play-based intervention, as opposed to the structured skill-station approach.

1.7 Summary

Despite the known correlation between adequate amounts of daily PA and improved overall health, the majority of Canadians are not committing to sufficient lifestyle adjustments (Janssen & Leblanc, 2010; Tremblay, 2012). Although it has long been assumed that preschool children naturally engage in PA throughout the course of their day, objective measures have shown otherwise (Pate et al., 2004). Moreover, awareness-based campaigns have proven ineffective at promoting sustained behavioural change (Craig et al., 2009) and a more direct approach is warranted.

The use of PL as a means of promoting life-long PA is a growing area of research in Canada (PHE Canada, 2010). Studies have supported the belief that improving FMS will consequently help promote PA within the preschool population (Cohen et al., 2014; Holfelder & Schott, 2014) making FMS-based research a necessary area of work. However, the relative enjoyment of these structured skill-based approaches has received no attention. The current study will compare three distinct groups, all of equal duration. The first group will receive a structured FMS intervention, an approach known to provide significant improvements in FMS ability. The second group will partake in organized

game-based play, herein referred to as “structured play”. The third and final group, acting as the control group, will participate in unstructured free play. It is hypothesized that both the structured play and skill-station intervention groups will demonstrate similar improvements in FMS ability compared to the free-play control. However, it is believed that those in the structured play group will show greater enjoyment, increasing the likelihood of continual participation (Allender et al., 2006; Bremer & Cairney, 2016) and consequently revaluing the importance of play to FMS development.

Chapter 2 Literature Review

2.1 Introduction

Yearly reports continually highlight the fact that very few Canadian children and youth meet recommended levels of PA for health benefits (Colley et al., 2011, Tremblay, 2012; ParticipACTION, 2016). In Canada, the CHMS was the first National study to provide objective measures of PA behaviour and the outcomes were discouraging, showing that less than 10% of Canadian children and youth were accumulating the recommended amounts of daily PA (Colley et al., 2011). Unfortunately, this review failed to include the preschool population (aged 3-5); focusing only on those aged 6-19 years of age.

The AHKC report card is a PA advocacy tool that publishes yearly reports on the overall PA-based health of children aged 3-11 and youth aged 12-17. Like the CHMS, the AHKC report card highlights areas that are in need of improvement, providing "grades" for various activity-related health indicators, including overall PA level, sport participation, sedentary behaviours, and active transportation (Tremblay, 2012). In their most recent report, overall PA levels received a D-, implying only approximately 20% of Canadian children and youth are sufficiently active (ParticipACTION, 2016).

Although general awareness on the physical inactivity issue is growing, the preschool population, aged 3-5 years, has long been overlooked. It was not until 2012 that PA guidelines for this age group were even created (Tremblay et al., 2012). While exact reasons for this lack of concern are unknown, they may be related to a misconception that at such young ages, children are naturally more active due to their inherent desire to explore (Pate et al., 2004). Unfortunately, when utilizing accelerometry

to examine 3-5 year olds exclusively, Pate and colleagues (2004) found that preschool children spent only 5% of their waking hours engaged in PA. Earlier survey-based results from Statistics Canada that collected primarily self-reported daily PA participation were misleading, and implied that the majority of Canadian children were obtaining adequate amounts of PA (Gilmour, 2007). The objective studies that followed, such as the CHMS and other contributors to the ParticipACTION report, however, disproved these claims and successfully highlighted a need for change in this area.

In response to the mounting evidence demonstrating the lack of PA participation in Canada, numerous national campaigns have been created to help promote PA, many of which target parental awareness (Tremblay, 2012). For example, on top of reporting the health status of the younger population, AHKC also utilizes the media attention of their yearly report to encourage parents, caregivers, and educators to become more actively involved, and help get their children moving (Gray et al., 2014). Similarly, ParticipACTION, a Canada-wide mass-media campaign that has only recently joined forces with the AHKC initiative, also encourages healthy lifestyles and promotes PA participation. The initiative has always targeted the parental audience by emphasizing the immediate and life-long risks associated with physical inactivity. The various media campaigns encourage parents to make changes in their children's lives and routines to help foster healthy habits early in life (Tremblay & Craig, 2009). Regrettably, while these campaigns have shown to be successful in increasing awareness on the issue of physical inactivity (Craig et al., 2009), few lifestyle improvements have been observed and PA rates are continually dropping (Gray et al., 2014; ParticipACTION, 2016). It is clear that a more aggressive approach is warranted.

2.2 Physical Literacy as the Foundation for Lifelong Physical Activity

PL is the motivation and physical competence required to utilize movement potential in order to contribute significantly to one's quality of life (Whitehead, 2007). PL requires guidance and practice for proper development. It is believed that those who fail to attain adequate levels of PL will lack confidence in their physical abilities, increasing their likelihood of avoiding PA throughout life (Whitehead, 2010).

Four core domains characterize PL: physical competence, motivation and confidence, knowledge and understanding, and an overarching component of daily behaviour. To truly assess one's PL, all four core domains must be assessed. The Canadian Assessment of Physical Literacy (CAPL) is the first comprehensive protocol to assess these four domains and provide a detailed, multidimensional assessment of overall PL levels (HALO, 2013). However, the tool is designed for children aged 8-12 years and is not appropriate for younger, preschool aged children. Physical competence is assessed with an obstacle course and a beep test for aerobic fitness ability, both tasks beyond the average skill levels of 3-5 year olds. Furthermore, motivation and competence, along with knowledge and understanding, are assessed through self-reported questionnaires, also too advanced for preschool children (HALO, 2013). That being said, within the preschool population, focus lies on the basic building blocks of movement, or FMS. These basic skills must first be mastered before the other aspects of PL, including more advanced movement ability and the psychological components of PL, can be developed (PHE Canada, 2010). Therefore, FMS development in particular, as opposed to a multidimensional assessment of PL, is the primary area of interest for the preschool population.

2.2.1 Canadian Initiatives for Physical Literacy development

The CS4L is a Canadian initiative created in 2005 aiming to promote PA throughout life and foster high-level athletic development in our youth. On top of being a leading presence in the PL movement, they have developed the long-term athlete development (LTAD) program. LTAD works to develop PL in young children, and ultimately aims to promote the maintenance of these habits throughout life. The LTAD model contains seven stages; the first three focus on PL development, the intermediate stages (4-6) focus on the development of sport excellence, and the final stage supports lifelong PA participation. Stage 1: "Active Start" targets children aged 0-6 years and aims to assist the development of FMS through active play. At this age it is essential that children develop the ABCs of movement (i.e., agility, balance, coordination and speed). These basic movement components are essential for the development of FMS, which then lead to the development of basic sport skills and later, sport excellence. The goal with active start is to enable children to view PA as a fun and exciting aspect of daily life to encourage continual participation. This stage not only encourages the development of FMS, but also helps to build confidence, imagination, and social skills and aims to create positive associations with PA. Once this stage is complete, children move on to the "FUNdamental" stage, which works with 6-8 year olds to build on FMS development by incorporating more structured learning through sport-based activities. Although activities are still focused on fun, more formal instruction and competition are introduced. The final developmental stage, "learn to train", works with girls aged 8-11 and boys aged 9-12 to increase the structure and formality of training while still maintaining a broad range of sport skills. Those who excel in this stage may then move on to single sport

specialization in the intermediate 3 stages, or progress to the final stage, "Active for Life", tailored to all Canadians aged 12 and up. "Active for Life" is the ultimate goal of both the CS4L and the LTAD programs. Here, individuals participate in a variety of lifelong recreational or competitive sports thereby continuing to maintain adequate levels of PA throughout life (CS4L, 2011).

To ensure this final stage of the LTAD model is attained, it is imperative that the FMS are developed at an early age. However, with the rising awareness of poor PA participation rates in the preschool population, it is becoming increasingly apparent that these skills are at risk of being underdeveloped and overlooked. This fact alone highlights the need for both increased PA participation and FMS development in the preschool population.

2.3 FMS Research in the Preschool Population

Numerous studies with the preschool population have uncovered positive associations between FMS and objectively measured PA. However, it is still unclear whether increased PA improves FMS, or whether children with more developed FMS are actually more active. Regardless of the cause and effect relationship, FMS interventions have been deemed a potential means of promoting PA (Cliff et al., 2009; Cohen et al., 2014; Fisher et al., 2005; Tonge, Jones, & Okely, 2016). Consequently, determining adequate means of improving FMS is an area worthy of additional research in the preschool population (Pate et al., 2004; Williams et al., 2008, Tonge et al., 2016).

Following an extensive review of the literature, various FMS interventions were discovered. For the purposes of the current review, studies were included if they were written in the English-language and involved preschool aged (i.e., 3-5 years) children. It

was also required that the primary focus be on FMS development, incorporating a structured intervention group compared to a free-play control. Studies that did not provide a supervised PA intervention, or control for time engaged in organized PA for the intervention groups, were also excluded (e.g., Bonvin et al., 2013; Hardy, King, Kelly, Farrell, & Howlett, 2010). The few studies that were completed prior to the year 1990 were disregarded, as design and assessment batteries did not align well with the studies of interest. Moreover, studies that examined the differential effects of delivery techniques, or "motivational climates", on the success of motor skill interventions (Robinson & Goodway, 2009; Martin, Rudisill, & Hastie, 2009; Valentini & Rudisill, 2004; Apache, 2005) were also not included. While these areas pose interesting research questions warranting further research, problems still exist with the fundamental research question of ***how*** to improve FMS in the preschool population.

2.3.1 Review of Related Studies

Seven studies were found that met the inclusion and exclusion criteria. For a summary of the research reviewed, including: country of origin, population of interest, age, size and study duration, study design and results see Table 1. Many of the studies utilized a PA program incorporating a series of skill stations, each teaching a specific FMS. Generally, lessons consisted of a warm-up, a training period and a cool down. Following the game-based warm up, children split into smaller groups and for a designated period, moved sequentially through the skill stations. Most lesson plans focused on up to three skills per lesson, and were repeated twice per week before moving on to new a FMS. Teachers or investigators were present at each station to demonstrate and explain the lesson, assist with the skill techniques, and promote learning (Goodway

Table 1 Summary breakdown of included FMS interventions compared to a free play control.

Authors	Population/ age	Country	Size	Intervention Duration	Assessment tool	Control Type	Intervention type	Results
Ignico, 1991	Typically developing Kindergarten	USA	30 int., 30 control children	28 min/day for 10 weeks	TGMD	Free play	Skill station approach	Treatment group improved considerably while the control group showed no change.
Hamilton, et al., 1999	At risk of DD 3-5 years	USA	3 int. & 2 control classrooms	45 min 2x/week for 8 weeks	5 OC skills from TGMD	Movement songs and activities	2 skills taught per lesson	Only the intervention group showed improvements in FMS ability.
Goodway & Branta, 2003	At risk of DD 4 year olds	USA	31 int. 28 control children	45 min, 2x/week for 12 weeks	TGMD	Free play	Skill station approach	Intervention group improved significantly in both LM and OC skills.
Goodway, Crowe & Ward, 2003	At risk of DD Mean age 4.9 years	USA	33 int., 30 control children	35 min, 2x/week for 9 weeks	TGMD	Outdoor free play	Skill station approach	Intervention group performed significantly better than control in both LM and OC skills.
Reilly et al., 2006	Typically developing Mean age 4.2 years	Scotland	545 children from 36 nurseries	30 min, 3X/week for 24 weeks	MABC	Control	Specific details not provided	Significant improvements in FMS were reported in the intervention group compared to the control.
Jones et al., 2011	Typically developing 3-5 years	Australia	52 int. 45 control children	20 min lessons 3x/week for 20 weeks	TGMD-2	Outdoor free play	JUMP START program	Intervention group showed greater improvements for motor skill development and a significant increase in PA time.
Adams, Zask, & Dietrich, 2009 / Zask et al., 2012	Priority to disadvantaged preschools Preschool children	Australia	18 int. & 13 control preschools	2x/week for 10 months	TGMD-2	Free play	"Fun Moves" curriculum; game-based	Intervention group showed significant improvements in FMS, food choices, waist circumference and BMI scores as compared to control.

BMI – Body Mass Index, DD – Developmental Delay, FMS – Fundamental Movement Skills, Int. – Intervention, LM – Locomotor, Min. – Minutes, MABC – Movement Assessment Battery for Children, OC – Object Control, PA – Physical Activity, TGMD – Test of Gross Motor Development, TGMD-2 – Test of Gross Motor Development 2nd Edition

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& Branta, 2003; Goodway et al., 2003; Hamilton et al., 1999; Ignico, 1991). Although this was the most common approach, other methods that were used are detailed below.

