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The Development, Short-Term Efficacy, and Pilot Implementation of an e-Learning Course in Physical Activity and Sedentary Behaviour for Pre-Service Early Childhood Educators

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Abstract

The overarching purpose of this dissertation was to develop an e-Learning course in physical activity and sedentary behaviour and test its short-term efficacy and implementation among pre- and in-service early childhood educators (ECEs). The Delphi approach was adopted for Study 1, wherein a panel of international experts in physical activity and sedentary behaviour suggested topics for the course and, together with a panel of ECE experts, rated their importance. Study 2 employed a pre-post design to explore the changes in pre- and in-service ECEs' physical activity and sedentary behaviour-related knowledge, self-efficacy, behavioural intention, and perceived behavioural control following course completion. Study 3 quantitatively and qualitatively examined the pilot implementation of the course and gathered participants' perspectives.

In Study 1, 19 unique content areas were recommended for inclusion in the e-Learning course by 26 physical activity and sedentary behaviour experts. After pooling importance ratings with the ECE expert panel (n = 35), *Outdoor Play* was considered the top-rated area, while *Monitor Physical Activity and Sedentary Time in Your Classroom* had the lowest combined rating. Overall, inter-panel agreement of content area importance rankings was moderate-to-strong (r_s = .60; 95% CI: 0.20 to 0.83).

Results from Study 2 demonstrated that the e-Learning course significantly increased pre-service (n = 32) and in-service (n = 121) ECEs' physical activity and sedentary behaviour-related knowledge (p < .05) and barrier self-efficacy (p < .025), as well as in-service ECEs' task self-efficacy (p < .025). In-service ECEs also exhibited

significant improvements in their behavioural intention ($p < .007$) and perceived behavioural control ($p < .007$), while only certain behaviours showed significant change among pre-service ECEs.

Findings from Study 3 indicated that pre- and in-service ECEs demonstrated moderate-to-high fidelity to the e-Learning course intervention (67.6% and 62.8% completion, respectively), and communicated that they enjoyed the course. Despite reporting some challenges (e.g., technology issues, lengthy modules), participants were very pleased with the content, useability, and compatibility of the e-Learning course. In conclusion, the successful pilot implementation of the expert-developed e-Learning course provides evidence of scalability to wider populations.

Keywords: early childhood educator, e-Learning, physical activity, sedentary behaviour, self-efficacy

Summary for Lay Audience

Early childhood educators (ECEs) are important role models in the childcare setting with respect to young children's physical activity and sedentary behaviours. However, ECEs have reported that they receive little related education in their pre-service (i.e., post-secondary) training. Therefore, the overall purpose of this dissertation was to develop an e-Learning course in physical activity and sedentary behaviour (Study 1) and explore: a) if it could increase pre- and in-service (i.e., practicing) ECEs' physical activity and sedentary behaviour-related knowledge, confidence, and intentions (Study 2); and, b) if participants enjoyed the course, and found it to be informative and easy to use (Study 3).

In Study 1, experts in young children's physical activity and sedentary behaviour suggested 19 topics to include in the e-Learning course. The importance of these topics was then rated by the physical activity and sedentary behaviour experts and by a panel of ECE experts. *Outdoor Play* was the topic with the highest combined rating. Overall, both panels of experts agreed on the importance rankings of the topics suggested for the course.

Study 2 involved examining (via online survey) whether the e-Learning course influenced pre- and in-service ECEs' physical activity and sedentary behaviour-related knowledge, confidence, and intentions. Findings demonstrated substantial increases in both pre- and in-service ECEs' knowledge, confidence, and intentions; however, only certain elements of pre-service ECEs' confidence and intentions showed significant change.

In Study 3, pre- and in-service ECEs were surveyed about their experiences with the course content and e-Learning platform, and a sample of ECEs also participated in an interview to discuss these experiences further. Both pre- and in-service ECEs expressed their enthusiasm for the course, and despite reporting some challenges (e.g., technology issues, lengthy modules), they were very pleased with its content, ease of use, and link to ECE perspectives. In conclusion, the expert-developed e-Learning course showed very positive results in a small population of pre- and in-service ECEs, which suggests that it may be a useful learning opportunity for pre-service ECEs to engage in prior to entering the ECE workforce.

Co-Authorship Statement

This dissertation represents my original work; however, I would like to acknowledge the valued contributions of 10 co-authors. My supervisor, Dr. Trish Tucker, was fundamental in the conceptualization, design, and implementation of the studies included in this thesis. I would also like to thank my co-authors, Drs. Kristi Adamo, Shauna Burke, Valerie Carson, Rachel Heydon, Jennifer Irwin, Andrew Johnson, Patti-Jean Naylor, Brian Timmons, and Leigh Vanderloo for their analytical and editorial expertise for Study 1 (AJ), and Studies 2 and 3 (KA, SB, VC, RH, JI, AJ, PJN, BT, LV).

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Table of Contents

List of Tables

Study 1

Study 2

Study 3

List of Figures

Study 1

Study 2

List of Appendices

List of Abbreviations

CFIR: Consolidated Framework for Implementation Research

CSEP: Canadian Society for Exercise Physiology

ECE: Early Childhood Educator

ECE-COMPASS: Early Childhood Educators' Confidence in Outdoor Movement, Physical Activity, Sedentary and Screen behaviours

ECE-MBIPC: Early Childhood Educator Movement Behavioural Intention and Perceived Control

MVPA: Moderate-to-Vigorous Physical Activity

OECD: Organisation for Economic Co-Operation and Development

SCT: Social Cognitive Theory

SPSS: Statistical Package for the Social Sciences

TEACH: Training pre-service EArly CHildhood educators in physical activity

TPB: Theory of Planned Behaviour

Chapter 1: Introduction and Literature Review

Physical Activity and Sedentary Behaviour in Early Childhood

Establishing healthy movement behaviours (i.e., physical activity, sedentary behaviour, and sleep) in early childhood (<5 years) is critical to foster young children's physical, cognitive, and psychosocial development (Carson et al., 2017; Poitras et al., 2017). Specifically, physical activity participation among children in the early years can improve cardiometabolic health (Timmons et al., 2012), foster increased attention and executive functioning (Carson et al., 2017), mental wellbeing (Taylor et al., 2021), the development of social skills (Lees & Hopkins, 2013), and encourage healthy bodyweights (Ekelund et al., 2012). Physical activity also benefits young children's motor skill development (Zeng et al., 2017), which contributes to their physical literacy (i.e., their confidence, competence, and motivation to engage in a variety of physical activities for life; Whitehead, 2010). Physical literacy is particularly important to foster during the early years, because if children do not master fundamental movement skills (e.g., running, jumping, throwing, kicking, etc.) or cultivate a love of movement when they are young, they are likely to lack the confidence, motivation, and skill to engage in physical activities when they are older (Whitehead, 2010). Since physical activity levels have been known to track from early childhood into later childhood, adolescence, and adulthood (Taylor et al., 2013), ensuring young children build healthy physical activity habits is essential.

While engaging in regular physical activity is important for young children, it is equally as important to ensure their sedentary behaviours (i.e., behaviours with low

energy expenditure while sitting, reclining, or lying down; Tremblay, Aubert, et al., 2017) are appropriate and broken up with movement (Hnatiuk et al., 2019). This is because prolonged time spent in sedentary behaviours, independent of physical activity level, has been associated with negative health outcomes across the lifespan (Leblanc et al., 2012; Thorp et al., 2011; Tremblay et al., 2011). While no direct associations have been reported between overall time spent in sedentary behaviour and health indicators in the early years, the type of sedentary behaviour (e.g., screen-based activities, reading, restrained in a stroller, etc.) has been frequently cited to impact children's health. For example, Poitras and colleagues' (2017) systematic review identified that both reading and storytelling were associated with improved cognitive development, while television-viewing was associated with poorer language development, delayed executive function, and higher adiposity. As such, limiting young children's prolonged sedentary behaviour, and ensuring sedentary pursuits are high in quality (i.e., not screen-based, and cognitively engaging), are recommended for this age group (Tremblay et al., 2017).

The Canadian 24-Hour Movement Guidelines for the Early Years

In recent years, guidelines for young children's physical activity and sedentary behaviours have shifted to a 24-hour approach, wherein sleep is also considered in the makeup of a healthy day (Tremblay et al., 2017). This shift is mainly due to the finding that physical activity, sedentary behaviour, and sleep have a cumulative effect on children's health (Chaput et al., 2014). According to these guidelines, a "healthy day" for infants (<1 year) consists of at least 30 minutes of tummy time (i.e., active play in a prone position), no more than 1 hour of consistent sedentary behaviour (including time

restrained in a car seat or highchair), and no screen-viewing, as well as 14 to 17 and 12 to 16 hours of high-quality sleep for those 0 to 3 months and 4 to 11 months, respectively (including naps; Canadian Society for Exercise Physiology [CSEP], 2017). For toddlers (1 to 2 years) and preschoolers (3 to 4 years), recommendations include a minimum of 180 minutes per day in total physical activity (TPA; for preschoolers, 60 minutes of this time should be spent in moderate-to-vigorous physical activity [MVPA]), no screen-viewing under age two (and limited to 1 hour per day for those over age two), and keeping prolonged sedentary behaviour to a maximum of 1 hour (CSEP, 2017). Toddlers and preschoolers are also recommended to get 11 to 14 and 10 to 13 hours per day of high-quality sleep, respectively (CSEP, 2017). These guidelines, first launched in Canada, have been used to inform guidelines in multiple other countries including Australia (Australian Government, 2017), New Zealand (New Zealand Ministry of Health, 2017), and South Africa (Draper et al., 2020), as well as by the World Health Organization (WHO; World Health Organization, 2019), demonstrating global consensus regarding the 24-hour approach.

As evidenced in the literature, meeting all components of the 24-hour movement guidelines is associated with the most health benefits (Chaput et al., 2017). Yet, in Canada, few young children (11.9% of toddlers, and 12.7% of preschoolers) meet all three recommendations (Chaput et al., 2017; Lee et al., 2017). In studies by Lee *et al.* (2017) and Chaput *et al.* (2017), a minority of toddlers and preschoolers met their respective screen time recommendations (15.2% and 24.4%, respectively), while the majority met the sleep (82.1% and 83.9%, respectively) and physical activity (99.3% and

61.8%, respectively) recommendations. These trends have been echoed in other countries; for example, in Australia, only 8.9% of toddlers and 14.2% of preschoolers met all three guidelines, with the screen time guideline representing the lowest level of adherence (Santos et al., 2017). While no Canadian-specific data has been published in the infant cohort, evidence from Australia suggests poor adherence to movement guidelines, with only 3.5% of Australian infants reported to meet all guideline components (Hesketh et al., 2017). This low proportion of adherence was principally due to poor tummy time (29.7%) and screen time (27.9%) guideline compliance (Hesketh et al., 2017). In light of this research, there is significant room for improvement to ensure young children in Canada (and worldwide) receive the many health benefits of moving their bodies (and minimizing their sitting and screen time).

Physical Activity and Sedentary Behaviour in the Childcare Environment

The childcare environment (including centre- and home-based childcare, preschool, early learning centres, and kindergarten settings) is an ideal venue to support young children's development of healthy habits, including adequate physical activity and appropriate sedentary behaviours (Goldfield et al., 2012; Lessard & Breck, 2015). In Canada, roughly one-quarter of infants and two-thirds of toddlers and preschoolers attend childcare (Statistics Canada, 2019), and these children spend the majority of their weekday waking hours (approximately 30 hours per week; Bushnik, 2006) in these settings. However, Vanderloo and colleagues (2014) found that preschoolers in London, Canada only engaged in 17.42 min/hr of TPA and 1.54 min/hr of MVPA, while Tucker *et al.* (2015) reported that preschoolers were sedentary for over two-thirds of their day at

childcare. However, when looking at the specific environments in which young children are active at childcare, the outdoor setting has been consistently reported to promote physical activity participation (and deter sedentary behaviour) when compared to the indoor environment (Tandon et al., 2015; Truelove et al., 2018; Vanderloo et al., 2013). Thus, considering the poor overall rates of physical activity and sedentary behaviour that have been reported in early learning settings (Tucker et al., 2015; Vanderloo et al., 2014), and the ability of the outdoor space to promote children's movement at childcare (where kids are reported to engage in 10 times as much MVPA compared to indoors; Vanderloo et al., 2013), the childcare environment should be used strategically to target this young cohort with health promotion interventions.

Interventions to Promote Healthy Movement Behaviours in Childcare

Child health researchers have developed a variety of different childcare-based interventions which target some of the key factors that influence young children's movement behaviours. These interventions have employed strategies such as: developing physical activity and sedentary behaviour policies (Erinosho et al., 2016; Finch et al., 2012; Tucker et al., 2019); implementing a prescribed physical activity program (Pate et al., 2016; Tandon et al., 2019); modifying the physical environment (e.g., through playground renovation or providing portable play equipment; Cosco et al., 2014; Robinson et al., 2019); altering the daily schedule (e.g., to maximize outdoor play; Tandon et al., 2019; Tucker et al., 2017); and, providing training in physical activity and sedentary behaviour to early childhood educators (ECEs; Leis et al., 2020; Pate et al., 2017; Tucker et al., 2017). Many of these strategies, both in isolation, and in

combination, have been successful in supporting improved levels of physical activity and sedentary behaviour among participating children (Pate et al., 2016; Tucker et al., 2017); in recent years, more attention is being paid to how ECEs can support healthy behaviour changes in early learning environments.

What Role do Early Childhood Educators Play?

ECEs play an important role in the childcare setting with respect to influencing young children's movement behaviours (Carson et al., 2020; Vanderloo et al., 2014). They are responsible for developing and facilitating daily programming, for which their personal choice to include (or leave out) physical activity opportunities or interrupt prolonged time in sedentary behaviours may impact children's daily affordances (Copeland, Kendeigh, et al., 2012). In addition to programming, ECEs also act as children's primary daytime role models (Robinson et al., 2012), and young children's movement behaviours often reflect the active or sedentary profile of their classroom educator (Bell et al., 2015; Carson et al., 2020). Taken together, these factors greatly influence the extent to which healthy movement behaviours are supported in childcare settings. However, ECEs have previously reported barriers to implementing appropriate movement behaviours in childcare, including limited space (van Zandvoort et al., 2010), lack of training related to physical activity and sedentary behaviour (Tucker et al., 2011), and low confidence to engage children in physical activities (Derscheid et al., 2010). These barriers highlight the importance of ensuring ECEs are educated in the promotion of healthy behaviours among young children, and that they are provided with the

necessary resources to make use of their unique childcare environment for physical activity.

Training Early Childhood Educators in Physical Activity and Sedentary Behaviour

In spite of the many benefits of having ECEs who value and support the need for physical activity programming and minimizing sedentary behaviour in childcare (highlighted above), a breadth of literature has reported that ECEs are not provided these opportunities in their pre-service (i.e., post-secondary) training (Bruijns et al., 2019; Gehris et al., 2015; Martyniuk & Tucker, 2014; Sevimli-Celik, 2021), nor their in-service (i.e., in practice) professional learning (Copeland, Kendeigh, et al., 2012; Tucker et al., 2011; van Zandvoort et al., 2010). This is problematic, as ECEs might not be providing the children in their care with adequate movement opportunities to support their health, and also because they may not be equipped with the proper understanding of how to deliver physical activity curriculum components, which are required by many early learning programs in Canada (Vercammen et al., 2020). In fact, ECEs have attributed their lack of confidence to facilitate physical activity to their lack of training in this area (Derscheid et al., 2010; Dyment & Coleman, 2012; Froehlich & Humbert, 2011). Evidently, greater support for ECEs is needed in the form of targeted physical activity and sedentary behaviour training.

To address the gap in physical activity and sedentary behaviour education noted within ECEs' foundational and professional training, childcare-based interventions have transpired (Peden et al., 2018). Some of these training interventions have focused on physical activity and physical literacy education in combination with healthy eating

(Bélanger et al., 2016; Green et al., 2020; Hassani et al., 2020), while others have used professional learning to teach ECEs how to implement a specific physical activity program (Alhassan et al., 2016; Annesi & Smith, 2013; Green et al., 2020; Hoffman et al., 2020; Pate et al., 2016), or to support other intervention components, such as a modified outdoor play schedule (Tucker et al., 2017). Despite only select interventions including training content on sedentary behaviour (Hassani et al., 2020; Tucker et al., 2017), many exhibited positive intervention effects, including increased physical activity (Alhassan et al., 2016; Annesi & Smith, 2013; Hoffman et al., 2020; Pate et al., 2016; Tucker et al., 2017) and motor skill development (Leis et al., 2020) among preschoolers, enhanced health promoting practices by ECEs (Green et al., 2020; Ward et al., 2020), and decreased sedentary time among young children (Tucker et al., 2017). Yet, despite their importance, little attention has been paid to how the specific attributes (e.g., values, knowledge base, confidence, intentions, etc.) of ECEs are influenced by targeted professional learning, and how these attributes may affect childcare practices, warranting the need for additional research.

Knowledge, Self-Efficacy, and the Social Cognitive Theory (SCT)

Bandura's Social Cognitive Theory (SCT) delineates that self-efficacy (i.e., an individual's confidence to complete a task), formed in part by knowledge acquisition via observational modelling, predicts behaviour (Bandura, 1977; Bandura, 2004). Therefore, in the context of health behaviours in childcare settings, ensuring ECEs have the appropriate knowledge base in physical activity promotion is critical to support their self-efficacy (and predicted likelihood) to promote physically active childcare classrooms

(Bandura, 2004). For example, in a study by Bruijns and colleagues (2019), pre-service (i.e., post-secondary student) ECEs (*n* = 1,292) who had undergone training in physical activity reported significantly higher levels of self-efficacy for teaching and facilitating physical activity in childcare. These findings are consistent with ECE training intervention studies in early years research, where similar increases in both ECEs' knowledge and self-efficacy related to physical activity have been reported (Bruijns et al., 2021; Hassani et al., 2020). However, most research in this area has neglected to consider ECEs' knowledge or self-efficacy regarding minimizing sedentary behaviour or promoting outdoor play, which can be problematic when looking to comprehensively assess these outcomes (Szpunar et al., 2021).

Behavioural Intention and the Theory of Planned Behaviour (TPB)

While ECEs' knowledge and self-efficacy are important attributes to consider when implementing health behaviour interventions in childcare, the Theory of Planned Behaviour (TPB) is also useful to apply, as important constructs related to health behaviours are overlooked in the SCT (Ajzen, 1991). This theory posits that attitudes, social norms, and perceived behavioural control (i.e., ease or difficulty to perform a behaviour) determine an individual's behavioural intention (or their determination to perform a behaviour; Ajzen 1991). Given behavioural intention is recognized as the closest factor to actual human behaviour (and a natural extension of self-efficacy; Ajzen, 1991), this psychosocial variable is beginning to be measured in behaviour change interventions, particularly those incorporating professional learning (Bai et al., 2020; Gagné & Harnois, 2013). Bai *et al.* (2020) recently administered two different physical

activity professional learning interventions for ECEs (*n* = 84 and *n* = 64 per group, respectively), and found that ECEs in both training groups significantly increased their perceived behavioural control for promoting physical activity. Such studies elucidate the value of training for ECEs to positively alter their perspectives on the importance of movement-based programming, while also providing insight into whether a behaviour is within their control to modify (as total autonomy in programming is often hindered by childcare policies; Copeland, Sherman, et al., 2012). As such, these psychosocial variables are important to consider in the design of professional learning interventions for ECEs, as they can act as important indicators of successful training.

Training at the Post-Secondary Level

While professional learning interventions in physical activity and sedentary behaviour have been developed and tested among in-service ECEs, researchers have inquired into why only remedial rather than proactive approaches have been explored to address the shortcomings of ECEs' pre-service education on these topics (Goldfield et al., 2012). In Canada, specifically, Bruijns and colleagues (2019) reported that just under one-third of pre-service ECEs (*n* = 1,292) reportedly received physical activity or screen-viewing-specific courses in their program, and participants communicated their desire to learn more about physical activity and sedentary behaviour-related concepts. As evidence of the benefit of including courses in movement-based education for pre-service ECEs, Altunsöz *et al.* (2015) found that pre-service ECEs in Turkey who had completed a 14-week course in physical education and games (*n* = 49) reported significantly greater self-efficacy to teach fundamental movement skills when compared

to pre-service ECEs who were not enrolled in the course (*n* = 34). Therefore, there is a growing need for evidence-based training interventions in physical activity and sedentary behaviour at the pre-service level to better support ECEs' knowledge acquisition, self-efficacy, and intentions to promote healthy movement behaviours in childcare.

Research Program Rationale

Given the childcare setting is an ideal environment to target physical activity and sedentary behaviour improvements among young children (Goldfield et al., 2012), and ECEs are these children's primary daytime role models who are responsible for delivering programming (Robinson et al., 2012), ensuring ECEs are equipped with the understanding and ability to facilitate active childcare settings is essential. However, ECEs have been reported to receive little education on physical activity and sedentary behaviour in their pre-service programs (Bruijns et al., 2019), and few professional learning opportunities exist for in-service ECEs to expand their learning in these content areas (Peden et al., 2018). While some professional learning interventions have been developed for in-service ECEs, most of these training initiatives have only focused on prescribed physical activity programming (Alhassan et al., 2016; Pate et al., 2016), or physical activity training in combination with healthy eating education (Hassani et al., 2020; Leis et al., 2020); sedentary behaviour, as well as the importance of outdoor play in facilitating physical activity among children, are often overlooked. Further, ECE-focused outcome measures, such as changes in knowledge, self-efficacy, behavioural intention, and perceived behavioural control, have been infrequently measured in these

interventions (Peden et al., 2018), leaving questions regarding training efficacy at the individual level, and how improvements in personal attributes may influence ECEs' practices. As such, the Training pre-service EArly CHildhood educators in physical activity (TEACH) study was created to address these research gaps, with a primary objective of developing an evidence-informed physical activity and sedentary behaviour e-Learning course to support pre-service ECEs' related knowledge and self-efficacy.

Purpose Statement

The purpose of this dissertation was to develop the TEACH e-Learning course and test its short-term efficacy and implementation in a sample of both pre- and in-service ECEs. While the course was to be designed for the pre-service ECE population, pilot testing in a sample of in-service ECEs was undertaken to ensure the course provided them with relevant and useful education to support ECEs' programming of active opportunities in a variety of childcare settings (and if effective, to support future implementation with this population). Three studies were undertaken to achieve this purpose. First, Study 1 entailed a Delphi study to develop and generate expert consensus regarding content areas to include in an e-Learning course. Study 2 and Study 3 then involved pilot testing the e-Learning course in a sample of both pre- and in-service Canadian ECEs and: a) examining pre- to post-course changes in their knowledge, self-efficacy, behavioural intention, and perceived behavioural control; and, b) exploring the implementation (e.g., fidelity, complexity, usability, acceptability, etc.) of the e-Learning course via e-Learning metrics, an online survey, and interviews to determine its feasibility for scale-up. Since an integrated article format was adopted for

this dissertation, some of the content from the introduction and literature review will be repeated in subsequent chapters.

The Consolidated Framework for Implementation Research (CFIR)

The CFIR, introduced by Damschroder and colleagues (2009), is one of the most commonly used implementation frameworks in public health (McKay et al., 2019), and was adopted to guide this program of research. The CFIR provides a comprehensive set of constructs to consider when designing, implementing, and evaluating interventions, and these are organized into five domains: 1. *intervention characteristics* (i.e., designing the intervention to fit the target organization; e.g., completing a needs assessment); 2. *outer setting* (i.e., the external social context within which an organization resides; e.g., provincial/territorial Ministries of Education and colleges/associations of ECEs); 3. *inner setting* (i.e., organization-specific characteristics; e.g., pre-service ECE program instructors' desire for curriculum development); 4. *individual characteristics* (i.e., individuals' characteristics within the target organization; e.g., pre- and in-service ECEs' own desire to pursue this type of education); and, 5. *implementation process* (i.e., implementing the intervention with consideration to the promotion of fidelity and acceptance; e.g., partnering with pre-service ECE program staff/instructors and associations of ECEs to champion the intervention). Following this framework for the e-Learning course development and pilot testing phases of the TEACH study was important to ensure that the intervention was optimized for scale-up to pre-service ECE programs across Canada. For a comprehensive overview of how this framework was used to guide this research, consult Appendix A.

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Chapter 2

Content Development for a Physical Activity and Sedentary Behaviour e-Learning Course for Early Childhood Education Students: A Delphi Study[1]

For young children (<5 years), regular participation in physical activity is key to healthy physical, psychosocial, and cognitive development (Carson *et al.,* 2017). Specifically, increased duration and frequency of physical activity in early childhood positively influences executive function and language (Carson *et al.,* 2016), while higher intensity physical activity has been associated with improved motor skill development (Figueroa & An, 2017). Further, limiting prolonged sedentary time, particularly in front of screens, is critical; in young children, television-viewing has been linked to decreased attention and disruptive sleep (Leblanc *et al.,* 2012), as well as decreased cognitive development (including literacy and numeracy; Carson *et al.,* 2015). As such, establishing healthy physical activity and sedentary behaviour habits in early childhood is highly important, and the childcare environment, where two-thirds of young Canadian children spend the majority of their weekdays (Statistics Canada, 2019), has been identified as a prime setting to target these health behaviours.

ECEs are influential role models in the childcare setting, and with respect to programming, they control a substantial portion of young children's days (Henderson *et al.,* 2015; Hesketh *et al.,* 2017; Robinson *et al.,* 2012). However, research has shown that

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both educator values and self-efficacy relating to physical activity, as well as their level of training in this area, influence the amount of physical activity they incorporate in their programming (Connelly *et al.,* 2018; Copeland *et al.,* 2012; Dyment & Coleman, 2012). ECEs have acknowledged their limited pre-service training in physical activity and sedentary behaviour (Copeland *et al.,* 2012; Tucker *et al.,* 2011), and have associated this with their low self-efficacy to promote and lead physical activity opportunities in childcare (Dyment & Coleman, 2012). A recent Canadian study found that only 32.2% and 26.7% of Canadian pre-service ECEs reported receiving physical activity and screen-viewing-related training in their post-secondary programs, respectively (Bruijns *et al.,* 2019). Further, in Canada, only three provinces/territories specifically reference physical activity, and one references screen-viewing, in their childcare regulation (Vanderloo & Tucker, 2018), and few childcare centres have adopted physical activity (30%) and screen-viewing (29%) policies of their own (Ott *et al.,* 2019). Given such limited regulations, it is often ECEs who are responsible for determining the duration and frequency of physical activity opportunities and screen use in their classroom (Connelly *et al.,* 2018; Copeland *et al.,* 2012). With the strong curricular focus placed on preparing children in their care for school, ECEs may not consider opportunities for physical activity as integral programming components (Copeland *et al.,* 2012; Wilke *et al.,* 2013). Providing ECEs with proper training in physical activity has been introduced as a possible solution to ensure children are afforded appropriate daily opportunities to be active (Coleman & Dyment, 2013).

Both in-service ECEs (van Zandvoort *et al.,* 2010) and pre-service ECEs (Bruijns *et al.,* 2020) have expressed their desire for additional training in physical activity and sedentary behaviour, and the provision of such learning opportunities is essential to assist them in promoting the development of healthy movement behaviours among children in childcare. Recent efforts to better support ECEs in promoting and leading physical activity, and minimizing excessive sedentary time in childcare environments, have shown promising results (Bruijns *et al.,* 2021; Ellis *et al.,* 2018; Howie *et al.,* 2016; Pate *et al.,* 2016; Tucker *et al.,* 2017). For example, interventions that have provided ECEs with physical activity training have resulted in preschoolers accumulating increased MVPA (+0.5 min/day and +1.28 min/day; Pate *et al.,* 2016; Tucker *et al.,* 2017), and decreased sedentary time (-2.13 min/day; Tucker *et al.,* 2017) while in childcare. ECEs' receptiveness to both of these interventions was positive, and they communicated that they would continue to use the knowledge gained from the training after the interventions ceased (Driediger *et al.,* 2018; Howie *et al.,* 2016). While professional development in physical activity and sedentary behaviour for ECEs is essential to support ongoing learning and scaffold their physical activity-related teaching self-efficacy (Bruijns *et al.,* 2021; Pate *et al.,* 2016), there is a need for this supplementary education at the post-secondary level (i.e., within pre-service ECE programs). This initiative will ensure ECE graduates are well-prepared to support healthy movement behaviours among young children upon entering a childcare-based profession (Goldfield *et al.,* 2012).

Given the success of physical activity training programs for ECEs (Pate *et al.,* 2016; Tucker *et al.,* 2017), and the importance of providing this training to all ECEs pre-employment (where physical activity-related education is lacking; Bruijns *et al.,* 2019), the next step is to narrow down key physical activity and sedentary behaviour content areas to include in training at the pre-service level. Further, there is a need to introduce more ECE outcome measures (e.g., physical activity-related knowledge, self-efficacy, and teaching behaviours) in order to find out what content best supports their knowledge acquisition and retention, as well as their development of self-efficacy to lead physical activity and minimize prolonged sedentary time in childcare. As such, the goal of the TEACH study is to develop, implement, and evaluate the impact of a physical activity and sedentary behaviour e-Learning course for students in Canadian post-secondary ECE programs. As a first step, the current study aimed to identify and reach agreement on physical activity and sedentary behaviour content areas that are necessary for ECEs to be trained in.

Methods

The Non-Medical Research Ethics Board (REB) at the University of Western Ontario provided ethical approval (REB# 114435) for the conduct of this research (Appendix B).

Study Design

The Delphi method, developed by Dalkey and Helmer (1963), was adopted as the study design, as it is appropriate in cases where the subjective opinion of a group of experts is needed to reach consensus on a topic, but these individuals cannot meet to

discuss in-person (due to constraints such as distance and time; Dalkey & Helmer, 1963; Yousuf, 2007). The Delphi technique involves multiple rounds of surveys with controlled feedback, allowing participants to reassess their answers based on their review of other panelists' responses (Yousuf, 2007). Further, this method allows for anonymity, which mitigates challenges associated with traditional group consensus methods, where dominant individuals and pressure to conform can be confounding factors (Dalkey & Rourke, 1971). The study design and procedures were loosely modeled after Gillis and colleagues' (2013) Delphi study, which aimed to achieve consensus on research priorities for children's and adolescents' physical activity and sedentary behaviours.

Participants and Recruitment

Canadian (*n* = 13) and international (*n* = 18) early years physical activity and sedentary behaviour experts were identified by the research team and invited via email to participate in two online surveys through Qualtrics©. Experts were selected based on: 1. their established research in the field; and, 2. provincial/geographic location (i.e., to ensure appropriate representation within and outside of Canada). Additional experts (*n* = 17), referred to the research team by the initial group of study participants, were then invited as national (*n* = 2) and international (*n* = 15) experts. If no response was received within 2 weeks, a reminder email was circulated. Recruitment took place in October 2019 and a total of 25 physical activity and sedentary behaviour experts agreed to participate prior to the first round of surveys. One additional expert agreed to participate prior to the second round of surveys (53% response rate).

In order to ensure module content was appropriate and contextually relevant to integrate into Canadian ECE curricula, 46 Canadian ECE experts were identified by the research team and invited via email to participate. Experts were selected based on their: 1. occupational position (i.e., ECE university professor, board/executive member of a relevant ECE organization, dean or program head/instructor of a post-secondary ECE program); 2. years of experience in the ECE field (5 years minimum); 3. provincial/ territorial location (i.e., to ensure appropriate representation); and, 4. online email address availability. Additional experts (*n* = 14), referred to the research team by the initial group of ECE experts, were also invited to participate. Recruitment took place in November 2019 and a total of 35 ECE experts agreed to participate (58% response rate). See Figure 1 for the full recruitment process of physical activity/sedentary behaviour and ECE experts.

Study Procedures

Upon reviewing a Letter of Information and Consent (Appendix C), physical activity/sedentary behaviour experts completed two online surveys. The first survey (Appendix D) gathered their top 12 physical activity and sedentary-behaviour-related content areas they felt should be included in an e-Learning course for pre-service ECEs (with a brief justification for each topic). Two study investigators (BAB, PT) reviewed the topics generated in the first round of surveys and pooled them together. Similar topics were merged, and a list of unique content areas was created. Content areas that were only mentioned by one participant were excluded from the final list.

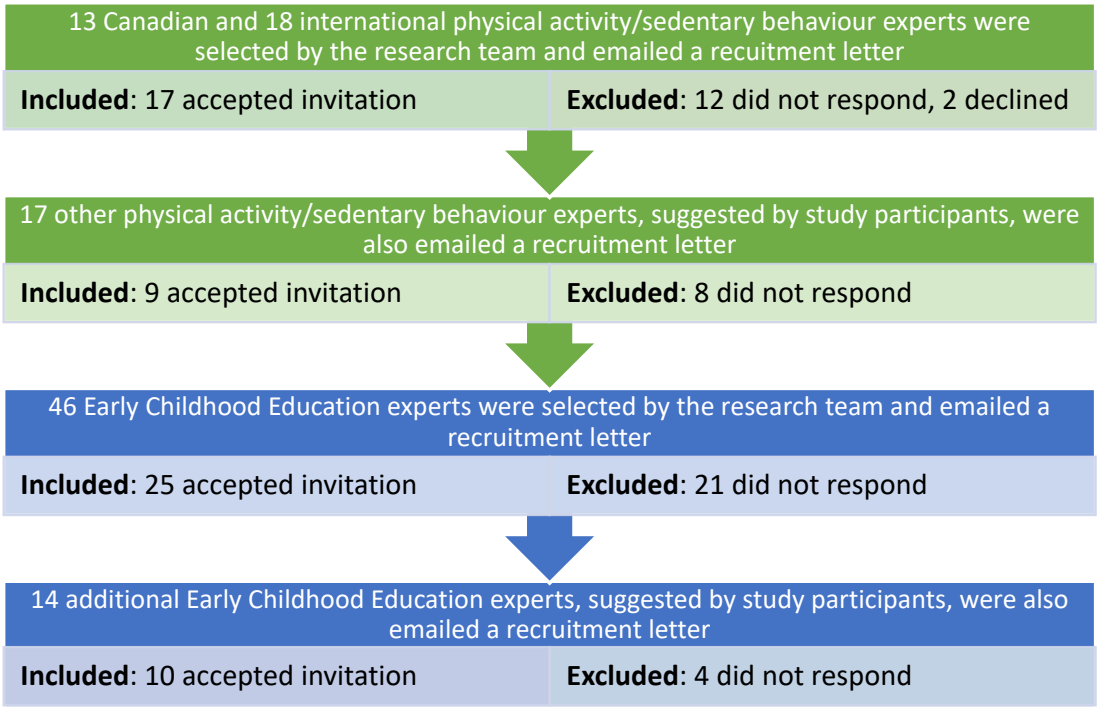

Figure 1. Purposeful sampling process undertaken to recruit physical activity/sedentary behaviour and Early Childhood Education experts.

