User-centred Perspectives in the Design of Innovative Technologies to Promote Physical Activity in Young People with Physical Disabilities

by

Tara Joy Knibbe

A thesis submitted in conformity with the requirements for the degree of Masters of Rehabilitation Science
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Abstract

**Background:** Young people with physical disabilities have low physical activity levels. Social support networks facilitated by technologies may be one way of addressing this, but have not yet been explored.

**Objective:** To explore the perceived benefits and impact of social networks on physical activity in young people with physical disabilities, and to identify design considerations when creating social technologies to support physical activity.

**Method:** A 2-stage, iterative design included individual interviews and group design workshops with eleven young people aged 12 to 18 with physical disabilities.

**Results:** Supportive environments for physical activity included those that promote fair and equitable participation, belonging through teamwork, and opportunities for interdependence. Participants perceived some benefits to using social technology for physical activity, provided it is tailored to suit their needs and abilities. The promotion of self-determination through social technologies was considered critical.
Conclusions: This study contributes specific user-generated design recommendations for social technologies to promote physical activity in young people with physical disabilities that align with principles of inclusive design and self-determination theory.
Acknowledgments

I would like to first extend my gratitude to the young people who shared their stories and imaginative ideas with me. It was a pleasure to work with young people who were excited about the possibilities of research.

Thank you to my supervisors, Elaine Biddiss and Amy McPherson, for giving me the opportunity to pursue graduate studies and for seeing and fostering my potential. Thank you for helping me realize my passion for social inclusion. Your tireless critical engagement of my work was a significant contribution to my learning. Finally, thank you for upholding a strong commitment to excellence and encouraging me to meet both the standards I set for myself and the standards of good science.

I received enormous support from my committee member, Brenda Gladstone. Thank you for sharing with me your knowledge and passion for qualitative research. Your insights were invaluable and have helped open my eyes to the breadth of what is still left to discover. Thank you for always encouraging me to be reflexive in my work.

Thank you to my parents for fostering in me an unquenchable curiosity and passion for science. Thank you for modeling a drive to learn and to explore the physical and social world that we live in. Your unconditional love and support has been a significant encouragement to me throughout my education.

Finally, thank you to Brent, my husband, for your consistent encouragement, support, and listening ear. It is an incredible gift to have a best friend who not only listens to me and understands my work, but also gets excited about it with me. You have challenged me to stretch myself and have reminded me along the way that I can accomplish my goals in faith. Most of all, thank you for going alongside me in this journey and reminding me that “we are all in this together.”
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Chapter 1

1 Introduction

1.1 An exploration of social technology as a platform for social inclusion and physical activity participation

This dissertation explores how social technology can be used to cultivate supportive social networks that may help to promote physical activity participation for young people with physical disabilities. Using qualitative inquiry, the relationship between social support and physical activity is examined and specific technological strategies to facilitate social support and physical activity are identified. More specifically, this dissertation presents the following: an in-depth look at some of the factors in the social environment that contribute to young people’s participation in physical activity; the perceived benefits and purpose of social technologies for physical activity promotion; and a guide to important design considerations for future intervention design.

1.2 Rationale

Young people with physical disabilities participate in less physical activity and are more sedentary than their typically developing peers (1-4), which may have serious negative health outcomes and reduce quality of life. As such, there is a great need for health promotion related to physical activity in this population. This issue is particularly salient for youth, defined here as young people between the age of 10 and 19 (5), as physical activity drastically declines during adolescence and the physical activity patterns that are developed during this time often continue into and throughout adulthood (6-11). Therefore, it is highly important to help young people form positive health behaviours in this stage of life. This is a particular problem with young people with physical disabilities because they already exhibit low levels of physical activity participation and high levels of sedentary behaviour.

One established barrier to participation in physical activity for young people with physical disabilities is a lack of social support (12-14). Social support has been shown to be an effective motivator for physical activity in resource intensive fitness and therapy programs (15,16). Families with children or young people with physical disabilities often do not have access to
physical activity programs due to accessibility or financial constraints (15). There is a great need for more affordable, accessible, and engaging solutions designed specifically for this vulnerable population that take into consideration the added constraints and barriers faced by young people with physical disabilities and their families.

Recently, the potential of social support networks facilitated by technologies including social media (17), web-based interventions (18), and mobile technologies (19) has been suggested for physical activity promotion, largely in typically developing populations. For young people, the use of technology is considered to be ubiquitous in daily life (20) as 93% of adolescents have a computer in their home, and 78% own a cell phone in North America (21). Technology has the capacity to overcome barriers to physical activity experienced by young people with physical disabilities, such as accessibility, time constraints, and limited financial resources.

This study is an initial step towards designing practical solutions to address the high levels of physical inactivity in the current population of young people with physical disabilities. It investigated the feasibility and interest in technology-supported interventions that use social support as a motivator for sustained physical activity.

1.3 Purpose and objectives

The central purpose of this dissertation was to identify strategies for innovative technologies to foster a supportive social environment that may help facilitate physical activity participation for young people with physical disabilities. The objectives of this research were to first, explore young people with physical disabilities’ experiences relating to social inclusion and physical activity participation, by exploring how young people with physical disabilities define socially supportive environments and what role these environments have in supporting participation in physical activity. Second, this research aimed to understand the role social technologies could play in motivating physical activity for young people with physical disabilities and to provide guidance for the design of social technologies that meet the specific needs of young people with physical disabilities.
The overarching research question that was explored is:

*What role might technology-supported social networks play in promoting and sustaining physical activity, as perceived by young people with physical disabilities?*

In order to answer this question, the following questions required examination:

a. How do young people with physical disabilities define socially supportive environments that facilitate physical activity participation?

b. Do young people with physical disabilities perceive a benefit for social technologies to promote physical activity?

c. What design considerations must be addressed to successfully create social technologies that support physical activity for young people with physical disabilities?

### 1.4 Research paradigm and design

This research was conducted within an interpretivist paradigm. Ontologically, this paradigm is concerned with the subjective interpretation of an objective world, which is a lived phenomenon (22). Epistemologically, within this paradigm, knowledge is created through the interpretations and meanings we assign to the world. We adopted a research tradition that “seeks to understand experience through the eyes of the person experiencing it” (22, p 530, 23). This tradition recognizes that knowledge is co-produced by both researcher and research participant—it is transactional work and a result of human interaction. This tradition drove our research design and methodology. We employed a partial participatory design approach, which means we included young people with physical disabilities in our research process as co-constructors of knowledge. However, we limited it to a *partial* approach for feasibility reasons, meaning that our participants were not included in the formation of the research question or the final analyses, but rather in the direction of the research process throughout data collection and the iterative analysis. This approach was applicable to our research topic as we sought out a more personal and in depth understanding of what the needs and preferences are of young people with physical disabilities in relation to physical activity and social support as facilitated by social technology.
1.5 Reflections on positionality of the researcher & research tradition

(In order to emphasize my role in this work as graduate student, researcher, and author, this section uses the personal pronoun “I”.)

In qualitative tradition, it is imperative for a researcher to engage in reflexivity and consider one’s position in relation to the research they do. This practice allows the reader to understand how the researcher’s assumptions, biases, and position in society influence their study (24). By engaging in reflexivity and recognizing my own lens through which I view the world, I acknowledge the co-constructive nature of my research, that I am also a participant in my own work. My subjectivity is viewed as an asset as it is critical for the co-creation of knowledge. I impact the way that meaning is constructed and shared along with the research participants. Through the meaning and interpretation of people’s experiences, we can understand the world we live in. I value this concept and therefore feel it is important to articulate it in the context of this thesis.

In agreement with my epistemology, it was very important to me to speak with young people who had direct experiences themselves in relation to my research questions. The participants in this study shared their stories, opinions, reflections, and sometimes questions around the topics of social inclusion, physical activity, and social technology. Sometimes these interviews frustrated me, as I would come up against a thought process that did not align with own assumptions, for example, my assumptions about physical disability, or my values, for example, my value of independence. As an example, the notion that rehabilitation is a quest for independence has been cultivated in my thought processes by the cultural climate I live in. I became increasingly uncomfortable with this perception of rehabilitation and what it assumes of living with a physical disability. This is certainly reflected in this research—my assumptions made a difference to how I interpreted and formed a story of the data. I recognize that my assumptions and values are a product of my own experiences.