The earliest study that has been included comprised the largest amount of time spent in PA incorporating approximately 28 minutes of daily training over a 10-week period. The Test of Gross Motor Development (TGMD) (Ulrich, 1985) was utilized to assess movement ability, and the skill station technique described above was used. Results found that the intervention group showed significant improvements in FMS as compared to the free-play control group. Control subjects received no instruction; however, participation in approximately 20-25 minutes of free play per day was required. Despite nearly equivalent time spent in either unstructured free-play or PA interventions, no improvements were noted in the control group (Ignico, 1991).

The next three studies focused on children at risk of developmental delay. Whether due to biological or environmental factors, all children involved in these studies were deemed vulnerable, warranting extra attention due to their increased risk of poor motor development. Hamilton and colleagues (1999) assessed 27 African American children from five pre-set classrooms, three participating in the intervention and two as controls. The importance of parental involvement was also assessed by allowing the parents to lead professionally-developed interventions. These involved two 45-minute sessions per week, over 8 weeks. Children in the intervention group participated in a parent-assisted motor skill program where the parent tutored their child individually on throwing, kicking, catching, striking and bouncing. The control group was more structured than most comparable studies, having movement songs and activities led by the parents, but lacking skill instruction. The study focused solely on the object control (OC) components of the TGMD (stationary strike and dribble, catch, kick, underhand

roll, overhand throw) comparing pre- and post-intervention scores. Prior to the intervention, both groups showed similar scoring means and performed below the 20th percentile. No improvements in OC skills were noted in the control group; however, significant improvements in the intervention group were reported where participant score averages advanced to the 67th percentile.

In 2003, Goodway led two similar studies, both assessing all 12 items of the TGMD (Ulrich, 1985) before and after interventions for the exercise and free-play control groups. The first study focused on low-income Hispanic children over a 9-week period having two 35-minute sessions per week. The control group engaged in approximately 15-20 minutes of outdoor free play per day, lacking any formal instruction (Goodway et al., 2003). The second study incorporated two 45-minute training sessions per week over a twelve-week period. The control group participated in unstructured free play with timing and duration designated by the instructor. During the intervention period, only seven 45-minute intervals of PA were recorded (Goodway & Branta, 2003). Despite minor differences in design, both studies showed no change in the control group, while the intervention groups improved significantly in both the OC (detailed above) and locomotor (LM) skills, which include run, hop, gallop, leap, horizontal jump and slide (Goodway et al., 2003; Goodway & Branta, 2003).

In 2006, a large-scale study involving 545 Scottish children from 36 different nurseries was conducted (Reilly et al., 2006). This study incorporated both a PA intervention and a home-based health education program to reduce sedentary behaviours. The four-month intervention consisted of three 30-minute training sessions per week, based off of the Movement Assessment Battery for Children (MABC), developed by Henderson and Sugden (1992). The MABC focuses on 30 skills in the realm of manual

dexterity, balance and aiming and catching and aims to detect delay or deficiencies in motor skill development. The current study focused primarily on the jumping, balance, skipping and ball exercise-based performance aspects of the tool. The control group continued with their usual curriculum where teachers agreed not to increase PA time or revise the existing movement curriculum. Unfortunately, actual time spent participating in PA was not monitored for the control group throughout the intervention period. Primary outcomes (BMI scores) showed no significant between-group effects, yet FMS ability, observed as a secondary outcome, improved significantly in the intervention group alone (Reilly et al., 2006).

As an international leader in childhood FMS research, an extensive body of research is beginning to emerge from Australia. Tooty Fruity Vegie, one of the many ongoing studies, recruited 18 intervention and 13 control preschools. The intervention design involved 10 training sessions, each repeated twice per week over a 10-week term. The entire program was then repeated in the following semester, resulting in an overall study duration of one year. For this program, a "Fun Moves Curriculum" was developed, which involved game-based FMS training focusing on both the LM and OC skills of interest for the 2nd edition of the TGMD (TGMD-2). Preschool teachers were in charge of running interventions. However, to facilitate delivery, they were provided with program notes and instruction cards for each of the activities (Adams, Zask, & Dietrich, 2009). On top of the physical intervention, Tooty Fruity Vegie held workshops with parents discussing the importance of increasing fruit and vegetable consumption while limiting unhealthy food intake and reducing sedentary behaviours. Results, published in a later work, showed that the intervention group improved in all aspects, including FMS and

fruit and vegetable consumption, compared to the control (Zask, Adams, Brooks, & Hughes, 2012).

The final FMS intervention reviewed included the recruitment of two daycare centers with 52 intervention and 45 control participants. Similar to Zask et al. (2012), a FMS curriculum named "JUMP START" was used which involved teaching the skills through a series of games and activities designed specifically to work on a given skill. For example, the first lesson was designed to work on running ability and specifically focused on aspects of the skill such as maintaining eye gaze forward and moving arms in opposition to legs. The program ran over 20 weeks and involved three 20 minute training sessions per week. There were a few factors unique to this study worth mentioning. For one, the intervention design also included set unstructured playtime in the afternoons, enabling children to practice the skills learned in the morning session. Furthermore, this is the only study that kept track of objectively measured PA with the help of accelerometers. The control group continued with the usual preschool curriculum, which included unstructured outdoor free play. Again, as with all previous studies, the intervention group showed significant improvements in FMS ability along with a significant increase in PA participation (Jones et al., 2011).

2.4 Limitations in the Current Research

There is a growing body of research tackling various aspects of movement skill interventions. When focusing solely on the effect of structured FMS interventions compared to a free-play control, all of the studies reviewed provide evidence that FMS interventions are an adequate means of improving skill ability. Free-play, on the other hand, failed to produce significant improvements in FMS ability, suggesting that "play" alone is not enough to foster sufficient FMS development, and that structured

interventions are ultimately required. However, a more critical review of the free play control groups raises the question of whether or not these children were actually playing. Of the nine studies reviewed, only one provided any structure to the control group's PA, utilising movement songs and activities (Hamilton et al., 1999). Another major limitation was the inequality of PA timing between comparator groups. For example, Ignico (1991) was the only study with nearly equivalent amounts of intervention/play time within the two groups. In that study, the control participated in approximately 20-25 minutes of daily play-time and the intervention engaged in 28 minutes per day. The remaining studies used control groups in which children continued to participate in their normal daily curriculum. As a result, the PA times varied significantly amongst the various control groups. One study claimed to complete approximately 15-20 minutes per day (Goodway et al., 2003). Another recorded seven 45-minute intervals of free play compared to the twenty-four 45-minute sessions completed in the intervention group (Goodway & Branta, 2003). Others, however, kept no track of the time spent in PA for the control, complicating between-group comparison and devaluing the lack of results reported for the control groups (Reilly et al., 2006; Jones et al., 2011).

Due to the lack of structure within the control groups, it is arguable that some children may not have been incorporating much PA into their free-play. With this in mind, the claim that play alone is not enough to improve FMS may be to put to question. Although the structured control in the 1999 study by Hamilton and colleagues did not create any positive changes, some of the more game-based interventions, as opposed to the very structured skill station approaches, were able to demonstrate improvements in FMS ability (Adams et al., 2009). From these observations, it is hypothesized that the problem is not inherent to play, but lies in the sedentary habits that children are

developing (i.e., lack of PA time). Furthermore, an essential aspect of life-long PL development relates to teaching children to enjoy PA and create positive associations with sport and activity. In the LTAD program, Active Start avoids structure, focusing on fun and creativity to foster skill development while allowing children to use their imaginations. By employing too much structure, the enjoyment aspect of play may be hindered (CS4L, 2011). Although the structured interventions have shown to be capable of improving FMS ability, failure to provide enjoyment may cause their benefits to be less sustainable as enjoyment contributes to the maintenance of PA habits throughout life (Allender et al., 2006). It is believed that a structured play intervention will not only provide the same improvements in terms of FMS when compared to a carefully regimented skill-station intervention, but will also provide greater enjoyment ratings.

2.5 Summary

Increasing PA participation has been linked to a reduced rate of developing chronic disease later in life (Janssen & Leblanc, 2010). Despite an increased awareness of the risks associated with physical inactivity, however, few behavioural changes are actually being made (Tremblay et al., 2012). A more aggressive approach is warranted and as a result, the field of PL is growing. Preschool children were long believed to be inherently active, however objective measures of PA behaviour have demonstrated otherwise, highlighting the need for work in this area (Pate et al., 2004). At such a young age, the focus lies on the development of FMS, the basics of movement, which have been associated with increased PA participation (Cliff et al., 2009; Cohen et al., 2014). Unfortunately, studies have reported that play and PA alone is not enough to improve these skills, and that structured interventions are required (Goodway et al., 2003; Ignico, 1991; Goodway & Branta, 2003; Hamilton, et al., 1999). After critically reviewing these

studies, design flaws were noticed. A lack of consistency between the groups in terms of PA timing, along with a lack of monitoring activity within the control groups, were noted. Ultimately, the question that arises is whether or not these "free-play control" groups were in fact playing, and if so, for how long? For this study, we will observe the results of two interventions, one utilizing the very structured skill-station approach, which has been shown to be effective, and the other utilising structured yet game-based play. The results from both groups will be compared to one-another and to a free-play control. It is hypothesized that both of the structured interventions will provide positive improvements in the children's FMS abilities, yet the play-based intervention will be favourable in terms of participant enjoyment. Consequently, these results will demonstrate the ongoing value of play to children's motor development.

Chapter 3 Methods

3.1 Study Design

The present study was a three-arm, pilot cluster-randomized trial design with intervention effects measured at the participant level. Representing the same academy and learning philosophy, a convenience sample of three separate daycare centers located within the Halifax Regional Municipality (HRM) were invited to participate. Participating centers were randomly allocated to one of three groups: 1) Skill Station Approach, 2) Structured Play, or 3) regular daycare curriculum acting as the free play control. The intervention ran over an 8-week period and included a baseline and post-study assessments to evaluate the efficacy of each intervention on participant FMS and overall program enjoyment. Initial skill assessments were completed one week prior to the intervention and again the week following intervention completion, resulting in a total (planned) study duration of 10 weeks. Individual effects along with between- and within-group effects for FMS skill ability and overall enjoyment were observed.

3.2 Study Site Selection, Recruitment, and Randomization

The project was conducted at three separate daycare centres within the HRM that are all members of a daycare franchise that spans across four Canadian provinces. The daycare academy was targeted for study participation as it prioritizes movement development and acknowledges the value and importance of PA by incorporating PA into their daily curriculum. Furthermore, the daily program already contains two outdoor gross-motor play components, thereby minimizing the study impact on the children's normal routine. Moreover, as members of the same daycare academy, all three centers operate using the same daily curriculum and follow similar daily meal plans, thereby minimizing between-group variability.

Recruitment of daycares began with an initial letter of invitation that was emailed to the directors of the three identified daycare centres. A follow-up meeting between the directors and the lead researcher was then coordinated to explore each site's interest in participating and to provide any additional information requested. Following director approval, allowing their site to participate, centers were randomly allocated by an independent researcher to one of the three study arms. Center directors, staff, parents, and students were not blinded to group allocation.

3.3 Participant Recruitment

Following approval from the three participating daycare centers, recruitment began by sending out short messages about the upcoming project in the academy newsletter. Information packages regarding the importance of physical literacy, specific study details, and consent forms, were then provided to all parents of preschool aged children (3-5 years) by the classroom teachers. Investigator contact information was also provided should the parents have had any questions or concerns regarding the study or their child's involvement. Along with the information packages, an information session with the lead investigator was arranged to allow parents to meet with the lead researcher and enable them to ask any further questions in person. A 2-week recruitment period was provided and all willing children who obtained parental consent were allowed to participate in the study. For data to be included in the analysis, children were required to be in the desired age-range (3-5 years), have sufficient English language ability to understand the activities, be present both at the daycare for the duration of the intervention and on the intervention days specific to their site, and have no pre-existing motor impairments that would impair the child's ability to safely participate. In the event that any pre-existing impairment may have caused undue risk to the child if they were to

participate, those children, along with those who did not consent to participate, continued with their normal preschool curriculum during the intervention time.

3.4 Procedures

Parental consent was obtained for all participants prior to conducting any study related procedures. The intervention consisted of two 45-minute sessions per week held during the predetermined outdoor gross-motor play periods to avoid excessive disruption in the children's daily schedules. Importantly, the selected daycare centers had sufficient indoor space if the weather had prevented the intervention from occurring outdoors. Baseline data for movement proficiency were assessed using the 2nd edition of the Test of Gross Motor Development (TGMD-2; Ulrich, 2000). Raw scores (for each subtest and overall score) were collected to enable comparison to standardized age and sex-related norms. Following the 8-week intervention, these measurements were repeated for comparison. The primary investigator (PI) completed all TGMD-2 assessments with the help of two trained research assistants (RA). Each test required approximately 15 to 20 minutes per child to administer. During the assessments, three children at a time were selected to complete simultaneous one-on-one testing with the PI and RA's before heading back to their classrooms.