In the second round of surveys, experts were provided the pooled list of content areas (along with a brief description of what would be included in that section of the course). They were asked to rate the importance of each content area on a 5-point Likert scale (0 = unimportant to 5 = very important; Appendix E). In order to ensure all proposed content areas were captured in the pooled list, experts were asked to indicate whether the topics they proposed in the first survey were accurately represented. Occupational positions for physical activity experts were retrieved by the research team via their institutional websites.

Upon reviewing a Letter of Information and Consent (Appendix F), the ECE expert panel completed a version of the second online survey (Appendix G), which, in addition to gathering their importance ratings of the content areas generated by the physical activity/sedentary behaviour expert panel, also captured: 1. demographics (occupational position, years of experience); 2. suggestions for topics not already proposed; 3. how important they felt this type of training was for pre-service ECEs; and, 4. whether they felt the course content aligned with ECE curriculum objectives and accreditation criteria/vocational learning outcomes, and complemented current ECE curriculum. Experts were assigned a unique participant code to use when filling out each online survey so that study investigators could determine which panel (i.e., Canadian, international, or ECE) each expert belonged to, and who had participated (in order to determine the need for subsequent survey dissemination).

Data Analysis

Descriptive statistics of demographics, content area importance ratings, representation of panel-suggested topics, and perspectives regarding the importance of this type of training were completed in SPSS (version 25). Within each panel of experts (i.e., physical activity/sedentary behaviour and ECE), mean (*M*) scores for each of the 19 content areas were generated. Pearson product-moment correlation coefficient was then calculated between the means of the two panels, and the 19 content areas were ranked within each panel. Similarity in rankings between the two panels was assessed using Spearman's *rho* (r_s). Analyses were conducted in R version 3.6.1. (R Core Team, 2019).

Results

Demographics

Physical activity and sedentary behaviour expert panel. Physical activity/sedentary behaviour experts represented six different countries (Canada [*n* = 13], Australia [*n* = 5], the United States [*n* = 4], the Netherlands [*n* = 2], the United Kingdom [*n* = 1], and New Zealand [*n* = 1]). All experts held positions in academia (including two post-doctoral fellows, five assistant professors, 10 associate professors, and 9 professors). See Figure 2a for geographical representation of the physical activity/sedentary behaviour expert panel.

ECE expert panel. ECE experts represented 10 Canadian provinces/territories (Ontario [*n* = 11], Quebec [*n* = 6], Saskatchewan [*n* = 6], British Columbia [*n* = 3], Alberta [*n* = 2], Newfoundland and Labrador [*n* = 2], Nova Scotia [*n* = 2], Manitoba [*n* = 1], New

Brunswick [*n* = 1], and Yukon [*n* = 1]; Figure 2b). Experts held a wide range of ECE occupational positions, including six as university professors (three assistant professors, one associate professor, one professor, and one professor emeritus), 11 as board/executive members of ECE-related organizations, and 18 as faculty/staff within ECE programs (one dean, four program/department heads/coordinators, one curriculum writer, and 12 instructors). On average, these experts had 23.11 ± 11.43[2] years of experience in the ECE field.

Physical Activity and Sedentary Behaviour Content Areas

A total of 22 content areas were generated by the physical activity/sedentary behaviour expert panel. Three content areas were excluded due to not being relevant to other panelists' topics; as such, 19 content areas were carried forward. The majority (90.5%) of panelists reported their suggested topics were appropriately represented in the final list of content areas. See Appendix H for a detailed list and description of the content areas.

Physical activity and sedentary behaviour expert panel. On average, physical activity/sedentary behaviour experts (*n* = 21[3]) rated all content areas as important to include in the e-Learning course (*M* range = 3.76 to 4.81). These experts rated *Benefits of Physical Activity in the Early Years* as the most important content area (*M* = 4.81 ± 0.40), and *Monitor Physical Activity and Sedentary Time in Your Classroom* as the least

[2] All mean scores presented as *M* ± *SD*
[3] Five members of the panel did not respond to the second round of surveys.

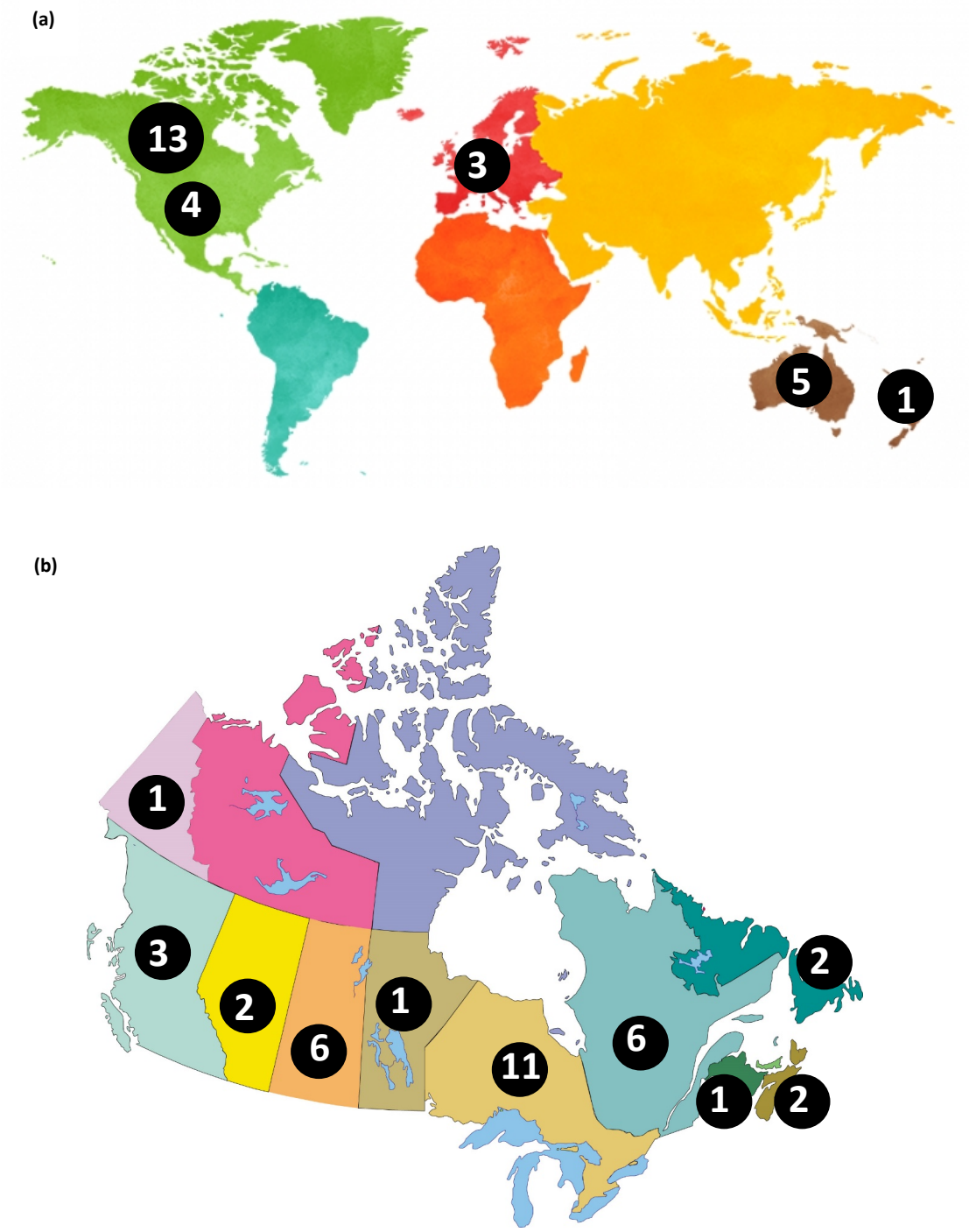

Figure 2. (a) Geographical representation of participating physical activity/sedentary behaviour experts (number indicates how many experts were from that region). **(b)** Provincial/territorial representation of participating Early Childhood Education experts (number indicates how many experts were from that province/territory).

important content area (*M* = 3.76 ± 1.14]), to include in the e-Learning course. See Table 1 for content area importance rankings.

ECE expert panel. ECE experts (*n* = 35) also had moderate to high ratings of the importance of the content areas (*M* range = 3.77 to 4.83). They rated *Outdoor Play* as the most important content area to include in the e-Learning course (*M* = 4.83 ± 0.45]) and *Monitor Physical Activity and Sedentary Time in Your Classroom* as the least important content area (*M* = 3.77 ± 0.88]). See Table 1 for content area importance rankings by panel.

Final ranking and inter-panel agreement. In the final ranked list of content areas, *Outdoor Play* (*M* = 4.77 ± 0.64), *Benefits of PA in the Early Years* (*M* = 4.75 ± 0.66), and *Factors Influencing PA and SB in Childcare* (*M* = 4.71 ± 0.74) had the highest combined scores. *Monitor PA and Sedentary Time in Your Classroom* had the lowest combined score (*M* = 3.77 ± 1.44). There was moderate-to-strong inter-panel agreement across the 19 content areas, with mean scores correlating 0.63 (95% CI: 0.25 to 0.84) and ranked scores demonstrating an association (r_s) of 0.60 (95% CI: 0.20 to 0.83). See Figure 3 for a graphical representation of the associations between panels for each content area ranking.

ECE Panel Perspectives on the e-Learning Course

The majority of ECE experts (94.3%) rated this type of training as 'Important' or 'Very Important' for pre-service ECEs to receive. Most experts (91.4%) reported they agreed that the physical activity and sedentary behaviour e-Learning course aligned with the objectives of the current post-secondary ECE curriculum, and 88.6% reported they

Table 1. *Ranked Content Areas in Physical Activity and Sedentary Behaviour Suggested for Inclusion in an e-Learning Course for Canadian Pre-Service Early Childhood Educators.*

Content Area	PA/SB Panel (n = 21) *M* (*SD*)	PA/SB Panel Rank	ECE Panel (n = 35) *M* (*SD*)	ECE Panel Rank	Both Panels *M (SD)*	Final Rank[a]
Outdoor Play	4.71 (.46)	4	4.83 (.45)	1	4.77 (.64)	**1**
Benefits of Physical Activity in the Early Years	4.81 (.40)	1	4.69 (.53)	3	4.75 (.66)	**2**
Factors Influencing Physical Activity and Sedentary Behaviour in Childcare	4.76 (.44)	2.5	4.66 (.59)	5	4.71 (.74)	**3**
Defining Physical Activity and Sedentary Behaviour	4.57 (.60)	8	4.74 (.44)	2	4.66 (.74)	**4**
Promote Physical Activity and Minimize Sedentary Time through Instruction and Interaction	4.76 (.44)	2.5	4.51 (.66)	8	4.64 (.79)	**5**
Create and Make Use of Environments to be Supportive of Physical Activity	4.57 (.68)	8	[a]4.68 (.48)	4	4.63 (.83)	**6**
Become a Role Model and Champion for Physical Activity	4.62 (.74)	5.5	4.40 (.74)	10.5	4.51 (1.05)	**7**
Program Time for Physical Activity and Active Breaks to Limit Sitting Time	4.62 (.67)	5.5	4.37 (1.03)	12	4.50 (1.23)	**8**
The Canadian 24-Hour Movement Guidelines for the Early Years (<5 years)	4.38 (.81)	12.5	4.60 (.60)	7	4.49 (1.01)	**9**

Risky Play	4.24 (.83)	15.5	4.63 (.60)	6	4.44 (1.02)	**10**
Get Parents/Guardians On Board!	4.43 (1.03)	10.5	4.40 (.78)	10.5	4.41 (1.29)	**11**
Physical Literacy and Fundamental Movement Skills	4.38 (.81)	12.5	4.43 (.78)	9	4.41 (1.12)	**11**
Incorporate Physical Activity into Other Educational Objectives	4.24 (1.00)	15.5	[a]4.35 (.65)	13	4.30 (1.19)	**13**
Resources and Professional Development	4.33 (.80)	14	4.26 (.78)	15	4.30 (1.12)	**13**
Suggest the Creation of Physical Activity and Screen-Viewing Policies at Your Centre	4.43 (.60)	10.5	[a]4.06 (.92)	16.5	4.25 (1.10)	**15**
Example Activities	4.57 (.75)	8	3.91 (1.10)	18	4.24 (1.33)	**16**
Risks of Excessive Sedentary Behaviour and Screen-Viewing	4.10 (.94)	17	4.34 (.68)	14	4.22 (1.16)	**17**
Prevalence of Physical Activity, Sedentary Behaviour, and Screen-Viewing among Young Children	3.95 (.92)	18	[b]4.06 (.85)	16.5	4.01 (1.25)	**18**
Monitor Physical Activity and Sedentary Time in Your Classroom	3.76 (1.14)	19	3.77 (.88)	19	3.77 (1.44)	**19**

Note. PA = physical activity; SB = sedentary behaviour; ECE = Early Childhood Educator; *M* = mean; *SD* = standard deviation; [a] Final rank was determined by the highest combined mean score between panels; [b] Only 34 respondents for this question.

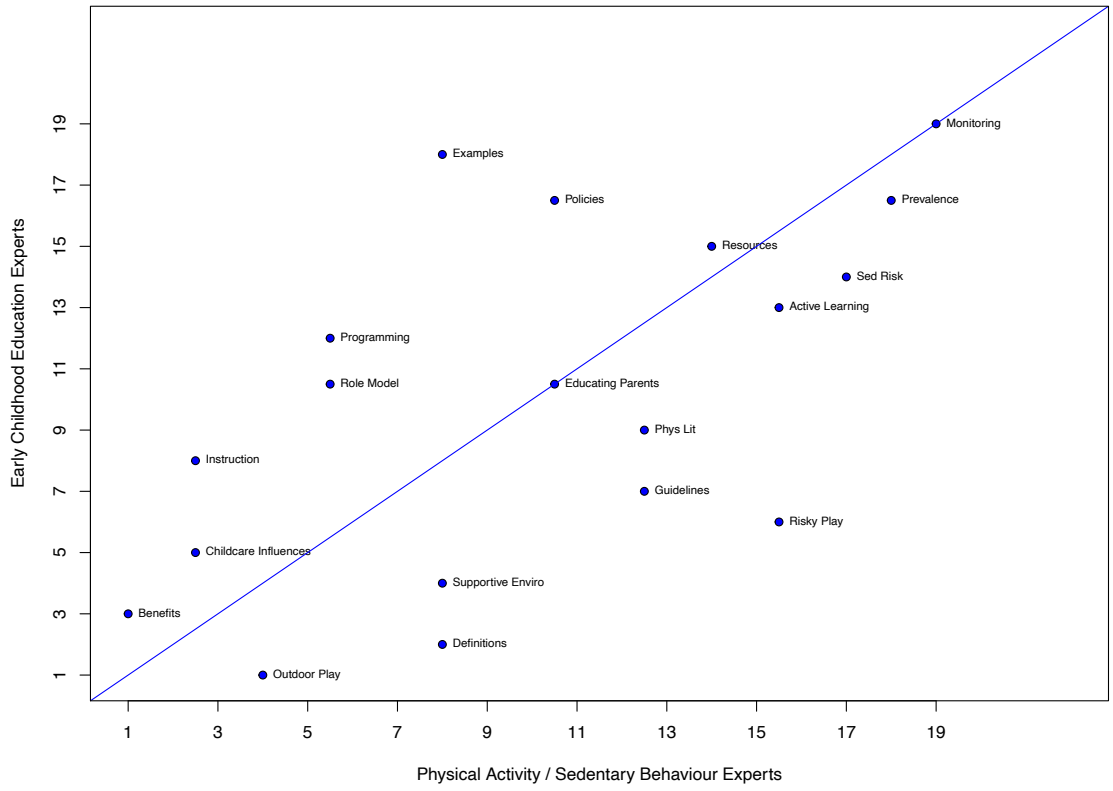

Figure 3. Scatterplot of the associations between panels' rankings for each content area.

agreed that the training would complement this curriculum. The majority of ECE experts (78.8%) also communicated their agreement that this type of training aligned with ECE professional accreditation standards.

Discussion

This was the first study to employ the Delphi method to generate physical activity and sedentary behaviour content to be included in training for pre-service ECEs. The use of two field-specific expert panels to offer their insights on this training provided a unique perspective on module content development, and their general consensus on important rankings of the content areas provides helpful direction regarding areas of foci for the e-Learning course. A number of important findings from this study are discussed below.

Six content areas proposed by the experts focused on giving pre-service ECEs necessary background information on physical activity and sedentary behaviour, ranging from definitions and benefits/risks of these behaviours to guidelines and current prevalence rates. These content areas are essential to include, as pre-service ECEs have noted the lack of physical activity and sedentary behaviour-specific training in their program (Bruijns *et al.,* 2019). Bruijns and colleagues (2019) surveyed 1,292 pre-service ECEs, and while the majority of students reported that their courses covered gross motor development (86.6%), few covered concepts such as physical literacy (46.2%), screen-viewing (47.3%), or sedentary behaviour (41.5%). Without a proper introduction to these concepts and their importance to consider when programming, it is unlikely that pre-service ECEs will be receptive to strategies to promote physical activity and

minimize sedentary time (Bruijns *et al.,* 2020). As evidenced by Bruijns *et al.* (2020), pre-service ECEs felt it was more important and their responsibility to teach physical activity-related skills (such as fitness activities, locomotor skills, and play skills) in childcare if they reported receiving training in physical activity. As such, if pre-service ECEs are introduced to these concepts during their post-secondary schooling, it is likely that they will promote healthy movement behaviours among the children they care for upon entering the ECE profession.

Physical activity/sedentary behaviour experts also suggested including training related to factors that influence young children's physical activity and sedentary behaviour in the childcare environment, with specific attention paid to outdoor and risky play (receiving heightened attention in the ECE field as of late; Herrington & Pickett, 2015). This review of correlates is critical within the course, as it will highlight to pre-service ECEs the varying aspects of the childcare environment, and ECE behaviours, that act as facilitators/barriers to children's physical activity and that influence their sedentary behaviours (Bower *et al.,* 2008; Vanderloo *et al.,* 2015). Stemming from the review of correlates, eight additional content areas suggested by the panel related to providing pre-service ECEs with practical strategies on how to promote physical activity and minimize sedentary time in their classroom (noted as important within childcare ECE training interventions; Ellis *et al.,* 2018; Kennedy *et al.,* 2017). In addition, two content areas focused on helpful resources and training, and practical video example activities, to further aid pre-service ECEs in this respect. The focus of the content suggested for the course on these strategies and resources is encouraging, as ECEs have

reported they lack the appropriate training on how to lead skill-based physical activities in childcare (Howie *et al.,* 2014). Further, ECE training interventions have noted the benefit of this type of practical support in scaffolding their physical activity-related self-efficacy (Bruijns *et al.,* 2021), and both increasing physical activity (De Marco *et al.,* 2015) and decreasing sedentary time (Ellis *et al.,* 2018) among children in their care. Offering video examples may teach pre-service ECEs how to engage children in physical activity, and promises to support their self-efficacy in this pursuit via vicarious reinforcement and modeling (Bandura, 2004).

While both expert panels expressed their views of the importance of all proposed content areas for the e-Learning course, the top-rated content areas (i.e., *Outdoor Play, Benefits of Physical Activity in the Early Years, Factors Influencing Physical Activity and Sedentary Behaviour in Childcare*) were logical. Considering outdoor time is a required component of all childcare in Canada, coupled with the knowledge that children accumulate the majority of their daily MVPA outdoors while attending childcare (Vanderloo *et al.,* 2013), the high prioritization of *Outdoor Play* by both expert panels is reassuring and important to educate pre-service ECEs about. The introductory content area regarding benefits of physical activity stresses the need to provide pre-service ECEs with solid foundational knowledge of physical activity and sedentary behaviour concepts. Further, overviewing the factors influencing children's movement behaviours in the childcare environment was considered very important. Specifically, ECE behaviours, known to influence children's movement behaviours in childcare (Vanderloo *et al.,* 2014), was highlighted as critical for targeted education. Taken together, the top-

rated content areas represent topics in need of focus within training interventions for ECEs, and are pertinent to include in the e-Learning course for pre-service ECEs.

The moderate-to-strong inter-panel agreement, both in terms of content area mean score and rank-order, demonstrates general consensus regarding the importance of each topic for inclusion within the course. While select content areas were rated higher by one panel than the other (e.g., *Creation of Physical Activity/Screen-Viewing Policies* was favoured by the physical activity/sedentary behaviour experts, and *Risky Play* was favoured by the ECE experts), most content areas were similarly rated and ranked by both panels. Given the overarching goal of the TEACH study is to implement this e-Learning course in pre-service ECE programs, it is critical that the content created for the course is pertinent to the ECE field. It is reassuring, then, that the large majority of ECE experts rated this training course as both in line with objectives of, and of added benefit to, the current post-secondary ECE curriculum. Hnatiuk and colleagues (2019) stress the importance of tailoring early years physical activity interventions to community needs (in this case, lack of physical activity and sedentary behaviour training in the present ECE curriculum). With the overwhelming support of the ECE expert panel (nearly 100% of ECE experts reported this training was important for ECE students to receive), the creation of the e-Learning course using the content areas generated from this Delphi study is likely to be well-received by ECE programs within Canadian post-secondary institutions.

Research Implications and Future Directions

This research study has a number of important implications. First, the results of this study will be used to generate a physical activity and sedentary behaviour e-Learning course that is tailored specifically to pre-service ECEs, the first study globally to focus this training within ECEs' post-secondary education. Having ECEs who are well-trained in physical activity and sedentary behaviour will ensure children in childcare are provided sufficient movement opportunities daily, which is vital for their healthy development. Second, the recruitment of top international experts in the field to generate the content for the course ensures that this training covers the most important and relevant information for pre-service ECEs to promote healthy movement behaviours in childcare-based professions upon graduation. In addition, having a diverse panel of ECE experts review the content proposed by the physical activity/sedentary behaviour panel confirmed the applicability of this training to the ECE field, and will ease its receptivity by post-secondary ECE programs.

The implementation of the e-Learning course across Canada will shed light on whether this training is successful in ECE programs in multiple locations. In Canada, ECE curricula and professional accreditation standards are governed at the provincial/territorial level; as such, testing the effectiveness of this educational tool nationwide will determine the versatility of the e-Learning course to be implemented in multiple educational environments. If successful, the e-Learning course can be adapted (e.g., changing country-specific movement guidelines) for use in other countries, which would maximize the reach and global public health impact of this training. Given the

global call for physical activity and sedentary behaviour training to be made available within ECEs' pre-service schooling (Coleman & Dyment, 2013; Goldfield *et al.,* 2012; Kreichauf *et al.,* 2012), international collaborations are warranted to support this initiative.

Limitations

Although this study has many strengths, including a high online survey response rate (53% for physical activity experts, 58% for ECE experts) and the use of the Delphi technique with two field-specific expert panels, it is not without limitations. First, the purposeful sampling method may have introduced selection bias. While efforts were made by the research team to overcome this bias (e.g., ensuring sufficient recruitment of international/provincial experts, allowing participants to suggest researchers to recruit), the selection of experts by the research team may have included experts with similar ideals and values regarding the importance of this training for ECEs; this may limit the generalizability of the findings. Second, despite the anonymous nature of the online surveys, participants may have been subject to social desirability bias, as they may have felt that higher importance ratings were 'expected' of someone in their profession. Third, as is the case in any Delphi study, data gathered were based upon availability and the subjective opinion and expertise of participants.

Conclusion

Using the Delphi method to identify and reach agreement on physical activity and sedentary behaviour-related topics to include in supplementary training for pre-service ECEs provided a unique perspective on e-Learning course content development.

The high importance ratings of all 19 content areas, coupled with the moderate-to-strong inter-panel agreement across these topics, suggest the need for this tailored education. Further, the agreement by the ECE expert panel regarding the appropriateness of incorporating this type of training within ECE programs demonstrated that there is a desire for physical activity and sedentary behaviour-related education at the post-secondary level, and that the addition of this content would support curriculum objectives and accreditation standards. Moving forward, creating an e-Learning course with evidence-based and expert-developed content, endorsed by those working in a wide range of ECE professions, will ensure that ECE graduates receive the necessary and most relevant education to be able to promote children's healthy development of movement behaviours in childcare settings. Integrating such physical activity and sedentary behaviour training within ECE programs is a population-level approach to public health that has the potential to benefit a vast number of young children.

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Chapter 3

Change in Pre- and In-Service Early Childhood Educators' Knowledge, Self-Efficacy, and Intentions Following an e-Learning Course in Physical Activity and Sedentary Behaviour: A Pilot Study[4]

Childcare is a unique environment to promote young children's (<5 years) healthy physical, cognitive, and psychosocial development (Goldfield *et al.,* 2012). In developed countries, 39% of 2-year-olds, and over three-quarters of 3- and 4-year-olds, are enrolled in childcare, and spend nearly 40 hours per week (~66% of their weekday waking hours) in these settings (OECD, 2021). Young children's movement behaviours (i.e., physical activity, sedentary behaviours, and sleep) are particularly important drivers of healthy early childhood development. Physical activity supports healthy development, such as strong bones and muscles and enhanced cognitive development (Carson, Lee, *et al.,* 2017). Further, limiting prolonged time in sedentary pursuits, particularly screen-based behaviours, can help children avoid detrimental effects including delayed language development and decreased cognitive and psychosocial health (Carson, Rahman, *et al.,* 2017; Leblanc *et al.,* 2012). Considering young children in childcare engage in low levels of physical activity (24 min/hr; Vanderloo *et al.,* 2014) and spend most of their day (66%) in sedentary behaviours (Tucker *et al.,* 2015),

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interventions to support the promotion of more physically active childcare environments are critical.

To date, childcare physical activity and sedentary behaviour interventions have focused largely on: the physical environment (Cosco *et al.,* 2014; Robinson *et al.,* 2019); modifications to policy and practice (Carson *et al.,* 2015; Erinosho *et al.,* 2014; Finch *et al.,* 2012); and, training and support for ECEs (Green *et al.,* 2020; Pate *et al.,* 2016; Tucker *et al.,* 2017). Training for ECEs has proven to be essential, not only for its impact on children's movement behaviours in childcare (Trost *et al.,* 2010), but also for its supportive role in facilitating successful environment, and policy and practice interventions (Bruijns, Johnson, Irwin, *et al.,* 2021; Howie *et al.,* 2016). This is logical, as ECEs are highly influential in the care setting with regard to role modelling and programming physical activity and appropriate sedentary behaviours (Robinson *et al.,* 2012). Professional learning interventions for ECEs have been noted to increase both their knowledge in and confidence to support and lead physical activity in childcare settings (Hassani *et al.,* 2020), which seem to naturally support ECEs' motivation and ability to utilize the environment to facilitate physical activity and carry out health-promoting changes to policy and practice – associations which are consistent with tenets of SCT (Bandura, 2004).

Professional learning for ECEs focused on physical activity and sedentary behaviour is critical for movement behaviour interventions in childcare, as ECEs have reportedly received little education (32% and 27% of Canadian pre-service ECEs have completed courses in physical activity and screen-viewing, respectively) in these areas

during their pre-service training (Bruijns *et al.,* 2019). It is counterintuitive, then, to expect ECEs to carry out physical activity-promoting practices and programming in childcare settings when they often do not have the appropriate knowledge-base and know-how to support this behaviour. For example, Tucker *et al.*'s (2019) childcare-based intervention was designed to improve young children's movement behaviours by providing ECEs with an evidence-based physical activity policy for 8 weeks; ECEs expressed difficulty implementing the policy components because they lacked in-depth training on how to do so (Szpunar *et al.,* 2020). Given the variability in ECEs' educational backgrounds, it is critical that they be supported with training, both pre-service and in-service, so they can confidently integrate movement (and minimize sedentary behaviour) in their daily programming and practices.

Professional learning related to children's physical activity and sedentary behaviour has been requested by pre- and in-service ECEs themselves (Bruijns *et al.,* 2019; van Zandvoort *et al.,* 2010), and has been associated with increases in both ECEs' self-efficacy and their intention and perceived control over their ability to lead physical activity opportunities for the children in their care (Bai *et al.,* 2020; Hassani *et al.,* 2020). SCT and the TPB highlight the importance of self-efficacy, behavioural intention, and perceived behavioural control for behaviour change (Ajzen, 1991; Bandura, 2004), which are particularly important constructs to consider in these types of interventions. Specifically, self-efficacy is developed from knowledge acquisition; thus, this construct of SCT is predicted to be influenced by educational interventions (Bandura, 2004). Further, behavioural intention is the closest factor to human behaviour, and is often

regulated by perceived behavioural control (Ajzen, 1991); for example, ECEs may intend to program outdoor play opportunities in all weather conditions, but if their childcare centre has policies preventing outdoor play in inclement weather, this behaviour would not be within their control. Therefore, ECEs' behavioural intention and perceived control can act as important indicators of potential behaviour change, particularly in online learning interventions where actual behaviour change cannot be measured. However, educator-based constructs (i.e., self-efficacy, behavioural intention, and perceived behavioural control) are infrequently measured in childcare intervention studies, and few studies explored the direct relationship between educator training and improved physical activity levels among children in childcare (Peden *et al.,* 2018).

There has been little focus on professional learning for ECEs as an intervention uniquely (it is often coupled with prescribed physical activity programming; Green *et al.,* 2020) and few researchers have explored how supplementary education in physical activity and sedentary behaviour could benefit pre-service ECEs in their post-secondary training (Altunsöz, 2015). As such, the TEACH study was designed to fill this gap (Tucker *et al.,* 2021). The purpose of this pilot study was to examine the short-term efficacy of the TEACH e-Learning course in physical activity and sedentary behaviour on Canadian pre-service and in-service ECEs' related knowledge, self-efficacy, behavioural intention, and perceived behavioural control. While the TEACH e-Learning course was designed for pre-service ECEs, pilot testing in a sample of in-service ECEs was undertaken to ensure the course was relevant, informative, and helpful for real-world practice.

Methods

Pre- and in-service ECEs were purposefully recruited to pilot test the 5-hour TEACH e-Learning course in physical activity and sedentary behaviour. Expert-developed content was generated via a Delphi process (Bruijns *et al.,* 2020) and the course comprised four modules developed for ECEs, which covered: introductory content on physical activity and sedentary behaviour in early childhood; the influence of the childcare environment on children's movement behaviours, and outdoor and risky play; practical strategies to promote physical activity and minimize sedentary time among children in childcare; and, ECE-focused professional learning, resources, and a video library. For more details about the course and its development, consult the TEACH study protocol (Tucker *et al.,* 2021).

Recruitment and Study Procedures

From March to May 2021, three Canadian ECE programs (1-year certificate, or 2-year diploma programs) were purposefully recruited, and pre-service ECEs were eligible to participate if they were enrolled in a participating cohort. One ECE program provided in-class time for pre-service ECEs to complete the course, while the other two programs provided online (unmonitored) class time. In-service ECEs were recruited via social media advertisements (e.g., Twitter, Facebook), and were eligible to participate in the study if they were employed in a centre- or home-based childcare, preschool, or kindergarten setting. The research team also emailed Canadian and provincial/territorial childcare organizations to request that they share the study advertisement with their members. Participants were instructed to complete the e-Learning course within 2

weeks; however, accounts were not deactivated until the study closure date, which was advertised to participants via reminder emails. This pilot study was conducted in accordance with the Declaration of Helsinki and approved by the Non-Medical Research Ethics Board at Western University (REB# 116816; Appendix I).

Online Survey

Pre- and in-service ECEs completed an online survey via Qualtrics (~25 minutes) at two timepoints: (1) prior to commencing; and, (2) immediately following completion of the e-Learning course. Prior to beginning the first online survey, pre- and in-service ECEs were instructed to review a Letter of Information and Consent (Appendices J and K, respectively). Participants were asked to create a unique participant identification in the baseline survey to link their data to follow-up responses. The 129-item online survey comprised five sections: demographics (*n* = 12 items); knowledge (*n* = 30 items); self-efficacy (*n* = 31 items); behavioural intention (*n* = 28 items); and, perceived behavioural control (*n* = 28 items).

Demographics

The demographics section (Appendix L) captured: participant age, gender, and ethnicity; province/territory; the type of ECE pre-service training program in which participants were enrolled/had completed; the number of courses in participants' pre-service schooling (to their knowledge) that covered physical activity, outdoor play, and sedentary behaviour; their previous experience with e-Learning courses; and, their hours per week spent in MVPA and recreational screen time. Additional questions (*n* = 3) were also added to the in-service ECE baseline questionnaire (Appendix M), including:

the type of childcare setting in which participants were employed; their years of experience; and, their past professional learning in physical activity, outdoor play, and/or sedentary behaviour.

Knowledge of Physical Activity, Outdoor/Risky Play, and Sedentary Behaviour Concepts

ECE knowledge was assessed via items pertaining to: *The Canadian 24-Hour Movement Guidelines for the Early Years* (CSEP, 2017) and movement behaviour recommendations for childcare settings (8 multiple choice items); important definitions (7 multiple choice items); appropriate ECE behaviours to support healthy movement behaviours (7 multiple choice items); and, facts about movement behaviours in childcare (8 true or false items; Appendix N). A composite score (out of 30) was produced.

Physical Activity, Outdoor/Risky Play, and Sedentary Behaviour Self-Efficacy

The valid and reliable *ECE Confidence in Outdoor Movement, Physical Activity, Sedentary and Screen behaviours* (ECE-COMPASS) questionnaire (Bruijns, Johnson, Burke, *et al.,* 2021a; Appendix O) was administered to assess ECEs' self-efficacy. This tool was informed by Bandura's Guide for Creating Self-Efficacy Scales (Bandura, 2006) and comprised of 21 task ($\alpha = 0.92$; $\omega = 0.96$; hierarchal $\omega = 0.60$) and 10 barrier ($\alpha = 0.89$; $\omega = 0.97$; hierarchal $\omega = 0.79$) self-efficacy items (i.e., confidence to complete a *task* [while overcoming a challenge; *barrier*]). Participants were asked to rate their confidence in their ability to perform a number of physical activity, sedentary behaviour, and outdoor play-related tasks during their childcare day on a scale from 0 (not

confident at all) to 10 (completely confident). Composite scores for task and barrier self-efficacy were produced.

Behavioural Intention and Perceived Behavioural Control

The valid and reliable *ECE Movement Behavioural Intention and Perceived Control* (ECE-MBIPC) questionnaire (Bruijns, Johnson, Burke, *et al.,* 2021b; Appendix P), informed by TPB questionnaire construction recommendations (Ajzen, 2013) and modelled after the tool employed by Gagné and Harnois (Gagné & Harnois, 2013), was used to measure participants' intention and perceived control to perform seven behaviours pertaining to physical activity (n = 3; α = 0.91), sedentary behaviour (n = 2; α = 0.88), and outdoor and risky play (n = 2; α = 0.92). Four items with a 7-point Likert scale were used to measure behavioural intention: *I have the intention to…*(1 = strongly disagree to 7 = strongly agree); *I plan to…*(1 = strongly disagree to 7 = strongly agree); *I estimate that my chances of…are* (1 = extremely unlikely to 7 = extremely likely); and, *I am going to…* (1 = extremely unlikely to 7 = extremely likely). Similarly, four items were used to measure participants' perceived behavioural control for each of the seven abovementioned behaviours (α range = 0.88 to 0.91): *for me…would be* (1 = extremely difficult to 7 = extremely easy); *if I wanted to, I could easily…*(1 = strongly disagree to 7 = strongly agree); *it is up to me to…*(1 = strongly disagree to 7 = strongly agree); and, *I feel able to…*(1 = strongly disagree to 7 = strongly agree). Behavioural intention and perceived behavioural control composite scores for each of the seven behaviours were calculated. For behavioural intention, ω was 0.91 and hierarchal ω was 0.72. For perceived behavioural control, ω was 0.94 and hierarchal ω was 0.76.