My educational background is in the discipline of psychology, in which I hold an undergraduate degree. I do not have any clinical training, but have had many interactions with young people with physical disabilities and their families through research in a lab at the hospital through which I conducted this study. I developed a deep appreciation for the support that families
provided for their daughter, son, brother or sister who had a physical disability, but at the same time, I became aware of the yearning that so many of these young people had for peer interaction. I became interested in how these young people’s social relationships and physical activity participation were related, and how there was a great need for innovative interventions to address the challenges they face. These underlying assumptions influenced my research from topic choice and the development of research questions, to how I conducted my data collection, the decisions I made along the way, and finally through to my analysis and the story I chose to tell with the data. For example, I have a particular interest in social psychology, which was fostered through my first exposure to research in my undergraduate training for a social psychologist. This experience as well as my own personal tendencies toward inclusivity sensitized me to explore the topic of social inclusion and social support. Because of my passion for these issues, the focus of analysis may be situated around social inclusion more than if a researcher with a different background and/or passions were to conduct a study driven by similar research questions. During my graduate work, I was fortunate to participate in a course that explored different theories in rehabilitation science. This course exposed me to a variety of theories within the field and helped develop the more critical lens through which I now view rehabilitation. An example of how this influenced my work is evident in Chapter 3 where I discuss traditional versus more progressive views of rehabilitation to explain how young people wish to receive support from their family and friends to engage in physical activity.

Aside from my educational background and how I arrived at this topic of study, I hold many positionalities related to the young people who participated in this research. My participants were young people in their adolescent years, a time in which they are seeking to establish their identity. They attended various grade schools and high schools across a large urban city in Southern Ontario, were of varying ethnicities, socio-economic statuses, and possessed varying levels of interest in physical activity, social activities, and social technology usage. In many ways, these positionalities were different from mine. I am a young, typically developing, Caucasian woman, enrolled in a graduate program studying rehabilitation science and working at the children’s rehabilitation hospital where my participants attend for treatment. I have a strong social network of family and friends who support me and I have a strong interest and passion for being physically active. Beyond my mere involvement in social and physical activities, I value these very highly in my life and consider both social activities and physical activities a critical
part of my identity and development as a human being. On another hand, despite my interest in social technologies as a facilitator for social networks and physical activity promotion, I myself engage in very little online social networking and consider myself to be a novice in relation to most technologies.

Beyond my own position as a researcher, I recognize that the positionalities of my supervisors as well as my program advisory committee member had an influence on this research study as well. One of my supervisors conducts primarily quantitative research with some explorative, qualitative projects and has a background in biomedical engineering (EB). My other supervisor shares my interpretivist paradigm with a background in health psychology (AM). My committee member comes from a critical social paradigm and has a background in health sociology (BG). Each researcher brought their reflections, insights, and ideas to this work from their own traditions and expertise as rehabilitation scientists. Elaine Biddiss has expertise in the area of innovative technology design for young people with physical disabilities to increase participation in physical activity. Amy McPherson has expertise in the areas of participation and inclusion in everyday life, health promotion, and multimedia and technology. Brenda Gladstone’s research focuses on children, young people, and family mental health in regards to challenges experienced in everyday life within communities. She provided advice regarding how to engage young people in participatory research as well as other methodological issues to do with qualitative approaches overall, including strategies for data analysis and interpretation. Brenda Gladstone also contributed an alternative critical sociological perspective to our results, which shaped how I conceptualized the data.

1.6 Terminology

There are several terms that are used in this dissertation that can frequently be found in the rehabilitation literature. For the purpose of clarity, these terms will be defined here as they are used in this dissertation. Rehabilitation is a term that carries a variety of subtle and not so subtle implications and meanings and has, in recent years, been widely debated. For the purpose of this research, we define rehabilitation according to the Institute of Medicine Model 1997 (IOM), which is a more developed revision of the Nagi Model (25). Historically, the “problem” of disability was understood to be inherent to the individual and their diagnosed condition (26). In contrast, the IOM defines disability as an interaction between the person and the environment. It
illustrates a process called enablement, a movement away from disability, that is, toward rehabilitation (25). This study focuses specifically on young people with physical disabilities, including disabilities or chronic health conditions that affect body structure and/or function (27).

We use Barnett & Casper’s (28) definition of a social environment, which refers to the social relationships one has, one’s physical surroundings, and one’s cultural climate. More specifically, we focus on social support at the level of peer and family relationships. Social technology is used to describe technologies that can be used for communicating with family or friends, including chat, playing games, sharing information or ideas, personal messages and e-mail, and sharing content such as photos or videos (29). These technologies may utilize the Internet or mobile devices for communication.

Finally, this study looks at how to promote physical activity participation. We define physical activity as any play, game, sport or exercise that gets young people moving, breathing harder, and gets their hearts beating faster (30). This definition, along with our definition of social technology, was discussed with the young people who participated in the study. The young people were given the opportunity to share their own definitions of these terms.

This dissertation uses personal pronouns such as “I” or “we”. The reason for this is to embrace the subjectivity of our research, recognizing the biases and assumptions that I myself brought as a graduate student and that my supervisors and program advisory committee brought to this work as well. The personal pronoun, “I” was used in Chapter 1 subsection 1.5, “Reflections on positionality of the researcher & research tradition” in order to emphasize my role and influence on this work as researcher and author. However, throughout the full dissertation, first-person plural pronouns such as “we” or “our” are used for consistency, as Chapters 3 and 4 are multi-authored papers, as well as to reflect the collaborative nature of research.

1.7 Thesis organization

This thesis is presented using a manuscript format. This chapter (Chapter one) has introduced the purpose and objectives of this thesis as well as discussed the research paradigm, research design, reflections on the researcher’s positionality and research tradition, and terminology. Chapter 2 reviews the current literature on health promotion needs for young people with physical disabilities, the importance of social support as a facilitator for physical activity participation,
and the potential in both typically developing populations and the population of interest for social technology as a platform for physical activity and social support. Gaps in the literature are discussed. Chapter 3 consists of a manuscript entitled, “Defining the role of socially supportive environments as they relate to physical activity participation for young people with physical disabilities”. This paper explores how young people with physical disabilities define socially supportive environments and examines the role these environments have in supporting participation in physical activity. Chapter 4 consists of a second manuscript entitled, “Social technology as a potential facilitator for self-determined physical activity participation for young people with physical disabilities”. This paper discusses the perceived benefit of social technologies for the promotion of physical activity for young people with physical disabilities as well as design considerations for these technologies that support young people’s needs and abilities. Chapter 5 is the final chapter of this dissertation and focuses on a summary of key findings, contributions made by this research, and considerations and implications for the field of rehabilitation and more specifically future technology design. Areas for future research are also identified.
Chapter 2

2 Literature review

2.1 Health promotion needs and physical activity interventions

Physical activity is a key component in young people’s psychological and physical health (31,32). Physical activity levels among Canadian young people are lower than the recommended daily 60 minutes to several hours (33-35) and 1/4 of the population of young people are overweight or obese (36,37). Young people with physical disabilities are at an even higher health risk and are less physically active and more sedentary than their typically developing peers (1-4,14). These behaviours result in the development of secondary health conditions, such as risk for cardiovascular disease, diabetes (7,38), poor musculoskeletal health (39), and chronic pain, therefore adding to the already challenging issues related to pre-existing health conditions (12,13).

There is a deficiency of physical activity interventions designed for young people with physical disabilities (40,41) and they are often explicitly excluded from physical activity interventions (42). A comprehensive scoping review of health interventions designed for children and young people with physical disabilities found only 7 randomized control trials evaluating physical activity and nutrition interventions (42). This review also revealed a lack of long-term interventions lasting longer than 3 months, illustrating that very little is known about the efficacy and sustainability of interventions that already exist.

Physical activity interventions designed for young people with physical disabilities tend to focus on the physiological and/or therapeutic benefit, such as function or mobility (43). Although these interventions may be effective at increasing flexibility, improving balance or function of limbs (43,44), very little research is conducted around young people’s actual preferences and enjoyment of these interventions. Enjoyment is a major predictor of adherence to a physical activity regimen (12), and therefore must be considered to achieve maximum effectiveness. In a study by Newton et al. (45), parents and young people shared their feedback on an intervention using pedometers and text messaging to increase the physical activity of adolescents with Type 1 diabetes. The intervention was ineffective because it did not hold enough appeal or enjoyment.
for sustained adherence and motivation to engage. It was suggested that adolescents require more frequent support for the intervention to be engaging and motivating (45).