3.5 Interventions

Previous work found positive results in interventions of 8-12 weeks of duration (Goodway et al., 2003; Ignico, 1991; Hamilton, et al., 1999; Goodway & Branta, 2003), the majority of which employed two 35-45 minute interventions per week. Based on the significant results observed in these studies, along with the limited timeframe, the current study ran over an 8-week period consisting of two 45-minute training sessions per week. Hamilton and colleagues (1999) employed an identical intervention time frame and

duration and found significant results within their intervention group compared to a free-play control.

3.5.1 Skill Station Approach Intervention

The skill station approach used was structured based on the Successful Kinesthetic Instruction for Preschoolers (SKIP) program that has been developed by a team of professionals and used in a number of studies (Goodway & Branta, 2003; Goodway et al., 2003; Hamilton, et al., 1999). These programs involve a general lesson outline of a warm up and cool down period completed in a group along with a series of skill stations to be completed in smaller groups. While this general outline was used, age-specific skill stations were developed by the lead researcher to focus on developing the movement skills of interest for the current project. Once the intervention began, stations were further adapted if the activity proved to be too challenging for the children. Each lesson consisted of four skill stations based on balance, locomotor, and/or object control skills that were repeated for both lessons within the week. The skill station approach site was completed entirely outdoors and a small portion of the outdoor play area was sectioned off to separate those children who were involved with the project from the rest of the children to minimize disruption. Optimal volunteer numbers were 4 per session. Each volunteer was responsible for a single skill station, and the lead researcher was then able to circulate between stations to assist with any difficulties and to manage the children as they switched between stations. Although possible to complete with only 3 volunteers, this required the lead researcher to cover one of the stations and complicated lesson flow. That being said, it was possible to complete the intervention with just 3 volunteers, having the lead researcher guide the children while also covering one of the skill stations. An intervention outline (Appendix C) along with an example lesson plan

(Appendix E) and a breakdown of general lesson plan organization (Appendix D) have been provided. PDF versions of the full lesson plan are also available by request. Each lesson plan consisted of the suggested warm-up and cool-down activities, the designated skill stations and an area to provide feedback as a means of improving later lessons.

3.5.2 Structured Play Intervention

The structured play intervention was developed using the Active for Life lesson plan builder (http://activeforlife.com/lesson-plans-and-resources-2/). Active for Life is a non-profit organization aiming to assist in the development of physical literacy by increasing awareness and providing free resources for parents, educators, and coaches. The lesson plan builder, one of the many free resources available, includes a bank of age-appropriate games developed to improve balance, locomotion and object manipulation skills (Active for Life, 2015). The structured play group intervention was conducted in either an indoor gymnasium attached to the center or outdoors on a large field located in close proximity to the centre. In both settings, participating children were separate from the remaining daycare group to minimize disruption and facilitate focus on the structured play. For this group it was ideal to have at least 2 volunteers present to assist the lead researchers with the movement games and to help with crowd control. A program outline is provided in Appendix A along with an example lesson plan in Appendix B. Full lesson plan manuals are available by request. Each lesson plan provides demonstrations of the skills being practiced, structured games to engage children over the 45 minutes, and a final page to provide notes and feedback as a means of improving future lessons or potential follow-up interventions.

3.5.3 Free-Play Control Group

The free-play control group continued with their daily routine. The lead researcher was present at one 45-minute session per week to observe play behaviours and obtained attendance from the daycare teachers for the second 45-mintute period. During this time the children were allowed to play in their outdoor play area, which had free space, ample toys and loose-parts to facilitate play, a large playground and even bicycles on some days. The children also occasionally went on group walks during this period however; for the most part it involved free-play activities.

3.6 Measures

Demographics were assessed along with motor skill proficiency and overall enjoyment ratings using the procedures described below.

3.6.1 Demographics

Age and sex were by provided by consenting parents on pre-study eligibility screening forms (Appendix H).

3.6.2 Motor Skill Assessment

The study utilized the TGMD-2 (Ulrich, 2000) to measure gross motor ability and development through a qualitative process-oriented approach comparing each child's results to pre-determined standardized norms. The test is ideal for identifying delays or improvement in development, evaluating the success of motor skill interventions or other gross-motor related research, and to plan motor skill development programs. Twelve skills, that include six object control (stationary strike and dribble, catch, kick, underhand roll, and overhand throw) and six locomotor (run, hop, gallop, leap, horizontal jump and slide) tasks, were observed. Following demonstration and verbal description of the task, children were allowed a practice trial followed by two test trials. During the assessment,

the examiner observed a set of specific skill performance criteria awarding a point for each successful criterion demonstrated. As noted above, in the case that an examiner missed a specific skill criteria they were allowed to ask the child to repeat the skill one final time to confirm their assessment. Scores were then compared to age and sex-referenced norms providing both descriptive and percentile based performance scores. When first developed, a large sample of children aged 3-10 years old were used to create normative data and Ulrich (2000) reported high test-retest reliability for both LM and OC aspects with correlations of r=0.88 and r=0.93 respectively. High inter-rater reliability (i.e., ICC >0.90) has also been reported for both object control and locomotor subset scores (Barnett, Minto, Lander, & Hardy, 2014). Consequently, inter-rater reliability was not assessed in the current study.

On top of readily available normative data and the tool's high reliability/validity, the process-oriented approach is another benefit of the TGMD-2. This is of particular importance when working with young children where movement patterns may not be fully developed. Quantitative measures focusing on time to complete or number of repetitions may not accurately assess the movement ability of this age group. Process-oriented tools contain a defined set of skill criteria enabling researchers to observe the aspects of movement that led to task completion, to determine if the skill is truly developed. Speed or number of repetitions may not be a valid indication of movement skill at this age (Goshi, Demura, Kasuga, Sato, & Minami, 1999).

3.6.3 Self-reported Enjoyment Rating

Enjoyment was assessed with a seven-point Likert scale, adapted from the patient mood assessment scale by Lorish and Maisiak (1986) which incorporates various levels

of enjoyment ranging from a very happy to a very unhappy face (see Figure 1). Although more precise tools to assess PA enjoyment are available, including the Physical Activity and Enjoyment Scale (Kendzierski & De Carlo, 1991) and the Children's Assessment of Participation and Enjoyment (Imms, 2008), both are survey-based and were not designed for the young age of the current population. The simple and visual representation of enjoyment used in the employed Likert scale was easy to explain to participants and required minimal time commitment to complete, while effectively providing face validity of enjoyment. Enjoyment was assessed once per week for the two structured groups. Children were provided with a scale and asked to color-in the face that they "feel like" or to color in the face that "shows how you feel". In cases where the children misunderstood and colored in all or numerous faces, one of the volunteers or the lead researcher would ask the children to point at the ONE face that they felt like and would then mark the scale accordingly.

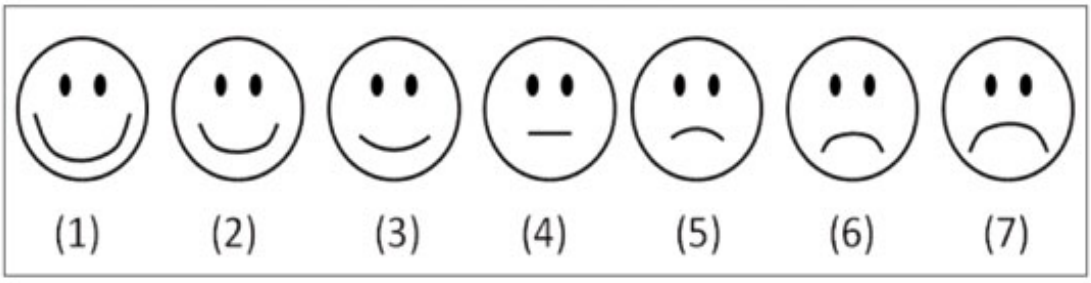


Figure 1 7-point Likert Enjoyment Scale displaying various levels of enjoyment ranging from a very happy (1) to a very unhappy (7) face.

3.7 Sample Size

As this was a pilot study, no formal power calculations were made. However, as the identified daycare centers had a minimum of one preschool age classroom with a maximum of 16 children per classroom, a pragmatic decision was made to recruit a minimum of 8 children from each site. Following participant recruitment an initial

number of 62 eligible children consented to participate in the study. Eighteen were part of the structured play group, 20 consented to participate in the skill stations, and 24 were recruited for the free-play control group. Of the initial 62 eligible children recruited, 51 children between the three groups completed the intervention (see Figure 2).

3.8 Statistical Analysis

The Gross Motor Quotient (GMQ) was used as the representative score for all participants. GMQ has been touted as a highly reliable and useful value, composed of both subtests of the score that well represents the subject's current gross motor development. High GMQ scores are correlated with developed LM and OC skills while low values indicate room for improvement (Ulrich, 2000). Baseline and post-intervention GMQ results for all participants were determined and values were qualitatively compared to the normative percentile scores available with the tool.

Prior to any statistical analysis tests of normality were completed. Significant differences between pre- and post-intervention GMQ scores were examined between the three groups using a mixed-factorial ANOVA. The factorial design allowed for the interpretation of within group effects caused by the intervention type between the three distinct groups. A planned post-hoc comparison was run to examine between group effects. This served to increase power by focusing results on the key comparisons of interest, primarily the pre- and post- GMQ results between the three groups. Enjoyment ratings between the two intervention groups were compared using a Kruskal-Wallis H test due to its ability to look for statistically significant differences between two or more groups.

Chapter 4 Results

4.1 Recruitment

With assistance from the daycare directors, 200 recruitment packages were sent out to parents of all children within the eligible age range (3-5 years). A total of 68 children obtained parental consent to participate. Following initial screening, 62 of those children were eligible to take part in the study. Although substantial efforts were made to collect baseline and final movement assessments (e.g., parental reminders, rescheduling assessment times, etc.) for all children, in a few cases the child was either sick or away on vacation during the testing period. Participant flow throughout the study is presented in Figure 2.

4.2 Demographics

For a summary of participant demographics see Table 2.

Table 2 Summary of participant demographics between the 3 groups.

Intervention	Average Age	Sex (n)	
		Male	Female
Free-Play	3.85	10	9
Skill-Station	4.21	10	6
Structured Play	4.51	6	10

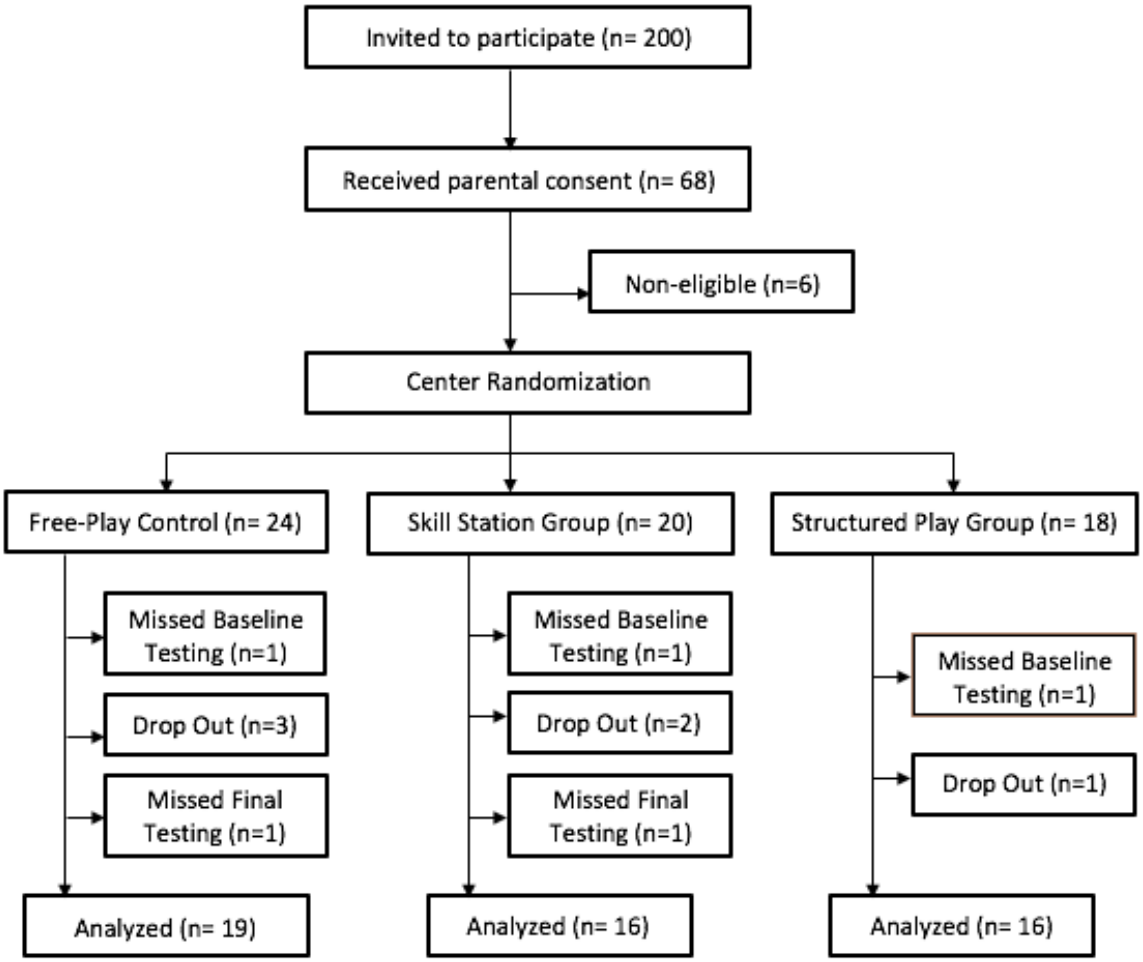


Figure 2 Participant flow throughout study. Children who were not present on the days of their site's specific intervention days were not eligible along with those who would not be with the center for the duration of the study.