Data Analysis

All statistical analyses were conducted in SPSS (version 27). Descriptive statistics were calculated to report participant demographics. Frequencies were generated for knowledge questionnaire responses, while means and standard deviations were calculated for self-efficacy (task, barrier), behavioural intention (composite for each behaviour), and perceived behavioural control (composite for each behaviour).

To determine the efficacy of the e-Learning course with regard to increasing pre- and in-service ECEs' knowledge, paired samples *t*-tests were run to analyze changes in mean composite scores, and McNemar chi square tests were conducted for individual questions. Considering the self-efficacy, behavioural intention, and perceived behavioural control data were non-normally distributed (Shapiro-Wilk = 0.86; p <.000*), Wilcoxon Signed Ranks Tests were used. Bonferroni corrections were performed to account for familywise error within each set of multiple comparisons.

Results

Fifty-one pre-service ECEs completed the baseline survey (from 65 invited; 78.5% response rate) and 36 completed the follow-up survey (32 retained for analysis [i.e., participant ID matched baseline survey]; 59.3% retention from baseline).[5] From the 274

[5] Pre-service ECEs retained for analysis were significantly younger, and reported to: have taken more courses in physical activity; have experience with e-Learning workshops; and, not meet the physical activity and screen time guidelines within the *Canadian 24-Hour Movement Guidelines for Adults*, than those lost to follow-up (p < .05).

in-service ECEs that were recruited at baseline, 133 completed the follow-up survey, and 121 were retained for analysis (42.3% retention from baseline).[6]

Participant Demographics

Pre-service ECEs were from Ontario (34.4%), Alberta (18.8%), and the Northwest Territories (21.9%). Participants were female (93.8%), 26.7 years old (*SD* = 6.9), and most were South Asian (28.1%%) or First Nations/Inuit/Métis (28.1%), and enrolled in an early childhood education diploma program (93.8%). The vast majority of participants self-reported that their program offered at least one course covering content relating to physical activity (100.0%), sedentary behaviours (87.7%), and outdoor and/or risky play (91.9%). Most participants (65.6%) had previous experience with e-Learning courses/workshops. A minority of pre-service ECEs self-reported to meet the MVPA guideline (150+ min/week; 31.3%) or the recreational screen time guideline (<3 hours/day; 37.5%) outlined in the *Canadian 24-Hour Movement Guidelines for Adults* (CSEP, 2020).

In-service ECEs represented seven Canadian provinces/territories. The average age of in-service ECEs was 37.1 years (*SD* = 9.5), and most were female (99.2%), Caucasian (66.1%), employed in a centre-based childcare setting (62.5%), and had an average of 10.9 (*SD* = 8.8) years of experience as an ECE. Reflecting on their pre-service training, 67.8% of in-service ECEs completed a diploma program, and many reported having taken at least one course covering content in physical activity (81%), sedentary

[6] In-service ECEs retained for analysis were significantly more likely to have completed a diploma program and meet the screen time guideline within the *Canadian 24-Hour Movement Guidelines for Adults*, than those lost to follow-up ($p < .05$).

behaviours (47.9%), and outdoor and/or risky play (77.6%). A number of ECEs also reported having completed professional learning in physical activity (38.0%), sedentary behaviour (16.5%), and outdoor and/or risky play (56.2%), and 70.2% had previous experience with e-Learning courses/workshops. Just over a quarter of ECEs (28.1%) self-reported to meet the MVPA guideline within the *Canadian 24-Hour Movement Guidelines for Adults* (CSEP, 2020), while most ECEs (69.4%) met the recreational screen time guideline. See Table 1 for full participant demographics.

Knowledge of Physical Activity and Sedentary Behaviour Concepts

There were significant improvements in pre-service participants' total knowledge score from pre- to post-course (Figure 1 [a]). While item-specific answers trended in the expected direction (i.e., increase in percentage of correct responses), insufficient cell sizes prevented item-by-item analysis. Similarly, in-service ECEs' total knowledge score also increased significantly from pre- to post-course (Figure 1 [a]). Of note, ECEs significantly increased their knowledge of the physical activity and screen time guidelines within the *Canadian 24-Hour Movement Guidelines for the Early Years* (Table 2). For example, when asked to select the appropriate screen time guideline for a 3-year-old, only 11.6% of ECEs indicated the correct time limit pre-course, whereas 61.9% of ECEs selected the correct answer after completing the course (X^2 [117] = 50.21, p = <.001). See Table 2 for further item-specific data.

Physical Activity and Sedentary Behaviour Self-Efficacy

There was a significant change in pre-service ECEs' barrier self-efficacy from pre- to post-course (Figure 1 [b]), but not in their task self-efficacy (Figure 1 [c]). For in-

Table 1. *Pre- and In-Service Early Childhood Educators' Demographic Information*

Variable	Pre-Service (N = 32)		In-Service (N = 121)		Variable	Pre-Service (N = 32)		In-Service (N = 121)	
	n	**%**	***n***	**%**		***n***	**%**	***n***	**%**
Age (*M, SD*)	26.7	6.9	37.1	9.5	**Current/Past ECE Program Type**				
Gender					Certificate	2	6.3	12	9.9
Female	30	93.8	120	99.2	Diploma	30	93.8	82	67.8
Male	2	6.3	1	.8	Bachelor's Degree	--	--	18	14.9
Ethnicity					Graduate Degree	--	--	4	3.3
Caucasian	5	15.6	80	66.1	Other	--	--	5	4.1
African Canadian	1	3.1	2	1.7	**Years of ECE Experience (*M, SD*)**	--	--	10.9	8.8
South Asian	9	28.1	10	8.3	**ECE Program Courses in Physical Activity[b]**				
East Asian	4	12.5	11	9.1	No courses	--	--	23	19.0
Southeast Asian	2	6.3	3	2.5	1 course	3	9.4	64	52.9
Middle Eastern	--	--	3	2.5	2 courses	11	34.4	22	18.2
First Nations/Inuit/Métis	9	28.1	1	.8	3+ courses	18	56.2	12	9.9
Latin Canadian	1	3.1	4	3.3	**ECE Program Courses in Sedentary Behaviour[b]**				
Other	1	3.1	4	3.3	No courses	4	12.5	63	52.1
Prefer not to answer	--	--	3	2.5	1 course	10	31.3	37	30.6
Province/Territory					2 courses	2	6.3	10	8.3
Alberta	6	18.8	24	20.0	3+ courses	16	50.1	11	9.0
British Columbia	--	--	16	13.3	**ECE Program Courses in Outdoor and Risky Play[b]**				
Manitoba	--	--	7	5.8	No courses	2	6.3	27	22.3
Newfoundland & Labrador	--	--	5	4.2	1 course	2	6.3	62	51.2
Northwest Territories	7	21.9	4	3.3	2 courses	7	21.9	15	12.4
Ontario	11	34.4	61	50.8	3+ courses	21	63.7	17	14.0
Saskatchewan	--	--	3	2.5	**Childcare Type**				
					Centre-based childcare	--	--	75	62.5

Meeting the Adult Physical Activity Guideline[a]									
Yes	10	31.3	34	28.1	Home-based childcare	--	--	11	9.2
No	22	68.8	87	71.9	Kindergarten	--	--	18	15.0
Meeting the Adult Screen Time Guideline[a]					Preschool	--	--	16	13.3
Yes	12	37.5	84	69.4	**Professional Development**				
No	20	62.5	37	30.6	Physical Activity	--	--	46	38.0
Previous e-Learning Experience					Sedentary Behaviour	--	--	20	16.5
Yes	21	65.6	85	70.2	Outdoor/Risky Play	--	--	68	56.2
No	11	34.4	36	29.8	None	--	--	41	33.9

Notes. ECE = Early Childhood Education; -- = not applicable; [a] 150 min/week of moderate-to-vigorous physical activity and <3 hours/day of recreational screen time as per the *Canadian 24-Hour Movement Guidelines for Adults* (CSEP, 2020); [b] Self-reported courses in program.

Table 2. *Change in Early Childhood Educators' Knowledge Following the e-Learning Course*

Item	Study Population	N	Pre-Course Correct Responses		Post-Course Correct Responses		*df*	X^2	*p*
			N	%	N	%			
Guidelines (*n* = 8 Questions; Multiple Choice)									
How many minutes of tummy time are infants recommended to engage in each day? [a]	Pre-service	31	12	37.5	17	53.1	30		
	In-service	119	47	38.8	84	70.6	118	23.56	<.001*
How many minutes of total physical activity are toddlers and preschoolers recommended to engage in each day? [a]	Pre-service	31	9	28.1	13	40.6	30		
	In-service	119	18	14.9	64	53.8	118	35.63	<.001*
How many minutes of moderate-to-vigorous physical activity are preschoolers (3-4 years) recommended to engage in each day? [a]	Pre-service	31	17	53.1	17	54.8	30		
	In-service	119	38	31.4	81	68.1	118	28.92	<.001*
How many minutes of screen time should a 3-year-old be limited to each day? [a]	Pre-service	31	16	50.0	22	71.0	30		
	In-service	118	14	11.6	73	61.9	117	50.21	<.001*
	Pre-service	31	16	50.0	18	58.1	30		

How much good-quality sleep, including naps, should infants (4-11 months) get each day? [a]	In-service	118	65	53.7	60	50.4	117	.28	.596
How much good-quality sleep including naps, should toddlers get each day? [a]	Pre-service	31	16	50.0	25	80.6	30		
	In-service	120	69	57.0	81	67.5	119	2.24	.134
For full-day programs (8 hours), what is the recommendation for preschoolers' physical activity while in care? [b]	Pre-service	31	4	12.5	12	38.7	30		
	In-service	119	47	38.8	74	61.7	118	13.02	<.001*
What is the recommendation for screen-viewing in childcare? [b]	Pre-service	31	4	12.5	24	77.4	30		
	In-service	120	69	57.0	114	95.0	119	40.50	<.001*
Important Definitions (*n* = 7 Questions; Multiple Choice)									
Galloping, hopping, and jumping are examples of what type of fundamental movement skill?	Pre-service	28	25	78.1	26	92.9	27		
	In-service	115	100	82.6	111	96.5	114		
	Pre-service	28	26	81.3	20	71.4	27		

What is an example of a muscle and bone-strengthening activity?	In-service	116	60	49.6	86	74.1	115	20.10	<.001*
The "motivation, confidence, physical competence, knowledge, and understanding to value and take responsibility for engagement in physical activities for life" is the definition of what?	Pre-service	28	22	68.8	23	82.1	27		
	In-service	116	49	40.5	99	85.3	115	46.45	<.001*
What type of play is "a form c gross motor or total body movement in which young children use energy in a fun and freely chosen manner"?	Pre-service	28	22	68.8	20	71.4	27		
	In-service	115	75	62.0	99	85.3	114	19.18	<.001*
What type of play invites curiosity by allowing children to play with everyday items or natura elements?	Pre-service	28	26	81.3	25	89.3	27		
	In-service	116	107	88.4	116	100.0	115		
What practice can be used to limit sedentary time while waiting for the next activity	Pre-service	28	26	81.3	24	85.7	27		
	In-service	117	106	87.6	107	91.5	116		

or travelling to a different part of the classroom?									
What is NOT considered a category of risky play?	Pre-service	28	27	84.4	22	78.6	27		
	In-service	117	96	79.3	106	90.6	116	4.65	.031
Appropriate ECE Behaviours (*n* = 7 Questions; Multiple Choice)									
Which of the following behaviours of ECEs does NOT promote physical activity?	Pre-service	28	10	31.3	22	78.6	27		
	In-service	116	95	78.5	114	97.4	115		
Which strategy does NOT encourage risky play?	Pre-service	28	26	81.3	28	100.0	27		
	In-service	117	110	90.9	117	100.0	116		
When it comes to outdoor play, it is okay to move activities indoors if:	Pre-service	28	28	87.5	27	96.4	27		
	In-service	117	120	99.2	116	99.1	116		
When is it NOT appropriate to lead structured physical activities during outdoor play	Pre-service	28	10	31.3	18	64.3	27		
	In-service	114	61	50.4	76	65.5	113	5.63	.018
To make a throwing activity more challenging, you can:	Pre-service	28	22	68.8	25	89.3	27		
	In-service	117	108	89.3	108	92.3	116		

According to the Active Play and Physical Literacy Everyday (APPLE) Model, what four elements can educators utilize to encourage their children's development of physical literacy?	Pre-service	28	22	68.8	24	85.7	27		
	In-service	116	74	61.2	104	89.7	115	21.95	<.001*
Why is communicating with families about movement behaviours at childcare so important?	Pre-service	28	29	90.6	25	89.3	27		
	In-service	117	119	98.3	117	100.0	116		
Facts About Physical Activity and Sedentary Behaviour in Childcare (*n* = 8 questions; True/False)									
Regular physical activity helps children sleep better, which gives them more energy the next day to stay active.	Pre-service	28	32	100.0	28	100.0	27		
	In-service	117	120	99.2	117	100.0	116		
Too much screen-viewing in early childhood may delay children's language development.	Pre-service	28	23	71.9	25	89.3	27		
	In-service	117	104	86.0	117	100.0	116		
Fixed play equipment promotes increased physical	Pre-service	28	24	75.0	23	82.1	27		
	In-service	117	110	90.9	110	94.0	116		

activity when compared to portable play equipment.									
A light-intensity physical activity may get a person warm and starting to sweat. The person may not be able to sing.	Pre-service	28	29	90.6	23	82.1	27		
	In-service	117	107	88.4	112	95.7	116		
Boys tend to be more active than girls.	Pre-service	28	17	53.1	24	85.7	27		
	In-service	116	54	44.6	99	85.3	115	39.51	<.001*
In childcare, children are twice as active outdoors than indoors.	Pre-service	28	28	87.5	26	92.9	27		
	In-service	117	101	83.5	102	87.2	116	.552	.458
If the weather outside isn't favourable, you should cancel outdoor play time.	Pre-service	28	14	43.8	26	92.9	27		
	In-service	117	91	75.2	102	87.2	116		
Regular tummy time helps infants learn how to roll over and crawl.	Pre-service	28	31	96.9	28	100.0	27		
	In-service	117	121	100.0	116	99.1	116		

Note. [a] = As per the *Canadian 24-Hour Movement Guidelines for the Early Years* (CSEP, 2017); [b] As per research-based recommendations presented in the e-Learning course; McNemar Chi Square Tests were between early childhood educators' pre- and post-course self-efficacy ratings; Shaded box = McNemar statistics could not be computed due to insufficient cell size and/or item difficulty; * = significant <.001 after adjusting for multiple comparison bias.

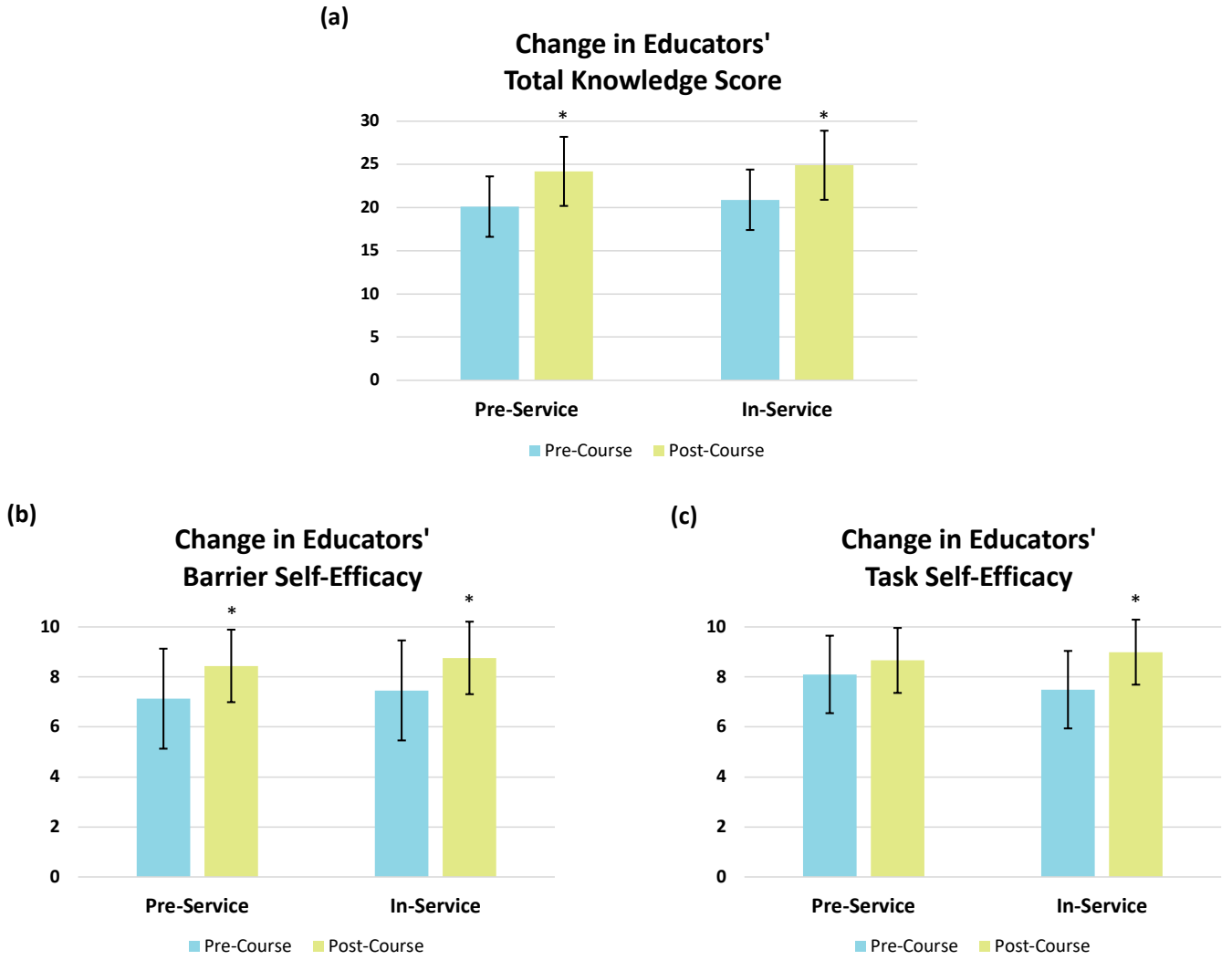

Figure 1. (a) Change in pre- and in-service early childhood educators' (ECEs) total knowledge score (out of 30) from pre-course to post-course (* = significant [$p < .05$]); **(b)** Change in pre- and in-service ECEs' barrier self-efficacy from pre-course to post-course (* = significant [$p < .025$]); **(c)** Change in ECEs' task self-efficacy from pre-course to post-course (* = significant [$p < .025$]).

service ECEs, there was a significant positive change in both their task and barrier self-efficacy from pre- to post-course completion (Figure 1 [b] and [c]).

Behavioural Intention and Perceived Behavioural Control

Pre-service ECEs' behavioural intention to "*promote outdoor play*" and "*avoid screen use during childcare*" increased significantly from pre- (M = 5.70 [SD = 1.44] vs. M = 5.58 [SD = 1.35], Z = 3.227, p = .001, respectively) to post-course (M = 6.58 [SD = .70] vs. M = 6.61 [SD = .78], Z = -2.921, p = .003, respectively). Further, pre-service ECEs' perceived behavioural control to "*engage children in my care in at least 120 min/day of physical activity*" and "*avoid screen use during childcare*" increased significantly from pre-course (M = 5.88 [SD = .78] vs. M = 5.92 [SD = .87], Z = -2.858, p = .004, respectively) to post-course completion (M = 6.32 [SD = .73] vs. M = 6.46 [SD = .74], Z = -2.958, p = .003, respectively). However, there were no significant differences in behavioural intention or perceived control for any of the remaining behaviours (p > .007). In-service ECEs significantly increased behavioural intention and perceived behavioural control across all seven behaviours (p < .007; Table 3). See Table 3 for item-specific analyses.

Discussion

Given ECEs have been noted to largely influence movement affordances in childcare settings (Copeland *et al.,* 2012), ensuring they have the understanding, confidence, and motivation to facilitate physical activity opportunities in these settings in important. To our knowledge this is the first study to examine the short-term effect of an e-Learning course in physical activity and sedentary behaviour on both pre- and in-service ECEs' knowledge, self-efficacy, behavioural intention, and perceived behavioural

Table 3. *Change in Early Childhood Educators' Behavioural Intention and Perceived Behavioural Control Following the e-Learning Course*

Item	Study Population	N	Pre-Course		Post-Course		+ve Rank (N)	-ve Rank (N)	*Z*	*p*
			M (*SD*)	Median (IQR)	*M* (*SD*)	Median (IQR)				
Behavioural Intention (*n* = 7 items)										
Engage children in my care in at least 120 min/day of physical activity	Pre-service	26	6.06 (.90)	6.0 (5.75-6.75)	6.55 (.57)	6.75 (6.25-7.0)	12	7	-1.757	.079
	In-service	113	6.05 (.95)	6.25 (5.5-7.0)	6.42 (.69)	6.5 (6.0-7.0)	62	19	-4.782	<.001*
Promote children's development of physical literacy by incorporating fundamental movement skills	Pre-service	26	6.26 (.68)	6.25 (6.0-7.0)	6.59 (.62)	7.0 (6.25-7.0)	11	8	-1.719	.086
	In-service	112	6.22 (.75)	6.25 (5.88-7.0)	6.53 (.60)	6.75 (6.0-7.0)	58	21	-4.469	<.001*
Be a good role model for children's physical activity by participating in movement-based activities	Pre-service	24	6.42 (.70)	6.75 (6.0-7.0)	6.63 (.67)	7.0 (6.38-7.0)	10	5	-.799	.424
	In-service	112	6.27 (.86)	6.5 (6.0-7.0)	6.59 (.72)	7.0 (6.25-7.0)	57	11	-5.119	<.001*
Promote outdoor play during all seasons and weather conditions	Pre-service	26	5.70 (1.44)	6.0 (4.5-7.0)	6.58 (.70)	7.0 (6.25-7.0)	16	2	-3.227	.001*
	In-service	109	6.28	6.5	6.61	6.75	48	25	-4.143	<.001*

			(.89)	(6.0-7.0)	(.49)	(6.25-7.0)				
Lead opportunities for outdoor risky play for children in my care	Pre-service	26	5.73 (1.50)	6.0 (5.5-7.0)	6.42 (.75)	6.75 (6.0-7.0)	14	6	-2.037	.042
	In-service	111	5.74 (1.31)	6.0 (5.25-6.75)	6.16 (1.02)	6.25 (6.0-7.0)	62	19	-4.226	<.001*
Minimize long periods of sedentary time (>60 minutes) for children in my care	Pre-service	25	5.95 (1.10)	6.0 (5.63-7.0)	6.50 (.74)	6.75 (6.25-7.0)	11	5	-1.997	.046
	In-service	111	6.14 (1.01)	6.5 (5.75-7.0)	6.53 (.61)	6.75 (6.0-7.0)	61	18	-4.399	<.001*
Avoid children's use of screen based technology during childcare hours	Pre-service	26	5.58 (1.35)	6.0 (4.25-7.0)	6.61 (.78)	7.0 (6.5-7.0)	16	3	-2.921	.003*
	In-service	112	6.35 (1.11)	7.0 (6.0-7.0)	6.73 (.61)	7.0 (6.75-7.0)	41	13	-4.263	<.001*
Perceived Behavioural Control (*n* = 7 items)										
Engage children in my care in at least 120 min/day of physical activity	Pre-service	27	5.88 (.78)	6.0 (5.31-6.69)	6.32 (.73)	6.5 (6.0-7.0)	19	4	-2.858	.004*
	In-service	112	5.69 (1.22)	6.0 (4.88-6.75)	6.16 (1.14)	6.5 (5.75-7.0)	64	20	-4.947	<.001*
	Pre-service	28	6.01 (.65)	6.0 (5.75-6.69)	6.38 (.75)	6.75 (6.0-7.0)	19	5	-2.465	.014

Promote children's development of physical literacy by incorporating fundamental movement skills	In-service	109	5.99 (.97)	6.0 (5.5-6.75)	6.46 (.62)	6.75 (6.0-7.0)	61	20	-5.268	<.001*
Be a good role model for children's physical activity by participating in movement-based activities	Pre-service	27	6.32 (.60)	6.25 (6.0-7.0)	6.49 (.71)	6.75 (6.0-7.0)	12	5	-1.839	.066
	In-service	106	6.16 (.88)	6.5 (5.75-7.0)	6.50 (.84)	7.0 (6.0-7.0)	56	16	-4.734	<.001*
Promote outdoor play during all seasons and weather conditions	Pre-service	26	5.76 (1.17)	6.0 (5.25-6.75)	6.33 (.84)	6.75 (6.0-7.0)	15	5	-2.692	.007
	In-service	111	6.03 (.94)	6.25 (5.5-7.0)	6.37 (.72)	6.63 (6.0-7.0)	57	22	-3.790	<.001*
Lead opportunities for outdoor risky play for children in my care	Pre-service	28	5.84 (1.12)	6.0 (5.56-6.75)	6.27 (.92)	6.88 (6.0-7.0)	16	5	-1.916	.055
	In-service	107	5.42 (1.38)	5.75 (4.5-6.56)	5.88 (1.21)	6.0 (5.5-6.75)	67	20	-4.736	<.001*
Minimize long periods of sedentary time (>60 minutes) for children in my care	Pre-service	28	5.91 (.88)	5.88 (5.25-6.75)	6.35 (.81)	6.88 (6.0-7.0)	14	5	-2.339	.019
	In-service	110	6.00 (.95)	6.25 (5.5-6.75)	6.41 (.78)	6.75 (6.0-7.0)	65	20	-4.995	<.001*

Avoid children's use of screen-based technology during childcare hours	Pre-service	28	5.92 (.87)	6.0 (5.25-6.75)	6.46 (.74)	6.88 (6.0-7.0)	17	6	-2.958	.003*
	In-service	109	6.25 (1.13)	6.75 (5.75-7.0)	6.62 (.72)	7.0 (6.5-7.0)	50	18	-4.157	<.001*

Note. M = mean; *SD* = standard deviation; IQR = interquartile range; Behavioural intention and perceived behavioural control were scored on a 7-point Likert scale using 4 questions each (composite scores across these 4 questions are presented); Wilcoxon Signed Ranks Tests were between early childhood educators' pre- and post-course behavioural intention and perceived behavioural control ratings; Where positive and negative rank N values do not equal sample N, remaining participants tied their baseline score; * = significant after adjusting for multiple comparison bias (alpha compared at .0071).

control to support physical activity and minimize sedentary behaviour in childcare. After taking the course, both pre- and in-service ECEs demonstrated significant positive changes in their knowledge and self-efficacy regarding physical activity, sedentary behaviour, and outdoor play in childcare settings. Their intention and perceived control to promote healthy levels of physical activity and appropriate sedentary behaviour also increased following training. A number of these findings are discussed below.

As noted above, both pre- and in-service ECEs significantly increased their total knowledge of physical activity and sedentary behaviour. These improvements could largely be attributed to increased scores in the *Guidelines* and *Important Definitions* sections of the questionnaire. Of note, very few ECEs demonstrated an understanding of the physical activity and screen-viewing recommendations within the *24-Hour Movement Guidelines for the Early Years* prior to taking the e-Learning course. This is consistent with previous work by Bruijns and colleagues (2021) which showed that less than 20% and 13% of ECEs (*n* = 83) correctly recalled physical activity and screen-viewing guidelines, respectively, prior to participating in training (Bruijns, Johnson, Irwin, *et al.,* 2021). More positively, findings from the present study showed that in-service ECEs' guideline recollection approached 100% for some items following the e-Learning course, indicating that participants were able to learn this content effectively via e-Learning. Significant increases were also observed for the in-service ECEs who provided the correct responses for questions pertaining to physical literacy, active play, and muscle and bone-strengthening activities definitions. Our baseline finding related to physical literacy and subsequent improvements aligns with the findings of Foulkes *et al.*

(2020) who found early care providers were not aware of the meaning of the term 'physical literacy'. It is clear that ECEs need additional training in physical activity domains to both understand the importance of being active in a variety of ways and how to integrate active play experiences into early learning settings.

In addition to marked increases in pre- and in-service ECEs' knowledge, the e-Learning course was also associated with a significant increase in ECEs' self-efficacy. This finding speaks to the well-rounded nature of the e-Learning course, as previous professional learning studies with ECEs have typically focused only on children's physical activity (Adamo *et al.,* 2017; Hoffman *et al.,* 2019; Pfeiffer *et al.,* 2013), with sedentary behaviour often left out. By including sedentary behaviour content and placing focus on the importance of outdoor play in facilitating physical activity among children in childcare, the ECEs in our study appear to have gained confidence in these other domains as well. Similarly, Hassani *et al.* (2020) measured Canadian ECEs' (*n* = 1,819) confidence following a professional learning intervention in healthy eating and physical activity (which also included content on sedentary behaviour), and found that ECEs demonstrated significant increases in both physical activity and sedentary behaviour-related confidence. As such, supporting ECEs' self-efficacy development via professional learning is a useful tool that can increase the likelihood that they will incorporate movement-based programming, while satisfying their request for additional training in these domains.

Not only did ECEs show improvements in their knowledge and self-efficacy scores, but behavioural intention and perceived behavioural control relating to physical

activity and sedentary behaviour also increased, consistent with previous literature (Bai et al., 2020). Bai and colleagues (2020) implemented both a nature play and a fundamental movement skill professional learning intervention for Australian ECEs (*n* = 84 and *n* = 64, respectively), and observed significant increases in self-efficacy, intention, and perceived behavioural control for promoting physical activity. In accordance with the TPB (Ajzen, 1991), when ECEs exhibit greater intention to promote active childcare settings and better ability to control their practices and programming, behaviour change is expected. The intersection of these psychosocial variables is likely to influence children's physical activity levels in childcare (Gagné & Harnois, 2013), which is important to consider when designing childcare-based intervention studies. As such, fostering ECEs' own knowledge, confidence, intentions, and perceived control is an efficacious way to promote sustainable change in the childcare setting with respect to movement opportunities.

Research Implications and Future Directions

The findings from this pilot study are important for public health researchers in the early years population. Specifically, the comprehensiveness of the e-Learning course itself, which included content on physical activity, sedentary behaviour, and outdoor and risky play, lends itself to be applicable to childcare providers both within and outside of Canada, as the course was not designed for a specific program or intervention, but rather to provide general training in these areas. The preliminary efficacy of the e-Learning course at increasing ECEs' physical activity and sedentary behaviour-related knowledge, self-efficacy, behavioural intention, and perceived

behavioural control is encouraging for the use of this training to address public health issues, such as physical inactivity in childcare settings, by ensuring ECEs understand how to and are confident in promoting healthy physical activity and sedentary behaviour in early learning environments. Moreover, the virtual nature of the course increases the potential for population-level reach, and only simple modifications would be needed to tailor it for other settings. Future research in this field should explore whether ECEs' knowledge, self-efficacy, behavioural intention, and perceived behavioural control (uniquely or in combination) are important drivers of young children's physical activity in the childcare setting.

Strengths and Limitations

While this pilot study has many strengths, including its diverse Canadian sample, inclusion of both pre- and in-service ECEs, and the high response rate within the context of online surveys, there are also limitations which must be highlighted. First, as this was a pilot study, findings should be interpreted with caution given there was no control group against which to compare intervention samples. Second, the small sample size of the pre-service ECEs, due to logistical issues with implementation in post-secondary settings during the COVID-19 pandemic, lacked the power needed to demonstrate complete intervention efficacy in this population. Further, the low retention of in-service ECEs (~40%), as compared to pre-service ECEs (~60%), is important to acknowledge, as in-service ECEs retained for analysis differed on select demographic variables from those lost to follow-up. While these differences in retention may have been attributed to the differential recruitment and implementation methods in these

study populations, as well as the burden of the COVID-19 pandemic on in-service ECEs' time to partake in professional learning, it is possible these differences may have impacted the study findings. Third, the knowledge questionnaire was not a validated instrument, as it was created based on the specific e-Learning course content which was unique to this study. As such, while face validity was achieved through expert review and consensus, measures of knowledge in this study may not be generalizable to other research with this population. Further, lack of sufficient cell sizes and item difficulty within the questionnaire limited the analyses that could be conducted with these data. Finally, given the self-reported nature of the online survey, social desirability bias may have been at play, as ECEs may have felt that more positive responses (i.e., rating themselves as more confident or intentional) were expected of someone in their profession. Despite these limitations, we found significance in a study that was underpowered to do so; as such, it is predicted that scale-up of this pilot study with a more robust sample and a comparison group is likely to demonstrate effectiveness within this population.

Conclusion

Utilizing e-Learning to train both pre- and in-service ECEs in physical activity and sedentary behaviour may be an effective strategy to ensure they are competent, confident, and motivated to promote physical activity and minimize sedentary behaviours in childcare. Given the current paucity of educator-focused outcome measures in early years physical activity literature (Peden *et al.,* 2018), this study's findings provide preliminary evidence that educator-based factors such as knowledge,

self-efficacy, and behavioural intention and perceived control may play an important role in how physical activity, sedentary behaviour, and outdoor play are valued and facilitated by ECEs in childcare programming. While additional testing with a more robust sample and comparison group is needed before specific recommendations can be made, the potential reach and public health impact of e-Learning in physical activity and sedentary behaviour for ECEs is vast.

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Chapter 4

Implementation of an e-Learning Course in Physical Activity and Sedentary Behaviour for Pre- and In-Service Early Childhood Educators: Evaluation of the TEACH Pilot Study[7]

ECEs are important role models for young children (<5 years) in childcare (Robinson *et al.,* 2012), and can profoundly influence their movement behaviours (e.g., physical activity, sedentary behaviour; Bell *et al.,* 2015). In fact, ECEs' confidence (Bruijns *et al.,* 2021) and values (Connelly *et al.,* 2018) regarding physical activity, as well as their own physical activity levels (Bell *et al.,* 2015; Carson *et al.,* 2020) and the amount of physical activity-related training they have completed (Alhassan *et al.,* 2016; Trost *et al.,* 2010), have all been associated with children's physical activity levels in childcare. Given the importance of promoting healthy movement behaviours in early childhood (Goldfield *et al.,* 2012), which is when young children establish health-related habits (Jones *et al.,* 2013), it is essential that ECEs are educated about physical activity and sedentary behaviour so that they are confident and able to incorporate appropriate amounts of high-quality movement experiences for children in their care.