There is extensive research done on the barriers and facilitators for physical activity participation among young people with physical disabilities. Barriers and facilitators can be divided into three categories, those that are associated with the individual, physical resources, and the social environment (See Table 1).

Table 1. Barriers and facilitators to participation in physical activity for young people with physical disabilities associated with the individual, physical resources, and the social environment (12,13,36,46-56)

<table>
<thead>
<tr>
<th>Individual</th>
<th>Physical Resources</th>
<th>Social Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Low self-concept of athletic ability</td>
<td>- Inaccessible fitness or recreational facilities</td>
<td>- Low parental support</td>
</tr>
<tr>
<td>- Feelings of inadequacy</td>
<td>- Poor funding</td>
<td>- Limited information or support from healthcare professionals</td>
</tr>
<tr>
<td>- Low self-confidence</td>
<td>- Lack of awareness of adaptive or non-adaptive activities</td>
<td>- Poor program facilitation</td>
</tr>
<tr>
<td>- Low self-efficacy</td>
<td>- Transportation</td>
<td>- Low level of peer friendship</td>
</tr>
<tr>
<td>- Fatigue</td>
<td>- Weather</td>
<td>- Lack of encouragement</td>
</tr>
<tr>
<td>- Health complications</td>
<td>- Time</td>
<td>- Poor education</td>
</tr>
<tr>
<td>- Fear of developing injuries</td>
<td></td>
<td>- Social isolation</td>
</tr>
<tr>
<td>- Joint and muscle pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Depression</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Mobility and function</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This research study focused particularly on the social environment, and specifically on parental and peer support networks. We focus on the social environment as there is a gap in our current understanding of its role in promoting physical activity for young people with physical disabilities.

2.2 Social support as a facilitator for physical activity

Feeling “normal” and having meaningful relationships with their peers is a developmental priority among adolescents (57). Young people with physical disabilities are often socially excluded because their disability makes them ‘different’ (58). Young people with chronic health conditions are three times more likely than their typically developing peers to experience social exclusion including a lack of social integration, fewer friendships, and a lower level of overall peer support (59-62). This is worrying as participation and inclusion in physical activity is an integral component of young people’s mental, physical, and social health (63). The World Health
Organization (WHO) recognizes the crucial role of participation in determining quality of life as it pertains to social, recreational, and skill-building activities (64).

The major roles in a young person’s social environment include those of parents, siblings, friends, neighbours, teachers, and coaches. For typically developing young people, as they age, the main influences in their life turns from parents to peers, with whom they spend most of their time (56). However, the social networks of young people with physical disabilities tend to be much smaller and maintain parental influence to a much older age (60).

Social support and physical activity participation can be mutually beneficial to each other. Engagement in physical activity provides an opportunity for social inclusion (32, 65-67). On the other hand, social support and social contact are associated with participation in sport for young people with physical disabilities (68). The social environment is a large contributing element to a young person’s physical activity and sedentary behaviour levels (69, 70). To develop effective and sustainable physical activity interventions requires an understanding of young people’s social support networks (71). Family and peers must be included in physical activity behaviour change because young people reach for their maximum potential when they have a supportive social network surrounding them (72). Buffart et al. (12) emphasizes that physical activity interventions should take a holistic approach, modifying psychological, physical, environmental, and social aspects to attain a long-term, sustainable change in activity level (12). It is therefore, highly relevant to develop realistic solutions to engaging young people in physical activity as facilitated by social support.

### 2.3 Technology as a potential solution

Among young people, a large portion of social interaction occurs online or via cell phones (73, 74). In a study by Fitton et al. (2013), a sample of typically developing young adolescents age 13 and 14 reported technology to be an integral part of all aspects of their daily life (20). They also reported technology as an enabler for psychosocial development, especially communication and relationship development (20). A substantial number of young people aged 12 to 17, as reported by the Pew Research Internet Project (75), have a computer in their home (93%), have a personal tablet computer (25%), and own a cell phone (78%, of which 55% go
online using their phone). Young people with chronic health conditions have been reported to exhibit Internet use that is equal to or surpasses that of the typically developing population (76).

Social technology has the potential to facilitate and sustain social networks through the formation of online communities, connecting young people with similar health conditions, experiences, and interests (77,78). Online activity is a platform for young people’s empowerment, enabling young people with physical disabilities to control and independently determine life direction (57). For young people who feel isolated because of their health condition or disability, social technology can boost friendship and social support (53,79). It provides a new way for isolated young people to participate in community with peers with or without physical disabilities and/or with family, providing an opportunity to receive the benefits that participation and inclusion offer (80). This is demonstrated in a research study focused on a group of persons with disabilities and homebound elderly (81). Internet usage allowed for this group of individuals to engage in community development with virtual friends who shared similar experiences and circumstances. It was found to decrease isolation and increase the evolution of new friendships.

Online socialization allows young people to explore outside of their geographically local community, as it does not require geographical proximity (78) or transportation (53). It reduces time constraints and provides a private and accessible space for young people to play, share, and connect with each other (53). Online, young people are presented on the same level as their peers in terms of socioeconomic status, gender, and ability, potentially reducing stigma and discrimination (82).

There are various recently-developed technologies that facilitate social support and promote physical activity designed for typically developing young people. However, the efficacy of these interventions for young people with physical disabilities is largely unknown. Examples of existing technologies designed for typically developing young people that enable some level of social support to achieve physical activity promotion can be found in Appendix A. This table summarizes a number of technologies and concisely outlines the benefits and limitations of each. This table also includes examples for the application of these technologies for young people with physical disabilities where information is available.
Negative aspects of technology must also be considered and managed. Among such risks are online harassment and bullying, privacy and safety concerns, influences of third-party advertising groups, and the possibility of intensive online activity triggering depression in young people (73). It is possible to manage these risks through creative technology design. For example, an effective strategy for safe social networking has been developed for Upopolis, a secure social networking site designed for hospitalized young people that requires approval for participation by healthcare professionals and parents and enforces chat board monitoring by healthcare professionals (83). Despite the identified risks, the popularity and use of technology among young people is exponentially increasing (75), and therefore is not only relevant, but is a critical topic to study. It is therefore important to learn if and how technology-based interventions can be designed and implemented to make positive changes in young people’s social and physical health.

2.4 Conclusion (Research gap)

Although it is well established in typically developing young people that social networks play an important role in promoting and sustaining physical activity, no studies to date have examined how young people with physical disabilities perceive their social networks and physical lifestyle in conjunction. This study will broaden the limited scope of current literature investigating young people’s preferences around supportive social environments and physical activity interventions and the potential for technology to facilitate social networks and physical activity. Technology can be tailored to a specific population, or even an individual. For this resource to be fully appreciated, it is crucial to first explore young people with physical disabilities’ perspective on whether the assumption to use technology is valid and if so, how these future interventions should be designed for maximum effectiveness.

There is a lack of physical activity interventions designed for this population of young people with physical disabilities (41,42,84). Therefore, strategies are required for effective physical activity promotion in this population, as well as recommendations for the design of future interventions and supportive social networks uniquely constructed in partnership with young people with physical disabilities.
Chapter 3

3 Defining the role of socially supportive environments as they relate to physical activity participation for young people with physical disabilities

3.1 Chapter introduction

This chapter includes a manuscript that presents the first stage of a 2-stage, iterative design including explorative interviews (Stage 1) and design workshops (Stage 2 presented in Chapter 4). This chapter explores how young people with physical disabilities define socially supportive environments and examines the role these environments have in supporting participation in physical activity.

3.2 Abstract

**Background:** Social support is a significant facilitator to physical activity participation. Young people with physical disabilities are more likely to experience social exclusion than their typically developing peers, which can have negative implications for their participation in physical activity and overall health and well-being.

**Objective:** This study explores the experiences of young people with physical disabilities relating to social inclusion and physical activity and defines the role of young people’s social environments in supporting participation in physical activity.

**Method:** An iterative, qualitative design employed in-depth, semi-structured interviews with eleven young people with physical disabilities aged 12 to 18. Thematic analysis was applied.

**Results:** The young people described several ways that their social environments help motivate and support them in their physical activity participation. These include providing fair and equitable participation, a sense of belonging through teamwork, and socially supported independence.