4.3 TGMD-2 Scores

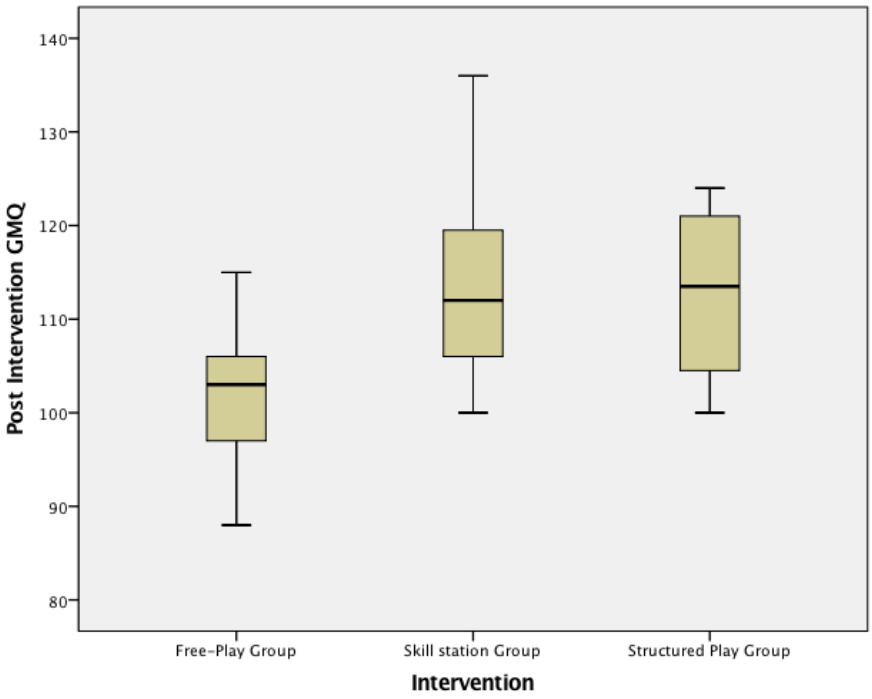
Following tests of normality, a repeated measures ANOVA was used to observe pre- and post-intervention GMQ scores. As detailed above, the GMQ is an age and sex-references score indicative of each child's overall movement ability. A summary of pre- and post-intervention results between the 3 groups can be found in Table 3. Prior to the intervention there were no significant differences in mean GMQ scores between the three groups, F (2, 48) =0.204, p=0.816. Following the intervention, both intervention groups

showed significantly higher mean GMQ scores compared to the free-play control group, $F(2,48)=10.26$, $p<0.05$ (See Figure 3). As seen in Figure 4, there was a significant main effect for time on GMQ scores $F(1, 48) =58.4$, $p<0.05$, $\varepsilon^2=0.55$, and a main effect for intervention on GMQ scores, $F(2, 48) =3.11$, $p=0.054$, $\varepsilon^2=0.12$ approached significance. Furthermore a significant combined effect of time and intervention was found, $F(2, 48) =14.4$, $p<0.05$, $\varepsilon^2=0.38$. A post-hoc Tukeys honestly significant difference test was completed obtaining a critical value of 5.23, further supporting the significance of results obtained.

Table 3 Summary of GMQ results before and after 8-week intervention.

	Pre-intervention GMQ results			**Post-intervention GMQ Results**		
Intervention	**Mean**	**Median**	**Std. Dev.**	**Mean**	**Median**	**Std. Dev.**
Free-Play	101.11	100.00	9.29	101.42	103.00	7.71
Skill Station	102.44	104.50	10.17	113.13	112.00	9.35
Structured Play	100.38	104.50	8.26	112.56	113.50	9.18

Note: GMQ = Gross motor Quotient, Std. Dev. = Standard Deviation



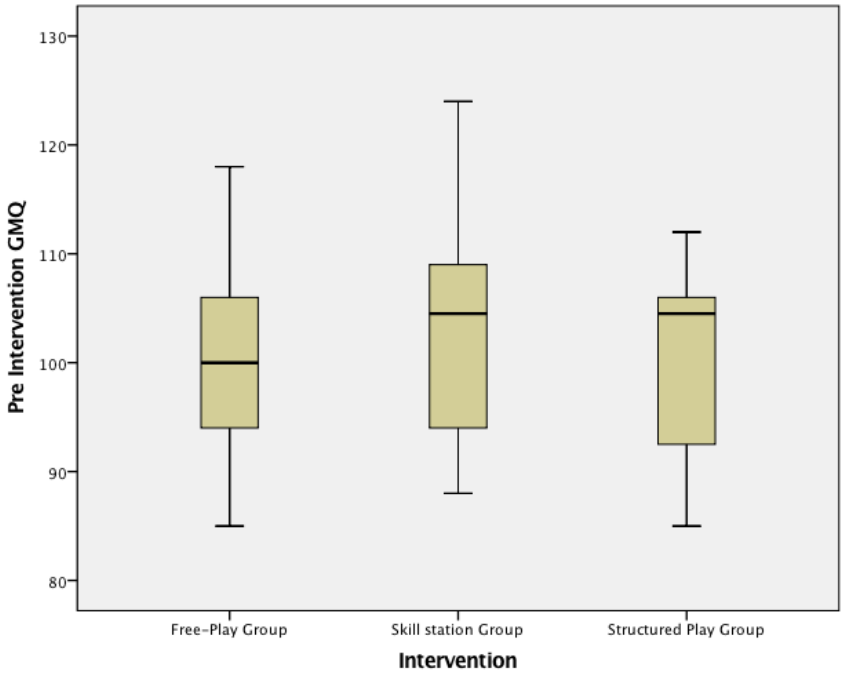


Figure 3 Gross Motor Quotient (GMQ) score distributions between the three groups pre- and post- intervention. No statistically significant differences were found in the pre-intervention scores, yet post-intervention GMQ scores were significantly higher for both the structured play and skill station groups compared to the free-play control following completion.

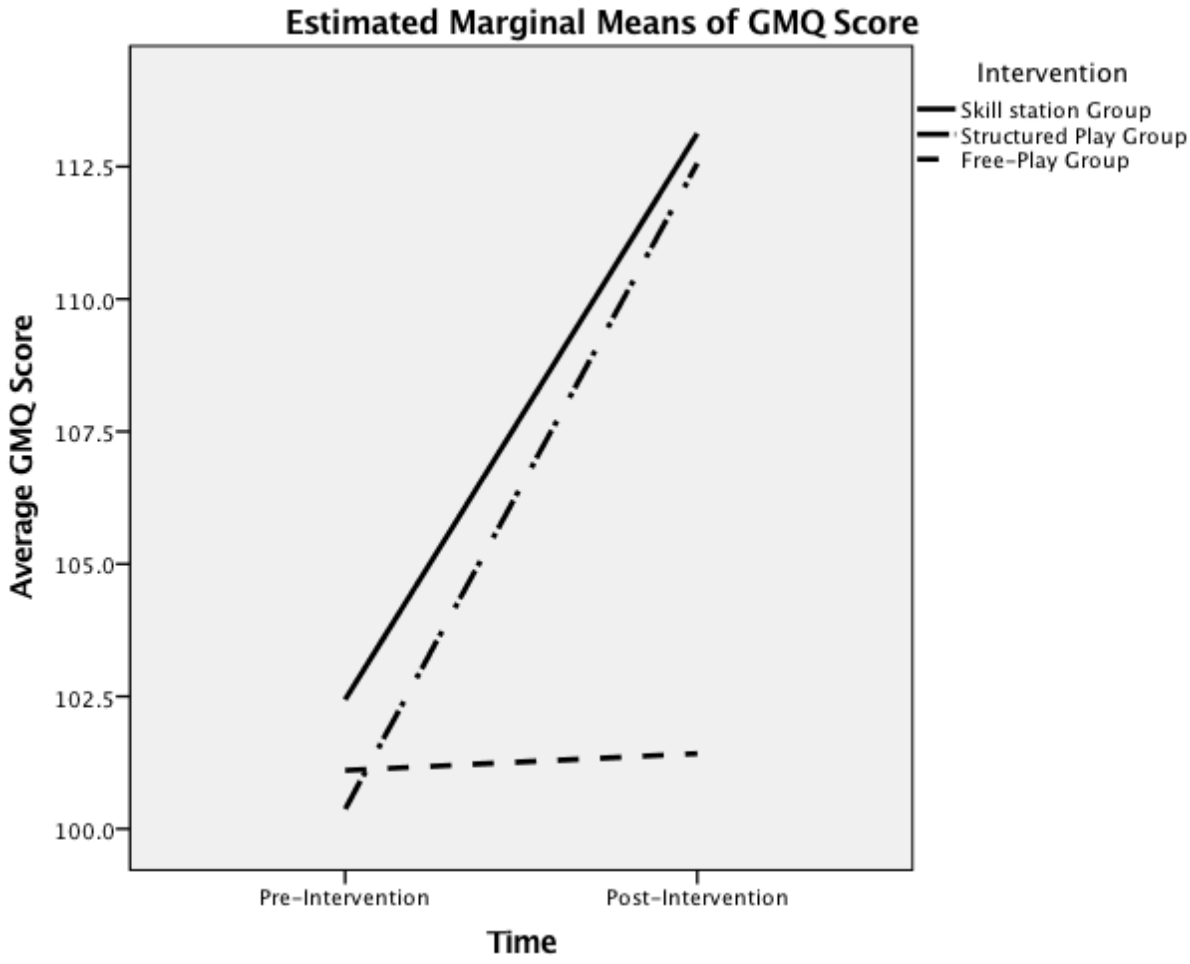


Figure 4 Pre- and post-intervention Gross Motor Quotient (GMQ) scores between the three groups showing a significant increase in GMQ scores following the 8-week intervention.

4.4 Enjoyment

Enjoyment ratings were collected on a weekly basis from the two intervention groups immediately following intervention completion. Children were required to colour in one of the faces on a 7-point Likert scale, ranging from 1 (very happy) to 7 (very sad) to show "How they are feeling" (See Figure 5). If a child coloured in more than one face, the teachers then asked the child to point to the face that shows "how they are feeling right now" and would mark down this score (See Figure 6). Enjoyment was collected as a

group average, and was not kept individual to the child. A non-parametric Kruskal-Wallace H. Test was completed to observe for any differences in mean enjoyment ratings between the two intervention groups. Results found no significant differences between the two groups ($\chi^2(1) = 0.934$, p=0.334). That being said, both groups showed high average enjoyment ratings with an overall average enjoyment score of 2.45 for the skill station group and 2.33 for the structured play group.

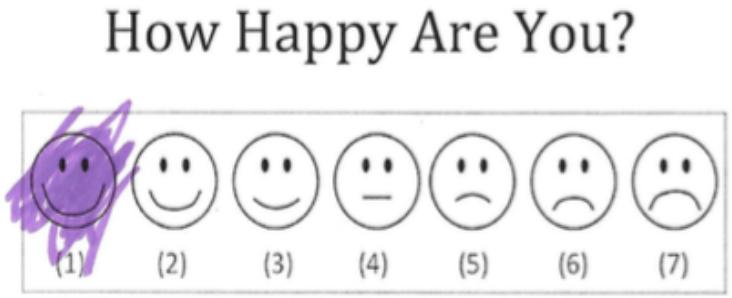


Figure 5 Example of a successfully completed enjoyment scale

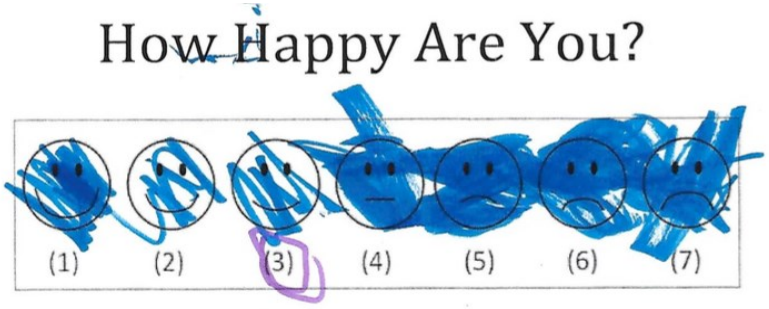


Figure 6 Example of an enjoyment scale requiring assistance.