Although sedentary behaviour-related content is largely missing from existing professional learning initiatives, several previous childcare-based interventions have included physical activity training for ECEs (Adamo *et al.,* 2017; Bonvin *et al.,* 2013; De Marco *et al.,* 2015; Hoffman *et al.,* 2020; Leis *et al.,* 2020; O'Dwyer *et al.,* 2013; Pate *et*

[7] A version of this manuscript has been submitted for publication. Bruijns, B.A., Vanderloo, L.M., Johnson, A.M., Adamo, K.B., Burke, S.M., Carson, V., Heydon, R., Irwin, J.D., Naylor, P.J., Timmons, B.W., & Tucker, P. (submitted Sep 16, 2021). Implementation of an e-Learning course in physical activity and sedentary behaviour for pre- and in-service early childhood educators: Evaluation of the TEACH pilot study. *BMC Pilot and Feasibility Studies*.

al., 2016; Tucker *et al.,* 2017), many of which have been successful at increasing young children's physical activity while in care (De Marco *et al.,* 2015; Hoffman *et al.,* 2020; Pate *et al.,* 2016; Tucker *et al.,* 2017). For example, an intervention led by Pate and colleagues (2016), involving in-person training for ECEs regarding the promotion of structured and unstructured physical activity and active learning, was shown to be effective at increasing preschoolers' (*n* = 379) MVPA. Similarly, Hoffman and colleagues (2020) administered online training in physical activity for ECEs, and children whose educators received the training increased their daily MVPA by nearly 13 minutes. However, mixed results have been noted regarding the effectiveness of training interventions at improving ECEs' knowledge and confidence regarding physical activity; some studies have reported improvements in these outcomes (Bruijns *et al.,* 2021; Hassani *et al.,* 2020), while others have reported no change (Ward *et al.,* 2020). While measuring effectiveness of interventions is important, it is beneficial to look at implementation outcomes and determinants of both effective and ineffective interventions to provide context as to which components of implementation help or hinder intervention success.

To guide researchers regarding the implementation and scale-up of interventions relating to physical activity and nutrition, McKay and colleagues (2019) conducted a Delphi study to generate consensus on implementation and scale-up frameworks, indicators, and measures. From this study, a minimum set of implementation outcomes (*n* = 5) and determinants (*n* = 10) was created, which included indicators such as fidelity, sustainability, acceptability, and feasibility (among others; McKay *et al.,* 2019). Previous

childcare-based ECE training interventions have reported on these implementation outcomes and determinants; frequently, fidelity and acceptability scored high (Driediger *et al.,* 2018; Jones *et al.,* 2011; Kennedy *et al.,* 2017), while mixed results have been found for feasibility (Driediger *et al.,* 2018; Kennedy *et al.,* 2017). These findings provide insight into which implementation outcomes and determinants (e.g., feasibility) should be targeted with greater attention and support in future ECE physical activity training interventions to achieve better success.

While a number of childcare-based physical activity interventions have included ECE training (Adamo *et al.,* 2017; Bonvin *et al.,* 2013; De Marco *et al.,* 2015; Hoffman *et al.,* 2020; Jones *et al.,* 2011; Leis *et al.,* 2020; O'Dwyer *et al.,* 2013; Pate *et al.,* 2016; Tucker *et al.,* 2017), few have employed training as the sole intervention component (De Marco *et al.,* 2015; Hoffman *et al.,* 2020; Leis *et al.,* 2020; Pate *et al.,* 2016), and training was often used to educate ECEs about a physical activity-promoting program they were required to administer (De Marco *et al.,* 2015; Jones *et al.,* 2011; O'Dwyer *et al.,* 2013; Pate *et al.,* 2016) rather than to provide ECEs with general knowledge and strategies to facilitate active childcare settings. Additionally, a lack of focus in previous training interventions has been apparent concerning educating ECEs about sedentary behaviour and risky play. Most studies only focus on physical activity (Adamo *et al.,* 2017; Bonvin *et al.,* 2013; Jones *et al.,* 2011; O'Dwyer *et al.,* 2013; Pate *et al.,* 2016) or physical activity in combination with nutrition education (Bélanger *et al.,* 2016; Hassani *et al.,* 2020). However, with in-person training often reported as resource-intensive and lacking scalability, advances in training interventions for ECEs have since moved training online,

via webinars and e-Learning courses (Hassani *et al.,* 2020; Hoffman *et al.,* 2019; Saunders *et al.,* 2019; Ward *et al.,* 2020). As such, the goal of the TEACH study was to improve ECEs' knowledge, confidence, and intentions regarding promoting healthy movement behaviours by providing comprehensive training in physical activity and sedentary behaviour in childcare settings via an e-Learning course (Tucker *et al.,* 2021). To achieve this goal, a pilot study was undertaken to test the short-term efficacy and explore implementation of the e-Learning course with both pre-service and in-service ECEs. This paper presents the evaluation undertaken to examine implementation of the TEACH pilot study.

Methods

A pre-post (within-subjects) study design was employed for the TEACH pilot study, and implementation outcomes were measured cross-sectionally post-intervention via an online survey, interviews, and e-Learning course metrics. This process evaluation examined 13 implementation outcomes and determinants selected from recommendations by McKay *et al*. (2019) and the CFIR (Damschroder et al., 2009) and with consideration to those that were able to be measured within the pilot study design. These outcomes and determinants included: dose delivered; fidelity; acceptability; feasibility; compatibility; complexity; self-efficacy; context; perceived effectiveness; perceived benefits; motivation; tension for change; and, relative priority. See Table 1 for the TEACH pilot study implementation outcomes and determinants and the corresponding data source(s) and analyses. This study was approved by the Non-Medical Research Ethics Board at Western University (REB# 116816; Appendix I).

Table 1. *Implementation Outcomes and Determinants of the TEACH Pilot Study*

Implementation Outcome/ Determinant	**Question**	**Measurement Tool/ Procedure**	**Data Analyses**
Dose Delivered	To what degree were e-Learning course modules completed?	e-Learning platform metrics	Module completion %
Fidelity (Adherence)	What proportion of participants successfully completed the e-Learning course?	e-Learning platform metrics	% of registered participants who successfully completed the e-Learning course
Acceptability	How satisfied were participants with the e-Learning course?	Process evaluation survey; interviews	Descriptive statistics; thematic analysis
Feasibility	To what extent was the e-Learning course easy and convenient to complete?	e-Learning metrics; interviews	# of days to complete the course; thematic analysis
Compatibility (Appropriateness)	To what extent does the e-Learning course fit with the mission, priorities, and values of the ECE profession?	Process evaluation survey; interviews	Descriptive statistics; thematic analysis
Complexity	To what extent was the e-Learning course difficult or easy to complete?	e-Learning platform metrics; process evaluation survey; interviews	*M* score across all module knowledge assessments; descriptive statistics; thematic analysis

Self-Efficacy	How did participants perceive their ability to achieve e-Learning course outcomes?	Process evaluation survey	Descriptive statistics
Context	What were the barriers and facilitators for completing the course?	Process evaluation survey; interviews	Descriptive statistics; thematic analysis
Perceived Effectiveness	To what extent did the e-Learning course increase participants' knowledge about physical activity and sedentary behaviour? To what extent did the e-Learning course design/method of delivery help them achieve learning outcomes?	Process evaluation survey; interviews	Descriptive statistics; thematic analysis
Perceived Benefits	To what degree did participants feel the e-Learning course was advantageous for their professional development?	Process evaluation survey; interviews	Descriptive statistics; thematic analysis
Motivation	What motivated participants to complete the course? To what extent did completing the course influence their interest in the topic?	Process evaluation survey; interviews	Descriptive statistics; thematic analysis
Tension for Change	To what degree did participants feel current ECE educational opportunities in physical activity and sedentary behaviour were lacking?	Interviews	Thematic analysis

Relative Priority	To what extent did participants feel the e-Learning course was important for those in their profession?	Process evaluation survey; interviews	Descriptive statistics; thematic analysis

Note. Implementation outcomes and determinants derived from McKay et al. (2019) and the *Consolidated Framework for Implementation Research* (Damschroder et al., 2009); *M* = Mean.

Study Procedures and Participant Recruitment

Pre-service ECEs from three purposefully selected (based on location and class size) Canadian colleges with an early childhood education program were recruited; one college from Ontario, Alberta, and the Northwest Territories. In-service ECEs employed in various childcare settings across Canada were also recruited, via social media advertisements, to participate in this study. Participants were recruited from March to May 2021 and implied consent was given by commencing the first survey. For additional details about pilot study participants and recruitment, consult Bruijns *et al.* (2021).

Following a baseline survey, pre- and in-service ECEs completed an e-Learning course in physical activity and sedentary behaviour in early childhood. The course content was developed via a Delphi process (Bruijns *et al.,* 2020), and the e-Learning course comprised four modules (each of which was approximately 90 minutes in length). To pass each module, participants needed to score 10 out of 12 correct responses on a knowledge assessment (which included multiple-choice and matching questions to test learners on module content). Unlimited attempts were provided to pass each assessment. Participants were encouraged to complete the e-Learning course within a 2-week timeframe; however, e-Learning accounts were not deactivated until the study closure date (i.e., participants were allowed to take more than 2 weeks to complete the course). Upon receiving their e-Learning course certificate, participants were directed to a follow-up survey. Pre-service ECEs were required by their instructors to complete the e-Learning course in its entirety, but pre- and post-course surveys were completed voluntarily. One college provided in-person class time to complete the e-

Learning course, while the other two colleges provided virtual (unmonitored) class time. In-service ECEs completed all study elements (i.e., surveys and the e-Learning course) on their own volition. For more details about the course and its development, consult the study protocol for the TEACH study (Tucker *et al.,* 2021).

Tools

e-Learning Course Metrics

Course metrics available through the web-based learning management system (LMS; i.e., *TalentLMS)* platform were retrieved, including: percent of registered learners who successfully completed the course (fidelity); completion rate of modules (dose delivered); percent of learners who passed each end-of-module knowledge assessment on the first, second, or third (or more) attempt (complexity); and, the average number of days it took learners to complete the course (feasibility).

Process Evaluation Survey

An online process evaluation survey (Appendix Q) was developed and administered via Qualtrics for the purposes of this study, informed by the *Evaluating E-Learning System Success* model (Al-Fraihat *et al.,* 2020). The survey comprised 38 items, with 34 of which were rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). These 34 items (Cronbach's α = 0.98 and 0.94 for pre- and in-service ECEs, respectively) were grouped into the following implementation outcomes and determinants: *acceptability* (*n* = 10 items); *complexity* (*n* = 5 items); *self-efficacy* (*n* = 2 items); *compatibility* (*n* = 1 item); *perceived effectiveness* (*n* = 8 items); *perceived benefits* (*n* = 3 items); *content novelty* (*n* = 1 item); and, *motivation* (*n* = 4 items). An

additional four questions were designed to gather participants' perspectives on the course content, delivery, challenges experienced, and suggestions for improvement (two of which allowed for open-ended responses).

Interviews

At the end of the follow-up survey, ECEs were asked whether they would participate in a 20 to 30-minute Zoom interview to discuss their experiences with the course. Randomly selected volunteers from the pre- and in-service ECE study populations were contacted via email to schedule an interview time. Following verbal consent, all interviews were conducted by BAB using a semi-structured interview guide (Appendix R) that was informed by codebook guidelines from the CFIR (CFIR Guide, 2021). In the interviews, ECEs self-reported participant demographics and were asked to share their perspectives regarding: their likes and dislikes about the course; the complexity of the course content and assessments; course elements that supported/hindered their learning; course content that was new to them; how the course compared to previous e-Learning courses they had taken; suggestions for improvement; and, the extent to which they thought the course would integrate well into post-secondary early childhood education curricula. Saturation was reached after six interviews for in-service ECEs; however, two additional interviews were completed to confirm findings. Due to the small number of pre-service ECE volunteers, only three interviews were conducted. All interviews took place between April and May 2021 and were recorded and transcribed verbatim.

Data Analysis

Descriptive statistics were conducted in Excel Workbook to analyze e-Learning course metrics and in SPSS (version 27) to analyze quantitative data from the online survey (independently by study group) and interview participant demographics. Means and standard deviations were calculated for average days needed to complete the course and Likert scale responses from the process evaluation survey. Frequencies were calculated to report the percent of learners who passed the course (in its entirety), total modules completed, learners who passed end-of-module knowledge assessments on the first attempt or multiple attempts, learners' preferred/novel topic areas of the course, and course delivery elements (e.g., text, audio, video) that best supported participants' learning. Using deductive pre-planned codes from the interview guide, thematic analysis was completed in QSR NVivo (version 12) to analyze interview transcripts and open-ended survey questions. Two researchers coded the interview transcripts independently and identified common themes within each study population (pre- and in-service ECEs). To minimize confirmation bias, a research assistant was recruited solely to code the data (and was not directly involved in the research project). Trustworthiness of the data was ensured throughout by following Patton's (2014) recommendations regarding credibility, confirmability, dependability, and transferability (e.g., member-checking).

Results

Participant Demographics and e-Learning Course Metrics

A total of 51 pre-service and 274 in-service ECEs were recruited for the pilot study. Of the 71[8] and 199 pre- and in-service ECEs who registered for the course, 48 (67.6%) and 125 (62.8%) pre- and in-service ECEs successfully completed the course, respectively. For dose delivered, 93.9% and 90.5% of modules were completed by pre- and in-service ECEs, respectively. Across the four end-of-module knowledge assessments, 29.4% and 53.8% of pre- and in-service ECEs passed on the first attempt, 33.3% and 24.8% passed on the second attempt, and 37.3% and 21.4% needed three or more attempts to pass, respectively. The mean number of days it took pre- and in-service ECEs to complete the course was 4.3 (*SD* = 11.5) and 13.1 (*SD* = 12.3) days, respectively.

A total of 32 pre-service ECEs and 121 in-service ECEs completed the process evaluation survey (response rates of 62.7% and 44.2%, respectively). Pre-service ECEs were 26.7 years old (*SD* = 6.9), and the majority were female (93.8%). The most prevalent self-reported racial or cultural identities were South Asian (28.1%) or First Nations/Inuit/Métis (28.1%). Most participants reported having previous experience with e-Learning courses/workshops (65.6%). In-service ECEs were 37.1 years old (*SD* = 9.5), and most were Caucasian (66.1%) and had experience with e-Learning courses or workshops (70.2%). See Bruijns *et al.* (2021) for complete participant demographics.

[8] Does not match recruitment sample due to some participants selecting the wrong ECE level during sign-up.

Perspectives on Course Content and Delivery

Pre-service ECEs reported enjoying the *Introduction to Physical Activity* (87.5%) and *Outdoor Play* (87.5%) topics the most, and least enjoyed the content on *Creating Physical Activity and Sedentary Behaviour Policies* (15.6%). In-service ECEs enjoyed the content on *Loose Parts Play* the most (92.6%) and the *Video Library of Activities* the least (26.4%). For pre- and in-service ECEs, the top content areas that represented new topics for them were *How to Track and Set Goals for Movement Behaviours in Childcare* (37.5%) and *The Canadian 24-Hour Movement Guidelines for the Early Years* (46.3%), respectively. See Table 2 for frequencies of ECEs' preferences and perspectives of novelty for all course topics.

Of the design elements used in the e-Learning course (i.e., text, voiceover, images, animations, videos, within-module knowledge checks, and end-of-module knowledge assessments), most pre-service ECEs communicated that the elements that best facilitated their learning were the images (81.3%) and videos (75.0%), while only 43.8% reported that the animations helped facilitate their learning. In contrast, in-service ECEs communicated that the within-module knowledge checks (81.0%), text (73.6%), and video (73.6%) elements were most supportive to their learning. Like pre-service ECEs, a minority of in-service ECEs (38.0%) reported that the animations facilitated their learning.

Process Evaluation Survey Implementation Outcomes

Across 10 items (rated on a 5-point Likert scale), pre- and in-service ECEs rated the acceptability of the e-Learning course very high on the 5-point scale (M_{range} = 4.52 to

Table 2. *Pre- and In-Service Early Childhood Educators' Preference for and Novelty of Topic Areas in the e-Learning Course*

Topic	Enjoyed Topic the Most N (%)		Enjoyed Topic the Least N (%)		Topic was New to Them N (%)	
	Pre-service (N = 32)	In-service (N = 121)	Pre-service (N = 32)	In-service (N = 121)	Pre-service (N = 32)	In-service (N = 121)
Introduction to physical activity	28 (87.5)	99 (81.8)	2 (6.3)	14 (11.6)	4 (12.5)	5 (4.1)
Introduction to sedentary behaviour	21 (65.6)	85 (70.2)	4 (12.5)	14 (11.6)	8 (25.0)	22 (18.2)
The Canadian 24-Hour Movement Guidelines for the Early Years	20 (62.5)	69 (57.0)	4 (12.5)	7 (5.8)	9 (28.1)	56 (46.3)
Physical literacy	27 (84.4)	93 (76.9)	0 (0.0)	4 (3.3)	6 (18.8)	25 (20.7)
Fundamental movement skills	24 (75.0)	96 (79.3)	2 (6.3)	9 (7.4)	6 (18.8)	18 (14.9)
Factors that influence physical activity and sedentary behaviour in childcare	22 (68.8)	94 (77.7)	4 (12.5)	6 (5.0)	8 (25.0)	21 (17.4)
Outdoor play	28 (87.5)	111 (91.7)	1 (3.1)	3 (2.5)	1 (3.1)	1 (.8)
Risky play	27 (84.4)	107 (88.4)	1 (3.1)	2 (1.7)	3 (9.4)	18 (14.9)
Loose parts play	23 (71.9)	112 (92.6)	2 (6.3)	4 (3.3)	7 (21.9)	11 (9.1)
How to track and set goals for movement behaviours in childcare	18 (56.3)	58 (47.9)	3 (9.4)	22 (18.2)	12 (37.5)	46 (38.0)
Role modelling appropriate movement behaviours	25 (78.1)	102 (84.3)	3 (9.4)	10 (8.3)	2 (6.3)	7 (5.8)

How to modify your teaching behaviours to support activity	26 (81.3)	96 (79.3)	2 (6.3)	7 (5.8)	5 (15.6)	15 (12.4)
Programming physical activity	24 (75.0)	100 (82.6)	2 (6.3)	5 (4.1)	8 (25.0)	15 (12.4)
Programming active breaks, transitions, and learning opportunities to minimize sedentary behaviour	26 (81.3)	92 (76.0)	1 (3.1)	4 (3.3)	10 (31.3)	25 (20.7)
Getting families on board	24 (75.0)	80 (66.1)	2 (6.3)	17 (14.0)	7 (21.9)	24 (19.8)
Creating physical activity and sedentary behaviour policies	19 (59.4)	63 (52.1)	5 (15.6)	21 (17.4)	11 (34.4)	46 (38.0)
Professional learning opportunities	23 (71.9)	46 (74.4)	3 (9.4)	9 (7.4)	7 (21.9)	31 (25.6)
Resources for early childhood educators	24 (75.0)	87 (71.9)	2 (6.3)	10 (8.3)	7 (21.9)	34 (28.1)
Video library of activities	21 (65.6)	69 (57.0)	4 (12.5)	32 (26.4)	8 (25.0)	24 (19.8)

Note. Participants were directed to “check all that apply” when selecting their most/least preferred topics, and topics that were new to them.

4.71 and 4.50 to 4.80 for pre- and in-service ECEs, respectively). Complexity of the course (including its usability, flexibility, clearness of instructions, organization, and conciseness) was also positively rated by both pre-service (M_{range} = 4.61 to 4.71) and in-service ECEs (M_{range} = 4.47 to 4.79). Pre- and in-service ECEs also demonstrated that they had high self-efficacy to complete the course (M_{range} = 4.65 to 4.68 and 4.16 to 4.68 for pre- and in-service ECEs, respectively), and agreed that the course was compatible with their ECE training (*M* = 4.71 [*SD* = .78] and 4.64 [*SD* = .76] for pre- and in-service ECEs, respectively). When asked to rate the perceived effectiveness of the course at facilitating their learning and increasing their physical activity and sedentary behaviour-related knowledge, pre- and in-service ECEs reported high scores (M_{range} = 4.42 to 4.73 and 4.45 to 4.74 for pre- and in-service ECEs, respectively). ECEs were also positive about the perceived benefits of the e-Learning course (M_{range} = 4.71 to 4.74 and 4.77 to 4.79 for pre- and in-service ECEs, respectively), and reported feeling motivated to both complete the course (M_{range} = 4.50 to 4.55 and 4.56 to 4.74 for pre- and in-service ECEs, respectively) and further their learning in physical activity (*M* = 4.65 [*SD* = .84] and 4.50 [*SD* = .95] for pre- and in-service ECEs, respectively) and sedentary behaviour (*M* = 4.52 [*SD* = .89] and 4.42 [*SD* = .86] for pre- and in-service ECEs, respectively). Pre- and in-service ECEs provided a moderate rating for the novelty of the course content (*M* = 3.77 [*SD* = 1.12] and 3.48 [*SD* = 1.14] for pre- and in-service ECEs, respectively); however, *SD*s for this item were higher than other items, demonstrating greater variability in participant perspectives. See Table 3 for full process evaluation survey ratings.

Table 3. *Pre- and In-Service Early Childhood Educators' Perspectives on e-Learning Course Implementation*

Item	Pre-Service (N = 32)		In-Service (N = 121)	
	M	***SD***	***M***	***SD***
Acceptability				
Overall, I enjoyed using the course	4.55	.81	4.69	.78
Overall, I was satisfied with the course	4.61	.803	4.69	.70
The course provided me with sufficient information about *physical activity* in early childhood	4.69	.69	4.80	.42
The course provided me with sufficient information about *sedentary behaviour* in early childhood	4.71	.69	4.72	.50
The course met my requirements	4.58	.81	4.74	.54
The design of the course (e.g., fonts, style, colours, images, videos) was acceptable	4.52	.81	4.74	.46
The course used interesting and appropriate delivery methods (e.g., animation, video, audio, text, simulation, etc.)	4.65	.80	4.50	.73
The evaluation and assessment components of the e-Learning course were appropriate based on course content presented	4.55	.93	4.56	.69
I had enough time to complete the course	4.71	.69	4.60	.71
The length of each module within the e-Learning course was appropriate	4.52	.93	4.31	1.04
Complexity				

It was easy to use the course	4.68	.60	4.61	.76
The course was flexible to navigate	4.61	.76	4.47	.90
There were clear instructions about how to use the course	4.71	.59	4.74	.59
The structure of the course was well organized into understandable components	4.68	.79	4.79	.58
Information presented in the course was concise and clear	4.65	.80	4.74	.66
Self-Efficacy				
My previous experience with e-Learning systems and/or computer applications helped me in using the course	4.65	.76	4.16	.90
I was able to perform tasks in the course successfully	4.68	.70	4.68	.57
Compatibility				
Taking the course was a useful experience to complement my early childhood education training	4.71	.78	4.64	.76
Perceived Effectiveness				
The course helped me learn effectively	4.63	.85	4.55	.84
The course was an effective educational tool	4.73	.79	4.74	.66
The course helped me to achieve the learning outcomes of each module	4.55	.89	4.65	.72
The course increased my knowledge about *physical activity* in early childhood	4.56	1.10	4.64	.69
The course increased my knowledge about *sedentary behaviour* in early childhood	4.62	.94	4.50	.91

The within-module knowledge checks helped facilitate my learning	4.58	.81	4.52	.74
The end-of-module knowledge assessments helped facilitate my learning	4.58	.85	4.45	.85
The e-Learning mode of delivery helped me learn as effectively as in-person instruction	4.42	1.06	4.48	.81
Perceived Benefits				
The knowledge I gained from this course will be useful to me as an early childhood educator	4.74	.77	4.79	.62
Access to this course would be beneficial to me as an early childhood educator	4.71	.90	4.77	.64
Future early childhood education students would benefit from this course being integrated into the post-secondary curriculum	4.71	.90	4.78	.66
Content Novelty				
The course content was new to me	3.77	1.12	3.48	1.14
Motivation				
I had a positive attitude toward using the course	4.50	.80	4.74	.51
The course was ***not*** intimidating to use	4.55	.93	4.56	.93
My interest in learning about *physical activity* in early childhood increased as a result of the course	4.65	.84	4.50	.95
My interest in learning about *sedentary behaviour* in early childhood increased as a result of the course	4.52	.89	4.42	.86

Note. M = mean; *SD* = standard deviation; All items were rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree).

Qualitative Perspectives

Three and 8 pre- and in-service ECEs participated in an interview, respectively. Pre-service ECEs were 35.0 years old (*SD* = 11.0), 100% were female, 66.7% were Caucasian and from Ontario, and all were enrolled in Year 2 of an ECE diploma program. In-service ECEs were 35.3 years old (*SD* = 6.8), 100% were female, 75% were Caucasian, 50% were from Ontario, and they had an average of 6.8 years of experience as an ECE (*SD* = 4.7).

Twenty distinct themes were referenced by pre- and in-service ECEs (via text responses in the anonymous survey and interviews with pre- and in-service ECEs). These themes represented the following implementation determinants and outcomes: acceptability (*n* = 1 theme); feasibility (*n* = 3 themes); compatibility (*n* = 2 themes); complexity (*n* = 2 themes); context (*n* = 3 themes); perceived effectiveness (*n* = 2 themes); perceived benefits (*n* = 2 themes); motivation (*n* = 2 themes); tension for change (*n* = 2 themes); and, relative priority (n = 1 theme). Overall, ECEs were very satisfied with the course; one participant noted, “I give it an A++, it was amazing!”, while another commented that “it was the best online workshop I’ve taken.” Further, respondents stated that “the course was straightforward and easy to follow”, while also noting that the e-Learning platform was convenient and “time-friendly” to work into their already busy schedules. However, they also commented on the longer than anticipated duration of the course and suggested that breaking the course into smaller modules would promote motivation and would fit more easily into their schedules. Participants also suggested adding in a discussion forum to make the experience more

interactive. While many participants communicated that they appreciated the various design elements (e.g., text, audio, video, external links) in the course, some ECEs reported having technological issues when using a mobile device.

Several ECEs commented on the wealth of new information they learned; one ECE said that they found “lots of topics were new” to them, while another stated that they “did not truly understand the importance of physical activity until [they] took this course.” Even though certain ECEs mentioned that some of the course content was more reinforcement of information they already knew, one ECE noted that it still “gave [them] a new passion for teaching children about physical literacy and the importance of it.” Many ECEs also reported that the course increased their knowledge and confidence to promote physical activity in childcare. For example, one ECE noted that they “love[d] the knowledge it gave [them]”, while another commented that “it wasn’t until this course that [they] were actually confident in implementing risky play.” One ECE even mentioned that they have “already started trying to do more active transitions and…active breaks” to reduce prolonged sedentary time in their classroom, highlighting the applicability of the course content to childcare practice. Additionally, many participants stressed the importance of learning this content for those in their profession, and that this course would be a welcomed addition to pre-service ECE curricula. For example, one ECE commented that “it should be part of [their] ECE learning right from the college level,” while another reported that the course “could be easily incorporated into an ECE program all across the country.” See Table 4 for example quotations for all themes.

Table 4. *Pre- and In-Service Early Childhood Educators' Qualitative Perspectives on the Implementation of the TEACH Study e-learning Course*

		Example Quotes	
Implementation Outcome	**Theme**	**Process Evaluation Survey**	**Interview**
Acceptability	Satisfaction	• "I thoroughly enjoyed all the components of this course. I also thought it was very well put together." ***(Pre-Service)*** • "I enjoyed the course. I've been in the field for 15 years and still found new relevant information in this and that was very exciting." ***(In-Service)*** • "It was the best online workshop I've taken." ***(In-Service)***	• "I give it an A++, it was amazing!" ***(Pre-Service-1)*** • "Everybody took it, and everybody loved it… including myself. And we were very thankful that we got to do it because it was so interactive, and we learned so much from it." ***(Pre-Service-2)*** • "Overall, it was all rich and interesting." ***(In-Service-8)***
Feasibility	Convenience	• "I liked that I was able to work at my own pace. Sometimes I could do one module in one sitting, sometimes I couldn't,	• "Anybody who has a computer can do these courses… people can do them kind of in their own time and it's available to more people." ***(Pre-Service-2)*** • "There's a certain demographic that benefits from having the e-learning opportunity. I mean, if you work full time and if you have, you know—your

	but I appreciate the flexibility." ***(In-Service)***	family life on top of it, taking part in e-Learning courses is much more manageable, you know what I mean? A lot more time-friendly." ***(In-Service-3)***
Time Commitment	• "It took me longer than 5 hours to complete because of note taking." ***(In-Service)*** • "Finding time to complete the course during the week was tricky. I work full-time, so it was the weekends when I had the time to complete the course. It seemed to take me longer than the recommended time." ***(In-Service)***	• "The video library at the end and the resource at the end are all very, very useful. But it did take a little while to get through it all." ***(In-Service-3)***
Integration into Pre-Service ECE Programs	• "I would love for this to be a part of students' learning through their course work while learning/studying to become an early childhood educator." ***(In-Service)***	• "I think it fits into our courses so well that I think that there could be a whole course that we take over four months and just learn about this. I think it would be very beneficial to educators because even doing this in six, seven hours, my whole outlook kind of changed." ***(Pre-Service-2)*** • "I think that this could be easily incorporated into an ECE program all across the country." ***(In-Service-1)***

Compatibility (appropriateness)	Alignment with ECE Philosophy	• "Everything was rewarding for our profession." ***(In-Service)*** • "After being in the early years field actively working with children of various age groups, it was refreshing to know that some of things I have learned haven't changed and I don't have to feel like such a "dinosaur" when I encourage the children to play more instead of them wanting to be glued to their screens all day." ***(In-Service)***	• "Based on what we're taught in school, it most definitely aligns with our philosophy." ***(In-Service-1)*** • "I think it aligns very well because… everything we do is for the benefit of our children in our care and the families … learning how to maximize their time with us is important. And I think, yeah, it aligns very well with what our philosophies are or should be." ***(In-Service-3)***
	COVID-19 Influence	• "Given the restricting realities facing many children during COVID shutdowns and quarantines, this information is so important and	• "I sit way too much, especially now because of COVID. I'm a hermit crab … I don't leave my apartment ... It really opened my eyes that we shouldn't be sitting as much as we do." ***(Pre-Service-2)*** • "I think it's very relevant material … especially given the current setting. I mean, we have more and more children who are forced to be sitting at home

		relevant to ECEs right now." ***(In-Service)***	on their couch now…and I think it's very important for educators and families to be aware of the dangers of not getting your children out and active." ***(In-Service-3)***
Complexity	Knowledge Checks and Assessments	• "Some of the end knowledge checks were challenging for first time learners." ***(In-Service)***	• "They were challenging, which is nice, because … I don't like doing things and just having these knowledge checks that are just like, OK, I know that…I know that…I know that…I know that. It's nice when it's challenging because then you know that you're getting new information." ***(In-Service-1)*** • "They weren't super easy, but they weren't so hard. So, if you paid attention and focused and did the course and didn't multitask…I thought it was like in the middle." ***(In-Service-5)***

	e-Learning Platform	• "The course was really easy to use, which I think is great, especially for people who aren't tech savvy." ***(In-Service)*** • "The course was straight forward and easy to follow." ***(In-Service)***	• "I'm…technologically challenged and I got through it quite nicely." ***(Pre-Service-1)*** • "It's very smooth. Like, yeah…it's very easy to complete it." ***(Pre-Service-3)*** • "The navigation was very simple. It was easy to follow" ***(In-Service-1)***
Context	e-Learning Likes	• "This is really awesome! Great presentation, side notes and illustrations that added to visual learning." ***(In-Service)*** • "I liked the fact that you had to complete a full lesson before moving on. As well as not being able to fast forward was ideal to fully understanding the material."	• "The videos were incredible. Like there was a lot of them. And being an online student now, videos are really useful to me, especially because it really hones in the information." ***(Pre-Service-2)*** • "I liked the external links because those are things you can save for later as well as the audio" ***(In-Service-2)*** • "I think they have a good mixture of text and image and video. So, it's balanced." ***(In-Service-6)***

		(In-Service) • "I really appreciated the additional resource materials- both websites and videos." ***(In-Service)***	
	e-Learning Challenges	• "It was not super compatible with my phone." ***(In-Service)*** • "There were also a few times where the voiceover couldn't be paused as I was writing things down and I had to begin the whole section again." ***(In-Service)*** • "Sometimes the audio wouldn't catch up	• "I did have a couple issues with the voiceover." ***(Pre-Service-2)*** • "I feel like the only negative to it is that there's no way to clarify anything and there's no live interaction." ***(In-Service-5)*** • "If incorrect it didn't not show the correct answers. So, we had to repeat that." ***(In-Service-8)***

		with the slide progression." ***(In-Service)***	
	Suggestions for Improvement	• "It would have been great to have more information on the 0-18-month age group." ***(In-Service)*** • "Break down some content into smaller modules." ***(In-Service)*** • "More examples from Canadian childcare centres (i.e., videos)." ***(In-Service)*** • "A discussion board section where we can connect with other educators taking the course to further our professional development." ***(In-Service)***	• "It would be cool to kind of have, like, a PDF resource thing at the end … like a resource of all the different activities that were discussed or something like that." ***(In-Service-2)*** • "I think it was missing in the e-learning was for the children with the diverse needs. So, the special needs children…like how we can alternate physical activities for them." ***(In-Service_6)*** • "Maybe you can interview the early educators on what they do to incorporate those skills into the practice—like a testimonial" ***(In-Service-6)***

Perceived Effectiveness	Increased Confidence	• "I feel more confident in my ability to provide great physical experiences." ***(In-Service)*** • "Now that I have completed this e-Learning course, and been provided with countless resources, I feel more confident about leading physical literacy interactions in my future endeavors." ***(Pre-Service)***	• "It wasn't until this course that I was actually confident in implementing risky play." **(Pre-Service-2)** • "Having a course that's full of strategies and videos and games and examples that show you that really boosted my confidence and being able to do these things with children." **(Pre-Service-2)** • "I'm more comfortable and confident in my abilities of going outside in [poor weather] and being able to stay engaged in the children's learning." **(In-Service-7)**

	Increased Knowledge	• "I love the knowledge it gave me and the resources for me to expand further as well as ways I can help my families see the importance." ***(In-Service)*** • "I feel more comfortable with risky play with the knowledge I have taken from this study." ***(In-Service)*** • "I found lots of topics were new to me. The videos and resource library were very helpful in learning the new concepts." ***(In-Service)***	• I learned a lot of things that were briefly touched on in my courses, but I learned a lot more in depth." ***(Pre-Service-2)*** • "…gaining more knowledge on … the guidelines, because it's not necessarily something you talk about in school." ***(In-Service-2)***

Perceived Benefits	Prompted Awareness	• "It was all very informative and eye opening." ***(In-Service)*** • "I liked a lot of resources that provide new ideas for the physical activities. It surprised me sometimes how little effort it might take to get children become physically active." ***(In-Service)*** • "I did not truly understand the importance of physical activity until I took this course." ***(In-Service)***	• "A lot of it was reinforcement, but it gave me a new passion for teaching children about physical literacy and the importance of it." ***(Pre-Service-1)*** • "It really opened my eyes that we shouldn't be sitting as much as we do." ***(Pre-Service-2)*** • "My co-worker here in preschool and I—we both did this together. And so, we were able to talk about the things we were learning as we were doing it. And we really stood back and watched and were thinking about the different activity levels inside versus outside. And when we stopped and really realized what we were doing and what the kids were doing, we thought—*oh, my gosh, they're right."* ***(In-Service-3)***

	Useful for Training and Practice	• "Tons of great info, with tons of resources to be able to go back to in the future." ***(In-Service)*** • "I enjoyed the amount of links to other sites to get more information on outdoor and risky play and all of the other physical literacy websites – I will be using these!" ***(In-Service)***	• "As an educator… this whole course was great for me … because I learned so much and so many strategies for how to implement this into my everyday work." ***(Pre-Service-2)*** • "I used a lot of this information in my classes and to help kind of hone in my points and help others when we were doing like a risky play assignment. So even in school, after doing this, of course, I was able to put it into my classwork. And I think being able to do that made me understand it even more because I actually got to use it in something that I was planning." ***(Pre-Service-2)*** • "I have actually already started trying to do more active transitions and the active breaks. I haven't gathered any of the like the big outdoor loose parts materials, but I have spoken to my administrator about trying to find resources for that because I really enjoyed that part of it" ***(In-Service-1)***

Motivation	Interest in Content	• "The [*professional*] learning hours didn't matter. I just…found the topic interesting." ***(In-Service-5)***
	Knowledge Checks and Assessments	• "I wanted to prepare for them even more because I knew there is a test coming up … I wanted to do well, I wanted to ace it." ***(Pre-Service-1)*** • "I certainly liked, again, the different testing methods to keep you on your toes and make sure you're paying attention" ***(In-Service-3)***
Tension for Change	Current Issues with Practice	• "I would have loved to have learned more about sedentary behavior and physical activity before I started in my career because…like applying it now, yeah it helps the kids I have now. But what about the kids they had before? It didn't help them, right? So, it'd be nice to have it before people go into the work field." ***(In-Service-4)*** • "The situation is becoming very troubling these days and concerning that, children are spending more time online." ***(In-Service-8)*** • "You have these superiors over us…who are the ones who decide, not me. A little bit of rain, a few drops or a bit of snow. They would cancel recess just because of that." ***(In-Service-8)***

	Current Issues with Pre-Service Curriculum	• "That's not something that was really touched on in undergrad. So, not a lot of ECEs really know what that is. I think it should be touched on more and this is kind of a great way to segue into that and start the discussion on it." ***(In-Service-2)*** • "When I went to [*college*] we didn't do any training…like any physical activity." ***(In-Service-5)***
Relative Priority	Importance of Training	• "I think all educators, no matter if you're starting out like me or if you've been in this in the school system for 30 years, I think everybody should take this course because there's so much information and it's so helpful and there's so many strategies for us educators. And I think the more strategies we have as educators, the better educators we become. And it gives the children we work with higher quality care." ***(Pre-Service-2)*** • "I think that it's a very important topic and it should be learned early in the career." ***(In-Service-1)*** • "I've already told my supervisor—you really need to do this it's so good! She's like, really it was that good? I was like, yeah, it was awesome. You should definitely do it." ***(In-Service-4)***

Note. ECE = early childhood educator; Quotes from the process evaluation survey were submitted anonymously.