**Conclusions:** Social environments are highly valued by young people with physical disabilities and are critical to the promotion of this population’s health and well-being.
3.3 Introduction

Young people with physical disabilities exhibit low levels of physical activity and high levels of sedentary behaviours (1-4,14), which puts them at risk for the development of secondary health conditions (12,13). As such, there is a great need for health promotion related to physical activity in this population. Many barriers and facilitators to physical activity participation for young people with physical disabilities have been identified. One important barrier is a lack of social support networks (12-14), described as social interactions and personal relationships that care for, assist, and protect an individual by providing practical assistance, helpful information, companionship, and encouragement (85-87). This definition comes from LaGreca’s theory of social support, which outlines four main categories of social support, including instrumental support, informational support, companionship and belonging, and emotional support (85-87). This theory holds particular relevance for young people with chronic health conditions (88).

Social support and physical activity can be mutually reinforcing, but young people with physical disabilities are more likely than their typically developing peers to be excluded from both. With respect to physical activity, there are many social challenges that lead to this exclusion, including teasing from peers, under-estimation of abilities, limited peer relationships, lack of accessibility (89), unfair disadvantages in competition (90), and insufficient parental support or encouragement such as overprotectiveness or a lack of knowledge of available resources (89).

Two different approaches to address this social exclusion as it relates to participation in physical activity are: integration of young people with and without physical disabilities in the same physical activity programs, and dedicated programs designed specifically for young people with physical disabilities. Ebegawa, Wensley, and Murphy-Sims (91) promote ‘integrated’ physical activities that accommodate young people with various gross motor, attention, and social skills. For example, they demonstrated that participation in an inclusive karate program for children with and without disabilities could have a positive effect on young people’s social and emotional well-being. In particular, the karate program encouraged young people to develop socialization skills with peers of all abilities, ultimately increasing quality of life and well-being for young people with physical disabilities. However, successful inclusion in integrated environments can be very challenging, often requiring significant parental involvement, including both instrumental and emotional support, to assist the integration of the young person (92). This led
Wynnyk & Spencer-Cavalier (93) to suggest that social inclusion is more attainable in an environment just for young people with physical disabilities, or what they refer to as a “specialized sport environment” (p 300). This study looked at young people’s social relationships and their motivation to participate in a sledge hockey program just for young people with physical disabilities. The authors conclude that specialized physical activity programs offer physical, emotional, and social support benefits that an integrated physical activity environment cannot, including specialized instruction, peer acceptance and understanding, modified activities, and a fair opportunity for skill development and success.

In this paper, we explore how young people with physical disabilities define socially supportive environments to understand what role these environments have in supporting participation in physical activity. This paper adopts Barnett & Casper’s (28) definition of a social environment, which includes the social relationships one has, one’s physical surroundings, and one’s cultural climate, with a particular focus on social support at the level of the family and peer community.

### 3.4 Method

#### 3.4.1 Research design

This study was designed to answer the question: “how do young people with physical disabilities define socially supportive environments that facilitate physical activity participation?” We used an iterative, qualitative design using in-depth, individual interviews. This research was conducted within an interpretivist paradigm (22). This paradigm allowed us to explore multiple interpretations of what a socially supportive environment is according to our participants who had direct experiences related to the aims of our research question and according to our own observations and understanding. We adopted a research tradition that “seeks to understand experience through the eyes of the person experiencing it” (22, p 530, 23).

Our participants were young people with physical disabilities that affected their body structure and/or function (27), and who had a self-identified goal to achieve greater levels of physical activity participation. The study was approved by both a hospital and university Research Ethics Board.
3.4.2 Sample and recruitment

The sample included young people aged 12 to 18 years who were attending a large, urban, pediatric rehabilitation hospital in Canada as inpatients or outpatients. We purposively sampled (94) 10 to 12 young people with physical disabilities. To be eligible for the study, young people had to walk with or without the use of a handheld mobility device or other assistive devices (e.g. orthotics). They also had to be able to handle objects with some level of independence. Young people were required to have a self-identified goal related to increasing physical activity participation or at least some interest in increasing personal physical activity in order to ensure representation of the phenomenon of interest. Young people also needed to be able to answer questions that required reflection and insight, as determined by the interviewer’s discretion. The sample size of 10 to 12 is considered to be adequate for this research approach (95).

Young people were recruited through a Therapeutic Recreation and Life Skills program and a weekend physiotherapy group that combines physical activity with social participation for children and youth, both at a large pediatric rehabilitation hospital in Ontario, Canada. We chose to recruit from these programs because young people had direct experience relating to physical activity participation and had experienced some level of social support in respect to participation, making them key informants for the research question. The Therapeutic Recreation Specialists (TRS) and Physiotherapy Assistants involved in these programs identified young people and their families from their caseloads who fit the inclusion criteria, introduced the study to them, and gave them an information letter. If the client was interested in being contacted regarding the study, the TRS or Physiotherapy Assistant requested permission to share their contact information with the researcher. The researcher then contacted the family by telephone. If they agreed to participate, an interview date was discussed. Informed consent was obtained from young people who participated in the interviews.

3.4.3 Data collection

We conducted audiotaped, semi-structured interviews. Interviews explored young people’s definition of socially supportive environments for physical activity participation through descriptions of their existing social environments relating to physical activity as well as their perceptions of the role supportive social environments play in meeting physical activity goals. After the first two interviews, the research team revised the scripted introduction for the
interview and the order of the interview questions to provide clearer definitions of terms such as physical activity and social technology (explored in Chapter 4). The first two interviews revealed that young people needed additional cognitive support and initial definitions to help them understand the questions asked of them. The definitions were very broad to allow young people to think comprehensively about their experiences related to the topic. The interviewer used tailored prompts to explore young people’s explanations of what these definitions meant to them. Interested readers can find the interview guide in Appendix B.

Interviews were held in the participants’ homes or in a private room at the hospital, according to participant preference. Interviews were conducted individually with three exceptions where a family member was present to help facilitate the interview, share brief insights, or for lack of another room to be in. In one case, the familiarity and support of the family member facilitated conversation by providing prompts and added insights. In another case, the young person seemed unaffected by the presence of his family member and was very candid with his responses regardless of their proximity. The third participant seemed uncomfortable and overshadowed by their family members’ insights, limiting the flow of conversation and insight from the participant herself. The involvement of family members in these three interviews revealed added perspective that shaped our understanding of their social environments at the family level.

A journal was used to record field notes, reflexive notes, and an audit trail of decisions related to methodology and analysis (96).

3.4.4 Analysis

Interview data were analyzed using iterative, inductive thematic analysis (97). Full verbatim transcripts were divided among team members for review. Interview summaries were developed by TJK and distributed amongst the team. The team met regularly to discuss thoughts and early categories and themes.

NVivo software was used to manage the large data set for the purposes of analysis, which involved the process of coding the data. Initial codes were generated by identifying basic elements of the data that aligned with the research question. Codes were constructed from both researcher interpretations and participant phrases drawn directly from the transcripts. Codes were then sorted into potential themes and sub-themes (97). Contradictory cases were included.
Thematic web diagrams were used to help visualize the data. Candidate themes were reviewed for both internal and external homogeneity, where the data were consistent within themes and distinctly different between themes. Some candidate themes were discarded as they did not align with our research question. A final thematic map was drawn, using the reflexive notes and interview summaries to confirm it. Themes were titled using phrases from the transcripts. A detailed analysis for each theme was then compiled and organized into the narrative presented in this paper. All names in this paper are pseudonyms.

3.4.5 Strategies for rigour

The quality and trustworthiness of qualitative research is often evaluated using the following criteria: credibility, dependability, confirmability, and transferability (98). Credibility refers to the verification of the findings as representative of the participant’s described reality. Tracking decisions and providing sufficient information about analysis satisfy the dependability and confirmability criteria. Transferability refers to the provision of sufficient information that allows the reader to decide if the research is conceptually generalizable to different contexts and settings (99,100). Examples of how these criteria are fulfilled in this research are illustrated in Table 2. Beyond these criteria, this research demonstrated rigour through evidence of reflexivity, explicit reference to the interpretive nature of our research, and acknowledgement of strengths and considerations by which our results should be considered.