4.5 Attendance

A One-way ANOVA found a significant between-group difference, F (2, 48) =7.037, p=0.002 (See Figure 7) with the skills station group reporting the lowest attendance.

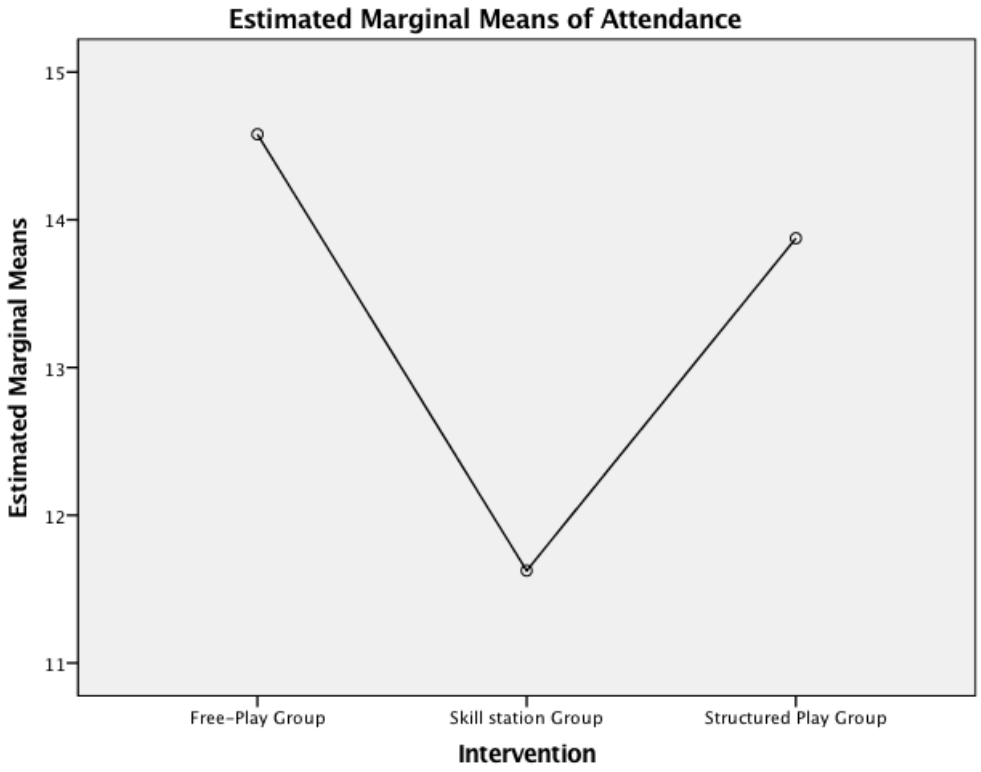


Figure 7 Graph demonstrating average attendance between the three groups.

4.6 Summary of Results

Throughout the course of the intervention, of the 68 participants initially recruited, 51 participants completed all aspects of the study. Despite finding no significant differences in GMQ scores between the three groups prior to the intervention, following completion, GMQ scores were significantly higher in both the skill station and the structured play groups. Attendance was obtained on a weekly basis from the two intervention groups (not from the free-play control) and scores showed no significant differences between the two intervention groups. Attendance was determined to be significantly lower for the skill station group compared to both the structured play and the free-play control.

Chapter 5 Discussion

5.1 Fundamental Movement Skill Ability

While the bulk of research to date has endorsed the use of structured skill-station-based learning, no study has systematically explored the potential of a structured play-based intervention in improving FMS ability. Accordingly, the primary focus of the current study was to explore the effectiveness of a structured play program for movement development.

In brief, using structured, age-appropriate movement-based games (AFL, 2016) we found the structured play intervention to be equally as effective as the skill-station approach in improving FMS in preschool aged children. Following baseline testing, no significant differences in GMQ scores between the three groups were found. When comparing pre- and post- intervention movement ability scores (i.e., GMQ of the TGMD-2), both the skill-station approach and the structured-play groups showed significant improvements in movement ability ($p< 0.05$) compared to the free-play control group (see figure 4).

Consistent with the literature and as hypothesized, the free-play control group GMQ score remained essentially unchanged over the duration of the 8-week study (Ignico, 1991; Goodway & Branta, 2003; Jones et al., 2011 etc.). While we did not observe any improvements in movement ability in the free-play group, it is important to note that the intent is NOT to trivialize the value of free-play. Free-play has a multitude of benefits for children's development ranging from improved social interaction to increased creativity and problem solving abilities (Ginsburg, 2007; Maxwell, Mitchell & Evans, 2008). Although free-play may not be an adequate means of improving movement ability, it is still a vital aspect of children's overall development and is not something that

we are suggesting be sacrificed in favour of alternative activities.

Within the structured play group, games initially focused on improving balance ability, which has been identified as a necessary foundational skill for the successful completion of all FMS. Following two weeks of balance work, games focused on locomotor based activities for two weeks, followed by two weeks dedicated solely to object control skills, and finished with two weeks of mixed lesson plans, working on all three aspects of movement development. Object control abilities include a variety of skills ranging from simple (e.g., kick, underhand roll, catch) to more complex (e.g., dribble, striking a stationary ball, overhand throw). For the most part, however, the Active for Life object control games worked with overhand or underhand throwing. Due to this limitation in the Active for Life lesson plan builder, one of the games was adjusted to incorporate kicking ability, and underhand throwing games were occasionally altered to incorporate underhand rolling. The more complex skills such as "dribble" and "striking a stationary ball", however, were not routinely practiced in this group as they did not incorporate well into group-based games. That being said, the children demonstrated an interest in using the batting tee again after baseline testing. Consequently, on one of the final sessions, we brought in the batting tee to let children have a turn practicing between games, however, individual skill technique was not adjusted, and the dribble skill was never practiced. On top of being a challenging task that did not work well in a group setting, children demonstrated no interest in revisiting the task. While not the primary purpose of the study, it was interesting to note that within the structured-play group, unpracticed skills, in particular dribbling, were also improved, despite only completing this skill in the baseline and post-intervention assessments. During baseline testing, the majority of children from all three groups were not able to complete the dribble task,

receiving no points, or a "did not complete" for the skill. The dribble skill was practiced three times over the course of the skill station approach and it was expected that improvements would be noted only in this group. During the final testing, however, it was observed that children in both intervention groups were more competent at the task. Although this was not validated statistically, the occurrence of a "did not complete" for the skill was a noticeable rarity in both groups. Although improvement was unexpected in the structured play group, results from a recent study exploring the effects of a movement intervention in preschool children focused exclusively on object control proficiency may explain these observations. Authors found increased dribbling skill ability even after a short, 6-week training session incorporating two 30-minute sessions per week. Their protocol involved sport-based drills and activities, similar to the skill station approach of this group. Authors suggested that more specialized skills, such as dribbling, require rhythmical movement patterns and improved hand eye-coordination while easier skills such as kicking, throwing and underhand roll rely specifically on practice and time-dependent familiarization (Donath, Faude, Hagmann, Roth, & Zahner, 2015). Thus, in the absence of any formal rehearsal, it is speculated that children in the play-based intervention improved their dribbling skill as a result of an overall improvement in movement ability and eye-hand coordination following the movement interventions. Consequently, a child's inherent ability for more complex skills, such as the dribble, may be improved without practicing the skill directly. Further research is needed however to fully illuminate these findings.

5.2 Intervention Design and Feasibility

A number of studies have been reviewed that imply play alone is not sufficient for fostering proper movement development. The current study however puts these findings

to question, suggesting that the lack of positive results within previous intervention free-play groups may not be inherent to play itself, but rather to whether or not children are incorporating *sufficient movement* into their play-time activities. Specifically, play was shown to be equally effective to the structured skill station approach when utilizing games that have been purposely developed to improve FMS ability. Although both approaches appear to foster equivalent improvements in movement development, a considerable difference between the skill and play-based interventions was the real-world application and feasibility of delivering the two approaches.

For example, one of the most challenging aspects of launching and maintaining the study was recruiting an adequate number of volunteers to help deliver the intervention. Although it was possible to complete the structured-play intervention with only two trained volunteers, a minimum of four were required to complete the skill-station lessons as planned. The skill stations also required a larger variety of equipment such as a batting tee, bowling pins, and various sized balls, whereas the structured-play group used primarily hoops and bean bags with the occasional additional prop such as balance disks. Furthermore, variability in child attendance had minimal impact on the group-based activities in our structured play, while alternating numbers for the skill station groups (due to child absence) required activities to be adapted at the last minute. Given often limited staff within early childcare centers, it is suggested that these are important factors to consider when looking at the overall feasibility of the two approaches. Correspondingly, associations have been found between poor movement development in daycare settings that have higher child-to-teacher ratios. In these cases, the focus falls primarily to basic hygiene and sustenance leaving less time to stimulate the children developmentally (Saccani, Valentini, Pereira, Müller & Gabbard, 2013). In Nova

Scotia, the mandatory child-to-teacher ratio is 8:1 for ages 3-5 years with a maximum group size of 24 (Province of NS, 2016). Despite these requirements however, it was observed while participating in the project that staff are still extremely busy with basic care and control, and unlikely to be supportive of changes that would require a significant increase to their work load. In particular, the additional help required to fully implement the skill station approach is greater requiring a minimum of 4:1 student to staff ratio and would be challenging, if not impossible, for the daycare staff to complete on their own. The structured play approach on the other hand, would be significantly easier for staff to incorporate into their daily routine and would present less of a burden. In addition to requiring less equipment to conduct the programming, the teachers can play the games with their entire class, without having to recruit additional help that would be required to successfully run the stations. Furthermore, the reduced equipment, personnel, and set-up would enable classroom teachers to play the games spontaneously, without the requirement of additional planning and preparation.

Another factor that contributed to the ease of intervention delivery was the space available for use at each site. Preschool design and layout has been found to be strongly correlated with increased PA participation, where the presence of large outdoor spaces is associated with increased PA participation (Tonge et al., 2016). Although we attempted to control for between-group variability by targeting two daycares from the same chain, their centers were quite different in terms of layout and design. At the structured-play site, we had a large indoor gym attached to the daycare that was used when weather did not permit outdoor activities. At that same location, there was a baseball diamond next to the daycare that could be used. By separating the children in the intervention from the rest of their peers, it was considerably easier to keep them focused on the scheduled

activities. In the skill station intervention location, we sectioned off a portion of the playground and kept children separated by building a wall of crates. While partially effective, children not part of the study would often wander over and attempt to join in on the activities. In addition to having other children occasionally interrupting, distraction levels were increased and some children often wanted to return and play with other friends who were not part of the intervention group. Moreover, no indoor space was suitable for completing the skill based activities at this location. Fortunately, there were no days when weather interfered with intervention completion. However, if this were to be an ongoing approach to movement development, a larger indoor space would be an asset to successful completion, particularly during the winter months. While access to an outdoor environment has been associated with increased PA participation (Kreichauf et al., 2012; Tonge et al., 2016), adverse weather also has a significant effect on PA rates. Chan and Ryan (2009) completed a large-scale review on the weather-related effects on PA participation and empirically concluded that while not all climates are affected, heavy rain or heavy snowfall seasons have been associated with decreased PA rates. All three Canadian studies included in the review confirmed that weather does have significant effects on PA participation. Therefore, although outdoor play space is an asset, it is also essential to have indoor space available to account for the adverse weather effects on PA participation.

5.3 Enjoyment

Bremer and Cairney (2016) recently completed a review exploring the health-related outcomes associated with FMS ability. On top of reiterating the importance of FMS ability for PA participation, fitness and a healthy body composition, they touched on the importance of enjoyment for the sustainability of PA participation. They stress the

importance of enjoyment for continued participation, as children will be less likely to keep practicing if they are not enjoying the activities, particularly in the younger years (Bremer & Cairney, 2016). Although more precise tools to assess PA enjoyment are available such as the Physical Activity and Enjoyment Scale (Kendzierski & De Carlo, 1991) and the Children's Assessment of Participation and Enjoyment (Imms, 2008), both are survey-based and were not designed for the young age of the current population. In the present study, a modified Likert scale, adapted from the patient mood assessment scale by Lorish and Maisiak (1986), which incorporates various levels of enjoyment ranging from a very happy to a very unhappy face, was used. Enjoyment scores were obtained solely for the two intervention groups on a weekly basis and were calculated as a group mean. Results for both groups were high with an average group enjoyment for the structured-play group of 2.33 and 2.45 for the skill-station approach (where a low score indicated higher enjoyment). Although it is acknowledged that this is a simplistic means of assessing enjoyment, no previous studies were found that attempted to assess enjoyment of a FMS intervention within a preschool population. Therefore, the current project was aiming to explore the feasibility of this measure of PA enjoyment within such a young group. While most children were able to complete the enjoyment scale, difficulties did arise for some. The enjoyment scale in Figure 8 provides an example of a form that was completed incorrectly and was not suitable for inclusion within the final analyses. This occurrence, however, was rare and for the most part children seemed to understand the concept well. On the few occasions where a child would fill in more than one face, one of the intervention volunteers would ask the child "how are you feeling right now" and would then circle the face that the child identified, an example of this was provided in Figure 6. Following study completion, in contrast to the stated hypotheses

that structured play would provide increased enjoyment, no significant differences were found between the two intervention groups. That being said, both groups displayed high enjoyment ratings overall, and while the structured skill-station approach was more controlled, activities still had to be completed in a playful manner to keep the young children engaged.