Discussion

This process evaluation of the TEACH pilot study aimed to highlight implementation factors that contributed to feasibility of the intervention for scale-up. Both pre- and in-service ECEs exhibited moderate-to-high fidelity to the TEACH study e-Learning course, and communicated that the course was highly acceptable, compatible, effective, feasible, and appropriate in complexity. Challenges reported by ECEs included technical difficulties with the e-Learning (LMS) platform when using mobile devices and a longer than anticipated course duration. These results highlight areas of improvement for the e-Learning course and its delivery prior to scale-up in pre-service ECE programs across Canada and offer unique implementation perspectives with respect to online training interventions for ECEs.

Overall, both pre- and in-service ECEs responded well to the e-Learning mode of delivery of the course. They reported that the online training effectively facilitated their learning and made it convenient to work into their schedules. The self-paced nature of the course allowed participants to take notes and review sections of content. The benefits of e-Learning compared to in-person delivery have been echoed in previous online training interventions for ECEs; for example, Kennedy and colleagues (2017) and Ward and colleagues (2020) both cited that the convenience of online learning supported participation and intervention fidelity among ECEs in their respective studies. Participants in the present study indicated that they thoroughly enjoyed the various design elements and commented that having so many videos and knowledge checks throughout the course supported their learning. However, participants did suggest that

adding a discussion forum component to the LMS platform would enhance their experience by making it more interactive, a component of in-person learning they valued. This is consistent with recommendations from Peden *et al.* (2018), which suggested that peer mentoring via forums would promote ongoing discussions and provide a sense of a belonging in the ECE community. Therefore, future e-Learning courses for ECEs should consider incorporating such discussion board elements to extend ECEs' learning beyond what is presented in the course and allow ECEs to network with peers with similar professional learning interests.

In addition to ECEs' positive perspectives of the e-Learning mode of delivery, the e-Learning course itself showed moderate-to-high fidelity, and dose delivered was close to 100%. These results were encouraging, particularly considering the intervention was delivered during the COVID-19 pandemic, when pre-service ECEs were less engaged in their class community (due to distance learning) and in-service ECEs were tasked with additional responsibilities (e.g., ensuring cleanliness and distancing within their classrooms were maintained). When compared to other online training interventions for ECEs, Hoffman and colleagues (2019) reported that 100% of participating ECEs completed their physical activity online training workshop (60 minutes); however, it is important to note the shorter course duration and that ECEs were able to complete the training during working hours, both of which likely contributed to the high fidelity reported. In contrast, Kennedy and colleagues (2017) reported that for their online training modules, 19 of the 26 participating ECEs (73%) completed the full training, and the average course completion rate (i.e., dose delivered) was 92.6%. The latter findings

are more consistent with fidelity and dose delivered results from in-service ECEs in the present study, likely due to the similar course duration and completing the course outside of work hours. Notably, pre-service ECEs in the present study completed the course in fewer days and reported higher intervention fidelity and dose delivered than in-service ECEs – likely a function of being provided class time (in-person or virtually) to complete the course. As such, these findings highlight important considerations, such as time to complete the training, for future implementation in post-secondary ECE programs and as professional learning for in-service ECEs to promote fidelity, feasibility, and dose delivered.

With respect to course content, nearly all topics were reported to be enjoyable by ECEs. However, of note, the large majority of both pre- and in-service ECEs selected both outdoor play and risky play as their favourite topics. This preference is consistent with recent literature, which has echoed the growing interest in outdoor and risky play among those working in early learning settings. For example, Dietze and Kashin (2019) analyzed discussion forum responses from Canadian ECEs (*n* = 207) who participated in an online course in outdoor play pedagogy; participants communicated that formal training in outdoor play was lacking from their post-secondary program and that participating in the online course gave them new knowledge in this area. ECEs in Dietze and Kashin's (2019) study also agreed that those in their profession should be made more aware of the importance of outdoor and risky play in early childhood, noting the importance of overcoming hesitancies of risk-averse colleagues and parents through education. These findings are similar to those from the present study, where ECEs

suggested that taking the TEACH study e-Learning course increased their comfort levels with risky play, while they also recommended that all ECEs should take the course. As such, increased opportunities for outdoor and risky play-related education, via formal pre-service schooling and professional learning opportunities, seem to be desired by ECEs to build their capacity to support these types of active play experiences for children in their care.

In addition to ECEs' reported interest in the course content, both pre- and in-service ECEs communicated that this type of education is important and necessary for all ECEs. Yet, many participants voiced their concerns over not having learned much about physical activity or sedentary behaviour during their pre-service schooling. Participants noted that topics relating to physical activity and sedentary behaviour were often mentioned, but not discussed in any substantive detail. These perspectives confirm the findings from Bruijns *et al.* (2019) who found that only 32.2% and 26.7% of Canadian pre-service ECEs (*n* = 1,292) reported having received physical activity and screen-viewing-related education in their college/university ECE program, respectively. Consequently, in-service ECEs have consistently requested to receive additional training and support in these areas (Dietze & Kashin, 2019; Szpunar *et al.,* 2020; van Zandvoort *et al.,* 2010). However, it was encouraging to find that many TEACH pilot study participants were optimistic about the feasibility of integrating this e-Learning course into pre-service ECE programs, and that the course aligned well with ECE philosophy. While a number of childcare-based interventions have used professional development to enhance intervention effectiveness (Mak *et al.,* 2021), ensuring ECEs receive

comprehensive education about physical activity and sedentary behaviour in their formal schooling is important to help scaffold their development of a health-promoting teaching philosophy.

Strengths and Limitations

While this pilot study has many strengths, such as the inclusion of both pre- and in-service ECEs and the evaluation of 13 distinct implementation outcomes and determinants via triangulation of e-Learning metrics, survey, and interview data, this work's limitations must be discussed. First, this study was conducted during the second and third waves of the COVID-19 pandemic in Canada, when post-secondary ECE programs were mainly delivered virtually and in-service ECEs were tasked with additional responsibilities at their workplaces. As such, pre-service ECEs were not as engaged with their program instructors (who helped facilitate students' recruitment and participation), resulting in a lower than anticipated sample size. Further, due to the increased workplace demands, in-service ECEs lacked time to be able to complete the course in the recommended timeframe, resulting in lower course completion rates (i.e., fidelity) and longer course completion timeframes (i.e., feasibility). Second, the small pre-service ECE sample size limited the number of volunteers that could be invited to participate in an interview. Due to competing demands of schoolwork and family commitments, only three participants volunteered; therefore, saturation in this study population could not be reached. Third, volunteer bias may have been present for the interview data, as it is more likely that participants who had a positive experience with the course volunteered to discuss their experiences with it than those who may have

had a more negative experience. Finally, while a diverse sample of both pre- and in-service ECEs was achieved, results from this study may not be generalizable to a future full-scale study sample or other research with this population.

Research Implications and Future Directions

The TEACH e-Learning course may be the first online professional learning opportunity for pre-service ECEs, specifically, that covers a broad range of movement behaviour concepts in early childhood, including, but not limited to: physical activity; sedentary behaviour; 24-hour movement behaviour guidelines; physical literacy; fundamental movement skills; outdoor play; risky play; and, loose parts play. As such, there is great potential for this course to be adapted for use in other countries, particularly in countries where 24-hour movement guidelines have been adopted. As the objectives of this pilot study were to improve broader implementation by gathering feedback about the e-Learning course content, delivery, and select implementation elements during a small window of time, reach, adoption, and sustainability of the e-Learning course could not be explored. However, with 48 pre-service and 125 in-service ECEs having completed the course, over 1,000 young Canadian children (based on Ontario's ECE to preschooler ratio of 1:8; Ontario Government, 2021) will have ECEs who are more knowledgeable and confident in facilitating active opportunities in the childcare setting. Longer-term implementation of the e-Learning course and assessing changes to childcare practices of participating ECEs will be key to determining whether the TEACH e-Learning course is a sustainable and effective professional learning initiative. Further, implementing in a larger sample of pre-service ECE programs, and

including perspectives of ECE program instructors, will help determine the feasibility and appropriateness of integrating the TEACH e-Learning course into post-secondary ECE curricula across Canada.

Conclusion

In conclusion, the TEACH e-Learning course appeared to be an implementation success and pre- and in-service ECEs were highly satisfied with their experience. Despite some technical difficulties experienced by a small number of learners, participants reported that the course effectively facilitated their learning, was appropriate in complexity, and presented content that was both interesting and important for their professional development. Additionally, participants enjoyed that the e-Learning course had many interactive elements and that it was convenient for them to work into their schedules. These findings demonstrate the value of e-Learning for ECEs' professional development. Participant suggestions and perspectives of the TEACH e-Learning course will be used to make improvements prior to future implementation with larger sample of pre- and in-service ECEs. Given the overwhelmingly positive feedback from participants, it is clear that Canadian ECEs are in need of more professional learning and development opportunities in physical activity and sedentary behaviour. As such, implementation and scale-up determinants and outcomes will need to be top of mind when expanding this training to promote reach, adoption, and sustainability of the TEACH e-Learning course.

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Chapter 5

Summary, Discussion, Limitations, Future Directions, and Conclusion

Summary

The overall goal of this dissertation was to develop content for the TEACH e-Learning course and pilot test it in a sample of pre- and in-service ECEs to: determine its preliminary efficacy to improve their movement behaviour-related knowledge, self-efficacy, and intentions; and, to explore implementation outcomes to optimize the intervention for scale-up. The Delphi approach was used for Study 1 to generate course content areas. Via online survey, international experts in young children's physical activity and sedentary behaviours were asked to suggest their top 12 topics to include in the course. Nineteen unique content areas were identified, and physical activity and sedentary behaviour experts, and a panel of ECE experts, rated each content area's importance for inclusion in the course. While physical activity and sedentary behaviour experts favoured *Benefits of Physical Activity in the Early Years* as the most important topic, *Outdoor Play* was considered the top-rated content area when ratings were pooled with the ECE expert panel. These findings stress the importance of the outdoor environment for supporting movement and deterring sedentary behaviour among young children in childcare settings, and ECEs can use this setting to their advantage to encourage physical activity. Despite some differences in content area importance rankings, the two expert panels showed moderate-to-strong agreement for how topics were ranked. This was exemplified by many of the foundational topics, such as *Factors Influencing Physical Activity and Sedentary Behaviour in Childcare*, being highly rated

across both panels. While the Delphi method has been used in the pediatric physical activity literature to generate research priorities (Gillis et al., 2013) or achieve consensus on definitions (Keegan et al., 2019) or implementation strategies (Christian et al., 2020), this was the first study to employ this approach to develop training content for ECEs. As such, this study serves as a resource for researchers and ECE curriculum developers to consult when designing training in physical activity and sedentary behaviour for ECEs.

After the course content was developed and translated to an e-Learning platform, Study 2 entailed pilot testing the course in three Canadian pre-service ECE programs to determine feasibility, and with in-service ECEs from across Canada to ensure the course was useful and relevant to their practical experience. Using an online survey, changes in pre- and in-service ECEs' physical activity and sedentary behaviour-related knowledge, self-efficacy, behavioural intention, and perceived behavioural control were explored. In both samples, significant improvements in total knowledge score ($p < .05$) and barrier self-efficacy ($p < .025$) were observed, while increases in task self-efficacy were only significant among in-service ECEs ($p < .025$). Further, in-service ECEs demonstrated a significant positive change across all behavioural intention and perceived behavioural control items ($p < .007$), while only select behaviours showed significant improvements for pre-service ECEs. These findings provide evidence of preliminary efficacy of the TEACH e-Learning course to positively influence a variety of ECE-based outcome measures that promote active programming in childcare settings (Ward et al., 2020). Moreover, this study underscores the value of professional learning for ECEs in movement behaviour domains, and that training can be used to supplement

their foundational education to better support their understanding, confidence, and motivation to facilitate movement opportunities for the children they care for.

Finally, Study 3 involved examining e-Learning course metrics, administering an online process evaluation survey, and conducting interviews with pre- and in-service ECEs to assess adherence to the intervention and to gather insight into their experiences of taking the course. Overall, participants showed high fidelity to the intervention, with approximately two-thirds of pre- and in-service ECEs fully completing the e-Learning course. From survey responses, participants reported that they most enjoyed learning about outdoor and risky play, and that the e-Learning course was acceptable, easy to use, effective in supporting their learning, and appropriate in complexity. In interviews with ECEs, participants echoed these responses, while also commenting on how important this education was for those in their profession, and that pre-service ECE programs should direct more instructional time to physical activity and sedentary behaviour concepts. Participants also reported some technical difficulties when accessing the course on a mobile device, and suggested to break the course up into shorter modules to ease completion. The findings from this study shed light on the novelty of this type of education for ECEs, suggesting the need to offer more opportunities for professional learning in these areas. Results also demonstrate that, with some minor modifications, the TEACH e-Learning course is a viable method of delivery for training ECEs in physical activity and sedentary behaviour.

Discussion

This program of research demonstrates that an expert-developed, comprehensive e-Learning course in physical activity and sedentary behaviour can benefit ECEs' understanding, confidence, and intention to support more active childcare environments, and is an engaging method to deliver professional learning to this population. Given such a complex process was undertaken in Study 1 to generate well-rounded content for the e-Learning course, it was expected (and observed in Study 2) that both pre- and in-service ECEs significantly increased their knowledge relating to physical activity and sedentary behaviour from pre- to post-course. While the lack of a comparison population limits the ability to claim that these positive changes were a direct result of taking the e-Learning course, similar positive changes across self-efficacy, behavioural intention, and perceived behavioural control outcomes, as well as the level of significance achieved with such a limited sample of pre- and in-service ECEs, were optimistic findings worth noting. Further, previous research has established the relationship between training and knowledge acquisition (Hassani *et al.,* 2020), self-efficacy development (Bruijns *et al.,* 2021), and improved behavioural intention and perceived behavioural control (Bai *et al.,* 2020), while the SCT also supports the benefit of educational pursuits for knowledge acquisition and self-efficacy development (Bandura, 2004). Therefore, it is likely that the TEACH e-Learning course facilitated (at least in part) the observed changes in the outcomes, stressing the need for more targeted training for ECEs in these areas.

Improvements in pre- and in-service ECEs' behavioural intention following the completion of the TEACH e-Learning course (presented in Study 2) are important to highlight, as behavioural intention is the most proximal factor to human behaviour (Ajzen, 1991). Consistent with the TPB (Ajzen, 1991), it can be postulated that ECEs who exhibited increases in their intention to promote physical activity and minimize sedentary behaviour in childcare settings are following through with these intentions and modifying their teaching practices. This hypothesis is supported by participant interview quotes from the '*Prompted Awareness'* and '*Usefulness for Training and Practice'* themes in Study 3, where multiple interviewees reported that taking the course changed their whole perspective on physical activity and sedentary behaviour, and that they had already started implementing some of the suggested activities from the course. Moreover, in a study by Ward and colleagues (2020), Canadian ECEs who had undergone online training in physical activity (*n* = 113) improved their physical activity-related practices in childcare when compared to the control group (*n* = 102). As such, given the influence that ECEs have on young children's movement behaviours (Carson *et al.,* 2020), providing them with sufficient training in this area is likely to support their prioritization of physical activity in their programming.

While the objective of the TEACH study was to create a comprehensive e-Learning course that covered foundational topics relating to children's movement behaviours in childcare settings, some content areas were covered more extensively than others. In Study 1, physical activity and sedentary behaviour experts and ECE experts agreed that outdoor play was the most important topic to discuss in the course.

As such, when designing the course, nearly an entire module was dedicated to outdoor play, and covered: the benefits of outdoor play (e.g., improved mood, less sedentary behaviour, etc.); the elements of the outdoor play setting that support movement (e.g., natural playgrounds, portable play equipment [including loose parts], etc.); and, how ECEs can modify their teaching behaviours to promote children's physical activity while outdoors (e.g., co-participate in activities, encourage risky play, etc.), among other topics. Interestingly, in Study 3, participants reported that outdoor play was their most preferred topic in the course; this is consistent with past Canadian research which highlighted that nearly 86% of pre-service ECEs (*n* = 1,292) were interested in further training in outdoor and risky play (Bruijns *et al.,* 2020). While some recent professional learning initiatives for ECEs have focused on outdoor play in early learning settings (Dietze & Kashin, 2019), additional opportunities for outdoor play-related education should be made available, particularly given ECEs' interest in the topic (Bruijns *et al.,* 2020), and the importance of the outdoor environment for supporting healthy movement behaviours among young children in childcare (Vanderloo *et al.,* 2013).

With over 90% of ECE experts in Study 1 indicating that physical activity and sedentary behaviour-related training is both important for ECEs and aligns with current pre-service ECE program objectives, increased attention to these topics is warranted at the pre-service level. Developing dedicated curriculum in ECE programs nationwide would help address the gap in physical activity and sedentary behaviour training noted within these programs (Bruijns *et al.,* 2019), while also responding to pre-service ECEs' desire to learn this content prior to entering the workforce (Bruijns *et al.,* 2020).

Initiatives such as the TEACH e-Learning course may supplement pre-service ECEs' learning in these domains where curriculum development is not possible, as the e-Learning method of delivery allows for widespread adoption and ease of integration into pre-existing curricula (Yang, 2013). In fact, both pre- and in-service ECEs in Study 3 reported that many topics within the TEACH course presented information they had not yet learned, and while interviews with participants revealed there was some repetition of content from their existing curriculum, they reported the TEACH course discussed these concepts in greater depth, which enhanced and scaffolded their learning. As such, there is a clear desire for and benefit of providing physical activity and sedentary behaviour training in pre-service ECE programs, and those in the position to carry out such changes in curriculum (e.g., Ministries of Education, pre-service ECE program administrators) should be encouraged to act on this evidence for wider reach.

Limitations

While the research presented in this dissertation represents the first research globally to test the efficacy and implementation of an expert-developed e-Learning course in physical activity and sedentary behaviour for ECEs, there are limitations of this work that must be acknowledged. In Study 1, purposeful sampling was used to form the expert panels, which could have introduced selection bias; despite efforts to minimize its impact (e.g., coupling purposeful sampling with snowball sampling), this potential bias may limit generalizability of the findings. Second, given the Delphi method was used to develop course content, topics generated were based on the subjective opinion and expertise of participants, potentially introducing personal biases; however, expert

panels were formed by inviting a geographically diverse sample of experts in physical activity, sedentary behaviour, and ECE research to participate, and eligibility criteria (e.g., years of experience) were used to ensure sufficient content expertise. Finally, it is possible that social desirability bias was at play when participants rated the importance of content areas, as participants may have felt that higher scores were expected of someone in their profession, potentially resulting in inflated ratings.

For Studies 2 and 3, a repeated measures pilot study design was employed, which was the primary limitation of Study 2, as only within-groups changes in outcomes could be explored. This study design was chosen because the main purpose of the pilot study was to gather feedback from pre- and in-service ECEs about e-Learning course fidelity, acceptability, and useability (Study 3) prior to launching in a larger sample (with a more robust sample size and comparison group) to determine true effectiveness of the TEACH e-Learning course. Additionally, Studies 2 and 3 were conducted during the COVID-19 pandemic in Canada; as such, pre-service ECEs had fewer in-person check-ins with their program instructors compared to pre-pandemic (due to the shift to virtual learning), resulting in a lower than anticipated sample size. This negatively impacted the power needed to demonstrate within-groups intervention efficacy, while also limiting the pool of volunteers that could be selected for an interview, and the ability to reach saturation. Further, in-service ECEs were tasked with additional COVID-related work responsibilities, impacting their ability to complete the course in the recommended timeframe, which negatively affected their course completion rates (i.e., fidelity) and timeframes (i.e., feasibility). Volunteer bias may have also been present for Study 3

interview data, as those who had a positive experience with the course may have been more inclined to volunteer to discuss their experiences than those who may have disliked the course. Finally, despite the participation by a diverse sample of Canadian pre- and in-service ECEs, results from these studies may not be generalizable to research outside of the Canadian context.

Future Directions

The findings from this dissertation support the launch of a full-scale TEACH study, wherein the effectiveness and scalability of the e-Learning course can be appropriately tested prior to exploring maintenance, sustainability, and global expansion initiatives. While a full-scale study will provide more robust evidence to support the consideration of physical activity and sedentary behaviour content in ECEs' pre-service training, this program of research generates new knowledge that can inform future research, as well as policy and practice recommendations. Specifically, this dissertation serves as a call to action for Ministries of Education to review their provincial/territorial curriculum requirements and ensure they incorporate movement behaviour education. While the TEACH e-Learning course was designed to be integrated into Canadian pre-service ECE curricula, until full-scale testing is complete, it is recommended that post-secondary ECE program administrators and curriculum writers consult the expert-developed, evidence-based TEACH e-Learning course content areas and build these concepts into existing courses with similar objectives (e.g., *Gross Motor Development*). Once a larger effectiveness and feasibility trial is complete, translation of the e-Learning course will be necessary to ensure equitable access for all Canadian pre-

service ECEs, and to pursue efforts to integrate the TEACH e-Learning course into all post-secondary ECE programs in the country.

Given the TEACH e-Learning course content was developed by international experts in young children's physical activity and sedentary behaviours, and approved by a panel of ECE experts, the findings from this compendium of studies can also be applied globally by informing professional learning standards for ECEs. Pending successful scale-up of the TEACH study (as predicted based on positive pilot study findings), implementing the TEACH e-Learning course in other countries will help determine if results in Canada can be replicated elsewhere. While the TEACH e-Learning course must be modified on a country-by-country basis to support each jurisdiction's unique training needs (e.g., updating the course to ensure country-specific movement guidelines and childcare regulations are presented, translating, etc.), the foundational nature of the training lends itself well to be applied in global contexts. Moreover, given the success of the e-Learning course among the in-service ECE sample noted in Studies 2 and 3, the opportunity also exists to launch this professional learning opportunity for practicing ECEs around the world. Offering the TEACH course to in-service ECEs can help supplement any gaps in their physical activity and sedentary behaviour training, while also acting as a helpful resource and motivating factor to encourage health promoting changes to their practice. It would also be of benefit to measure how any changes in ECEs' personal attributes as a result of the e-Learning course may influence their health promotion practices or the activity levels of the children in their care, as this would further emphasize the benefits of professional learning interventions for ECEs.

Conclusion

In light of the evidence that ECEs greatly influence young children's movement behaviours in childcare settings (Carson *et al.,* 2020; Robinson *et al.,* 2012), it is important to ensure that they are provided with the training to be able to facilitate physical activity opportunities, and minimize sedentary behaviours, in this environment. Yet, in Canada (Bruijns *et al.,* 2019), as well as other countries (Gehris *et al.,* 2015; Sevimli-Celik, 2021), ECEs have reported to receive little related education in their pre-service programs. This dissertation outlined expert-developed physical activity and sedentary behaviour content areas that are important to include in training for ECEs, and provided evidence that professional learning in these areas, delivered via an e-Learning platform, can elicit positive changes in pre- and in-service ECEs' movement behaviour-related knowledge, self-efficacy, behavioural intention, and perceived behavioural control. This research program also shed light on the receptiveness of ECEs to this type of training, and that e-Learning is a viable delivery method to engage this population in physical activity and sedentary behaviour content. Moving forward, additional consideration must be paid to movement behaviour education within pre-service ECE program curricula in Canada, and Ministries of Education, and ECE program administrators at post-secondary institutions, must collaborate to standardize this training across the country. This dissertation also serves as an important resource for those leading professional learning initiatives for ECEs globally to ensure their training opportunities are comprehensive, and that they support ECEs' practical application of course content in real-world settings. In summary, the research studies presented in this

dissertation highlight the need for professional learning in physical activity and sedentary behaviour for ECEs at the pre-service level, and acts as foundational evidence of the utility and efficacy of the TEACH e-Learning course in fulfilling this demand in training.

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Appendix A

CFIR Construct Checklist

The Consolidated Framework for Implementation Research Construct Checklist				
Construct	**Short Description**	**Source Determining Fulfillment**	**Was the Construct Fulfilled?**	**How the Construct Was/Will Be Fulfilled**
I. INTERVENTION CHARACTERISTICS				
A. Intervention Source	Perception of key stakeholders about whether the intervention is externally or internally developed.	Delphi Study *(Bruijns et al., 2020)*	Yes	The e-Learning course was developed in collaboration with ECE experts.
B. Evidence Strength & Quality	Stakeholders' perceptions of the quality and validity of evidence supporting the belief that the intervention will have desired outcomes.	Needs Assessment *(Bruijns et al., 2019)*	Yes	ECE stakeholders (college students, staff) were involved in this study, which determined that pre-service ECEs' physical activity self-efficacy was higher if they had completed physical activity training.
C. Relative Advantage	Stakeholders' perception of the advantage of implementing the	Delphi Study	Yes	ECE experts communicated that this type of training was

	intervention versus an alternative solution.	*(Bruijns et al., 2020)*		important for pre-service ECEs and supported (and helped with) the creation of content for the e-Learning course.
D. Adaptability	The degree to which an intervention can be adapted, tailored, refined, or reinvented to meet local needs.	e-Learning Course Development (Summer 2020)	Yes	Pre-service ECEs will be able to complete the e-Learning course at their own pace within a 2-week timeframe. The course itself will take 5 hours to complete.
E. Trialability	The ability to test the intervention on a small scale in the organization, and to be able to reverse course (undo implementation) if warranted.	Pilot Study *(Winter 2021)*	Yes	The intervention will be trialed with three colleges/universities (~50 pre-service ECEs) as well as ~100 in-service ECEs prior to large-scale implementation.
F. Complexity	Perceived difficulty of implementation, reflected by duration, scope, radicalness, disruptiveness, centrality, and intricacy and number of steps required to implement.	Program Evaluation Survey, Interviews *(Winter 2021, 2022)*	--	Pre-service ECEs and ECE instructors will be asked about the perceived ease of completion (students) or implementation (instructors).
G. Design Quality & Packaging	Perceived excellence in how the intervention is bundled, presented, and assembled.	Program Evaluation Survey, Interviews *(Winter 2021, 2022)*	--	Pre-service ECEs and ECE instructors will be asked about their perceptions of the e-Learning course's

				design quality and presentation.
H. Cost	Costs of the intervention and associated with implementing the intervention including investment, supply, and opportunity costs.	Government Funding *(2019-2023)*	Yes	Once created, the e-Learning course will only require webhosting (incurred for this project by the research team). For sustainability of the training, students or colleges may be required to pay a small fee to use the service, unless additional funds become available to the research team.
II. OUTER SETTING				
A. Patient Needs & Resources	The extent to which patient needs, as well as barriers and facilitators to meet those needs, are accurately known and prioritized by the organization.	e-Learning Course Development *(Summer 2020)*	Yes	Pre-service ECEs and ECE instructors will be consulted during e-Learning course development to ensure online learning needs are met.
B. Cosmopolitanism	The degree to which an organization is networked with other external organizations.	Ministry of Colleges and Universities	Yes	Each college/university is nested within their province's Ministry of Colleges and Universities.

C. Peer Pressure	Mimetic or competitive pressure to implement an intervention; typically because most or other key peer or competing organizations have already implemented or are in a bid for a competitive edge.	Recruitment *(Summer/Fall 2021)*	--	The participation of other colleges and universities is likely to encourage further participation, as this unique training will give programs a competitive edge by being the first to offer the learning opportunity to students.
D. External Policy & Incentives	A broad construct that includes external strategies to spread interventions, including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaboratives, and public or benchmark reporting.	Knowledge Mobilization (2022-2023)	--	Upon completion of the study, knowledge mobilization efforts will be aimed at college and university ECE curriculum experts, childcare organizations, and provincial policymakers to encourage the adoption of this training, as required, for the ECE profession.
III. INNER SETTING				

A. Structural Characteristics	The social architecture, age, maturity, and size of an organization.	Recruitment of College/University ECE Programs	Yes	The relatively new regulation of the early childhood educator profession has prompted the introduction of more college and university ECE programs. As such, ECE curricula are changing, and reviewed regularly to accommodate new research and foci. The nesting of ECE programs in larger, well-established academic institutions ensures resources are available for these changes.
B. Networks & Communications	The nature and quality of webs of social networks and the nature and quality of formal and informal communications within an organization.	ECE Program Faculty and Staff	Yes	ECE program staff and faculty have strong relationships and work collaboratively to provide pre-service ECEs with high-quality educational experiences.
C. Culture	Norms, values, and basic assumptions of a given organization.	College and University Reputation	Yes	Colleges and universities are esteemed to provide high-quality educational experiences and are increasingly using online

				platforms to deliver course content.
D. Implementation Climate	***The absorptive capacity for change, shared receptivity of involved individuals to an intervention, and the extent to which use of that intervention will be rewarded, supported, and expected within their organization.***			
1. *Tension for Change*	The degree to which stakeholders perceive the current situation as intolerable or needing change.	Needs Assessment *(Bruijns et al., 2019)*	Yes	Pre-service ECEs communicated that they wished to receive more training in physical activity and sedentary behaviour.
2. *Compatibility*	The degree of tangible fit between meaning and values attached to the intervention by involved individuals, how those align with individuals' own norms, values, and perceived risks and needs, and how the intervention fits with existing workflows and systems.	Needs Assessment *(Bruijns et al., 2019)* Delphi Study *(Bruijns et al., 2020)*	Yes	The e-Learning course we are developing addresses the gaps in content revealed in the needs assessment by pre-service ECEs. The Delphi study with ECE experts highlighted that the content developed for the course aligns with ECE curriculum objectives.
3. *Relative Priority*	Individuals' shared perception of the importance of the implementation within the organization.	Delphi Study *(Bruijns et al., 2020)* Program Evaluation Survey *(Winter 2021, 2022)*	--	ECE experts communicated that this training was important for pre-service ECEs to receive in their program. This will also be explored via the program evaluation.

4. *Organizational Incentives & Rewards*	Extrinsic incentives such as goal-sharing awards, performance reviews, promotions, and raises in salary, and less tangible incentives such as increased stature or respect.	e-Learning Course Certificate	--	Pre-service ECEs will receive a certificate of completion for the e-Learning course, which they can put on their resume for increased hirability upon graduation.
5. *Goals and Feedback*	The degree to which goals are clearly communicated, acted upon, and fed back to staff, and alignment of that feedback with goals.	Communication with ECE Instructors	--	ECE instructors implementing the intervention in their classroom will receive regular progress updates from the research team on their students' e-Learning course completion rates.
6. *Learning Climate*	A climate in which: a) leaders express their own fallibility and need for team members' assistance and input; b) team members feel that they are essential, valued, and knowledgeable partners in the change process; c) individuals feel psychologically safe to try new methods; and d) there is sufficient time and space for reflective thinking and evaluation.	Communication with ECE instructors	--	ECE instructors will act as partners in the intervention process. Adequate time will be given for pre-service ECEs to complete the e-Learning course, which will allow them to complete it at their own pace and give ECE instructors the ability to attend to student questions and concerns.