*Table 2. Illustrative examples of trustworthiness criteria*

<table>
<thead>
<tr>
<th>Trustworthiness criteria</th>
<th>Illustrations of fulfilled criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credibility</td>
<td>40 to 80 minute interviews; Iterative nature of data collection and analysis and; Reasonable time spent reviewing the data</td>
</tr>
<tr>
<td>Dependability</td>
<td>Field notes about interview and family context (e.g. parent-child dynamic), memos (e.g. reminders of successful probes), reflexive notes (e.g. researcher’s empathy, relatability, or discomfort with a participant’s story), and an audit trail to track decisions (e.g. revisions made to the interview guide)</td>
</tr>
<tr>
<td>Confirmability</td>
<td>Regular team meetings to discuss the data, codes, themes, and iterative written analysis; The use of interview summaries to confirm findings</td>
</tr>
<tr>
<td>Transferability</td>
<td>Detailed presentation of results: Robust analysis (e.g. sufficient data extracts); Interpretation (e.g. discussion of findings as a whole); Information about participants (e.g. diagnosis, mobility level)</td>
</tr>
</tbody>
</table>
3.5 Results

Eleven young people aged 12 to 18 years (four male and seven female) were recruited and participated in interviews lasting between 40 and 80 minutes each. Sixteen young people were initially referred as eligible to participate. Reasons for not taking part included upcoming surgeries and busy schedules. Young people were diverse on all inclusion criteria except diagnosis as all but one participant were diagnosed with cerebral palsy. Further participant characteristics can be found in Table 3. Three themes were identified from the data exploring how young people define socially supportive environments relating to physical activity: 1) Fair and equitable participation; 2) A sense of belonging through teamwork; and 3) Opportunities for interdependence.

Table 3. Participant characteristics

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Age</th>
<th>Gender</th>
<th>Diagnosis</th>
<th>Mobility while participating in physical activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jamal</td>
<td>12</td>
<td>Male</td>
<td>Cerebral palsy</td>
<td>Walks with some limitations; specifically struggles with balance and coordination in sport</td>
</tr>
<tr>
<td>Jasmine</td>
<td>12</td>
<td>Female</td>
<td>Cerebral palsy</td>
<td>Walks using a walker</td>
</tr>
<tr>
<td>Kallie</td>
<td>12</td>
<td>Female</td>
<td>Cerebral palsy</td>
<td>Walks using a walker</td>
</tr>
<tr>
<td>Angela</td>
<td>12</td>
<td>Female</td>
<td>Cerebral palsy</td>
<td>Walks using a walker or uses powered mobility</td>
</tr>
<tr>
<td>Katherine</td>
<td>13</td>
<td>Female</td>
<td>Cerebral palsy</td>
<td>Walks using a walker</td>
</tr>
<tr>
<td>William</td>
<td>15</td>
<td>Male</td>
<td>Cerebral palsy</td>
<td>Walks using a walker or uses powered mobility</td>
</tr>
<tr>
<td>Manny</td>
<td>16</td>
<td>Male</td>
<td>Cerebral palsy</td>
<td>Walks using one or two canes depending on the terrain</td>
</tr>
<tr>
<td>Bergin</td>
<td>16</td>
<td>Male</td>
<td>Cerebral palsy</td>
<td>Walks using a walker, self-propel using a manual wheelchair, or uses powered mobility depending on the activity</td>
</tr>
<tr>
<td>Marissa</td>
<td>17</td>
<td>Female</td>
<td>Cerebral palsy</td>
<td>Walks using a walker</td>
</tr>
<tr>
<td>Savannah</td>
<td>17</td>
<td>Female</td>
<td>Acquired spinal cord injury</td>
<td>Walks using a walker or self-propel using a manual wheelchair; still in recovery from injury</td>
</tr>
<tr>
<td>Rosanna</td>
<td>18</td>
<td>Female</td>
<td>Cerebral palsy</td>
<td>Walks using canes, a walker, or uses powered mobility</td>
</tr>
</tbody>
</table>

3.5.1 Fair and equitable participation

Young people expressed a desire to participate in a fair and supportive environment where they are treated as equitable participants. The young people in this study shared many accounts of exclusion from physical activities with their typically developing friends or family members,
which seemed to diminish self-efficacy and enhance social isolation. For example, one girl
described what it felt like to be overlooked by a classmate on the basketball court during gym
class, despite her best efforts in playing the game and advocating for herself:

“She came over and was blocking me. I told her she couldn’t block me, that she needed
to move back so I could throw. She knows I’m disabled. She wasn’t even thinking, she
was just being stupid.” (Katherine, 13)

This quote also could have been interpreted as a reflection of positive peer responses to try to
treat the young person with fairness and support her in developing her skills which would in turn
increase ease of participation.

Despite wanting to be included and accepted for their abilities and capacities for physical
activity, we interpreted that young people often did not see themselves as viable participants in
primarily typically developing environments. One young woman described her experience:

“The one thing I find really hard about trying to be active is when my sister is outside
playing with my neighbour. They sometimes do gymnastics and, like, basketball and
skipping. And so a lot of times I feel really left out and alone, ‘cause I can’t really do
those things…So I find myself just staying inside and reading because I know they are
doing something that I can’t do anyways…I try to be really positive about my disability
instead of negative, but sometimes when I think of that and how much I wish I could do
that, it kinda puts me in a really bad mood and feeling kinda bad about myself.” (Kallie,
12)

From these data, we found that this kind of exclusion and subsequent social isolation can lead to
young people feeling negatively about themselves, less than capable, and burdensome to others.
This is further illustrated in one young man’s account of his experience, where it seemed that he
perceived a trade-off between peer enjoyment of a physical activity and his participation and
inclusion:

I would prefer to do it [physical activity] with other people if…they’re able-bodied and
willing to slow down and, like, change up the game. If they’re willing to not have as much
fun themselves so I can have fun with them and compensate for that” (William, 15)
Despite wanting to participate with typically developing peers, some young people felt that a supportive and fair environment for active participation could only be realized with trusted friends and family members or by participating alongside other young people with physical disabilities. In these environments, accommodations are made to support young people with physical disabilities’ needs and abilities. One young man described an experience he had participating in a dedicated summer recreation camp for young people with disabilities:

“All of the physical activity games we played, we would be on a similar playing field…we would make accommodations ‘cause there were so many different disabilities there.”

(William, 15)

Another young man said,

“I don’t want to become a professional swimmer. Though I would find it a bit more fair if I was with other people with disabilities.” (Jamal, 12)

Participants emphasized that it was not just physical accommodations that were needed to support their participation in physical activities, but also a change in the attitudes and beliefs of typically developing peers. Firstly, from the following quote, we understood that when peers do not understand, acknowledge and respect differences in abilities, it can leave the young person feeling disrespected and ineffective:

“I can run and kick a ball, but I can’t contain it, like, keep it there though my friends they keep trying to teach me for some reason…they would like say, ‘here you have to do it’ or they wouldn’t let me play video games at their house.” (Jamal, 12)

We understood that young people felt a significant gap between their typically developing peers and themselves in terms of physical activity participation that they could not reconcile alone. One young man said,

“We need to change the psyche of everybody, able bodied kids. Because…they may not want to help the guy with disabilities. But it’s going to be hard to bridge that gap, ‘cause you’re going to encounter some strong resistance. Very strong resistance. It is possible someday though.” (William, 15)
3.5.2 A sense of belonging through teamwork

Emotional support through teamwork and togetherness can lead to a sense of belonging, which in turn can increase motivation for participation in physical activity. One young woman shared how being a part of a team supports her participation in physical activity:

“When you’re doing a physical activity with other people it’s more motivating than if you’re doing it by yourself because you have other people to encourage you to do more—or to be there as support…” (Rosanna, 18)

Sharing in each other’s successes and defeats was perceived to provide togetherness through the promotion of social bonding and understanding. Young people didn’t want to feel alone; they wanted to feel like they were sharing in common experiences as they worked towards their goals together. One young woman’s reflection on what it felt like to participate in her weekend physiotherapy group illustrates this:

“Well, it feels normal [to be exercising with other people] because everybody has some sort of disability so you don’t feel alone. You don’t feel like you’re the only person with it [a physical disability].” (Marissa, 17)

Participants shared what teamwork and togetherness meant to them in respect to physical activity. They expressed varying preferences for competition or cooperation within a team. There were some participants, typically those who were more mobile, who were motivated by highly competitive environments such as team sports. For example, one young woman described how her competitive nature motivated her to participate in physical activities with her peers:

“Well, I like to win things and be right. So if there’s a contest, then that helps me be physically active.” (Kallie, 12)

Others preferred cooperative environments where individuals work together as a group to achieve a common goal. One girl who seemed to struggle with finding common ground with her classmates shared how tossing around a football at recess was one way she could socialize with her peers. She reasoned,
“Because it’s cooperation. It’s cooperating with someone you do or don’t know, who you have to work it through with. You can become best buds.” (Katherine, 13)

Some young people in this study enjoyed a mixture of cooperation and competition in team dynamics with the latter focused on self-improvement. For example, a young woman shared a different perspective on competition when describing her community swim team:

“You see each other on weekends at meets and you’re all encouraging them to improve themselves, …. You’re not competing against them, you’re competing with them.”