Figure 8 Example of poorly executed enjoyment scale.

Although no significant differences in enjoyment were found, it was interesting to note that children in the structured play group attended significantly more sessions than those in the skill station group. While these observations were not empirically validated and it is recognized that attendance is not a direct measure of enjoyment, it is believed that this may have acted as an additional indicator of enjoyment. It was observed that children actively demonstrated their right to consent by refusing to participate in the skill station group, as the weeks progressed, numbers dropped consistently and teachers were required to help try and convince some of the children to participate. This was not an issue in the structured play group and children were consistently eager to participate with the movement games. Although the average enjoyment ratings were similar, it is possible that the children who did not enjoy the skill stations stopped participating; representing the poor participation rates in that group. If attendance were mandatory, the overall

enjoyment of this group may have been lower. However, future work focusing more critically on enjoyment between different types of movement intervention approaches would be required to further this claim. Another focus of Bremer and Cairney's (2016) recent review highlights the importance of developing healthy associations with PA at a young age. They emphasize enjoyment as a crucial aspect of any interventions targeting preschool children in order to promote continued participation in the activities. If the activity is not enjoyable for the child, their participation will be hindered. It is suggested that this may have been a factor in the reduced participation numbers found within the skill station group of the current project. Authors stipulate that as children age, increased skill proficiency may outweigh the importance of enjoyment for continued sport participation. However, these FMS must first be mastered in an enjoyable fashion before individual skill proficiency can work as inherent motivator for children's PA participation (Bremer & Cairney, 2016). These claims further support the need for more research exploring the most enjoyable approaches to FMS based interventions in preschool populations.

5.4 Strengths and Weaknesses

A strength of the current project is that it addressed a gap in the literature by controlling for time spent engaged in play for all groups. In particular, unlike previous studies reviewed (Goodway & Branta, 2003; Goodway et al., 2003; Reilly et al., 2006; Jones et al., 2011) the current study ensured equal durations of time spent in PA for all intervention groups, including the free-play control, by recording attendance of two 45-minute session per week for all three groups. Another strength of the current project is that we observed how different types of movement interventions compared in terms of participant skill improvement and enjoyment. The majority of previous work explored

the effectiveness of the skill station approach (Goodway & Branta, 2003; Goodway et al., 2003; Hamilton et al., 1999; Ignico, 1991) and compared improvements in movement ability to a free-play control group. In the current study two different intervention approaches were compared to a free play control group that continued with their daily preschool curriculum. Importantly, data from this study showed that a *structured-play approach* was equally effective to the skill-station approach, thereby revaluing the importance of play to children's movement development.

Despite the positive results, a few challenges and limitations are worth noting. Arguably, the most difficult aspect of the intervention was the reliance on volunteers for successful completion. Although the recruited volunteers were, for the most part, excellent assets to the team, finding individuals who were willing to commit to the 8-week project was a challenge. Of the seven individuals who had originally agreed to volunteer, three obtained summer jobs and had to leave early, two had issues with acquiring the required documentation (e.g., criminal record and child abuse registry check) on time and had to start late, and only one was able to attend all of the 16 sessions to which they had originally committed. As a result, back-up volunteers were required and were contacted as needed when another volunteer was unavailable. Although the majority of the recruited volunteers were great with the kids and enjoyed the project, there was a noticeable difference when the individual was more experienced either working with children, or being in a leadership role. Studies show that when working in a preschool setting, the ability to adapt activities to each individual child's ability is necessary as children develop at different rates. Therefore, successful training on movement competence and motor development is extremely important for those who are in charge of running an intervention. Additionally, knowledge on the importance of PA

and motor competence along with individual enthusiasm for PA is extremely important to adequately encourage the children throughout their learning experience (Kreichauf et al., 2012). Although all recruited volunteers were university students primarily from the kinesiology department, their education was not specialized to the project. Having volunteers (or teachers) that were more experienced working in a movement development program, particularly with preschool children, is advised for future studies.

Furthermore, a shortcoming of the current project was that the lack of direct staff involvement in the conduct of the intervention. Not only would their experience working with preschool children have been helpful for intervention completion, research shows that the policies and practices implemented within a childcare setting plays a major role on the child's development (Pate et al., 2004; Bower et al., 2008). This is of particular importance at young ages as a child's behaviour is malleable and habits are not fully formed. By implementing positive health behaviours early on, it may be more likely for these habits to solidify and persist throughout life (Goldfield et al., 2102). Within the daycare setting, it is the directors and teachers who have control over this behavioural malleability, therefore their level of involvement in the intervention substantially influences the potential for long-term sustainability of the positive effects found following the intervention. Of note, there was a perceptible difference when staff was supportive of the intervention. For example, at the structured-play site, staff encouraged the children to behave during the sessions and presented the intervention as an exciting and special opportunity. Having this support from the staff made sessions at that location considerably easier. At the other site, sessions were completed on a section of the playground, limiting available space for the other children, and on the whole the staff was less encouraging. Goldfield and colleagues (2012) touch on this issue, highlighting how

personal beliefs or attitudes towards the importance of PA may affect how willing individual staff members may be to facilitate PA participation or the implementation of similar movement interventions. Authors state that the staff's willingness to comply with both the intervention and the testing procedures may play a role in how effective and efficient the testing days and intervention sessions run. The current study supports this claim, as not only did support vary greatly between the staff members at both sites, but certain individuals voiced concern that the interventions took away from the creative importance of free-play, without the understanding that we were targeting an entirely different aspect of development. It has been suggested that early childhood educator training may benefit from additional knowledge related to the importance of promoting PA, reducing sedentary behaviours and ways to effectively assist movement development throughout each stage of the preschool years (Committee on Obesity Prevention Policies for Young Children, 2011). Overall, increased staff education and involvement is suggested for future movement development interventions in this population for both ease of delivery and potential long-term benefits.

On top of volunteer commitment and skill, as aforementioned, location had an effect on how well the lessons ran. It was particularly noticeable in the skill station group where children were still on their playground, partially separated from their peers. Having the possibility of easily connecting with their friends made it significantly more challenging to keep the children engaged. It is suggested that for future studies interventions should be completed at a location that has minimal distractions, as was done with the structured play group. For the current project, children were recruited from various classrooms at each site to complete the intervention. If this were to be completed with the daycare staff directly, parental consent would not have been required. Consequently, it would be easier

to have the entire classroom partake in the activity, avoiding excessive distractions and ensuring full participation.

Finally, limitations in study design were also noted. Specifically, as research assistants were not actively blinded to group allocation there was the potential for assessor bias during the testing procedures. For future studies it is suggested that external assessors be blinded to group allocation. Furthermore, the lead researcher's direct involvement in all aspects of the study has been highlighted as a limitation. On top of planning the study, the lead researcher led all interventions and assisted with movement interventions at all three sites. Although this increases the risk for potential bias, given the scope and nature of the graduate project it was felt to be an unavoidable limitation.

5.5 Practical Implications and Future Research

Although the primary objective of the current study was to explore overall movement development following different intervention approaches, it is felt that there were additional lessons learned worthy of mention. An interesting observation that was consistent across all groups was how the intervention introduced the children to new movement skills. In some cases, children genuinely believed they could not complete the new task as they had simply never thought to try it. In particular, this was noted with the "hop" skill where children were asked to hop on one foot three consecutive times. At baseline, many of the children stated "I can't do that" and wouldn't even attempt the skill. Over the course of both the structured skill and game-based interventions, this skill was revisited often. Once introduced to these more complex skills, the children began practicing them and wide-scale ability improvements were noted. This touches on the importance of positive reinforcement and encouragement where even a positive association with the possibility of completing a task seemed to have helped children

overcome mental barriers in their own movement development. The optimal ways to encourage this type of self-directed learning may warrant further study.

It is suggested that the findings from this study are an asset to the field of physical literacy and movement development within the preschool population. While the discovery that free-play alone is not sufficient to foster proper movement skill development is not novel, the capacity of structured play to provide improvements in movement development, equal to those create by a structured skill-station based approach, is significant. An equally important finding was the relative ease in which the structured play approach was implemented in the daycares daily routine, requiring fewer teachers and less equipment to complete. This is extremely important for such a program's feasibility and successful implementation.

Another important aspect to the program's success relates to the staff's competence and beliefs related to PA. It was noted that during the free-play time, daycare staff was minimally involved with the children's play. This time was a break for the staff, where they only had to get involved if an injury or disagreement arose among children. With this in mind, trying to impose change during a time that is taken as a break may not be well-received. However, research has found that when teachers observe passively during free-play activities, as opposed to engaging with the children, PA behaviours tend to be more sedentary (Brown et al., 2009). As aforementioned, the support of the daycare staff is crucial and a shared knowledge of the importance of the implementation of movement development programs may help to encourage staff to take part in the activities (Goldfield et al., 2012). A better understanding of how the teacher's own behaviour affects those of the children may help to promote positive behavioural adaptations.

Despite the importance of staff participation and support for successful movement

interventions, it is acknowledged that early childcare educators already have a busy work load. In an attempt to ease transition into such types of activities, the current project has provided all involved locations with a copy of both complete lesson plan manuals along with the required information to create their own lessons for other age groups at their center. On top of providing lesson plans for games tailored to movement development, Active for Life provides an assortment of education on the importance of PL, which may further assist the development of PA-related staff knowledge. Increased levels of training and PA knowledge for childcare providers have been associated with increased activity levels for the children that they are caring for (O'Connor & Temple, 2005). A recent Canadian study explored the effectiveness of increasing teacher involvement and education specifically. Their approach differed significantly from the current study as focus was solely on educating the staff of the involved daycare facilities. Staff members were instructed on ways to promote PA participation (e.g., increased outdoor playtime and adjusting the environment to free-up more space for movement) and were provided with the Healthy Opportunities for Preschoolers manual, providing examples for how to encourage active play. Along with the manual, staff received PA kits with toys and props to encourage movement (e.g., balls, bean bags, etc.) and intervention binders with additional resources such as the Canadian PA and Sedentary Behaviour Guidelines, and recommended weekly activity plans. Following a six-month period, results found significant improvements (p=0.025) in overall movement ability for children under the watch of teachers that had received the training, but not for the control groups that continued with normal curriculum (Adamo et al., 2016). These reports are promising as they demonstrate that by providing assistance to the staff in the form of increased education on PL and the importance of active play, improvements can be made.

Furthermore, the easily accessible free online resources that have been provided with the current study allow staff to make use of this material when they have the time and are willing to do so, as opposed to forcing change on an already overwhelmed staff. By easing this transition, it may create more positive associations and beliefs regarding movement programs for the teachers and directors, ultimately increasing the overall success of the program.

5.6 Conclusion

Increasing levels of physical inactivity within the preschool population pose an immediate and long-term threat to the health and well-being of children. As FMS skills have been associated with increased PA rates both on the short and long-term, finding ways to improve FMS ability within the preschool population is essential. Following a review of the available literature, design limitations were noted and the current study sought to fill these gaps by exploring the effectiveness of a structured play movement program, comparing it to both a free-play control and the commonly used and effective skill station approach. Following study completion, both intervention types showed equivalent improvements in movement ability, highlighting structured play as an adequate means of FMS development. While both programs proved to be effective, the structured play approach was significantly easier to implement. Due to the already demanding workload of childcare professionals, the structured play program is suggested as a more feasible and sustainable approach for increasing movement development within early childhood centers.