E. Readiness for Implementation	***Tangible and immediate indicators of organizational commitment to its decision to implement an intervention.***			
1. *Leadership Engagement*	Commitment, involvement, and accountability of leaders and managers with the implementation.	Communication with ECE Program Staff, Website Metrics	--	Researchers will be in constant communication with ECE program staff and instructors regarding their students' completion rates of the e-Learning modules to hold them accountable.
2. *Available Resources*	The level of resources dedicated for implementation and on-going operations, including money, training, education, physical space, and time.	e-Learning Course Development *(Summer 2020),* ECE Instructor Support	--	The e-Learning course will be designed to take ~5 hours to complete – a reasonable time requirement to integrate into pre-existing ECE courses. The course will be able to be accessed via mobile phone, tablet, laptop, or desktop, offering flexibility for pre-service ECEs. The course will initially be free of cost, and course instructors will be given a brief tutorial on how to use the e-Learning course so they can help their students.

3. *Access to Knowledge & Information*	Ease of access to digestible information and knowledge about the intervention and how to incorporate it into work tasks.	Communication with ECE Program Staff and Instructors	--	The research team will be readily available to answer any questions from participating ECE programs regarding program implementation.
IV. CHARACTERISTICS OF INDIVIDUALS				
A. Knowledge & Beliefs about the Intervention	Individuals' attitudes toward and value placed on the intervention as well as familiarity with facts, truths, and principles related to the intervention.	Demographics Survey *(Winter 2022)*	--	Pre-service ECEs' perceived value placed on this type of training will be measured prior to implementation.
B. Self-efficacy	Individual belief in their own capabilities to execute courses of action to achieve implementation goals.	Self-Efficacy Survey *(Winter 2022)*	--	Pre-service ECEs' perceived self-efficacy to successfully complete the e-Learning course will be measured prior to implementation.
C. Individual Stage of Change	Characterization of the phase an individual is in, as he or she progresses toward skilled, enthusiastic, and sustained use of the intervention.	Demographics Survey, Program Evaluation Survey (Winter 2022)	--	Pre-service ECEs' motivation to learn about physical activity and sedentary behaviour will be measured pre- and post-intervention, as well as their likelihood of using the knowledge they gained in their future profession.

D. Individual Identification with Organization	How individuals perceive the organization, and their relationship and degree of commitment with that organization.	Demographics Survey *(Winter 2022)*	--	Pre-service ECEs' level of commitment to their studies will be measured as part of participant demographics.
E. Other Personal Attributes	Other personal traits such as tolerance of ambiguity, intellectual ability, motivation, values, competence, capacity, and learning style.	Demographics Survey, Behavioural Intention Survey, Self-Efficacy Survey *(Winter 2022)*	--	Pre-service ECEs' motivation to learn about physical activity and sedentary behaviour, as well as their own physical activity levels and self-efficacy to use e-Learning platforms will be measured prior to implementation.
V. PROCESS				
A. Planning	The degree to which a scheme or method of behaviour and tasks for implementing an intervention are developed in advance, and the quality of those schemes or methods.	Communication with ECE Program Staff and Instructors	--	Early recruitment of colleges and universities will allow plenty of time for the research team to communicate with ECE program staff and instructors regarding timelines, surveys, and logistics of the e-Learning course.

B. Engaging	***Attracting and involving appropriate individuals in the implementation and use of the intervention through a combined strategy of social marketing, education, role modeling, training, and other similar activities.***			
1. Opinion Leaders	Individuals in an organization who have formal or informal influence on the attitudes and beliefs of their colleagues with respect to implementing the intervention.	Recruitment of ECE Programs *(Summer/Fall 2021)*	--	ECE programs will be recruited to participate in the intervention study, and program staff will act as opinion leaders who will manage implementation by course instructors.
2. Formally Appointed Internal Implementation Leaders	Individuals from within the organization who have been formally appointed with responsibility for implementing an intervention as coordinator, project manager, team leader, or other similar role.	Recruitment of ECE Instructors *(Fall 2021)*	--	ECE course instructors will be recruited to implement the intervention with students in their class.
3. *Champions*	"Individuals who dedicate themselves to supporting, marketing, and 'driving through' an [implementation]" [101] (p. 182), overcoming indifference or resistance that the intervention may provoke in an organization.	Research Team, Recruitment of ECE Student Champions *(Fall 2021)*	--	Research team members in each province will help champion the intervention, while pre-service ECEs in intervention classrooms will be recruited to promote their classmates' completion of the e-Learning course.

4. *External Change Agents*	Individuals who are affiliated with an outside entity who formally influence or facilitate intervention decisions in a desirable direction.	Communication with Stakeholder Groups *(Ongoing)*	--	The research team has been in communication with physical activity and early childhood organizations to include their content and promote our research project nationally.
C. Executing	Carrying out or accomplishing the implementation according to plan.	Website Metrics *(Winter 2022)*	--	Dose received will be calculated by pre-service ECEs' completion rates of each module within the e-Learning course. Average quiz scores will be calculated for each module to capture the extent of students' learning.
D. Reflecting & Evaluating	Quantitative and qualitative feedback about the progress and quality of implementation accompanied with regular personal and team debriefing about progress and experience.	Communication with ECE Programs, Program Evaluation Survey, Interviews *(Winter 2022)*	--	Researchers will be in constant communication with ECE programs about progress. Program Evaluation Surveys and Interviews with ECE students and instructors will capture their experiences with the e-Learning course and its implementation.

Appendix B

Ethics Approval - Study 1

Western Research

Date: 1 October 2019

To: Dr. Patricia Tucker

Project ID: 114435

Study Title: The Development of an e-Learning Physical Activity Module for Early Childhood Education Candidates: A Delphi Study

Application Type: NMREB Initial Application

Review Type: Delegated

Full Board Reporting Date: 01/Nov/2019

Date Approval Issued: 01/Oct/2019 16:44

REB Approval Expiry Date: 01/Oct/2020

Dear Dr. Patricia Tucker

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the WREM application form for the above mentioned study, as of the date noted above. NMREB approval for this study remains valid until the expiry date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

This research study is to be conducted by the investigator noted above. All other required institutional approvals must also be obtained prior to the conduct of the study.

Documents Approved:

Document Name	Document Type	Document Date	Document Version
ECE LOIC	Implied Consent/Assent	26/Sep/2019	2
Email Scripts	Recruitment Materials	26/Sep/2019	2
PA LOIC	Implied Consent/Assent	26/Sep/2019	2
Survey 1 PA Experts	Online Survey	26/Sep/2019	2
Survey 2 Canadian PA Experts	Online Survey	26/Sep/2019	2
Survey 2 International PA Experts	Online Survey	26/Sep/2019	2
Survey 3 Canadian PA Experts	Online Survey	26/Sep/2019	2
Survey 3 International PA Experts	Online Survey	26/Sep/2019	2
Survey 4 ECE Experts	Online Survey	26/Sep/2019	2
Volition to Receive Study Results Survey	Online Survey	01/Aug/2019	1

No deviations from, or changes to the protocol should be initiated without prior written approval from the NMREB, except when necessary to eliminate immediate hazard(s) to study participants or when the change(s) involves only administrative or logistical aspects of the trial.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario. Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB. The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

Please do not hesitate to contact us if you have any questions.

Sincerely,

Katelyn Harris, Research Ethics Officer on behalf of Dr. Randal Graham, NMREB Chair

Note: This correspondence includes an electronic signature (validation and approval via an online system that is compliant with all regulations).

Appendix C

Physical Activity and Sedentary Behaviour Expert

Letter of Information and Consent

Project Title: The Development of an e-Learning Physical Activity Module for Early Childhood Education Candidates: A Delphi Study

Principal Investigator:
Trish Tucker, PhD, Faculty of Health Sciences, Western University
PhD Student Investigator:
Brianne Bruijns, PhD Student, Health and Rehabilitation Sciences, Western University

Letter of Information and Consent

Invitation to Participate
You are being invited to participate in this Delphi study regarding the generation of an e-Learning physical activity module for Early Childhood Education (ECE) candidates because you are a researcher with expertise in physical activity or sedentary behaviour in the early years (<5 years).

Purpose of the Letter
The purpose of this letter is to provide you with information required for you to make an informed decision regarding participation in this research study.

Purpose of this Study
The purpose of this Delphi study is to generate physical activity and sedentary behaviour-related content for an e-Learning module that will be implemented with ECE candidates in Canadian college/university ECE programs.

Inclusion Criteria
Researchers invited by the research team who have expertise in physical activity or sedentary behaviour in the early years.

Exclusion Criteria
Researchers not invited by the research team.

Study Procedures
If you agree to participate in this study you will be asked to complete three, 10-minute surveys online through Qualtrics over a 3 month period.

Possible Risks and Harms
There are no known risks or discomforts associated with participating in this study.

Possible Benefits
You may not directly benefit from participating in this study; however, by participating, you will contribute to the development of content/topics for an e-Learning physical

activity module for ECE candidates, a training tool that is being created to better support those in the ECE profession to promote physical activity among young children.

Compensation

There is no direct compensation for your participation in this study.

Voluntary Participation

Participation in this study is voluntary. You may refuse to participate, skip any survey questions or withdraw from the study during survey participation at any time during survey completion (until your survey is submitted at which time, it will be included in the study - as the anonymous nature of the survey will inhibit us from knowing which survey is yours). You do not waive any legal right by consenting to this study.

Consent

Completion of the survey is indication of your consent to participate.

Confidentiality

The information collected will be used for research purposes only, and no personally identifiable information, other than your email address, will be collected within the Delphi surveys. Your email address willbe collected in order to send you subsequent study surveys. You will be assigned a unique code in your initial invitation email, which you will be asked to enter prior to your completion of each survey. As such, your email address will not be linked to your data, and the master list of email addresses will only be used for recruitment purposes. All data will be grouped with other participants for publishing or presentation purposes. All information collected for the study will be kept confidential by the study investigators. Representatives of Western University's Non-Medical Research Ethics Board may require access to your study-related records to monitor the conduct of the research. Your survey responses will be collected anonymously through a secure online survey platform called Qualtrics. Qualtrics uses encryption technology and restricted access authorizations to protect all data collected. In addition, Western's Qualtrics server is in Ireland, where privacy standards are maintained under the European union safe harbor framework. The data will then be exported from Qualtrics and securely stored on Western University's server. All electronic files will then be saved on password-protected computers. Data will be saved for 7 years before it is properly destroyed.

Contacts for Further Information

If you have any questions about the conduct of this study or your rights as a research participant you may contact the Office of Human Research Ethics at Western University [redacted]. If you have any questions about this study, please contact Dr. Trish Tucker [redacted].

Publication

If you would like to receive a copy of the overall results of the study, please indicate so by following the linked survey at the end of the Delphi survey.

Appendix D

Physical Activity and Sedentary Behaviour Expert Survey 1

Physical Activity and Sedentary Behaviour Experts – Survey 1

Please enter your participant ID (sent to you in your initial invitation email):

Please list your **top 12 topics** you believe should be covered in a *Physical Activity and Sedentary Behaviour e-Learning Course for pre-service Early Childhood Educators* below, and **provide a brief description** to justify your topic choice. Please note these topics are not ranked.

Topic 1:

Topic 1 Justification:

Topic 2:

Topic 2 Justification:

Topic 3:

Topic 3 Justification:

Topic 4:

Topic 4 Justification:

Topic 5:

Topic 5 Justification:

Topic 6:

Topic 6 Justification:

Topic 7:

Topic 7 Justification:

Topic 8:

Topic 8 Justification:

Topic 9:

Topic 9 Justification:

Topic 10:

Topic 10 Justification:

Topic 11:

Topic 11 Justification:

Topic 12:

Topic 12 Justification:

_____

Please list the name(s) of any researchers you believe should be included in the physical activity and sedentary behaviour expert panel:

Appendix E

Physical Activity and Sedentary Behaviour Expert Survey 2

Physical Activity and Sedentary Behaviour Experts – Survey 2

Please enter your participant ID (sent to you in your initial invitation email):

Your suggested topics in Survey 1 of this Delphi study were pooled with topics suggested by the entire Physical Activity and Sedentary Behaviour Expert Panel. Similar topics were merged in order to mitigate redundant topics, and a brief description of what would be covered in each topic is presented below. *At the end of the survey you will be asked to indicate if your suggested topics were appropriately represented in the pooled topic list.*

Please rate your perceived importance of the following list of topics for inclusion in a *Physical Activity and Sedentary Behaviour e-Learning Course for Pre-Service Early Childhood Educators*:

Topic 1: *Defining Physical Activity and Sedentary Behaviour*

- What is physical activity, and what does this behaviour look like in infants (<1y), toddlers (1-2y), and preschoolers (3-4y)?
  - What are the intensities of movement behaviours? (i.e., sedentary, light, moderate, and vigorous activity)
  - Structured vs. unstructured physical activity
  - What is active play?
- What is sedentary behaviour, and what does this behaviour look like in infants, toddlers, and preschoolers?
- What is screen-viewing?
  - Active vs. passive screen-viewing
  - Media usage in childcare – appropriate for educational purposes?

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 2: *The Canadian 24-Hour Movement Guidelines for the Early Years*

- How much light, and moderate-to vigorous-intensity physical activity should young children engage in each day?
- How much continuous sitting time should young children be limited to?
- How much screen-viewing should young children be limited do each day?
- How can these guidelines be adapted to the childcare day?

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 3: *Prevalence of Physical Activity, Sedentary Behaviour, and Screen-Viewing Among Young Children*

- Overall prevalence rates, and in various childcare settings (home-based childcare vs. centre-based childcare vs. full-day kindergarten)
- How do these compare to guidelines?
- Sociodemographic differences in movement behaviours

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 4: *What are the Benefits of Physical Activity in the Early Years?*

- Links with improved physical, psychosocial, and cognitive development (e.g., improved bone and skeletal health, weight status, brain development, emotional regulation)
- Importance of the early years for establishing physical activity habits that set the foundation for an active childhood, adolescence, and adulthood

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 5: *Physical Literacy and Fundamental Movement Skills*

- Fundamental movement skills and sport skills
- APPLE Model – Active Play and Physical Literacy Every day
- Building confidence and competence in a variety of physical activity settings (via mastery experiences, vicarious experiences, verbal persuasion)
- Importance of physical literacy for lifelong participation in physical activities

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 6: *What are the Risks of Excessive Sedentary Behaviour, Particularly Screen-Viewing?*

- Independent of physical activity, links with physical health (e.g., weight status), behaviour, cognitive development (including language development), irregular sleep patterns
- Establishing sedentary behaviour and screen-viewing habits that set the foundation for a healthy future

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 7: *Factors Influencing Physical Activity and Sedentary Behaviour in Childcare*

- Early childhood educators are important influences on young children's movement behaviours (in terms of programming, role modeling, and training in physical activity)
- Presence/size of indoor and outdoor play areas
- Fixed and portable play equipment
- Scheduling of outdoor time
- Physical activity and screen-viewing policies

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 8: *Outdoor Play*

- Importance of outdoor play for physical, psychosocial, and cognitive health (e.g., increased physical activity, improved mood and creativity)
- Outdoor play in various climates (cold, rain, snow, extreme heat) and solutions if outdoor time is not an option
- How to make the most out of outdoor space for physical activity
- What to do if outdoor play is not an option

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 9: *Risky Play*

- Importance of risky/adventurous play (building confidence through appropriate challenge)
- Difference between risky and dangerous/hazardous play
- How to encourage risky play among young children
- Cost/benefit analysis of engaging in risky play

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 10: *Monitor Physical Activity and Sedentary Time in Your Classroom*

- How are movement behaviours measured in research?
- How can movement behaviours be monitored by early childhood educators?
- How can early childhood educators create goals and track progress after implementing physical activity-promoting changes?
- Models of behaviour change to inform physical activity promotion strategies

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 11: *Become a Role Model and Champion for Physical Activity*

- Benefits of role modeling and co-participation
- Actively participating in outdoor play (not simply supervising)

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 12: *Promote Physical Activity and Minimize Sedentary Time through Instruction and Interaction*

- Avoid withholding physical activity and outdoor time as punishment, or using screens as a reward
- Involve children in daily activities (hanging coats, clearing the table, etc.)
- Notice individual differences and learn how each child responds to forms of encouragement to be active
- How to facilitate active play

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 13: *Program Time for Physical Activity and Active Breaks to Limit Sitting Time*

- How to design curriculum to be supportive of physical activity and minimize sitting time
- Teacher-led physical activity
- Developing physical activity opportunities for children of all abilities
- Scheduling indoor free play time
- How to incorporate muscle and bone-strengthening activities into programming
- Programming active breaks between sedentary tasks to break up prolonged sitting
- How to minimize sedentary behaviour during transition times

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 14: *Incorporate Physical Activity into Other Educational Objectives*

- How to integrate physical activity into other curriculum areas and typically sedentary activities (e.g., reading circles, arts and crafts)

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 15: *Create and Make Use of Environments to be Supportive of Physical Activity*

- How to set up your classroom to promote movement
- Making use of limited spaces/resources (moving furniture, using hallways)

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 16: *Suggest the Creation of Physical Activity and Screen-Viewing Policies at your Centre*

- Having a written physical activity and screen-viewing policy will aid in achieving goals to increase physical activity and minimize screen-viewing
- This will help parents understand that the centre prioritizes their child's health

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 17: *Get Parents/Guardians on Board!*

- Communicate with parents about the importance of physical activity and minimizing screen-viewing in early childhood
- Communicate with parents about their child's movement behaviours at childcare, and how they can support progress at home

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 18: *Resources and Professional Development*

- Importance of background training in physical activity and sedentary behaviour, and on-going professional development
- Many childcare organizations provide professional development workshops for early childhood educators
- Examples of professional development in physical activity and health (e.g., HighFIVE, Physical Literacy Instructor Program)
- Resources – Sport for Life, Active for Life, OPHEA, Healthy Kids Healthy Future
- Resources – Colleagues, social media (e.g., Pinterest)

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 19: *Example Activities*

- Video examples of teacher-led physical activities and active breaks

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Were your suggested topics appropriately represented in the pooled topic list?

a) Yes
b) No: _____

Appendix F

Early Childhood Educator Expert Letter of Information and Consent

Project Title: The Development of an e-Learning Physical Activity Module for Early Childhood Education Candidates: A Delphi Study

Principal Investigator:
Trish Tucker, PhD, Faculty of Health Sciences, Western University
PhD Student Investigator:
Brianne Bruijns, PhD Student, Health and Rehabilitation Sciences, Western University

Letter of Information and Consent

Invitation to Participate
You are being invited to participate in this Delphi study regarding the generation of an e-Learning physical activity module for Early Childhood Education (ECE) candidates because of your experience in the ECE field required to review and rank the importance of the topics generated for the module.

Purpose of the Letter
The purpose of this letter is to provide you with information required for you to make an informed decision regarding participation in this research study.

Purpose of this Study
The purpose of this study is to rank the importance of physical activity and sedentary behaviour-related topics, generated by physical activity experts, to be included in an e-Learning module for ECE candidates in Canadian college/university ECE programs.

Inclusion Criteria
ECE instructors/professionals working at a Canadian post-secondary institution invited by the research team who have experience working in the ECE sector.

Exclusion Criteria
ECE instructors/professionals not invited by the research team.

Study Procedures
If you agree to participate in this study you will be asked to complete a 10-minute survey online through Qualtrics.

Possible Risks and Harms
There are no known risks or discomforts associated with participating in this study.

Possible Benefits
You may not directly benefit from participating in this study; however, by participating, you will contribute to the development of an e-Learning physical activity module for ECE candidates, a training tool that is being created to better support those in the ECE profession to promote physical activity among young children.

Compensation
There is no direct compensation for your participation in this study.

Voluntary Participation
Participation in this study is voluntary. You may refuse to participate, skip any survey questions or withdraw from the study during survey participation at any time during survey completion (until your survey is submitted at which time, it will be included in the study - as the anonymous nature of the survey will inhibit us from knowing which survey is yours).

Consent
Completion of the survey is indication of your consent to participate.

Confidentiality
The information collected will be used for research purposes only, and no personally identifiable information, other than your email address, will be collected within the Delphi surveys. Your email address will be collected in order to send you the subsequent study survey. You will be assigned a unique code in your initial invitation email, which you will be asked to enter prior to your completion of each survey. As such, your email address will not be linked to your data, and the master list of email addresses will only be used for recruitment purposes. All data will be grouped with other participants for publishing or presentation purposes. All information collected for the study will be kept confidential. Only the investigators of this study will have access to any data collected. All electronic files will be saved on password-protected computers. Data will be saved for 7 years before it is properly destroyed.

Contacts for Further Information
If you have any questions about the conduct of this study or your rights as a research participant you may contact the Office of Human Research Ethics at Western University [redacted]. If you have any questions about this study, please contact Dr. Trish Tucker ([redacted].

Publication
If you would like to receive a copy of the overall results of the study, please indicate so by answering the final question of the survey.

Appendix G

Early Childhood Educator Expert Survey

Early Childhood Educator Expert Survey

Please enter your participant ID (sent to you in your initial invitation email):

What type of early childhood education occupation are you employed in?

_____

How many years of experience to you have in early childhood education?

_____

A panel of international experts in physical activity and sedentary behaviour in early childhood have generated a list of topics to be included in the e-Learning course for pre-service early childhood educators.

Please rate your perceived importance of the expert panel's topics generated for inclusion in a *Physical Activity and Sedentary Behaviour e-Learning Course for Pre-Service Early Childhood Educators*:

Topic 1: *Defining Physical Activity and Sedentary Behaviour*

- What is physical activity, and what does this behaviour look like in infants (<1y), toddlers (1-2y), and preschoolers (3-4y)?
  - What are the intensities of movement behaviours? (i.e., sedentary, light, moderate, and vigorous activity)
  - Structured vs. unstructured physical activity
  - What is active play?
- What is sedentary behaviour, and what does this behaviour look like in infants, toddlers, and preschoolers?
- What is screen-viewing?
  - Active vs. passive screen-viewing
  - Media usage in childcare – appropriate for educational purposes?

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 2: *The Canadian 24-Hour Movement Guidelines for the Early Years*

- How much light, and moderate-to vigorous-intensity physical activity should young children engage in each day?
- How much continuous sitting time should young children be limited to?
- How much screen-viewing should young children be limited do each day?
- How can these guidelines be adapted to the childcare day?

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 3: *Prevalence of Physical Activity, Sedentary Behaviour, and Screen-Viewing Among Young Children*

- Overall prevalence rates, and in various childcare settings (home-based childcare vs. centre-based childcare vs. full-day kindergarten)
- How do these compare to guidelines?
- Sociodemographic differences in movement behaviours

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 4: *What are the Benefits of Physical Activity in the Early Years?*

- Links with improved physical, psychosocial, and cognitive development (e.g., improved bone and skeletal health, weight status, brain development, emotional regulation)
- Importance of the early years for establishing physical activity habits that set the foundation for an active childhood, adolescence, and adulthood

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 5: *Physical Literacy and Fundamental Movement Skills*

- Fundamental movement skills and sport skills
- APPLE Model – Active Play and Physical Literacy Every day
- Building confidence and competence in a variety of physical activity settings (via mastery experiences, vicarious experiences, verbal persuasion)
- Importance of physical literacy for lifelong participation in physical activities

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 6: *What are the Risks of Excessive Sedentary Behaviour, Particularly Screen-Viewing?*

- Independent of physical activity, links with physical health (e.g., weight status), behaviour, cognitive development (including language development), irregular sleep patterns
- Establishing sedentary behaviour and screen-viewing habits that set the foundation for a healthy future

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 7: *Factors Influencing Physical Activity and Sedentary Behaviour in Childcare*

- Early childhood educators are important influences on young children's movement behaviours (in terms of programming, role modeling, and training in physical activity)
- Presence/size of indoor and outdoor play areas
- Fixed and portable play equipment
- Scheduling of outdoor time
- Physical activity and screen-viewing policies

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 8: *Outdoor Play*

- Importance of outdoor play for physical, psychosocial, and cognitive health (e.g., increased physical activity, improved mood and creativity)
- Outdoor play in various climates (cold, rain, snow, extreme heat) and solutions if outdoor time is not an option
- How to make the most out of outdoor space for physical activity
- What to do if outdoor play is not an option

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 9: *Risky Play*

- Importance of risky/adventurous play (building confidence through appropriate challenge)
- Difference between risky and dangerous/hazardous play
- How to encourage risky play among young children
- Cost/benefit analysis of engaging in risky play

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 10: *Monitor Physical Activity and Sedentary Time in Your Classroom*

- How are movement behaviours measured in research?
- How can movement behaviours be monitored by early childhood educators?
- How can early childhood educators create goals and track progress after implementing physical activity-promoting changes?
- Models of behaviour change to inform physical activity promotion strategies

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 11: *Become a Role Model and Champion for Physical Activity*

- Benefits of role modeling and co-participation
- Actively participating in outdoor play (not simply supervising)

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 12: *Promote Physical Activity and Minimize Sedentary Time through Instruction and Interaction*

- Avoid withholding physical activity and outdoor time as punishment, or using screens as a reward
- Involve children in daily activities (hanging coats, clearing the table, etc.)
- Notice individual differences and learn how each child responds to forms of encouragement to be active
- How to facilitate active play

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 13: *Program Time for Physical Activity and Active Breaks to Limit Sitting Time*

- How to design curriculum to be supportive of physical activity and minimize sitting time
- Teacher-led physical activity
- Developing physical activity opportunities for children of all abilities
- Scheduling indoor free play time
- How to incorporate muscle and bone-strengthening activities into programming
- Programming active breaks between sedentary tasks to break up prolonged sitting
- How to minimize sedentary behaviour during transition times

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 14: *Incorporate Physical Activity into Other Educational Objectives*

- How to integrate physical activity into other curriculum areas and typically sedentary activities (e.g., reading circles, arts and crafts)

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 15: *Create and Make Use of Environments to be Supportive of Physical Activity*

- How to set up your classroom to promote movement
- Making use of limited spaces/resources (moving furniture, using hallways)

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 16: *Suggest the Creation of Physical Activity and Screen-Viewing Policies at your Centre*

- Having a written physical activity and screen-viewing policy will aid in achieving goals to increase physical activity and minimize screen-viewing
- This will help parents understand that the centre prioritizes their child's health

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 17: *Get Parents/Guardians on Board!*

- Communicate with parents about the importance of physical activity and minimizing screen-viewing in early childhood
- Communicate with parents about their child's movement behaviours at childcare, and how they can support progress at home

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 18: *Resources and Professional Development*

- Importance of background training in physical activity and sedentary behaviour, and on-going professional development
- Many childcare organizations provide professional development workshops for early childhood educators

- Examples of professional development in physical activity and health (e.g., HighFIVE, Physical Literacy Instructor Program)
- Resources – Sport for Life, Active for Life, OPHEA, Healthy Kids Healthy Future
- Resources – Colleagues, social media (e.g., Pinterest)

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Topic 19: *Example Activities*

- Video examples of teacher-led physical activities and active breaks

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Do you have any additional topics to suggest for the e-Learning course that are not covered above?

How important would you rate physical activity and sedentary behaviour-related training for pre-service early childhood educators?

Unimportant	Somewhat Unimportant	Neither Important nor Unimportant	Important	Very Important

Do the e-Learning course topics presented in this survey align with ECE curriculum objectives?

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

Do the e-Learning course topics presented in this survey align with ECE professional accreditation/licensing criteria?

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

Please list the name(s) of any ECE professionals you believe should be included on the ECE expert panel for the creation of this e-Learning course:

Appendix H

e-Learning Course Content Area Descriptions

Module 1: An Introduction to Physical Activity and Sedentary Behaviour in the Early Years

1. *Defining Physical Activity and Sedentary Behaviour*
• What is physical activity, and what does this behaviour look like in infants (<1y), toddlers (1-2y), and preschoolers (3-4y)?
  ○ What are the intensities of movement behaviours? (i.e., sedentary, light, moderate, and vigorous activity)
  ○ Structured vs. unstructured physical activity
  ○ What is active play?
• What is sedentary behaviour, and what does this behaviour look like in infants, toddlers, and preschoolers?
• What is screen-viewing?
  ○ Active vs. passive screen-viewing
  ○ Media usage in childcare – appropriate for educational purposes?

2. *The Canadian 24-Hour Movement Guidelines for the Early Years* • How much light, and moderate-to vigorous-intensity physical activity should young children engage in each day? • How much continuous sitting time should young children be limited to? • How much screen-viewing should young children be limited do each day? • How can these guidelines be adapted to the childcare day?
3. *Prevalence of Physical Activity, Sedentary Behaviour, and Screen-Viewing Among Young Children* • Overall prevalence rates, and in various childcare settings (home-based childcare vs. centre-based childcare vs. full-day kindergarten) • Physical activity rates in boys vs. girls • How do these compare to guidelines? • Sociodemographic differences in movement behaviours
4. *What are the Benefits of Physical Activity in the Early Years?* • Links with improved physical, psychosocial, and cognitive development (e.g., improved bone and skeletal health, weight status, brain development, emotional regulation) • Importance of the early years for establishing physical activity habits that set the foundation for an active childhood, adolescence, and adulthood
5. *Physical Literacy and Fundamental Movement Skills*

- Fundamental movement skills and sport skills
- APPLE Model – Active Play and Physical Literacy Every day
- Building confidence and competence in a variety of physical activity settings (via mastery experiences, vicarious experiences, verbal persuasion)
- Importance of physical literacy for lifelong participation in physical activities

6. *What are the Risks of Excessive Sedentary Behaviour, Particularly Screen-Viewing?*
   - Independent of physical activity, links with physical health (e.g., weight status), behaviour, cognitive development (including language development), irregular sleep patterns
   - Establishing sedentary behaviour and screen-viewing habits that set the foundation for a healthy future

Module 2: Physical Activity and Sedentary Behaviour in the Childcare Environment

7. *Factors Influencing Physical Activity and Sedentary Behaviour in Childcare*
   - ECEs are important influences on young children's movement behaviours (in terms of programming, role modeling, and training in physical activity)
   - Presence/size of indoor and outdoor play areas
   - Fixed and portable play equipment
   - Scheduling of outdoor time
   - Physical activity and screen-viewing policies
8. *Outdoor Play*
   - Importance of outdoor play for physical, psychosocial, and cognitive health (e.g., increased physical activity, improved mood and creativity)
   - Outdoor play in various climates (cold, rain, snow, extreme heat) and solutions if outdoor time is not an option
   - How to make the most out of outdoor space for physical activity
   - What to do if outdoor play is not an option
9. *Risky Play*
   - Importance of risky/adventurous play (building confidence through appropriate challenge)
   - Difference between risky and dangerous/hazardous play
   - How to encourage risky play among young children

• Cost/benefit analysis of engaging in risky play
Module 3: How to Promote Physical Activity and Minimize Sedentary Time in Childcare
10. *Monitor Physical Activity and Sedentary Time in Your Classroom* • How are movement behaviours measured in research? • How can movement behaviours be monitored by ECEs? • How can ECEs create goals and track progress after implementing physical activity-promoting changes? • Models of behaviour change to inform physical activity promotion strategies
11. *Become a Role Model and Champion for Physical Activity* • Benefits of role modeling and co-participation • Actively participating in outdoor play (not simply supervising)
12. *Promote Physical Activity and Minimize Sedentary Time through Instruction and Interaction* • Avoid withholding physical activity and outdoor time as punishment, or using screens as a reward • Involve children in daily activities (hanging coats, clearing the table, etc.) • Notice individual differences and learn how each child responds to forms of encouragement to be active • How to facilitate active play
13. *Program Time for Physical Activity and Active Breaks to Limit Sitting Time* • How to design curriculum to be supportive of physical activity and minimize sitting time • Teacher-led physical activity • Developing physical activity opportunities for children of all abilities • Scheduling indoor free play time • How to incorporate muscle and bone-strengthening activities into programming • Programming active breaks between sedentary tasks to break up prolonged sitting • How to minimize sedentary behaviour during transition times
14. *Incorporate Physical Activity into Other Educational Objectives* • How to integrate physical activity into other curriculum areas and typically sedentary activities (e.g., reading circles, arts and crafts)
15. *Create and Make Use of Environments to be Supportive of Physical Activity*

- How to set up your classroom to promote movement
- Making use of limited spaces/resources (moving furniture, using hallways)

16. *Suggest the Creation of Physical Activity and Screen-Viewing Policies at your Centre*

- Having a written physical activity and screen-viewing policy will aid in achieving goals to increase physical activity and minimize screen-viewing
- This will help parents understand that the centre prioritizes their child's health

17. *Get Parents/Guardians on Board!*

- Communicate with parents about the importance of physical activity and minimizing screen-viewing in early childhood
- Communicate with parents about their child's movement behaviours at childcare, and how they can support progress at home

Module 4: Training, Resources, and Practical Examples of Activities

18. *Resources and Professional Development*

- Importance of background training in physical activity and sedentary behaviour, and on-going professional development
- Many childcare organizations provide professional development workshops for ECEs
- Examples of professional development in physical activity and health (e.g., HighFIVE, Physical Literacy Instructor Program)
- Resources – Sport for Life, Active for Life, OPHEA, Healthy Kids Healthy Future
- Resources – Colleagues, social media (e.g., Pinterest)

19. *Example Activities*

- Video examples of teacher-led physical activities and active breaks

Appendix I

Ethics Approval - Studies 2 and 3

Western Research

Date: 14 January 2021

To: Dr. Patricia Tucker

Project ID: 116816

Study Title: Training pre-service EArly CHildhood educators in physical activity: The TEACH Pilot Study

Short Title: The TEACH Pilot Study

Application Type: NMREB Initial Application

Review Type: Delegated

Full Board Reporting Date: 05/Feb/2021

Date Approval Issued: 14/Jan/2021 16:28

REB Approval Expiry Date: 14/Jan/2022

Dear Dr. Patricia Tucker

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the WREM application form for the above mentioned study, as of the date noted above. NMREB approval for this study remains valid until the expiry date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

This research study is to be conducted by the investigator noted above. All other required institutional approvals must also be obtained prior to the conduct of the study.

Documents Approved:

Document Name	Document Type	Document Date	Document Version
Recruitment Ad 1	Recruitment Materials	12/Nov/2020	1
Recruitment Ad 2	Recruitment Materials	12/Nov/2020	1
TEACH_Pilot_Study_Baseline_Survey_-_ECEs	Online Survey	18/Nov/2020	1
Email_Submission_to_Receive_e-Learning_Platform_Link_-_ECEs	Online Survey	18/Nov/2020	1
TEACH_Pilot_Study_Follow-Up_Survey_-_ECEs	Online Survey	18/Nov/2020	1
Pilot_Study_-_ECEs_-_Volition_to_Enter_Draw_or_Receive_Study_Results	Online Survey	18/Nov/2020	1
TEACH_Pilot_Study_Baseline_Survey_-_ECE_Students	Online Survey	18/Nov/2020	1
Email_Submission_to_Receive_e-Learning_Platform_Link_-_ECE_Students	Online Survey	18/Nov/2020	1
TEACH_Pilot_Study_Follow-Up_Survey_-_ECE_Students	Online Survey	18/Nov/2020	1
Pilot_Study_-_ECE_Students_-_Compensation_and_Study_Results	Online Survey	18/Nov/2020	1
Pilot Study Telephone Script	Recruitment Materials	18/Nov/2020	1
Pilot Study Email Scripts	Recruitment Materials	12/Jan/2021	2
Pilot Study - Interview Guides	Verbal Consent/Assent	12/Jan/2021	2
TEACH Pilot LOIC - ECE Students	Implied Consent/Assent	12/Jan/2021	2

TEACH Pilot LOIC - ECEs	Implied Consent/Assent	12/Jan/2021	2
Pilot Study - Interview Guides	Interview Guide	12/Jan/2021	2

Documents Acknowledged:

Document Name	Document Type	Document Date	Document Version
Eligibility Screening for ECEs - Piot Study	Screening Form/Questionnaire	05/Oct/2020	1

No deviations from, or changes to the protocol should be initiated without prior written approval from the NMREB, except when necessary to eliminate immediate hazard(s) to study participants or when the change(s) involves only administrative or logistical aspects of the trial.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario. Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB. The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

Please do not hesitate to contact us if you have any questions.