(Rosanna, 18)

Striving for one’s personal best within a team dynamic did not appear to be related to functional mobility and was a common story told by the participants. Our understanding is that achieving personal bests helped young people to be confident and secure in their bodies and to take pride in their physical abilities. One young woman shared the pride she experienced from feeling physically fit and capable after participating in a 12-minute push in her wheelchair during gym class:

“Well, I love it [pushing her chair for physical activity] because it helps you with upper strength…like, my heart rate went up to 72 beats!...And [my teacher] asked, ‘Did anybody go up to 70?’ And I was like, ‘Ya, I did’ (hand raised)…I was exhausted.”

(Katheri ne, 13)

From these data, we interpreted that young people perceived that meaningful engagement with peers in these different ways can promote a sense of belonging and provide emotional support, which is more motivating than if the young people participate in physical activities alone. In contrast, not all young people wanted to participate in physical activity with other people. One young man preferred to engage in physical activity on his own. When asked if there was any way that his family or friends could help him to be physically active, he replied:

“No, I just have to keep reminding myself.” (Manny, 15)
3.5.3 Opportunities for interdependence

Young people reported wanting to take the lead in their own lives, particularly with respect to goal-setting, while needing varying levels of support from family and friends to achieve these goals. For example, one girl shared her experience of goal-setting and how she was positively influenced by her family, while maintaining control of the process:

“I say, this [physical activity] is going to be terrible, and then it turns out to be amazing….telling me about how much fun they [my family] had kinda helps me. ‘Cause I’ll be like, ‘Oh that sounds amazing, now I want to do it too’...I mean, I guess my goals, I need to set them for myself…They can’t really make me.” (Kallie, 12)

Young people also identified requiring practical supports such as transportation. One girl shared how she developed a passion for wrestling and spent a lot of her time learning about it. However, despite her self-motivation and personal investment, she felt restricted because of a lack of support from her family to help her get to the gym:

“I want to lift weights…My brother always goes to the gym, I feel like jealous…I want them to help me go to a gym…but I can’t because my dad has work and all that stuff.” (Jasmine, 12)

In addition to physical supports (e.g. transportation), the young people in this study also expressed a need for informational support. They spoke of needing professionals or parents to help identify and facilitate opportunities for physical activities in line with their interests. One young woman who was interested in doing speed walking, swimming, or tennis said:

“Maybe they could help me get into programs in this area or something. Ya, that could really help.” (Savannah, 17)

Although most young people in this study recognized and felt empowered by the support of their social networks in achieving their personal goals for physical activity participation, one young man shared a contrasting perspective on how he wishes to achieve his physical activity goals:

“I just do it [physical activity] without the encouragement from others…I motivate myself, I don’t—I don’t want others to motivate me.” (Manny, 15)
This young man was very focused on exercising to manage his pain and improve his mobility and did not see how other people could help him with this. Through his personal accounts, we understood that his mom was very instrumentally supportive (e.g. accompanying him to the gym and supervising him during his daily treadmill workouts), and provided him with resources needed to achieve his goals. However, we interpreted that he was not acutely aware of her role in his adherence to his therapy regimen to manage pain through exercise, but rather was adamant that he was entirely independent and self-motivated. It is possible that he portrayed himself as independent and minimized his mom’s involvement because he wants to see himself as independently setting and achieving his goals. These interpretations are shaped by how the interviewer and researchers model independence in their own lives and projected it on his stories. In all the participants’ cases, we came to see that the young people were describing examples of interdependence, but recognized it in different ways.

3.6 Discussion

Our findings suggest that young people with physical disabilities highly value their social environments to motivate and support them in their physical activity participation in a number of ways. The young people in this study defined a socially supportive environment as one that engenders fair and equitable participation, a sense of belonging through teamwork, and socially supported independence, or otherwise defined as interdependence. The young people in this study shared many experiences where we interpreted that a socially supportive environment was not encountered. For the most part, young people wanted to participate in physical activity with typically developing peers, but past experiences of exclusion, bullying, and an inability to “keep up” seemed to have enforced negative associations around physical disability and a decreased sense of self-worth and self-efficacy. The young people wanted to be accepted and have a fair chance to participate in physical activity with whomever they choose, but instead we perceived that they often felt like they were a burden to others and that their participation would decrease enjoyment for other participants. This may also be evidence to support the notion of learned helplessness, where individuals feel powerless due to repeated exposure to disempowering experiences or environments (101). Our participants felt that typically developing populations needed to change their approaches and expectations for physical activity so that young people with physical disabilities could also be included. The young people in this study recognized that this would be a slow change that required significant support. We interpreted from the
experiences they shared that support is needed on multiple levels, including media, policy, and education. These findings align with the social model of disability, a model that promotes the removal of barriers, both physical and attitudinal, such as prejudice or discrimination, to provide equitable opportunities for participation and inclusion in society (102).

In contrast, when social and physical environments were designed to accommodate diverse needs and abilities, the young people shared positive experiences of participating in physical activity. This may be due to the young people’s previous involvement in the Therapeutic Recreation and Life Skills program and/or weekend physiotherapy group from which we recruited our participants. The environments within which the young people experienced accommodation embraced diversity, accommodated individual needs and thereby created a fair, positive space for physical activity participation by all. For example, one teacher measured success in a physical activity based on heart rate as opposed to metrics such as speed or accuracy that might be more linked to physical abilities. For inclusive participation to succeed, environments must be constructive, supportive, and celebrate the diversity of all participants in physical activities.

Our participants reported feeling motivated when they felt like they belonged to a group or a team. Emotional support, understanding and empathy can provide a strong sense of belonging for young people with physical disabilities (103). Social bonding with peers can be a major source of motivation for physical activity participation and can be achieved in different ways (e.g. through competition or cooperation) depending on personal preferences. However, the consistent strand that ties together each young person’s experience is a focus on personal best and personal achievement. This suggests that physical activity programs should focus attention away from peer comparison and towards the creation of personal norms. Young people can be empowered by family, peers, instructors, or teachers in this strategy. Previous research on inclusion in physical education has also challenged the notion that inclusion entails a “one size fits all” approach (104, p 139). We propose that it would be beneficial to rethink how we define success in physical activity. This may include a greater focus on achieving personal bests in activities, in order to support and encourage young people to feel confident and secure in their abilities.

Independence has historically been the ultimate goal for rehabilitation (105,106). However, more current literature identifies that traditional notions of independence (an individual doing everything for themselves) do not promote optimal functioning for young people with physical
disabilities, as it demands significant time and energy and can result in social isolation (107,108). This is reflected in this study’s findings. The young people in this study expressed a strong desire to be independent, particularly in goal-setting, which may reflect a desire to conform to developmental discourses about the importance of independence in becoming an adult. However, for the most part, they described their independence as being facilitated by their social networks, which has been defined as ‘interdependence’ (106). Interdependence is the acknowledgement that every individual is dependent on others to some extent, as opposed to individualistic independence that demands unrealistic time and energy and often results in isolation (106,109). Interdependence is more representative of how people successfully and realistically relate (109).

Encouragement, sharing positive experiences, freedom to choose activities and set goals, and practical resources (e.g., transportation, information or supervision) were revealed as essential factors that we understood contribute to young people’s capacity for interdependence. Our interpretation is that when provided unobtrusively by supporters of young people with physical disabilities (e.g. parents), these supports can contribute to young person’s sense of autonomy, self-efficacy and mastery.

Our results suggest that both integrated and dedicated environments can support young people with physical disabilities participation in physical activity as long as the fundamental ingredients of a socially supportive environment are preserved (i.e. fair and equitable participation, a sense of belonging through teamwork, and socially supported independence or interdependence). Physical activity programs should promote opportunities for equitable participation for young people with physical disabilities through curricula that fosters respect and acceptance of individual differences, a focus on strengths, and an emphasis on developing unique capacities for personal growth. These strategies apply to all social environments that young people with physical disabilities engage in, whether it is in a rehabilitation setting, at school, in the community, or among family. Future research is needed to create environments, interventions, and physical activity settings that apply these recommendations and provide an evidence base on which to build best practices. Strategies could include promotion of Paralympic athletes to shift attitudinal beliefs on disability and physical activity (110); use of virtual environments and technologies that can create equitable opportunity environments that transcend restrictions present in the real world (111); and training of rehabilitation, physical activity, and education professionals in different options for successful participation in physical activity that dignify
diversity (e.g. measurement of metabolic equivalent or heart rate as performance indicators (112).