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Appendices

Appendix A

Fundamental Movement Skill Play-based Intervention Outline

Week	Lesson	Focus	Equipment	Games
1	Lesson 1	Balance	Bean bags, benches, buckets, cones, hoops and low beams	- Connect it - Freeze and Thaw - Feed the Shark - Animal Balance - One-foot Hot Potato
	Lesson 2	Balance	Balance beams, bean bags, chalk (outdoor), cones, foam blocks, mats, ribbons, ropes, skipping ropes, strings, tape and thin mats	- Follow the leader - One-foot Hot potato - Cross the River - Line Statues - Animal Balance
2	Lesson 1	Balance	Balance beams, foam blocks, skipping ropes, tape and thin mats	- Simon Says - Cross the River - Balance tag - Connect it - Traffic Light
	Lesson 2	Balance (best-of)		
3	Lesson 1	Locomotion	Bean bags and 2 hoops	- Simon Says - Head and Shoulders - Animal walk/warm-up - Move and Grab
	Lesson 2	Locomotion	Bean bags and 2 hoops	- Be free and do like me - Bean bag body freeze - Move and grab - Animal walk - Head and Shoulders
4	Lesson 1	Locomotion	Bean bags and hoops	- Making shapes - Simon Says - Bean bag body freeze - Statue game - Island hopping
	Lesson 2	Locomotion (Best-of)		
5	Lesson 1	Object Control	Baskets, bean bags, bowling pins, foam blocks, hoops	- Follow my Throw - Target throwing overhand - Fruit Basket - Through the hoop - Circle bowling

Week	Lesson	Focus	Equipment	Games
5	Lesson 2	Object Control	Baskets, bean bags, bowling pins, foam blocks, hoops, inflatable pool, large box, large container	- Overhand throw to partner's hoop - Target throwing overhand - Musical hoops - Fill the pool - Circle bowling
6	Lesson 1	Object Control	bean bags, bowling pins, foam blocks, hoops	- Follow my throw - Overhand throw to partner's hoop - Hoop elimination - Fruit basket - Musical hoops
	Lesson 2	Mixed	Baskets, bean bags, cones, hoops	- Space bubble - Head and shoulders - Balance tag - One-foot hot-potato - Island hopping - Target throwing overhand
7	Lesson 1	Mixed	Balance beams, bean bags, bowling pins, chalk (outdoor), foam blocks, ribbons, ropes, skipping ropes, strings, tape, tape (indoor), thin mats, wood slats	- Line statues - Cross the river - Statue game - Bean bag body freeze - Circle bowling
	Lesson 2	Mixed	Bean bags, benches, buckets, hoops, inflatable pool, large box, large container, low beams	- Simon says - Feed the shark - Animal walk warm-up - Animal walk - Through the hoop - Fill the pool
8	Lesson 1	Mixed	Bean bags & hoops	- Traffic light - Freeze and thaw - Making shapes - Move and grab - Hoop elimination - Musical hoops
	Lesson 2	Mixed (Best-of)		

Appendix B

Structured Play Intervention Example Lesson Plan

Lesson 1

At a glance: Balance 3 - 5 years
TIME: 46 minutes
SKILL: Balance
EQUIPMENT: bean bags, benches, buckets, cones, hoops, low beams
ORGANIZATION: Dalhousie University
ACTIVITY LEADER: Lindsay
GROUP NAME: Structured Play Intervention
Notes: First lesson - Intro to balance. Start with balance demonstration followed by 5 short games geared around balance.

Introduction (1 - 2 minutes) Call the children into a circle or into designated lines and greet them. Explain any special safety rules and remind the children to stop, look, and listen whenever you signal. Explain in 20-30 seconds what you will be doing today.

Balance Demonstration (5 minutes)

GAME 1 – Connect it (8 minutes)

- Leader asks the children to move around the activity space when music starts (walk, run, hop, gallop or skip).
- When the music stops, leader calls out two body parts.
- Children join together those two body parts and freeze in that position.
- Suggested body parts:
  - *hand to foot*
  - *foot to foot*
  - *elbow to knee*
  - *hand to shoulder*
  - *head to hand*
  - *knee to ankle*
  - *foot to head (sit to do this)*
- Allow children to freeze for 3-5 seconds.
- The leader can ask the children to "switch" and join the opposite body parts together

Tips

- Praise children for being creative.
- Demonstrate the positions for children who have difficulty.

GAME 2 – Freeze and thaw (7 minutes)

- Leader asks children to walk or slowly jog a short distance behind.
- When leader turns around, children must "freeze" on the spot.

- For extra challenge, children can "freeze" standing on one foot.
- Children who move or fail to stop quickly collect a "thaw" point.
  - *"Who can avoid collecting thaw points"?*
- Play several rounds. For each round, the leader can change the type of locomotion to skipping, galloping, etc.
- Allow children to take turns as the leader each new round.

Tips

- Choose deserving leaders
- Build confidence in shy leaders
- Praise followers who "freeze" well
- **Cues**
  - *Bend knee(s) and "freeze"*
  - *Arms out if standing on one foot*

GAME 3 – Feed the shark (10 minutes)

- Leader sets up a low beam or bench for children to walk across the "water".
- Leader places a bucket or hoop on the floor at one end of bench. This is the "shark".
- Leader gives each child a bean bag as "food".
- Leader explains that they will work as a team to feed the shark.
- Leader demonstrates how to bring food to the shark by crossing the "bridge" (beam).
  - *"When you reach the end of the bridge, throw your food to the shark (hoop)".*
- Children then return to the start of bridge and the next child goes.
- Explain that the goal is to get as many pieces of food into the shark's mouth as they can before time runs out (2 minutes per round).

Tips

- Keep track of how many pieces of "food" go into the hoop.
- Repeat activity and challenge the children to beat their record.
- **Cues**
  - *Arms like wings*
  - *Arms straight*
  - *Look forward*

GAME 4 – Animal balance (8 minutes)

- When the leader says "Simon says...", children watch what the leader does and then follow the command.
- The leader should hold each balance position with the children for 10-15 seconds before giving another command.
- If the leader does not say "Simon says..." before a command, children remain still.
- If a child moves when the Leader does not say "Simon says...", the child must stand up quickly and chase their tail once around before resuming the activity.
- Suggestions for animal commands:

- *Star fish up (on back with hands, head, and feet in the air)*
- *Star fish down (face down, hands and feet spread wide with hips in the air)*
- *Crab position*
- *Three-legged crab (lift either hand or foot for 5 seconds at a time)*
- *Dog pointing (on all fours, pointing with either leg or arm)*
- *Frog pose (hands and feet flat on the ground, squatting low)*
- *Downward dog (yoga posture)*
- *Upward dog / cobra (yoga posture)*

Tips

- Leader can choose a child to demonstrate an animal for others to copy.
- Allow the children to be creative and have fun.

GAME 5 – One-foot hot potato (8 minutes)

- Leader uses cones to create a "square" in the center of the activity space.
- Children spread out inside square.
- Leader chooses 1 or 2 children to be "it".
- Leader explains that they will be playing "one-foot hot potato".
- Everyone must hop on one foot inside the square.
- Children who are "it" have a bean bag (hot potato) and must try to tag others.
- When a child is tagged, they are given the bean bag from the person who was "it" and they become "it".

Tips

- The square should not be too large.
- Allow for the hot potato to be passed several times.

Wrap-up (2 minutes) Call the children back into a circle and review what they learned today. When you shoot, why do you need airplane wings?

NOTES – Review lesson and suggest any areas for improvement

_____

_____

_____

_____

Favourite Game: _____ Why? _____

_____

Least Favourite Game: _____ Why? _____

_____

Appendix C

Structured Skill Station Approach Intervention Outline

Week	Lesson(s)	Focus	Equipment	Skill Stations
1	1 & 2	Balance	Balance disks, tape, bean bags	1: Balance Disk Games 2: Imaginary Balance Beam 3: One-foot Stand Challenge 4: Bean Bag Balance
2	3 & 4	Balance	Balance boards, balance disks, exercise balls, skipping ropes, bean bags, tape	1: Balance Boards 2: Exercise Ball Challenge 3: Balance Obstacle Course 4: Hop Scotch
3	5 & 6	Locomotion	Tape, animal cut-outs, hoops, ropes, blocks, (objects to jump over), bean bags	1: Imaginary Beep Test (basic) 2: Move like a… 3: Jumping Obstacle Course 4: Follow the Leader
4	7 & 8	Locomotion	Tape, jump ropes, balance beams, hoops, objects to jump over	1: Imaginary Beep Test (advanced) 2: Jump Rope 3: Locomotor Obstacle Course 4: Egg Races
5	9 & 10	Object Control	Balloons, balls to throw, bowling pins/balls, batting tees with bat and ball	1: Balloon Kicks 2: Catch and Throw 3: Bowling 4: Striking Practice
6	11 & 12	Object Control	Balls to dribble, balls to throw, tape and Bristol board (targets), soccer balls, pylons, bean bags	1: Dribble Tag 2: Target Practice 3: Pairs Soccer 4: Bean Bag Catch
7	13	Mixed	Balance disks, tape, bean bags, batting tees with bat and ball	1: Balance Disk Games 2: Imaginary Beep Test 3: Hop Scotch 4: Striking Practice
	14	Mixed	Balance boards, bowling pins/balls, balloons, jump ropes	1: Balance Boards 2: Bowling 3: Balloon Kicks 4: Jump Rope
8	15	Mixed	Bean bags, exercise balls, soccer balls, pylons	1: Bean Bag Catch 2: Exercise Ball Challenge 3: Simon Says 4: Pairs Soccer
	16	Mixed	Balls to dribble, bean bags, animal cut outs, tape and Bristol board (targets)	1: Dribble Tag 2: Bean Bag Balance 3: Move like a… 4: Target Practice

Appendix D

General Skill Station Lesson Breakdown

- **Group Warm-up (5-7 minutes)**
  - Consists of a game or movement activity to warm up the muscles and prepare the body for the activities at the skill stations, led by the lead investigator.

- **Skill Station cycles: (7 minutes per station, approximately 30 minutes)**
  - Prior to starting, have educator carefully demonstrate the skill(s) of interest to the group (detailed skill criteria manuals provided separately).
  - Children work in small groups and progress to the different levels as appropriate.
  - Small group size necessary for educators to successfully provide constructive feedback on the skills.
  - One educator present at each station to demonstrate and monitor while providing feedback. Lead researcher circulates between groups to ensure proper flow and address any unforeseen concerns.

- **Group Cool Down (5-10 minutes)**
  - Review of the skills learned by lead investigator – following same skill criteria provided to each individual educator.
  - Play a game or movement activity based around the skills of focus for the lesson plan to cool down and tie it all together, led by lead investigator.
  - Team stretch led by lead investigator.

Appendix E

Example Lesson Plan – Skill Station Approach

SKILLS: Balance
EQUIPMENT: Balance disks, tape, bean bags
NOTES: Use same skills for lessons 1 & 2 (WEEK 1) – demonstrate each activity before starting. I Will demonstrate each station during the introduction and then provide another demonstration before children start their skill practice. Balance is an all-encompassing skill that is necessary for all other movement skill abilities. There are no "specific" skills you are looking for but the different tasks will all help to improve balance overall so be sure to provide all the different options/skill levels.

Introduction (led by Lindsay)

Call the children into a circle or into designated lines and greet them. Explain any special safety rules and remind the children to stop, look, and listen whenever you signal. Explain what they will be doing at each station today.

Warm-Up Activity - Simon Says (led by Lindsay)

- When the leader says "Simon says...", children watch what the leader does and then follow the command.
- The leader should hold each balance position with the children for 10-15 seconds before giving another command. **If the leader does not say "Simon says..." before a command, children remain still.
- If a child moves when the leader has not said "Simon says...", the child must quickly sit down and stand up. This saves them from being eliminated.
- Suggestions for commands:
  - *Wide star (legs wide, arms wide)*
  - *Narrow star (legs together, arms wide)*
  - *Reach up high (legs together, hands together reaching up)*
  - *Reach up very high (on tippy toes)*
  - *Squat / chair (arms forward, knees bent)*
  - *Landed airplane (arms out to side, lean forward, front leg bent, back leg stretching straight back with toes touching the ground)*
  - *Advanced challenge: Stork stand / tree stand (balance on one foot, other foot placed against support leg below knee, arms stretched out at sides at shoulder height)*

Tips

- Leader can choose child to demonstrate a balance position for others to copy.
- Praise children for staying balanced.
- Cues
  - *Head up*
  - *Look forward*
  - *Hold yourself steady*

Skill Stations (Each volunteer responsible for ONE of the 4 stations)

- **Skill Station 1:** Balance Disk Games
    - Use balance disks at varying levels to work on balance
        - **Level 1:** two feet standing
        - **Level 2:** one-foot
        - **Level 3:** two feet eyes closed
        - **Level 4:** one-foot eyes closed
    - If children get bored set the disks up in a row and have them practice walking across the balance disks.
- **Skill Station 2:** Imaginary Balance Beam
    - Put tape on the floor to simulate a balance beam – have a wide and a thinner option
        - **Level 1:** walk slowly
        - **Level 2:** fast walking
        - **Level 3:** hop with 2 feet along line
        - **Level 4:** hop with 1 foot along the line
        - **Level 5:** complete with a bean bag on the head
- **Skill Station 3:** One-foot Stand Challenge
    - Have children compete in a time challenge to see who can stand on one foot the longest.
    - If children start to get bored, turn into a "follow-the-leader game where they mimic your movements while standing on one-foot. (E.g.: move arms, lift leg, bend knee etc.)
        - **Level 1:** right foot
        - **Level 2:** left foot
        - **Level 3:** right foot eyes closed
        - **Level 4:** left foot eyes closed
- **Skill station 4:** Bean Bag Balance
    - Have children place a bean bag on the head and walk around while keeping the bean bag balanced.
        - **Level 1:** slow walking
        - **Level 2:** fast walking
        - **Level 3:** try different movements (e.g.: bending knees, moving arms around, small jumps etc.)
    - Once the skills are getting better, if a bean bag falls off have make the child freeze until another classmate comes over, picks up the bean bag and places it back on their friend's head while STILL balancing their own.