Sincerely,

Ms. Katelyn Harris , Research Ethics Officer on behalf of Dr. Randal Graham, NMREB Chair

Note: This correspondence includes an electronic signature (validation and approval via an online system that is compliant with all regulations).

Appendix J

Pre-Service Early Childhood Educator Letter of Information and Consent

TEACH PILOT STUDY LOI/C – ECE Students

Project Title: Training pre-service Early CHildhood educators in physical activity: The TEACH pilot study

Principal Investigator:
Trish Tucker, PhD, Faculty of Health Sciences, University of Western Ontario
PhD Student Investigator:
Brianne Bruijns, PhD Candidate, Health and Rehabilitation Sciences, Western University

Letter of Information and Consent

Invitation to Participate

You are being invited to participate in this pilot study exploring the impact of an e-Learning course in physical activity and sedentary behaviour on Early Childhood Education (ECE) students' self-efficacy, knowledge, and behavioural intention, and the functionality of the course, because you are enrolled in a participating ECE program at a Canadian college/university.

Purpose of the Letter

The purpose of this letter is to provide you with information required for you to make an informed decision regarding participation in this research study.

Purpose of this Study

The purpose of this pilot study is to test an e-Learning course in physical activity and sedentary behaviour and examine its functionality and impact on ECE students' related self-efficacy, knowledge, and behavioural intention and perceived behavioural control.

Inclusion Criteria

Students enrolled in an ECE program at a participating English-speaking Canadian college/ university will be invited to participate in this study.

Exclusion Criteria

Students who are not enrolled in an ECE program at a participating English-speaking Canadian college/university will be ineligible to participate in this study.

Study Procedures

You will be asked to complete an e-Learning physical activity and sedentary behaviour course (4 modules, ~4 hours of total content) within a 2-week timeframe. Should you agree to participate, you will be asked to complete an online survey through Qualtrics (~20 minutes in length) assessing your physical activity and sedentary behaviour self-efficacy, knowledge, and behavioural intention and perceived behavioural control at 2 separate time points (baseline and post-course completion). The post-course survey (~25 minutes in length) will also include questions about your experience with the e-

Learning course, and after survey completion you may volunteer to participate in a 20 to 30-minute recorded Zoom interview to describe your perspectives on the course.

Possible Risks and Harms
There are no known risks or discomforts associated with participating in this study.

Possible Benefits
By participating, you have the potential to advance your knowledge in physical activity and sedentary behaviour in early childhood, which is likely to benefit your confidence, ability, and intentions to lead physical activity opportunities in childcare settings. You will receive a certificate of completion for completing the course in its entirety. You will also provide researchers with valuable information about the impact of physical activity and sedentary behaviour training on students' related self-efficacy, knowledge, and behavioural intention and perceived behavioural control.

Compensation
At the end of the post-course survey, you can opt in to receive a $10 gift card to Amazon as appreciation of your time. At this time, you can also indicate your volition to participate in a Zoom interview; if randomly selected as an interviewee, you will receive a $10 Amazon gift card for your participation in the interview.

Voluntary Participation
Participation in this study is voluntary. You may refuse to participate, skip any survey questions, or withdraw from the study at any time prior to data analysis with no effect on your grades or academic status. Interview participation is separate from your participation in the e-Learning course and study-related surveys, and you may withdraw your interview data separately from, or in conjunction with, other study-related data. To withdraw from the study, email the Principal Investigator ([redacted] with your unique participant ID.

Confidentiality
The information collected will be used for research purposes only. Your name will only be collected to set up a profile in the LMS platform and to administer you a certificate for completing the course and will be stored separate from your data. Your email address will be required to set up a single sign-on profile in the LMS platform, and will also be collected post-survey completion via a separate survey (not linked to your data) should you wish to receive a $10 Amazon gift card, or if you wish to participate in a Zoom interview and/or receive the study results. All data will be grouped with other participants for publishing or presentation purposes. All information collected for the study will be kept confidential. Only the investigators of this study will have access to any survey data collected. Representatives of Western University's Non-Medical Research Ethics Board may require access to your study-related records to monitor the conduct of the research. All electronic files will be saved on password-protected computers. Data will be saved for 7 years before it is properly destroyed.

Qualtrics survey platform. Your survey responses will be collected anonymously through a secure online survey platform called Qualtrics. Qualtrics uses encryption technology and restricted access authorizations to protect all data collected. In addition, Western's Qualtrics server is in Ireland, where privacy standards are maintained under the European Union safe harbor framework. The data will then be exported from Qualtrics and securely stored on Western University's server.

Learning Management System (LMS) platform. The LMS platform *Talent LMS* will collect module usage data (i.e., completion rates, average completion duration, knowledge check response accuracy) for this project, as well as information necessary to set up a single sign-on profile (i.e., email, password, participant ID, full name). The data is housed in the United Kingdom and only Talent LMS, the e-Learning design project administrator at Onlea, and the research team, will have access to it. Talent LMS implements reasonable and appropriate security procedures consistent with Data Protection Laws to protect data from unauthorized access by physical and electronic intrusion, including advanced encryption technology and secure login access to protect all participant data. Data collected via the LMS platform will be exported to be stored on Western University's server.

Interviews. All interviews will be recorded via Zoom and transcribed by a Western University approved professional transcription company (i.e., NVivo or Transcription Heroes).

Contacts for Further Information

If you have any questions about the conduct of this study or your rights as a research participant you may contact the Office of Human Research Ethics at Western University [redacted]. If you have any questions about this study, please contact Dr. Trish Tucker [redacted].

Publication

If you would like to receive a copy of the overall results of the study, please indicate so by answering the final question of the survey.

Consent

Completion of the baseline survey is indication of your consent to participate. Separate verbal consent will be obtained from those who volunteer and are selected to participate in an interview. You do not waive any legal right by consenting to this study.

Appendix K

In-Service Early Childhood Educator Letter of Information and Consent

TEACH PILOT STUDY LOI/C – ECEs

Project Title: Training pre-service Early CHildhood educators in physical activity: The TEACH pilot study

Principal Investigator:
Trish Tucker, PhD, Faculty of Health Sciences, University of Western Ontario
PhD Student Investigator:
Brianne Bruijns, PhD Candidate, Health and Rehabilitation Sciences, Western University

Letter of Information and Consent

Invitation to Participate

You are being invited to participate in this pilot study exploring the impact of an e-Learning course in physical activity and sedentary behaviour on early childhood educators' self-efficacy and knowledge, and the functionality of the course, because you are an early childhood educator employed in a Canadian centre- or home-based childcare, preschool, or kindergarten setting.

Purpose of the Letter

The purpose of this letter is to provide you with information required for you to make an informed decision regarding participation in this research study.

Purpose of this Study

The purpose of this study is to pilot test an e-Learning course in physical activity and sedentary behaviour and examine its functionality and impact on early childhood educators' related self-efficacy and knowledge.

Inclusion Criteria

Early childhood educators employed within a Canadian centre- or home-based childcare, preschool, or kindergarten setting will be invited to participate in this study.

Exclusion Criteria

Those who are not early childhood educators employed within a Canadian centre- or home-based childcare, preschool, or kindergarten setting will be ineligible to participate in this study.

Study Procedures

You will be asked to complete an e-Learning physical activity and sedentary behaviour course (4 modules, ~4 hours of total content) within a 2-week timeframe. Should you agree to participate, you will be asked to complete an online survey through Qualtrics (~20 minutes in length) assessing your physical activity and sedentary behaviour self-efficacy and knowledge at 2 separate time points (baseline and post-intervention). You will also be invited to complete a Qualtrics survey post-course completion (~25 minutes

in length) to communicate your experience with the e-Learning course, and to participate in a voluntary 20 to 30-minute recorded Zoom interview to describe your perspectives on the course.

Possible Risks and Harms
There are no known risks or discomforts associated with participating in this study.

Possible Benefits
By participating, you have the potential to advance your knowledge in physical activity and sedentary behaviour in early childhood, which is likely to benefit your confidence, ability, and intentions to lead physical activity opportunities in childcare settings. You will receive a certificate of completion for completing the course in its entirety. You will also provide researchers with valuable information about the impact of physical activity and sedentary behaviour training on educators' related self-efficacy, knowledge, and behavioural intention and perceived behavioural control.

Compensation
At the end of the post-course survey, you can opt in to receive a $10 gift card to Amazon as appreciation of your time. At this time, you can also indicate your volition to participate in a Zoom interview; if randomly selected as an interviewee, you will receive a $10 Amazon gift card for your participation in the interview.

Voluntary Participation
Participation in this study is voluntary. You may refuse to participate, skip any survey questions, or withdraw from the study at any time prior to data analysis with no effect on your professional status. Interview participation is separate from your participation in the e-Learning course and study-related surveys, and you may withdraw your interview data separately from, or in conjunction with, other study-related data. To withdraw from the study, email the Principal Investigator ([redacted] with your unique participant ID.

Confidentiality
The information collected will be used for research purposes only. Your name will only be collected to set up a profile in the LMS platform and to administer you a certificate for completing the course and will be stored separate from your data. Your email address will be required to set up a single sign-on profile in the LMS platform, and will also be collected post-survey completion via a separate survey (not linked to your data) should you wish to receive a $10 Amazon gift card, or if you wish to participate in a Zoom interview and/or receive the study results. All data will be grouped with other participants for publishing or presentation purposes. All information collected for the study will be kept confidential. Only the investigators of this study will have access to any survey data collected. Representatives of Western University's Non-Medical Research Ethics Board may require access to your study-related records to monitor the

conduct of the research. All electronic files will be saved on password-protected computers. Data will be saved for 7 years before it is properly destroyed.

Qualtrics survey platform. Your survey responses will be collected anonymously through a secure online survey platform called Qualtrics. Qualtrics uses encryption technology and restricted access authorizations to protect all data collected. In addition, Western's Qualtrics server is in Ireland, where privacy standards are maintained under the European Union safe harbor framework. The data will then be exported from Qualtrics and securely stored on Western University's server.

Learning Management System (LMS) platform. The LMS platform *Talent LMS* will collect module usage data (i.e., completion rates, average completion duration, knowledge check response accuracy) for this project, as well as information necessary to set up a single sign-on profile (i.e., email, password, participant ID, full name). The data is housed in the United Kingdom and only Talent LMS, the e-Learning design project administrator at Onlea, and the research team, will have access to it. Talent LMS implements reasonable and appropriate security procedures consistent with Data Protection Laws to protect data from unauthorized access by physical and electronic intrusion, including advanced encryption technology and secure login access to protect all participant data. Data collected via the LMS platform will be exported to be stored on Western University's server.

Interviews. All interviews will be recorded via Zoom and transcribed by a Western University approved transcription company (e.g., NVivo or Transcription Heroes).

Contacts for Further Information

If you have any questions about the conduct of this study or your rights as a research participant you may contact the Office of Human Research Ethics at Western University [redacted]. If you have any questions about this study, please contact [redacted].

Publication

If you would like to receive a copy of the overall results of the study, please indicate so by answering the final question of the survey.

Consent

Completion of the baseline survey is indication of your consent to participate. Separate verbal consent will be obtained from those who volunteer and are selected to participate in an interview. You do not waive any legal right by consenting to this study.

Appendix L

Pre-Service Early Childhood Educator Demographic Questionnaire

Pre-Service ECE Demographic Survey

By answering the following questions, you are creating a unique participant ID for yourself. This is necessary for the research team to link your data from baseline (Survey 1) to follow-up (Survey 2). The information that you provide will be kept confidential and will only be available to the research team. You will be asked to submit the exact same responses in the follow-up survey.

What is the date of your birth? (E.g., If your birthday is June 20th, select "20").
Select Date (1)

▼ 1 (1) ... 31 (31)

What are the last two digits of your phone number? (E.g., If your phone number is 905-555-1234, select "3" as digit 1, and "4" as digit 2)
Digit 1 (1)
Digit 2 (2)

▼ 0 (1) ... 9 ~ 9 (110)

26 How many **letters** are in your first name? (E.g., If your name is Alyssa, select "6")
Select number of letters (1)

▼ 1 (1) ... 31 (31)

68 How many **siblings** do you have?
Number of Siblings (1)

▼ 0 (1) ... 25 (26)

Please state your age (in years):

_____

What gender do you identify with? (Refers to **current gender** which may be different from sex assigned at birth and may be different from what is indicated on legal documents.)

- ○ Male
- ○ Female
- ○ Prefer not to answer
- ○ Prefer to self-describe:_____

What is your racial background/ethnicity?

- ○ Caucasian
- ○ African Canadian
- ○ South Asian
- ○ East Asian
- ○ Middle Eastern
- ○ First Nations/Inuit/Métis
- ○ Latin Canadian
- ○ Other_____
- ○ Prefer not to answer

What type of Early Childhood Education program are you enrolled in?

- ○ Certificate
- ○ Diploma
- ○ Bachelor's Degree
- ○ Graduate Degree

How many years is your Early Childhood Education program?

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6

In your program, how many courses (to your knowledge) cover physical activity in early childhood?

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5+

In your program, how many courses (to your knowledge) cover sedentary behaviour (i.e., sitting/reclining/lying while exerting little energy, includes screen time) in early childhood?

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5+

In your program, how many courses (to your knowledge) cover outdoor and/or risky play (i.e., adventurous play involving a chance of injury) in early childhood?

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5+

Have you ever completed an e-Learning course/workshop?

- ○ Yes
- ○ No

How many **hours per week** do you spend in **moderate-to-vigorous physical activity** (e.g., jogging, running, weight lifting, playing sports)?

- ○ Less than 1 hour/week
- ○ 1 to 1.4 hours/week
- ○ 1.5 to 1.9 hours/week
- ○ 2 to 2.4 hours/week
- ○ 2.5+ hours/week

How many **hours of recreational screen time** (e.g., personal use of phone, tablet, computer, and/or television) do you engage in **each day**?

- ○ Less than 1 hour/day
- ○ 1 to 1.9 hours/day
- ○ 2 to 2.9 hours/day
- ○ 3+ hours/day

Appendix M

In-Service Early Childhood Educator Demographic Questionnaire

In-Service ECE Demographic Survey

Are you employed as an early childhood educator in a **Canadian** centre- or home-based childcare or preschool/kindergarten setting?

- ○ Yes (1)
- ○ No (2)

By answering the following questions, you are creating a unique participant ID for yourself. This is necessary for the research team to link your data from baseline (Survey 1) to follow-up (Survey 2). The information that you provide will be kept confidential and will only be available to the research team. You will be asked to submit the exact same responses in the follow-up survey.

What is the date of your birth? (E.g., If your birthday is June 20th, select "20").
Select Date (1)

▼ 1 (1) ... 31 (31)

What are the last two digits of your phone number? (E.g., If your phone number is 905-555-1234, select "3" as digit 1, and "4" as digit 2)
Digit 1 (1)
Digit 2 (2)

▼ 0 (1) ... 9 ~ 9 (110)

How many **letters** are in your first name? (E.g., If your name is Alyssa, select "6")
Select number of letters (1)

▼ 1 (1) ... 31 (31)

How many **siblings** do you have?
Number of Siblings (1)

▼ 0 (1) ... 25 (26)

Please state your age (in years):

_____

Q27 What province/territory do you live in?

- ○ British Columbia
- ○ Alberta
- ○ Saskatchewan
- ○ Manitoba
- ○ Ontario
- ○ Québec
- ○ New Brunswick
- ○ Nova Scotia
- ○ Prince Edward Island
- ○ Newfoundland and Labrador
- ○ Nunavut
- ○ Northwest Territories
- ○ Yukon

What type of childcare setting are you employed in?

- ○ Centre-based childcare
- ○ Home-based childcare
- ○ Kindergarten
- ○ Preschool

What type of Early Childhood Education program did you complete for your schooling?

- ○ Certificate
- ○ Diploma
- ○ Bachelor's Degree
- ○ Graduate Degree

How many years was your Early Childhood Education schooling?

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6

In your schooling, how many courses did you complete that covered physical activity in early childhood?

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5+

In your schooling, how many courses did you complete that covered sedentary behaviour (i.e., sitting/reclining/lying while exerting little energy, includes screen time) in early childhood?

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5+

In your schooling, how many courses did you complete that covered outdoor and/or risky play (i.e., adventurous play involving a chance of injury) in early childhood?

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5+

Have you completed any professional development courses in physical activity, sedentary behaviour, and/or outdoor/risky play? Check all that apply.

- [ ] Yes - Physical Activity
- [ ] Yes - Sedentary Behaviour
- [ ] Yes - Outdoor and/or Risky Play
- [ ] No - I have not taken professional development courses in any of these areas

How many **hours per week** do you spend in **moderate-to-vigorous physical activity** (e.g., jogging, running, weight lifting, playing sports)?

- ○ Less than 1 hour/week
- ○ 1 to 1.4 hours/week
- ○ 1.5 to 1.9 hours/week
- ○ 2 to 2.4 hours/week
- ○ 2.5+ hours/week

How many **hours of recreational screen time** (e.g., personal use of phone, tablet, computer, and/or television) do you engage in **each day**?

- ○ Less than 1 hour/day
- ○ 1 to 1.9 hours/day
- ○ 2 to 2.9 hours/day
- ○ 3+ hours/day

Appendix N

Physical Activity and Sedentary Behaviour Knowledge Questionnaire

Physical Activity and Sedentary Behaviour Knowledge Questionnaire

The following questions will test your knowledge of the ***Canadian 24-Hour Movement Guidelines for the Early Years (0-4 years):***

How many minutes of *tummy time* are **infants (<1 year)** recommended to engage in each day?

- ○ 10 minutes
- ○ 20 minutes
- ○ 30 minutes
- ○ 40 minutes

How many minutes of *total physical activity* are **toddlers (1-2 years) and preschoolers (3-4 years)** recommended to engage in each day?

- ○ 60 minutes
- ○ 90 minutes
- ○ 120 minutes
- ○ 180 minutes

How many minutes of *moderate-to-vigorous physical activity* are **preschoolers (3-4 years)** recommended to engage in each day?

- ○ 30 minutes
- ○ 60 minutes
- ○ 90 minutes
- ○ 120 minutes

How many minutes of *screen time* should a **3-year-old** be limited to each day?

- ○ 30 minutes
- ○ 60 minutes
- ○ 90 minutes
- ○ 120 minutes

How much *good-quality sleep*, including naps, should **infants (4-11 months)** get each day?

- ○ 10-13 hours
- ○ 11-14 hours
- ○ 12-16 hours
- ○ 14-17 hours

How much good-quality sleep, including naps, should toddlers (1-2 years) get each day?

- ○ 10-13 hours
- ○ 11-14 hours
- ○ 12-16 hours
- ○ 14-17 hours

The following questions will test your knowledge of research-based recommendations for physical activity and screen-viewing **in childcare**:

For **full-day programs**, what is the recommendation for ***preschoolers' (3-4 years)*** *physical activity* while in care?

- ○ 60 minutes/day of total physical activity, 20 minutes of which is at a moderate-to-vigorous intensity
- ○ 90 minutes/day of total physical activity, 30 minutes of which is at a moderate-to-vigorous intensity
- ○ 120 minutes/day of total physical activity, 40 minutes of which is at a moderate-to-vigorous intensity
- ○ 180 minutes/day of total physical activity, 60 minutes of which is at a moderate-to-vigorous intensity

What is the recommendation for *screen-viewing* **in childcare**?

- ○ There are no screen-viewing limits
- ○ Limit screen-viewing to 30 minutes/day
- ○ Screen-viewing is only recommended for educational purposes
- ○ Screen-viewing is not recommended

The following questions will assess your knowledge of *common terms relating to physical activity and sedentary behaviour* among young children.

Galloping, hopping, and jumping are examples of what type of fundamental movement skill?

- ○ Stability
- ○ Locomotor
- ○ Manipulative
- ○ Isometric

What is an example of a muscle and bone-strengthening activity?

- Playing catch
- Kicking a ball
- Balancing on a bench
- Jumping rope

The "*motivation, confidence, physical competence, knowledge, and understanding to value and take responsibility for engagement in physical activities for life*" is the definition of what?

- Structured physical activity
- Active lifestyle
- Physical literacy
- Active play

What type of play is a form of gross motor or total body movement in which young children use energy in a fun and freely chosen manner?

- Outdoor play
- Loose parts play
- Risky play
- Active play

What type of play invites curiosity by allowing children to play with everyday items (like kitchen utensils and cardboard boxes) or natural elements (like tree stumps or pebbles)?

- Outdoor play
- Loose parts play
- Risky play
- Active play

What practice can be used to limit sedentary time while waiting for the next activity or traveling to a different part of the classroom?

- Active breaks
- Active learning
- Active transitions
- Active play

What is ***not*** considered a category of risky play?

- Play at heights
- Play at high speeds
- Play near elements
- Play with heavy machinery

What intensity of activity provides the greatest health benefit?

- Sedentary
- Light
- Light-to-moderate
- Moderate-to-vigorous

The following questions will assess your knowledge of *appropriate behaviours of early childhood educators* regarding activity promotion in childcare.

Which of the following behaviours of early childhood educators does ***not*** promote physical activity?

- ○ Co-participating in activities
- ○ Engaging in passive supervision during outdoor play
- ○ Providing verbal prompts
- ○ Role modelling active behaviours

Which strategy does ***not*** encourage risky play?

- ○ Always helping
- ○ Trusting the children
- ○ Asking the right questions
- ○ Making time for it

When it comes to outdoor play, it is okay to move activities indoors if:

- It is lightly raining or snowing
- I don't feel like going outside
- The playground is wet
- There is severe weather

When is it ***not*** appropriate to lead structured physical activities during outdoor play?

- When showing children how to use equipment
- When children consistently settle into sedentary play
- When children are engaging in rough and tumble play
- When children say they are bored

To make a throwing activity more challenging, you can:

- Move the target closer
- Use a bigger ball
- Use a smaller target
- Use two hands

According to the Active Play and Physical Literacy Everyday (APPLE) Model, what four elements can educators utilize to encourage their children's development of physical literacy?

- Play, Relationships, Environment, Engagement
- Play, Leadership, Environment, Skills Development
- Leadership, Relationships, Engagement, Supervision
- Environment, Relationships, Supervision, Skills Development

Please indicate whether each of the following statements are **true or false**.

Regular physical activity helps children sleep better, which gives them more energy the next day to stay active.

- ◉ True
- ○ False

Too much screen-viewing in early childhood may delay children's language development.

- ◉ True
- ○ False

Fixed play equipment (e.g., slides, playhouses) promotes increased physical activity when compared to portable play equipment (e.g., tricycles, hula hoops).

- ○ True
- ◉ False

A **light intensity** physical activity may get a person warm and starting to sweat. The person may not be able to sing.

- ○ True
- ◉ False

Boys tend to be more active than girls.

- ◉ True
- ○ False

In childcare, children are twice as active outdoors than indoors.

- ◉ True
- ○ False

If the weather outside isn't favourable (i.e., too much snow, rain, heat), you should cancel outdoor play time.

- ○ True
- ○ False

Regular tummy time helps infants learn how to roll over and crawl.

- ○ True
- ○ False

Appendix O

Early Childhood Educators' Confidence in Outdoor Movement, Physical Activity, Sedentary and Screen behaviours (ECE-COMPASS) Questionnaire

Child Health & Physical Activity Laboratory

Early Childhood Educators' Confidence in Outdoor Movement, Physical Activity, Sedentary and Screen behaviours (ECE-COMPASS) Questionnaire

Physical Activity | Sedentary/Screen Time | Outdoor/Risky Play

Please indicate, on a scale from 0 (not confident at all) to 10 (completely confident), how confident you are in your ability to perform the following during your childcare day:

0	1	2	3	4	5	6	7	8	9	10
Not confident at all					**Moderately confident**					**Completely confident**

TASK Self-Efficacy
Program opportunities for at least 120 min/day of physical activity *at any intensity*
Facilitate *higher intensity physical activity* (i.e., activities that induce sweating and heavy breathing) for children in my care everyday
Lead activities that promote children's development of physical literacy (e.g., including running, jumping, balancing, throwing, catching)
Adapt physical activities for different developmental abilities
Support children's motivation to move through verbal encouragement
Incorporate movement into your curriculum (e.g., literacy and numeracy)
Facilitate opportunities for unstructured (i.e., child-directed) active play each day
Lead structured (i.e., educator-facilitated) physical activity each day
Create an environment that supports children's active play
Teach children about the health benefits of physical activity
Communicate about children's physical activity and physical literacy with families
Develop organizational policies for physical activity
Serve as a positive role model for children's physical activity by participating in movement-based activities
Develop organizational policies for screen time

Serve as a positive role model for children's sedentary behaviours by limiting your own sitting during care hours
Serve as a positive role model for children's screen behaviours by limiting your own screen use during care hours
Minimize long periods (>60 minutes) of sitting time among the children in my care
Incorporate physical activity opportunities (e.g., active breaks and transitions) to minimize prolonged sitting time
Avoid children's use of screen-based technology during childcare hours
Engage children in age-appropriate risky play (i.e., adventurous play that tests children's limits but involves a chance of minor injury; e.g., play at heights, high speeds)
Provide children with multiple outdoor play opportunities everyday
BARRIER Self-Efficacy
Lead structured physical activities in a small/limited space
Encourage physical activity when my colleagues/superiors do not value it
Program opportunities for physical activity even when there are time constraints
Minimize children's sedentary behaviour when **they** are tired
Provide outdoor playtime even when the weather conditions are not favourable, but not extreme
Facilitate children's *active* play indoors when extreme weather prevents outdoor play
Facilitate opportunities for age-appropriate risky play even when met with resistance from parents/other educators
Facilitate outdoor active play opportunities even when I am tired
Facilitate outdoor active play opportunities even when transitions are difficult
Facilitate outdoor active play opportunities even when it takes additional time to get children dressed

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Appendix P

Early Childhood Educator Movement Behavioural Intention and Perceived Control (ECE-MBIPC) Questionnaire

Child Health & PHYSICAL ACTIVITY LABORATORY

Early Childhood Educator Movement Behavioural Intention and perceived Control (ECE-MBIC) Questionnaire

Physical Activity | Sedentary/Screen Time | Outdoor/Risky Play

1	2	3	4	5	6	7

BEHAVIOURAL INTENTION	
I have the intention to... • engage children in my care in at least 120 min/day of physical activity • promote children's development of physical literacy by incorporating fundamental movement skills • be a good role model for children's physical activity by participating in movement-based activities	Strongly Disagree to Strongly Agree
I plan to... • engage children in my care in at least 120 min/day of physical activity • promote children's development of physical literacy by incorporating fundamental movement skills • be a good role model for children's physical activity by participating in movement-based activities	Strongly Disagree to Strongly Agree
I estimate that my chances of... • engaging children in my care in at least 120 min/day of physical activity are... • promoting children's development of physical literacy by incorporating fundamental movement skills are... • being a good role model for children's physical activity by participating in movement-based activities are...	Extremely Unlikely to Extremely Likely
When I enter a childcare-based profession, I am going to... • engage children in my care in at least 120 min/day of physical activity • promote children's development of physical literacy by incorporating fundamental movement skills • be a good role model for children's physical activity by participating in movement-based activities	Extremely Unlikely to Extremely Likely
I have the intention to... • minimize long periods of sedentary time (>30 mins) for children in my care • avoid children's use of screen-based technology during childcare hours	Strongly Disagree to Strongly Agree
I plan to... • minimize long periods of sedentary time (>30 mins) for children in my care	Strongly Disagree to Strongly Agree

• avoid children's use of screen-based technology during childcare hours	
I estimate that my chances of… • minimizing long periods of sedentary time (>30 mins) for children in my care are… • avoiding children's use of screen-based technology during childcare hours are…	Extremely Unlikely to Extremely Likely
When I enter a childcare-based profession, I am going to… • minimize long periods of sedentary time (>30 mins) for children in my care • avoid children's use of screen-based technology during childcare hours	Extremely Unlikely to Extremely Likely
I have the intention to… • promote outdoor play during all seasons and weather conditions • lead opportunities for outdoor risky play for children in my care	Strongly Disagree to Strongly Agree
I plan to… • promote outdoor play during all seasons and weather conditions • lead opportunities for outdoor risky play for children in my care	Strongly Disagree to Strongly Agree
I estimate that my chances of… • promoting outdoor play during all seasons and weather conditions *are…* • leading opportunities for outdoor risky play for children in my care *are…*	Extremely Unlikely to Extremely Likely
When I enter a childcare-based profession, I am going to… • promote outdoor play during all seasons and weather conditions • lead opportunities for outdoor risky play for children in my care	Extremely Unlikely to Extremely Likely
PERCEIVED BEHAVIOURAL CONTROL	
For me… • engaging children in my care in at least 120 min/day of physical activity *would be…* • promoting children's development of physical literacy by incorporating fundamental movement skills *would be…* • being a good role model for children's physical activity by participating in movement-based activities *would be…*	Extremely Difficult to Extremely Easy
If I wanted to, I could easily…	Strongly Disagree to Strongly Agree

• engage children in my care in at least 120 min/day of physical activity • promote children's development of physical literacy by incorporating fundamental movement skills • be a good role model for children's physical activity by participating in movement-based activities	
It is up to me to… • engage children in my care in at least 120 min/day of physical activity • promote children's development of physical literacy by incorporating fundamental movement skills • be a good role model for children's physical activity by participating in movement-based activities	Strongly Disagree to Strongly Agree
I feel able to… • engage children in my care in at least 120 min/day of physical activity • promote children's development of physical literacy by incorporating fundamental movement skills • be a good role model for children's physical activity by participating in movement-based activities	Strongly Disagree to Strongly Agree
For me… • minimizing long periods of sedentary time (>30 mins) for children in my care *would be…* • avoiding children's use of screen-based technology during childcare hours *would be…*	Extremely Difficult to Extremely Easy
If I wanted to, I could easily… • minimize long periods of sedentary time (>30 mins) for children in my care • avoid children's use of screen-based technology during childcare hours	Strongly Disagree to Strongly Agree
It is up to me to… • minimize long periods of sedentary time (>30 mins) for children in my care • avoid children's use of screen-based technology during childcare hours	Strongly Disagree to Strongly Agree
I feel able to… • minimize long periods of sedentary time (>30 mins) for children in my care • avoid children's use of screen-based technology during childcare hours	Strongly Disagree to Strongly Agree
For me… • promoting outdoor play during all seasons and weather conditions *would be…*	Extremely Difficult to Extremely Easy

• leading opportunities for outdoor risky play for children in my care *would be…*	
If I wanted to, I could easily… • promote outdoor play during all seasons and weather conditions • lead opportunities for outdoor risky play for children in my care	Strongly Disagree to Strongly Agree
It is up to me to… • promote outdoor play during all seasons and weather conditions • lead opportunities for outdoor risky play for children in my care	Strongly Disagree to Strongly Agree
I feel able to… • promote outdoor play during all seasons and weather conditions • lead opportunities for outdoor risky play for children in my care	Strongly Disagree to Strongly Agree

Appendix Q

Online Process Evaluation Survey – Study 3

TEACH Pilot Study Process Evaluation Survey

Please confirm you are not a robot before entering the survey:

By answering the following questions, you are creating a unique participant ID for yourself. This is necessary for the research team to link your data from baseline (Survey 1) to follow-up (Survey 2). The information that you provide will be kept confidential and will only be available to the research team. You will be asked to submit the exact same responses in the follow-up survey.

What is the date of your birth? (E.g., If your birthday is June 20th, select "20").
Select Date (1)

▼ 1 (1) ... 31 (31)

What are the last two digits of your phone number? (E.g., If your phone number is 905-555-1234, select "3" as digit 1, and "4" as digit 2)
Digit 1 (1)
Digit 2 (2)

▼ 0 (1) ... 9 ~ 9 (110)

How many **letters** are in your first name? (E.g., If your name is Alyssa, select "6")
Select number of letters (1)

▼ 1 (1) ... 31 (31)

How many **siblings** do you have?

Select number of siblings (1)

▼ 0 (1) ... 25 (26)

What topic(s) did you ***most*** enjoy learning about in the e-Learning course? **Check all that apply.**

- ☐ Introduction to physical activity
- ☐ Introduction to sedentary behaviour
- ☐ The Canadian 24-Hour Movement Guidelines for the Early Years
- ☐ Physical literacy
- ☐ Fundamental movement skills
- ☐ Factors that influence physical activity and sedentary behaviour in childcare
- ☐ Outdoor play
- ☐ Risky play
- ☐ Loose parts play
- ☐ How to track and set goals for movement behaviours in childcare
- ☐ Role modelling appropriate movement behaviours

- [ ] How to modify your teaching behaviours to support activity
- [ ] Programming physical activity
- [ ] Programming active breaks, transitions, and learning opportunities to minimize sedentary behaviour
- [ ] Getting families on board
- [ ] Creating physical activity and sedentary behaviour policies
- [ ] Professional learning opportunities
- [ ] Resources for early childhood educators
- [ ] Video library of activities

What topic(s) did you ***least*** enjoy learning about in the e-Learning course? **Check all that apply.**

- ☐ Introduction to physical activity
- ☐ Introduction to sedentary behaviour
- ☐ The Canadian 24-Hour Movement Guidelines for the Early Years
- ☐ Physical literacy
- ☐ Fundamental movement skills
- ☐ Factors that influence physical activity and sedentary behaviour in childcare
- ☐ Outdoor play
- ☐ Risky play
- ☐ Loose parts play
- ☐ How to track and set goals for movement behaviours in childcare
- ☐ Role modelling appropriate movement behaviours
- ☐ How to modify your teaching behaviours to support activity
- ☐ Programming physical activity
- ☐ Programming active breaks, transitions, and learning opportunities to minimize sedentary behaviour
- ☐ Getting families on board

- ☐ Creating physical activity and sedentary behaviour policies
- ☐ Professional learning opportunities
- ☐ Resources for early childhood educators
- ☐ Video library of activities

Display This Question:

If If What topic(s) did you least enjoy learning about in the e-Learning course? Check all that apply. q://QID7/SelectedChoicesCount Is Equal to 1

Please let us know why you did not enjoy these topics:

_____

What design elements of the e-Learning course best facilitated your learning? **Check all that apply.**

- ☐ Text
- ☐ Voiceover
- ☐ Images
- ☐ Animations
- ☐ Videos
- ☐ Knowledge check questions

Please rate your agreement with the following statements about your experience with the e-Learning course:

Strongly Disagree					Strongly Agree
0	**1**	**2**	**3**	**4**	**5**
Overall, I enjoyed using the course					
Overall, I was satisfied with the course					
The course provided me with sufficient information about *physical activity* in early childhood					
The course provided me with sufficient information about *sedentary behaviour* in early childhood					
The course met my requirements					
The design of the course (e.g., fonts, style, colours, images, videos) was acceptable					
The course used interesting and appropriate delivery methods (e.g., animation, video, audio, text, simulation, etc.)					
The evaluation and assessment components of the e-Learning course were appropriate based on course content presented					
I had enough time to complete the course					
The length of each module within the e-Learning course was appropriate					
It was easy to use the course					
The course was flexible to navigate					
There were clear instructions about how to use the course					
The structure of the course was well organized into understandable components					
Information presented in the course was concise and clear					
My previous experience with e-Learning systems and/or computer applications helped me in using the course					
I was able to perform tasks in the course successfully					
Taking the course was a useful experience to complement my early childhood education training					

The course helped me learn effectively
The course was an effective educational tool
The course helped me to achieve the learning outcomes of each module
The course increased my knowledge about *physical activity* in early childhood
The course increased my knowledge about *sedentary behaviour* in early childhood
The within-module knowledge checks helped facilitate my learning
The end-of-module knowledge assessments helped facilitate my learning
The e-Learning mode of delivery helped me learn as effectively as in-person instruction
The knowledge I gained from this course will be useful to me as an early childhood educator
Access to this course would be beneficial to me as an early childhood educator
Future early childhood education students would benefit from this course being integrated into the post-secondary curriculum
The course content was new to me
I had a positive attitude toward using the course
The course was ***not*** intimidating to use
My interest in learning about *physical activity* in early childhood increased as a result of the course
My interest in learning about *sedentary behaviour* in early childhood increased as a result of the course

What challenges, if any, did you experience when completing the e-Learning course?