3.6.1 Strengths and considerations

This work contributes to the current social inclusion literature for the promotion of physical activity for young people with physical disabilities. This work has provided a more nuanced understanding of the barriers and facilitators to physical activity participation associated with the social environment (e.g. types of peer engagement that encourage participation; or participation restricted by measurements of athletic success that favor typically developing participants). The key elements of this study—the conceptual insights—are useful beyond this immediate research setting (113). Concepts such as equitable participation and interdependence inform our understanding of young people’s needs for socially supportive physical activity environments. Generalizable beyond physical activity and rehabilitation settings is the concept that social inclusion can be enhanced for young people with physical disabilities if we tailor social and physical settings to their individual needs. This work familiarizes other researchers and clinicians to these concepts, which they may encounter in their work with young people related to their social supports and engagement in physical activity.

In this research, we sought to include participants who had previously self-identified a goal related to physical activity participation knowing that the needs/views of this population may not be reflective of those who do not acknowledge the role of physical activity in their health promotion or for those who are already successfully engaging in physical activity. As such, the young people in our study were all sensitized to the topic and may have been more motivated to take part in physical activity than other young people with physical disabilities. Despite this, interviews revealed that several participants were not intrinsically interested in being physically active or in exercising. This strengthens our sample as it broadens the implications of our findings. Of note, all but one participant were diagnosed with cerebral palsy. This should be considered in the transfer and application of the concepts in this research to other populations. Finally, Therapeutic Recreation Specialists and Physiotherapist Assistants identified eligible young people for this study from physical activity programs that require significant social support to initiate participation. We acknowledge that the young people’s supportive social networks and previous engagement in physical activity may have shaped the results differently.
than if we recruited participants who were not involved in these programs. Other research is required to understand what this topic might mean for young people who do not have a background of social support and involvement in physical activity programs.

3.7 Conclusion

This study addressed the potential for social environments to support young people with physical disabilities’ participation in physical activity, as defined by young people. The role of social environments is to provide a fair and equitable playing field for young people with physical disabilities to participate alongside their peers where desired; to provide a strong sense of belonging through teamwork suited to individual’s preferences; and to allow young people with physical disabilities to explore interdependence through the support of their family and friends. These factors are critical for the promotion of health and well-being for young people with physical disabilities and should be considered in future research, intervention design, and clinical practice.
Chapter 4

4 Social technology as a potential facilitator for self-determined physical activity participation for young people with physical disabilities

4.1 Chapter introduction

This chapter includes a manuscript that presents the second stage (Stage 2 design workshops) of the study presented in Chapter 3. The manuscript in chapter 3 revealed that young people define a socially supportive environment as one that supports fair and equitable participation, belonging through teamwork, and interdependence. This chapter explores how this kind of an environment can be facilitated by social technologies. More specifically, it examines the perceived benefits of social technology to promote physical activity and the design considerations that must be addressed to successfully create social technologies that support physical activity for young people with physical disabilities.

4.2 Abstract

Background: There is a great need for health promotion related to physical activity for young people with physical disabilities. In typically developing populations, the potential of social support networks facilitated by technologies has been suggested for physical activity promotion. Little is known about its potential role(s) in supporting physical activity in youth with physical disabilities.

Objective: This study investigates the perceived role of social technologies in motivating physical activity for young people with physical disabilities.

Method: Two interactive design workshops for eight young people aged 12 to 15 and aged 16 to 18 were held to investigate the perceived benefit of social technologies in promoting physical activity and the design considerations that must be addressed to create social technologies that achieve this goal.

Results: The young people perceived significant benefit for social technologies to promote physical activity, as they have the potential to overcome considerable barriers to physical activity
participation. Social technologies designed to suit the needs and abilities of young people with physical disabilities should include: 1) accommodation for interests and preferences 2) informational support; 3) equitable technology design; 4) motivation through competition and play; and 5) opportunities to develop camaraderie and receive emotional support.

**Conclusions:** Virtual social environments have the potential to provide tailored, equitable opportunities environments through needs- and preference-specific design that align with the principles of self-determination theory, further supporting physical activity participation.

### 4.3 Introduction

Young people with physical disabilities are at a high risk of physical inactivity (1-4), which may have serious negative health outcomes and implications for quality of life (e.g. development of diabetes (7,38), poor musculoskeletal health (39)) (12,13). This population is faced with significant barriers to physical activity participation (15). One such barrier is a lack of social support (12-14). Social support is an effective motivator for physical activity in fitness and therapy programs for young people with physical disabilities (15,16) with benefits for both mental and physical health (114-117).

Recently, there has been an emergence of *social technologies* to help motivate physical activity while overcoming common barriers such as accessibility, time constraints, and limited financial resources. In this paper, we use the term *social technology* to describe technologies that support *social networking* (which refers to a web of social interactions and personal relationships) through talking with family and friends, and sharing in play, information, ideas, personal messages, and other content (e.g. photos, videos) (29). Social technology includes but is not exclusive to communication tools on the Internet or mobile devices intended for the development of communities online. Some examples of social technologies applied to physical activity promotion include active video games (118), web-based interventions that utilize social networking sites or e-mail (18,119), mobile technologies such as exercise tracking cell phones (19), and accelerometer-based toys (120). Many of these technologies integrate social networks to increase motivation.

Thus far, social technologies to help support physical activity have targeted typically developing populations (e.g. active video games (121,122), web-based physical activity programs using e-
mail or text-messaging for support (18,123)) with a few exceptions. For example, Newton et al. (45) studied the effectiveness of an intervention using pedometers and text messaging to increase the physical activity of adolescents with Type 1 diabetes. However, the intervention was deemed ineffective as its appeal was not sufficient to sustain adherence and motivation. The intervention also did not support peer connection, which has been suggested to be important in intervention design (111,124,125). Hernandez et al.’s (124,125) intervention design, the Liberi Exergame, is an action-based video game designed for young people with cerebral palsy to motivate children to participate in physical activity and socialize with their friends using Facebook and an open voice chat while using a stationary bike and game controller, regardless of geographical location. Results from a ten-week trial suggest a networked video game such as Liberi can be an effective way to foster rich social interaction and increase adherence to physical activity regimens, especially when playing online with peers (111).

This paper takes an initial step towards designing practical, technological solutions to facilitate intrinsically motivated, socially supported physical activity participation, with the purpose of addressing physical inactivity in this population. The goals of this paper are to better understand the role social technologies could play in motivating physical activity for young people with physical disabilities and to provide guidance for the design of social technologies that meet the specific needs of this population.

4.4 Method

4.4.1 Research design

This paper presents the second stage of a 2-stage, iterative design including explorative interviews (Stage 1 is reported in Chapter 3) and design workshops (Stage 2). The first stage explored the role of socially supportive environments in supporting physical activity participation for young people with physical disabilities. In the second stage, reported in this chapter, young people were invited to take part in an interactive design workshop to answer two research questions: “Do young people with physical disabilities perceive a benefit for social technologies to promote physical activity? What design considerations must be addressed to successfully create social technologies that support physical activity for young people with physical disabilities?” To this purpose, we took a partial participatory design approach that engaged young people who had experience related to the study’s objectives (126). These young
people were diagnosed with physical disabilities and had previously identified a goal related to increasing their participation in physical activity. Young people were involved in shaping the design of this second stage through the experiences they shared in the first stage. For example, in the first stage they shared how feeling a sense of belonging with their peers could help motivate them to be physically active. This was considered as we developed the format and content of the design workshops. Another reason for considering this work participatory is the involvement of young people in trialing and providing first hand feedback on different social technologies (as discussed in subsection 4.4.3 ‘Data collection’). We consider this a partial participatory design because, due to feasibility, our participants were not involved in the development of the research question and were included to a limited extent in the analysis. This research was conducted within an interpretivist paradigm, acknowledging the co-construction of meaning between the researchers and participants to answer questions about the benefits of social technology and design considerations to promote physical activity for young people with physical disabilities (126). Ethical approval was obtained from a rehabilitation hospital where the study was conducted and its affiliated university. Young people provided informed consent.