Cool Down Activity (led by Lindsay)

Kid-stretches

NOTES – Review lesson and suggest any areas for improvement

What worked: _____ Why? _____

What didn't work: _____ Why? _____

Appendix F

Informed Consent Form

DALHOUSIE UNIVERSITY

CONSENT FORM

Project title: Project PLaY: Physical Literacy and the early Years

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Introduction
We invite your child to take part in a research study being conducted by myself, Lindsay Roach, a student at Dalhousie University as part of my Master's degree program. Your child's participation in the study, entitled "**Project PLaY: Physical Literacy and the early Years**" 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 to withhold them from participating in this research. The study is described below and the information provided clarifies what is involved in the research, what your child will be asked to do along with any benefit, risk, inconvenience or discomfort that they may experience.

You should discuss any questions you have about this study with Lindsay Roach or her supervisor Dr. Melanie Keats. Please do not hesitate to ask as many questions as you like and should questions arise later, please contact the lead researcher.

Purpose and Outline of the Research Study

Physical inactivity is a growing concern for the health of Canadian children. Research has found that improved movement skills (e.g., running, hoping, throwing, balance) are linked with increased physical activity participation. While current research suggests that unstructured free-play seems unable to improve these skills, structured skill-based interventions have proven successful. Sadly, research also shows that play is becoming less physically active. As a result, children are spending less time moving and practicing the basic movement skills that are needed to support lifetime physical activity. Therefore, we must find ways to encourage more physically active play in our young children. The purpose of this study is to explore the effects of a structured play-based and a structured skill instruction-based movement intervention on children's movement skill ability. In addition to examining improvements in movement ability, this study will examine which approach is most enjoyable. This study will take part in three separate Willowbrae Academies located in the Halifax Regional Municipality. Two of the centers will be randomly (selected by chance) chosen to receive one of the two movement intervention approaches and the third will serve as a free-play control by continuing with the regular daily preschool curriculum. All participating children will complete assessments of movement skill ability before and after the 8-week interventions or established daycare curriculum using the 2nd edition of the Test of Gross Motor Development. During this test, which requires approximately 20 minutes to complete, your child will be asked to perform 12 movement skills. These include: run, hop, leap, gallop, slide, horizontal (i.e., side-to-side) jump, over-hand throw, strike, underhand roll, stationary ball bounce, two-hand catch and kick. With both you and your child's permission these tests will be videotaped to allow improved analysis of each child's skills**.** ***If you or your child objects to being videotaped, but still wishes to participate in the study, they will be able to do so.*** In these cases, the lead researcher will be required to score the child's performance directly at the time of the assessment.

Following study completion, we will be offering an optional 8-week intervention to the control group. This will consist of whichever intervention type was shown to be the most effective and enjoyable for the children assigned to one of the two intervention groups. We will also provide the daycare staff with the full lesson plan collection for these interventions along with training on how to successfully deliver the interventions to the children.

In addition to this study, we will also be conducting a small sub study that will be looking into the relationship between total physical activity participation and movement skill ability. If you agree to participate in this part of the study, your child will be provided with a small device, known as an accelerometer that is worn around the waist that will measure the amount and intensity of your child's daily physical activity. Should you agree to allow your child to participate in this additional portion of the study, we will arrange a time to introduce you and your child to the accelerometer. ***Please note:*** **Your child does not have to participate in this portion of the study to be included in the larger study.**

Who Can Take Part in the Research Study

Children enrolled in the daycare program between the ages of 3-5 years of age, that will be present for the entire duration of the study, and have no pre-existing cognitive (i.e., Down Syndrome or severe autism), or motor impairments (such as significantly delayed movement development), are eligible to participate in the study. Should any pre-existing impairment cause undue risk to the child if they were to participate, those children, along with those who do not consent to participate, will continue with their normal preschool curriculum during the intervention time.

What Your Child Will Be Asked to Do

Your child will be asked to take part in an 8-week movement skill intervention program. Prior to starting the program and following its completion, your child will be asked to complete a 20-minute movement skill assessment. These will be completed individually, and those children not being tested will participate in small group, game-based activities. Each child will be assigned to an individual assessor and will return to the group when the test is complete. ***With your permission,*** movement performance during these tests will be videotaped to allow more precise skill assessment, and to allow more than one assessment to be completed at a time. Trained research assistants will help complete the skill assessments. Videos will be destroyed following their review and final scoring.

During the 8-week intervention, children will participate in two 45-minute intervention sessions per week involving either play-based movement skill development involving the whole group, or directed skill-focused instruction where the children will rotate through a series of skill stations in smaller groups. All activities will be focused on specific movement skills including movement skills, such as running and hopping, object control skills, such as kicking, throwing and catching along with general balance ability. Those who are in the control group will continue with their daily preschool curriculum with the lead researcher present one day a week to observe and record the children's activities.

If you agree to allow your child to participate in the sub-study, your child will be asked to wear an accelerometer during waking hours for a period of 9 days at the beginning and end of the intervention. A diary will be provided and you will be asked 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.

Possible Benefits, Risks and Discomforts

While it is anticipated that the movement interventions will provide improvements in movement skill ability for your child, there are no guaranteed direct benefits. However, while participating in this study may not benefit your child directly, we hope to gain insight on the ideal methods to improve movement ability through motor interventions, along with their relative enjoyment. It is hoped that this new knowledge will benefit others by contributing to the growing area of knowledge regarding preschool movement skill development.

The risks associated with this study are minimal, and there are no known risks for participating in this research beyond your child becoming bored or fatigued. When performing the movement skill tests it is possible that your child may get tired; however, at any point during the test, they will be able to take breaks, or stop if they find the test too tiring. It is also possible that your child may feel anxious during the test, if they are not comfortable being observed or feel that they are being compared to other children. All efforts to make the testing process fun and enjoyable will be made to minimize initial worry. It is also important to note that we are not comparing skills between students. Rather, we are simply observing the movement patterns of each child. In an effort to allow the children to become familiar with the lead researcher, Lindsay Roach will be attending all three Willowbrae locations to meet with the participating children prior to the start of the study. It is hoped that having an opportunity to meet and get to know Lindsay prior to testing will further reduce any anxiety they may experience during testing. Note that your child's daycare teacher will also be present for all testing and study training sessions.

Following the movement intervention sessions, your child may have slight muscle soreness, but this would be no greater than performing general physical activity, similar to that completed during their regular preschool curriculum. If the child complains about any pain or discomfort during the test, they are able to take breaks as required. If this occurs during the interventions, children are also able to take breaks and the activity can be modified as necessary to reduce intensity or duration of each task.

There risks associated with the use of accelerometers are low. They will be worn around the waist and are firmly attached to an elastic waistband to prevent the small device from falling from your child's clothing. If the device causes any discomfort to their child while they are wearing it around their waist, they can remove it at any time. Although durable, should the accelerometer fall off your child and break, a small broken off piece may present a choking hazard to children under the age of 3. For this reason, please keep the accelerometer out of reach of children under the age of 3.

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. However, your child's name will not be used on any testing sheets or reports and all data related to movement skill abilities will be linked solely to participant ID numbers. 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 in Dr. Keats' secure research laboratory at Dalhousie University. All identifying information will be available solely to the lead researcher and her supervisor. Movement skill test videotapes will be destroyed following assessment. However, if you or your child does not wish to be videotaped they will still be able to participate in this study.

It is anticipated that we will describe and share our findings through a thesis paper, presentations, and ideally publish the final results in a journal article. 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***. 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.

For the Accelerometry sub study data stored electronically will be stored on password-protected computers accessible only to the lead researcher, her thesis supervisor (Dr. Melanie Keats), and committee member (Dr. Michelle Stone). Dr. Michelle Stone's research expertise is in accelerometry-measured physical activity behaviour in children and youth, and she will be responsible for analyzing and interpreting accelerometry data collected. Hard copy data (I.e., accelerometer tracking logs) will be stored in a locked and secure area within the Department of Kinesiology at Dalhousie University for at least 5 years.

If You Decide to Stop Participating

If at any point during the study you or your child no longer wishes to take part in the research project, you and your child are free to do so. In such cases the child will continue with the regular preschool curriculum, as opposed to participating in the movement skill intervention. We ask that you inform the research team as soon as possible by contacting the lead researcher; Lindsay Roach by telephone at (902) 580-1988 or email at LN271215@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. Once your child has completed the study, however, no data will be removed.

How to Obtain Results

Activity summaries will be provided to participating children in the daily report following the interventions to provide any highlights or issues with each group and to keep parents informed of study progress. Following study completion, a short description of group results will be provided to daycare staff and parents. No individual results will be provided at this time, however, if you are interested in obtaining your child's movement skill results, include your contact information at the end of the signature page and individual results will be delivered following study completion.

Questions

I am happy to discuss any questions or concerns you may have about your child's participation in this research study. Please contact Lindsay Roach or her supervisor at any time with questions, comments, or concerns. We will also keep you informed of any new information that could affect you or your child's decision to participate.

If you have any ethical concerns about your child's participation in this research, you may also contact Research Ethics, Dalhousie University at (902) 494-1462, or email: ethics@dal.ca providing reference

to REB file # 2016-3787

Signature Page

Project Title: Project PLaY: Physical Literacy and the early Years

Lead Researcher:
Lindsay Roach, MSc (c), Dalhousie University
P: (902) 580-1988
Email: LN271215@dal.ca

"I have read the explanation about this study. I have been given the opportunity to discuss it with my child, and my questions have been answered to my satisfaction. I hereby consent to my child taking part in this study. However I realize that my child's participation is voluntary and that I am free to withdraw my child from the study at any time and that my child is free to withdraw him/herself from the study at any time.

_____	_____	_____"
Parent's Name	Signature	Date

_____
Child's Name

I agree that my child may be videotaped for the purposes of data collection ☐Yes ☐No
I agree that my child may participate in the accelerometer sub study ☐Yes ☐No

If you have consented to the accelerometer sub study:

To ensure that your child's accelerometer data is collected an email reminder will be sent out to you the day before we collect accelerometers and their accompanying diary. Please provide us with an email address to send this reminder.

Email address: _____

Please provide your contact information if you wish to receive your child's individual results:

Name: _____

Address/E-mail:

_____

_____

Appendix G

Ethics Approval Letter

DALHOUSIE UNIVERSITY
Research Services

Health Sciences Research Board Letter of Approval
March 11, 2016
Ms. Lindsay Roach

Dear Lindsay,

REB #: 2016-3787
Project Title: Project PLaY: Physical Literacy and the early Years

Effective Date: March 11, 2016
Expiry Date:

The Health Sciences Research Ethics Board has reviewed your application for research involving humans and found the proposed research to be in accordance with the Tri-Council Policy Statement on *Ethical Conduct for Research Involving Humans.* This approval will be in effect for 12 months as indicated above. This approval is subject to the conditions listed below which constitute your on-going responsibilities with respect to the ethical conduct of this research.

Sincerely,

Dr. Brenda Beagan, Chair

Appendix H

Eligibility Screening Form

DALHOUSIE UNIVERSITY

Project PLaY: Physical Literacy in the early Years

Eligibility Screening From

Child's Name: _____

1. Is your child between the ages of 3 and 5 years of age? ☐Yes ☐No
   Date of birth: _____
2. Has a doctor ever told you that there are types of exercises or physical activity that your child should not do? ☐Yes ☐No
3. Has your child ever been diagnosed with a significant learning disability that would impair them from participating in small group activities? ☐Yes ☐No
4. Does your child regularly attend Willowbrae Academy every Monday & Wednesday on a weekly basis? ☐Yes ☐No
5. Do you have any planned absences of two weeks or greater during the period of May 9th – July 1st? ☐Yes ☐No
6. Does your child have any physical (e.g.: significantly delayed movement development), emotional (e.g.: severe social anxiety), or other limitations that would make it unsafe to participate in a physical activity program? ☐Yes ☐No

If you have answered **NO** to these questions (except questions 4 and 5), your child may be eligible for our research study examining the effects of an 8-week movement intervention program on movement development and relative participant enjoyment.

If you have answered **YES** to questions 1-3, or 6, your child will not be eligible for completing all aspects of the study.

Signature: _____