_____

Display This Question:

If If What challenges, if any, did you experience when completing the e-Learning course? Text Response Is Not Empty

What solutions helped you resolve these challenges?

_____

Do you have any suggestions that would improve the e-Learning course?

_____

Appendix R

Interview Guide - Study 3

Training pre-service EArly CHildhood educators in physical activity: The TEACH Pilot Study

Sample Interview Guide for Zoom Interviews with ECE Students/ Early Childhood Educators

Thank you for volunteering to participate in this interview. Today we will discuss your thoughts and experiences of the recently implemented TEACH intervention; an e-Learning physical activity training program for [*Early Childhood Education (ECE) students in Canadian colleges/universities OR early childhood educators*]. Specifically, we are looking to gather your feedback on the e-Learning course and the feasibility of introducing this training into post-secondary ECE curricula. Your view of the modules is valuable to improve the delivery and content prior to larger-scale distribution and implementation.

There are no right or wrong answers. Everything discussed today will be kept confidential, and your name will be removed from the transcripts and publications. In order to ensure we accurately capture your responses, the interview will be recorded and transcribed. As a reminder, you can withdraw your interview transcript at any time prior to data analysis, and your participation in this interview is separate from your participation in the e-Learning course and surveys. Video will remain off for the interview.

Do you have any questions before we start?

Do you consent to participate?

Do you consent to the publication of direct quotes from this interview transcript?

---

1. What are your thoughts on using an e-Learning platform to deliver this training?
    a. Please expand.
    b. In what ways did this platform of delivery impact your learning?

2. What were the **best** parts of the e-Learning course?

   a. What made those parts/characteristics so beneficial?
   b. What are some examples of these?
   c. Tell me more about that.

3. What content in the e-Learning course did you find **most** interesting?
   a. What made it so interesting?
   b. What are some examples?

4. What content in the e-Learning course did you find **least** interesting?
   a. What made it so uninteresting?
   b. What are some examples?
   c. How do you think this content could be delivered differently to make it more interesting?

5. What characteristic(s) of the e-Learning course do you feel was/were **most** beneficial for supporting your learning?
   a. What made it/them so beneficial?
   b. What are some examples?

6. What characteristic(s) of the e-Learning course do you feel was/were **least** beneficial for supporting your learning?
   a. What made it/them so unbeneficial?
   b. What are some examples?
   c. How do you think this aspect of the training could be tweaked so that it is more conducive to supporting your learning?

7. What **challenges** did you experience when completing the e-Learning course?
   a. Please expand.
   b. In what ways did this impact your learning?

8. What **solutions** did you undertake to deal with these challenges?
   a. Please expand.
   b. Tell me more about that.
   c. How much time and effort did these solutions require?

9. Overall, what has been your **overall experience** with the TEACH intervention?
   a. How 'effective' would you consider this training in increasing [*ECE students'/early childhood educators*'] knowledge and confidence to promote physical activity in childcare settings?

b. How ‘effective’ would you consider this training in increasing [*ECE students’/early childhood educators*’] knowledge and confidence to minimize prolonged sedentary behaviour in childcare settings?
c. How important would you consider this e-Learning training to be for [*ECE students/early childhood educators*]?
d. How ‘feasible’ would you consider this e-Learning training to implement in post-secondary ECE programs?
e. How receptive were your classmates/colleagues to this intervention?
f. Do you have anything else to add?

Curriculum Vitae

CURRICULUM VITAE – Brianne A. Bruijns

PERSONAL INFORMATION

Name: Brianne Aimée Bruijns Citizenship: [redacted]

Place of Birth: [redacted] Email: [redacted]

EDUCATION, SCHOLARHIPS, & AWARDS

Education

Doctor of Philosophy - Health and Rehabilitation Sciences 2018 - 2021
Field: Health Promotion
University of Western Ontario, London, ON

The Development, Short-Term Efficacy, and Pilot Implementation of an e-Learning Course in Physical Activity and Sedentary Behaviour for Pre-Service Early Childhood Educators (Dissertation Title)

Early Childhood Educators' Physical Activity-Related Self-Efficacy and Knowledge Following the SPACE and SPACE-Extension Physical Activity Interventions in Childcare (Comprehensive Examination Title)

Master of Science - Health and Rehabilitation Sciences 2016 - 2018
Field: Health Promotion
University of Western Ontario, London, ON

Exploring the Physical Activity and Screen Viewing-Related Knowledge, Training, and Self-Efficacy of Early Childhood Education Candidates (Thesis Title)
Available online: https://ir.lib.uwo.ca/etd/5697/

Honours Bachelor of Physical Education 2011 – 2016
Specialization in Physical Education
Brock University, St. Catharine's, ON

Additional Training and Education

Cours Intensif - B1 2014
Alliance Française - Rouen, France

- An intensive oral and grammar French course designed to prepare students for the Diplôme D'Études en Langue Française (DELF) examinations.

Trois-Pistoles Summer Exchange Program 2011
University of Western Ontario – Trois-Pistoles, QB

- In this exchange program, I completed a first year full-credit French Studies course at the University of Western Ontario's Trois-Pistoles campus. I attended classes and workshops and lived with a French host family. Only French was allowed to be spoken for the entire duration of the 6 weeks.

Awards and Honours

A. GRADUATE LEVEL

Scholarships

1. 2020-2023 Social Sciences and Humanities Research Council of Canada Joseph-Armand Bombardier Canada Graduate Scholarship. Value: $105,000 (competitive)
2. 2020 Ontario Graduate Scholarship. Value: $15,000 (competitive - declined to accept national award)
3. 2019 Ontario Graduate Scholarship. Value: $15,000 (competitive)
4. 2018 Ontario Graduate Scholarship. Value: $15,000 (competitive)
5. 2017 Ontario Graduate Scholarship. Value: $15,000 (competitive)
6. 2016 Ontario Graduate Scholarship. Value: $15,000 (competitive)

Awards and Distinctions

1. 2018 North American Society for Pediatric Exercise Medicine Marco Cabrera Student Research Award. Value: $1,500 (USD)
2. 2018 Faculty of Health Sciences Conference Travel Award. Value: $500
3. 2018 Health and Rehabilitation Sciences Conference Travel Award. Value: $700
4. 2017 Conference Travel Award, The Lawson Foundation/Children's Health Research Institute. Value: $100

B. UNDERGRADUATE LEVEL

Scholarships

1. 2011 Brock Scholar's Award, Brock University. Value: $9,000

Awards and Distinctions

1. 2016 Distinguished Graduating Student Award – Physical Education (highest major average), Brock University. Value: $100
2. 2016 Dean's Honour's List, Brock University
3. 2015 National Grant Winner – Physical and Health Education Canada Student Leadership Initiative. Value: $5,000
4. 2015 Conference Travel Award, Faculty of Applied Health Sciences, Brock University. Value: $384
5. 2014 Dean's Honour's List, Brock University

6. 2013 Dean's Honour's List, Brock University
7. 2012 Dean's Honour's List, Brock University

WORK EXPERIENCE

Student Supervision & Mentorship

Undergraduate Student Co-Supervision:

- Saadia Abdel Wahab (2017-2018)
- Alyssa Aglipay (2019-2020)
- Emma Drake (2019-2020)
- Cara Davidson (2019-2020)
- Cole Misic (2020)
- Suzy Lee (2020-2021)
- Faith Heidary (2021)
- Kshitija Mundle (2021)
- Aidan Loh (2021)
- Tanya Nguyen (2021-2022)

Teaching Experience

e-Learning Course Developer Feb 2020 – Dec 2021
An Educator's Guide to Physical Activity and Sedentary Behaviour in Early Childhood
Supervisor: Dr. Trish Tucker

As a Co-Investigator on a SSHRC Insight Grant research project, I developed the course outline and content for an e-Learning course in physical activity and sedentary behaviour to be implemented in Canadian post-secondary Early Childhood Education programs. I developed the content in PowerPoint (4 Modules), which was then passed onto the e-Learning company for further development. After multiple stages of review, the course was pilot tested in 3 pre-service early childhood educator programs and is ready for full-scale evaluation.

Graduate Teaching Assistant

HS 9721a – Current Topics in Health Promotion Sep-Dec 2021
Professor: Dr. Leigh Vanderloo

As a Graduate Teaching Assistant for Dr. Vanderloo's graduate-level course (HS 9721a - Current Topics in Health Promotion), I am responding to all student inquiries regarding assignments, holding weekly office hours, moderating live Zoom presentations, and grading final papers. I will also be leading a guest lecture in Knowledge Mobilization Strategies on November 24th, 2021 for this class (live via Zoom).

APPLHSCI 9002B – Health Equity Jan-Apr 2021
Professor: Dr. Maxwell Smith

As a Graduate Teaching Assistant for Dr. Smith's graduate-level course, I tended to all student inquiries regarding assignments, held weekly office hours, moderated online reflection forums, and graded written assignments.

HS 9721a – Current Topics in Health Promotion Sep-Dec 2020
Professor: Dr. Jennifer Irwin

As a Graduate Teaching Assistant for Dr. Irwin's graduate-level course, I tended to all student inquiries regarding assignments, held weekly office hours, moderated live Zoom presentations, and graded written assignments.

Research Experience

Research Assistant Sept 2016 – Present
Child Health and Physical Activity Lab, University of Western Ontario, London, ON
www.childpalab.ca
Supervisor: Dr. Trish Tucker

As a research assistant and lab coordinator in the Child Health and Physical Activity Lab, I have been responsible for onboarding new students to the lab; liaising with research team members (including key knowledge users and stakeholders); creating knowledge mobilization outputs (including infographics, research summary videos, social media posts, news articles for The Conversation); leading systematic reviews and meta-analyses; drafting numerous manuscripts and >10 grant applications (institutional and tri-council [CIHR and SSHRC]); conducting quantitative and qualitative studies (including preparing ethics protocols, survey generation and administration in Qualtrics, and related analyses in SPSS© and QSR NVivo©); and leading an interdisciplinary research team of 11+ Canadian researchers.

Additional Work Experience

Manager[1] May 2012 – May 2020
Supervisor[2] August 2008 – May 2012
Marble Slab Creamery, London, ON

- [1]Store manager overseeing all operations; ordering of supplies; staff scheduling and supervision; customer service; attended to customer complaints; catering special events; preparation of goods

- [2]Shift supervisor; managed junior employees; customer service; attended to onsite customer complaints; catering special events; preparation of goods

Au Pair August 2014 - April 2015
Rouen, France

- Cared for two children (ages 6 and 8 years) before and after school; helped with homework; meal preparation; English tutoring

PUBLICATIONS AND PRESENTATIONS

Publications

A. PEER-REVIEWED JOURNAL ARTICLES (*n* = 11)

1. Szpunar, M., Vanderloo, L.M., **Bruijns, B.A.**, Truelove, S., Burke, S.M., Gilliland, J., Irwin, J.D., & Tucker, P. (2021). Children and parents' perspectives of the impact of the COVID-19 pandemic on Ontario children's physical activity, play, and sport behaviours. *BMC Public Health*, *2021*(21): 2271. https://doi.org/10.1186/s12889-021-12344-w

2. Szpunar, M., **Bruijns, B.A.**, & Tucker, P. (2021). Measuring early childhood educators' physical activity and sedentary-behaviour-related self-efficacy: A systematic review of assessment tools. *Health Education & Behavior*, *48*(4): 455-467. https://doi.org/10.1177%2F10901981211025471

3. Truelove, S., **Bruijns, B. A.**, Johnson, A. M., Burke, S. M., & Tucker, P. (2021). Factors that influence Canadian generalist and physical education specialist elementary school teachers' practices in physical education: A qualitative study. *Canadian Journal of Education/Revue Canadienne De l'éducation, 44*(1): 202-231. https://doi.org/10.53967/cje-rce.v44i1.4425

4. **Bruijns, B.A.**, Johnson, A.M., Irwin, J.D., Burke, S.M., Driediger, M., Vanderloo, L.M., & Tucker, P. (2021). Training may enhance early childhood educators' self-efficacy to lead physical activity in childcare. *BMC Public Health, 2021*(21): 386. https://doi.org/10.1186/s12889-021-10400-z

[θ] *This article was awarded the best publication in 2020-2021 in the International Journal of Behavioral Nutrition and Physical Activity – Early Care and Education Special Interest Group*

5. **Bruijns, B.A.**, Johnson, A.M., & Tucker, P. (2020). Content development for a physical activity and sedentary behaviour e-Learning module for Early Childhood Education students: A Delphi study. *BMC Public Health*, *2020*(20), 1600-1610. https://doi.org/10.1186/s12889-020-09670-w

6. Truelove, S., **Bruijns, B. A.**, Johnson, A. M., Gilliland, J., & Tucker, P. (2020). A meta-analysis of children's activity during physical education lessons taught by generalist and specialist teachers. *Health Behavior and Policy Review*, *7*(4), 292-313. https://doi.org/10.14485/HBPR.7.4.3

7. **Bruijns, B.A.**, Truelove, S., Johnson, A.M., Gilliland, J., & Tucker, P. (2020). Infants' and toddlers' physical activity and sedentary time as measured by accelerometry: A systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*. *17*(14), 1-14. https://doi.org/10.1186/s12966-020-0912-4

θ *This article was used to inform the 2020 ParticipACTION Report Card on Physical Activity for Children and Youth*

8. **Bruijns, B.A.**, Adamo, K.B., Burke, S.M., Carson, V., Irwin, J.D., Naylor, P.J., Timmons, B.W., Vanderloo, L.M., & Tucker, P. (2019). Exploring the physical activity and screen-viewing-related knowledge, training, and self-efficacy of early childhood education students. *BMC Pediatrics*. *19*(5), 1-13. https://doi.org/10.1186/s12887-018-1358-6

9. O'Brien, K.T., Vanderloo, L.M., **Bruijns, B.A.**, Truelove, S., & Tucker, P. (2018). Physical activity and sedentary time among preschoolers in centre-based childcare: A systematic review. *International Journal of Behavioural Nutrition and Physical Activity*. *15*(117), 1-16. https://doi.org/10.1186/s12966-018-0745-6

θ *This article was nominated as the 2nd best publication in 2018-2019 in the International Journal of Behavioral Nutrition and Physical Activity – Early Care and Education Special Interest Group, and was used to inform the 2020 ParticipACTION Report Card on Physical Activity for Children and Youth*

10. Driediger, M., Vanderloo, L.M., Truelove, S., **Bruijns, B.A.**, & Tucker, P. (2018). Encouraging kids to hop, skip, and jump: Emphasizing the need for higher intensity physical activity in childcare. *Journal of Sport and Health Sciences. 17*(22), 1-4. https://doi.org/10.1016/j.jshs.2018.03.003

11. Truelove, S., **Bruijns, B.A.**, O'Brien, K.T., Vanderloo, L.M., & Tucker, P. (2018). Physical activity and sedentary time during childcare outdoor play sessions: A systematic review and meta-analysis. *Preventive Medicine*. *108*(2018), 74-85. https://doi.org/10.1016/j.ypmed.2017.12.022

θ *This article was used to inform the 2020 ParticipACTION Report Card on Physical Activity for Children and Youth*

B. ACCEPTED PAPERS IN PEER-REVIEWED JOURNALS (*n* = 2)

1. **Bruijns, B.A.**, Vanderloo, L.M., Timmons, B.W., & Tucker, P. (2021). Exploring preschoolers' physical activity and sedentary time during outdoor play at childcare: A cross-sectional analysis of the SPACE study. *Journal of Physical*

Activity and Health. Available online ahead of print. https://doi.org/10.1123/jpah.2020-0849

2. **Bruijns, B.A.**, Adamo, K.B., Burke, S.M., Carson, V., Irwin, J.D., Naylor, P.J., Timmons, B.W., Vanderloo, L.M., & Tucker, P. (in-press). Early childhood education candidates' perspectives regarding physical activity and screen-viewing opportunities in childcare. *Journal of Early Childhood Teacher Education.*

C. SUBMITTED PAPERS (*n* = 6)

1. **Bruijns, B.A.**, Vanderloo, L.M., Johnson, A.M., Adamo, K.B., Burke, S.M., Carson, V., Heydon, R., Irwin, J.D., Naylor, P.J., Timmons, B.W., & Tucker, P. (revision submitted Dec 13, 2021). Change in pre- and in-service early childhood educators' knowledge, self-efficacy, behavioral intention, and perceived behavioral control following an e-Learning course in physical activity and sedentary behavior: A pilot study. *BMC Public Health*.

2. **Bruijns, B.A.**, Johnson, A.M., Burke, S.M., & Tucker, P. (submitted Oct 2021). Validation of a physical activity, sedentary behavior, and outdoor play behavioral intention and perceived behavioral control tool for early childhood educators. *Health Education & Behavior*.

3. Vanderloo, L.M., Szpunar, M., **Bruijns, B.A.**, Driediger, M., Burke, S.M., Johnson, A.J., & Tucker, P. (submitted Sep 22, 2021). Impact of a physical activity childcare policy on the self-efficacy of early childhood educators in Canada. *Journal of Research in Childhood Education*

4. **Bruijns, B.A.**, Johnson, A.M., Burke, S.M., & Tucker, P. (submitted Sep 21, 2021). Educators' self-efficacy to promote physical activity and outdoor play an minimize sedentary behaviour in childcare: A tool validation study. *Journal of Research in Childhood Education*.

5. **Bruijns, B.A.**, Vanderloo, L.M., Johnson, A.M., Adamo, K.B., Burke, S.M., Carson, V., Heydon, R., Irwin, J.D., Naylor, P.J., Timmons, B.W., & Tucker, P. (submitted Sep 16, 2021). Implementation of an e-Learning course in physical activity and sedentary behaviour for pre- and in-service early childhood educators: Evaluation of the TEACH pilot study. *BMC Pilot and Feasibility Studies*.

6. Tucker, P., **Bruijns, B.A.**, Adamo, K.B., Burke, S.M., Carson, V., Heydon, R., Irwin, J.D., Johnson, A.M., Naylor, P.J., Timmons, B.W., & Vanderloo, L.M. (submitted Apr 22, 2021). Training pre-service EArly CHildhood educators in physical activity (TEACH): Rationale and study design. *PLOS One.*

Conferences and Presentations

A. REFEREED ACADEMIC CONFERENCES & PRESENTATIONS

1. **Bruijns, B.A.**, Vanderloo, L.M, Timmons, B.W., & Tucker, P. (2021, Oct 14). *Are Preschoolers Most Active During the First Ten Minutes of Outdoor Play at Childcare?* International Society for Physical Activity and Health (ISPAH) Congress. *Abstract and Virtual Oral Presentation.*

2. **Bruijns, B.A.**, Johnson, A.M., & Tucker, P. (2021, Oct 14). *Using the Delphi Method to Develop Content for a Physical Activity and Sedentary Behaviour e-Learning Course for Pre-Service Early Childhood Educators.* International Society for Physical Activity and Health (ISPAH) Congress. *Abstract and Virtual Oral Presentation.*

3. **Bruijns, B.A.**, Truelove, S., Johnson, A.M., Gilliland, J., & Tucker, P. (2021, Jun 6). *A Systematic Review and Meta-Analysis of Infants' and Toddlers' Accelerometry-Measured Physical Activity and Sedentary Time Across Daytime Hours*. International Society of Behavioral Nutrition and Physical Activity (ISBNPA) Congress. *Abstract and Virtual Oral Presentation*.

θ *This submission was awarded the best presentation in the Early Care and Education Special Interest Group at the 2021 International Journal of Behavioral Nutrition and Physical Activity XChange Congress*

4. **Bruijns, B.A.**, Adamo, K.B., Burke, S.M., Carson, V., Irwin, J.D., Naylor, P.J., Timmons, B.W., Vanderloo, L.M., & Tucker, P. (2018, Oct 16). *Exploring the Relationship between ECE Students' Physical Activity Training and Self-Efficacy to Facilitate Active Opportunities in Childcare.* International Society for Physical Activity and Health (ISPAH) Congress. London, UK. *Abstract and Poster Presentation.*

5. Truelove, S., **Bruijns, B.A.**, O'Brien, K.T., Vanderloo, L.M., & Tucker, P. (2018, Aug 23). *Physical Activity and Sedentary Time during Childcare Outdoor Play Sessions: A Systematic Review and Meta-Analysis*. North American Society of Pediatric Exercise Medicine (NASPEM). Oakland, CA. *Abstract and Poster Presentation*.

B. INVITED SPEAKER PRESENTATIONS

1. **Bruijns, B.A.** (2021, Feb 17). *An Educator's Guide to Physical Activity and Sedentary Behaviour in Early Childhood: From Research to Practice.* Aurora College, Early Childhood Education and Care Program. Virtual presentation. *Invited Lecture.*

2. **Bruijns, B.A.**, & Truelove, S. (2019, Oct 22). *Screen-Viewing, Physical Activity, and Unstructured and Risky Play in Childhood.* Region of Waterloo Public Health, Physical Activity Workshop. Kitchener, ON. *Keynote Speaker Presentation.*

C. GUEST LECTURES

1. **Bruijns, B.A.**, & Truelove, S. (May 2019) *The Importance of Measuring Physical Activity*. Discovery Days. University of Western Ontario, London, ON.

2. **Bruijns, B.A.**, & Truelove, S. (April 2019) *Measuring Physical Activity in Children.* An invited lecture for Exercise Science Grade 12. Catholic Central High School, London, ON.

D. STUDENT CONFERENCES AND PRESENTATIONS

1. **Bruijns, B.A.**, Adamo, K.B., Burke, S.M., Carson, V., Irwin, J.D., Naylor, P.J., Timmons, B.W., Vanderloo, L.M., & Tucker, P. (2018, Oct 16). *Exploring the Relationship between ECE Students' Physical Activity Training and Self-Efficacy to Facilitate Active Opportunities in Childcare*. (2019, Apr 30). London Health Research Day. London, ON. *Abstract and Poster Presentation.*

2. **Bruijns, B.A.** & Tucker, P. *Exploring the Physical Activity and Screen Viewing-Related Knowledge, Training, and Self-Efficacy of Early Childhood Education Students*. (2018, Feb 1). Health and Rehabilitation Sciences Graduate Research Conference, University of Western Ontario. London, ON. *Abstract and Oral Presentation.*

3. **Bruijns, B.A.** & Tucker, P. *Exploring the Physical Activity and Screen Viewing-Related Knowledge, Training, and Self-Efficacy of Early Childhood Education Students*. (2017, Jun 23). Exercise is Medicine on Campus National Student Research Conference, University of Western Ontario. London, ON. *Abstract and Oral Presentation.*

4. **Bruijns, B.A.** *Physical Activity Training, Knowledge, and Self-Efficacy of Early Childhood Education Students.* (2017, Mar 14). Canadian Obesity Network – Student and New Professional Group Research Blitz, University of Western Ontario. London, ON. *Oral Presentation.*

5. **Bruijns, B. A.** & Tucker, P. *Physical Activity Training, Knowledge, and Self-Efficacy of Early Childhood Education Students*. (2017, Feb 1). Health and Rehabilitation Sciences Graduate Research Conference, University of Western Ontario. London, ON. *Abstract and Oral Presentation.*

6. **Bruijns, B. A.** & Statler, J. M. (2016, Nov 2). *To Sample or to Specialize: An Exploration of Youth Sport Participation*. An invited lecture for the graduate level course, HS9721a – Current Topics in Health Promotion. University of Western Ontario. London, ON. *Oral Presentation.*

7. **Bruijns, B.A.** (2016, Oct 20). *A Systematic Review of the Determinants of Sedentary Behaviour in Youth.* An invited lecture for the graduate level course, KIN9231a – Selected Topics in Exercise Psychology. University of Western Ontario. London, ON. *Oral Presentation*.

8. **Bruijns, B.A.** (2016, Sept 28). *The Association between Time Spent in Sedentary Behaviours and Blood Pressure: A Systematic Review and Meta-Analysis.* An invited lecture for the graduate course, KIN9231a – Selected Topics in Exercise Psychology. University of Western Ontario. London, ON. *Oral Presentation*.

D. CONFERENCES ATTENDED

1. International Society for Behavioral Nutrition and Physical Activity Congress (Jun 2020). Online XChange Initiative.
2. Research Western Conference (Aug 2019). University of Western Ontario, London, ON.
3. Research Western Conference (Aug 2018). University of Western Ontario, London, ON.
4. Children's Health and the Environment Workshop and Symposium (Jun 2017). University of Western Ontario, London, ON.
5. Exercise and Nutrition Symposium (Mar 2017). University of Western Ontario, London, ON.
6. Physical and Health Education Canada Student Leadership Conference (Sep 2015). Bancroft, ON.
7. The Kinesiology Games: National Undergraduate Kinesiology Conference (Mar 2014). McMaster University. Hamilton, ON.

RESEARCH FUNDING

Summary according to the following categories:

- Successful grants: 2 (total = $311,009)

A. SUCCESSFUL GRANTS (*n* = 2)

Start Date	End Date	Principal Investigator(s)	Co-Investigator(s)	Granting Agency - Competition	Grant Title	Total Amount Awarded
2021	2022	Patricia Tucker	Brianne Bruijns Leigh Vanderloo	Western University – Knowledge Mobilization Innovation Grant	Mobilizing findings of the Training pre-service Early Childhood educators in physical activity	$7,500

					(TEACH) pilot study	
2019	2023	Patricia Tucker	**Brianne Bruijns**, Kristi Adamo, Shauna Burke, Valerie Carson, Jennifer Irwin, Patti-Jean Naylor, Brian Timmons, Leigh Vanderloo	SSHRC - Insight Grant	The impact of an e-Learning physical activity module on Early Childhood Education candidates' Self-Efficacy and knowledge: The ECE-SE Study	$303,509

Knowledge Translation Activities

Infographic

- *Content Development for a Physical Activity and Sedentary Behaviour e-Learning Module for Early Childhood Education (ECE) Students*
    - Led content and creative design, distributed to physical activity researchers and ECE stakeholders
- *Exploring Physical Activity and Screen-Viewing-Related Knowledge, Training, and Self-Efficacy of Early Childhood Education Candidates* (August 2018)
    - Led content and creative design, distributed to college/childcare stakeholders

Infographic Content Creation

- *Supporting Physical Activity in the Childcare Environment: Results from the SPACE Study* (April 2018)
    - Assisted with content creation and creative design

Research Summary Video

- *Supporting Physical Activity in the Childcare Environment: Results from the SPACE Study - Extension* (March - May 2018)
    - Assisted with videography, audio content creation, and creative design
    - >1,450 views (https://www.youtube.com/watch?v=wtCB14pUbhE)

SERVICES & ADMINISTRATION

Grant Reviewer

1. Swiss National Science Foundation (Jun 2020) – 1 grant application

Evaluation of Articles for Scientific Journals

1. Reviewer for BMC Pediatrics (2021) – 1 paper

2. Reviewer for Journal of Science and Medicine in Sport (2019) – 1 paper
3. Reviewer for Global Pediatric Health (2019) – 1 paper
4. Reviewer for Infant Behavior and Development (2019) – 1 paper
5. Reviewer for BMC Public Health (2018; 2019) – 5 papers
6. Reviewer for Journal of Applied Nutrition and Behavioural Metabolism (2018) - 1 paper

Scholarly and Administrative Activities

Social Media Coordinator, Network of Early Career Researchers and Students of ISBNPA Jul 2021 - Present

International Society of Behavioral Nutrition and Physical Activity

Projects Committee Representative, Early Care and Education Special Interest Group Jul 2021 - Present

International Society of Behavioral Nutrition and Physical Activity

Graduate Student Representative, School of Health Studies Director Selection Committee Mar 2021

Faculty of Health Sciences, University of Western Ontario, London, ON

Judge, Health and Rehabilitation Sciences Graduate Research Conference Feb 2021

Faculty of Health Sciences, University of Western Ontario, London, ON

Vice President, Master of Science Representative Jun 2017 – May 2018

Health and Rehabilitation Sciences Graduate Student Society, Faculty of Health Sciences, University of Western Ontario, London, ON

Health and Rehabilitation Sciences Graduate Research Conference Planning Committee Oct 2016 – Feb 2017

Faculty of Health Sciences, University of Western Ontario, London, ON

Community Service

Graduate Advocacy Committee Member Dec 2016 – Apr 2017

Sit Less Western - University of Western Ontario, London, ON

Volunteer – Combined Fitness & Dynamic Balance Classes Sep 2016 – Dec 2016

The Canadian Centre for Activity and Aging – University of Western Ontario, London, ON

Volunteer Undergraduate Representative April 2016

Faculty of Applied Health Sciences Community Partners Reception – Brock University, St. Catharine's, ON

Lead Facilitator Sept 2015 – April 2016
Females Interactively Exercising to Regain Confidence and Esteem (FIERCE) Active Living Program – Brock University, St. Catharine's, ON

Activity Leader Sept 2015 – Dec 2015
Children's Movement Program – Brock University, St. Catharine's, ON

English Language Co-Instructor Sept 2014 – April 2015
École Maternelle Jacques Prévert – Préaux, Haute-Normandie, France

Movement Partner Sept 2013 – Dec 2013
Special Needs Activity Program – Brock University, St. Catharine's, ON

Professional Memberships & Affiliations

- Member (2020-Present) – International Society for Behavioral Nutrition and Physical Activity
- Student Member (2018 – Present) - International Society for Physical Activity and Health (ISPAH)
- Student Member (2016 – Present) – North American Society for Pediatric Exercise Medicine (NASPEM)
- Member (2016 – 2018) – Canadian Obesity Network, Student and New Professional Group – University of Western Ontario
- Member (2016 – 2018) – Exercise is Medicine on Campus (EIMC) – University of Western Ontario
- Member (2015 – 2017) – Physical and Health Education Canada

PROFESSIONAL DEVELOPMENT AND ADDITIONAL TRAINING

Research Western Conference Aug 2019 – May 2021
- Integrated Knowledge Translation (May 2021)
- Partnerships and Knowledge Exchange (May 2020)
- The Art of the One Page Summary (Aug 2019)
- Grant writing 101 (Aug 2019)

Using InCites and Web of Science to Measure your Research Impact May 2021
Knowledge Exchange School - Expanded Workshop
Western University

Moving Beyond Typical Notions of Physical Activity in Preschool Children Apr 2021
North American Society for Pediatric Exercise Medicine

Early Childhood Education & Care in A Shifting Landscape Sep 2020

University of Wollongong Early Start

International Society for Behavioral Nutrition and Physical Activity Feb 2017 - Jan 2018

- Early Care & Education – Sleep as an obesity-related health behavior in early childhood: Importance, Assessment & Intervention (Jan 2018)
- Early Care & Education Webinar - Physical Fitness in Young Children (Preschool Years): Importance, Measurement, and Intervention (Feb 2017)

The Hospital for Sick Children Aug 2017

- Introduction to Knowledge Translation Module – SickKids Knowledge Translation Program (Aug 2017)
- How to Prepare a Knowledge Translation Plan – SickKids Knowledge Translation Program (Aug 2017)

Public Health Ontario Oct 2016 – Aug 2017

- Interactions Among Sleep, Sedentary Behaviour, Physical Activity and Overall Health – Webinar (Aug 2017)
- Promoting Early Childhood Development Through Multi-Sectoral Intervention Packages Anchored in Nurturing Care – Webinar (Jan 2017)
- Evaluating Health Promotion Programs Course (Nov 2016)
- Planning Health Promotion Programs Course (Nov 2016)
- Health Promotion Foundations Course (Oct 2016)

Physical Activity Resource Centre (PARC) Feb 2017

- Healthy Children on the Move: Physical Activity and the Childcare Setting - Webinar (Feb 2017)
- Kids, Have You Played Today? Promoting Active Play for Children Aged 0-12 Years Through Community-Based Interventions - Webinar (Feb 2017)
- Physical Literacy Webinar (Feb 2017)

Keep Moving! Physical Activity in Schools Webinar Jan 2017
Action for Healthy Kids

National Collaborating Centre for Methods and Tools Jan 2017

- Quantitative Research Designs 101 (Jan 2017)
- Searching for Research Evidence in Public Health (Jan 2017)
- Implementing KT Strategies in Public Health (Jan 2017)

Introduction to Motivational Interviewing, Level One Jan 2017
University of Western Ontario

Health Impact Assessment: When to Use It and What to Expect Dec 2016
National Physical Activity Society

Development of Executive Function in Children Module Nov 2016
Washington State Department of Early Learning

Physical Activity Policy Research Network Course Oct 2016
National Physical Activity Society

WHO Growth Chart Training Program (Modules 1-5) Oct 2016
World Health Organization

Active, Healthy Lifestyles Course Oct 2016
The Open University

Public Health in Community Settings Course Sept 2016
The Open University

Tri-Council Policy Statement: Course on Research Ethics, Ethical Conduct for Research Involving Humans Sept 2016
Panel on Research Ethics

Diplôme D'Études en Langue Française (DELF), Niveau B2 Mar 2015
Ministère Chargé de L'Éducation Nationale

LANGUAGES

1. English (native)
2. French (highly proficient, verbal and written)