4.4.2 Sample and recruitment

The sample was drawn from a large, urban pediatric rehabilitation hospital. We purposively sampled young people who were inpatients or outpatients at the hospital on the following criteria: 1) Aged 12 to 18; 2) Physical disability or chronic health condition affecting body structure and/or function (27); 3) A self-identified goal related to increasing physical activity participation; 4) Able to walk with or without a handheld mobility device (e.g. walkers) or other assistive devices (e.g. orthotics); 5) Able to handle objects like a computer mouse or game controller with some level of independence (127); 6) Able to answer questions requiring reflection and insight, as determined by the interviewer through conversation with the participants. Young people diagnosed with autism spectrum disorders or epilepsy were excluded from participation as these diagnoses would significantly alter the types of technologies that would be considered because of their unique sensory requirements.

Young people who participated in the first, explorative interview stage were invited to participate in the design workshops described in this paper. The sample was drawn from two programs: the hospital’s Therapeutic Recreation and Life Skills program and a weekend physiotherapy group at
the hospital that aims to provide young people with social support and an opportunity for participation in physical activity.

4.4.3 Data collection

Two design workshops were held for participants of different age groups as young people experience rapid development during adolescence, making sharing with peers of a similar age more comfortable (128). Design workshops were scheduled for 2 hours and were held in a familiar and relaxed environment at the hospital where we thought the young people would feel comfortable. Potential uses for social technologies discussed in the explorative interviews in Stage 1 were presented to the participants at the beginning of the workshop (see Figure 1). Existing technologies designed for mainstream populations were presented along with one rough mock up (see Table 4 for full overview of technologies demonstrated in the design workshops and Figure 2 for mock up). Participants in each workshop were divided into groups of two or three to explore each of the social technologies presented. Each group was partnered with a “personal scribe”, a member of the research team who transcribed the young people’s comments and reactions to the technologies onto sticky notes. Scribes recorded verbatim comments when possible or summarized participant reactions with accuracy. Scribes were used to record real-time data whilst accommodating young people’s mobility and manual ability needs as some young people were unable to write on the sticky notes while operating the technologies and navigating the room using their mobility devices. The sticky notes were later used as physical aids to facilitate discussion and identify preferences.

A discussion group was held after the participants had a chance to trial each technology, led by two members of the research team. This time was used to discuss ideas for new technologies inspired by the technologies the young people had trialed or changes to existing technologies that the young people felt would facilitate their use and value for physical activity promotion. At the end of the discussion, the young people participated in analysis as they ranked and organized their recommendations and preferences with the use of a flipchart. Interested readers can find the discussion group guide in Appendix C. A reflexive journal was kept to record field notes (e.g. observations and reflections on the influence of age), reflexive notes (e.g. probes determined by researchers interests), and an audit trail of decisions relating to methodology and analysis.
Figure 1. Potential uses for social technology to promote physical activity explored in explorative interviews (Stage 1)

Table 4. Design workshop technology demonstrations

<table>
<thead>
<tr>
<th>Technology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active video games</td>
<td>A video game that demands higher intensity of physical activity than a conventional hand-controlled video game (121). Two gaming systems were available, one that used a handheld controller to control the avatar and one that relied on motion sensors. Games such as boxing and adventure sports were trialed.</td>
</tr>
<tr>
<td>Social pedometer</td>
<td>A pedometer that attaches to the wrist and tracks steps, distance, burned calories, and minutes spent being active. Information can be synched online, tracking progress and goals achieved. Users can connect online with friends and/or family to encourage or challenge each other or join fitness groups. Young people could try on the social pedometer and explore social features on a trial account. A second social pedometer that had an option for gaming with peers was introduced via video.</td>
</tr>
<tr>
<td>YouTube playlist</td>
<td>Videos including adaptive yoga, extreme wheelchair tricks, and wheelchair dance were shown on a playlist loop.</td>
</tr>
<tr>
<td>Fitness blog mock-up</td>
<td>A mock-up (See Figure 2) fitness blog on Bristol board was displayed. It included inspirational quotes, personal training or ask the expert comment boxes, links to YouTube, Twitter, Pinterest, and Instagram, weekly fitness</td>
</tr>
</tbody>
</table>
challenges, instructional exercise panels, a chat function, peer testimonials, and a photo board.

Fitness apps for tablet
Two apps were available for trial. One was a gaming app for which the user had to walk or run whilst holding the tablet to move the avatar. Users could connect with peers and compete using their avatars. The second was an informational app that included step-by-step instructions for different exercises at beginner, intermediate, and advanced difficulty. Users’ could track or plan exercises using this app and connect with peers to encourage, compete, or chat.

Facebook group
A mock Facebook group entitled “Active Teens” was created with anonymous members. The group was meant to demonstrate a place for young people to connect with peers who were also interested in being physically active. Posts and messages made under pseudonyms included scheduling events to get young people together at a local gym, park, bike path, or beach as well as posting information or questions regarding healthy living and active lifestyles. (e.g. Does anyone know of good martial arts places? I’m looking for a class that includes wheelchair users or I took my dog for a walk the other day and he found a new friend!)

*Figure 2. Fitness blog mock-up design on Bristol board*
4.4.4 Analysis

Design workshop discussion groups were audiotaped and verbatim transcripts were analyzed using iterative, inductive thematic analysis techniques (97). Team members independently reviewed verbatim transcripts and then met after each workshop to discuss further analysis and interpretations of the data moving from coding data to more abstract categorizations and eventually to build themes. Sticky notes were also transcribed and treated as data in the same way as the audio recorded transcripts. NVivo software was used to manage the data. First, a coding scheme was developed of inductive codes or codes developed from concepts embedded in our research questions (e.g. potential roles for social technologies). Codes were assigned to text segments, describing the basic elements of the data, and then were grouped into potential themes and sub-themes. Group discussions of similar themes were compared between age groups, being sure to differentiate individual opinions (i.e. disconfirming or minority opinions) from the group consensus. A thematic web diagram was developed. Candidate themes were reviewed for internal and external homogeneity and a final thematic map was developed. The researcher’s field notes and reflexive notes were used to confirm the final thematic map. Finally, a detailed account was written up of the analysis and interpretation that constituted each theme. Data were analyzed with an understanding and recognition of the group dynamic. Throughout this iterative process, it became evident that self-determination theory aligned well with the data and the final thematic map, and detailed analysis was informed by this theory (129). All names are pseudonyms.

4.4.5 Strategies for rigour

The level of trustworthiness of this study data is evaluated by its credibility, dependability, confirmability, and transferability (98). Examples of how these criteria were fulfilled in this research can be found in Table 5.
Table 5. Illustrative examples of trustworthiness criteria

<table>
<thead>
<tr>
<th>Trustworthiness criteria</th>
<th>Illustrations of fulfilled criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credibility</td>
<td>Purposive sampling of young people who had self-identified goals related to physical activity and therefore could provide greater insight into the aims of this study; Iterative nature of this research as the second stage of a two stage study design informed by the first stage’s results; Rapport developed with participants through two stage design</td>
</tr>
<tr>
<td>Dependability</td>
<td>Field notes (e.g. observations of participant involvement and of participant’s excitement or disinterest of different social technology design recommendations), memos (e.g. accommodations made for mobility needs), reflexive notes (e.g. impact of probes into experiences of cyber-bullying on discussion), and an audit trail to track decisions (e.g. changes in itinerary order or timing)</td>
</tr>
<tr>
<td>Confirmability</td>
<td>Sufficient data extracts to illustrate design recommendations made by participants and allow for transparency of interpretation; Use of field notes to confirm results (e.g. participant’s emphasis on social technologies that support play)</td>
</tr>
<tr>
<td>Transferability</td>
<td>Participant details are provided; Sufficient analytic detail to assess the interpretation presented and to assess whether or not the findings are conceptually generalizable to other contexts, including the application of design recommendations for other young people</td>
</tr>
</tbody>
</table>

4.5 Results

Eight young people were recruited for the design workshops from those interviewed in stage one of the study (n=11). Five were 12 to 15 years old (3 were female). The older group was 16 to 18 years old (two were female). All participants were diagnosed with cerebral palsy. They were diverse on mobility and manual ability. Participant details can be found in Table 6.

Each design workshop lasted approximately two hours. The following section presents the perceived benefits of social technologies for physical activity promotion and design considerations to be addressed when designing these technologies as identified by young people with physical disabilities. These are presented under the following subheadings, which reflect our thematic analysis: interests and preferences, informational support, equitable technology design, motivation through competition and play, and camaraderie and emotional support.
**Table 6. Participant characteristics**

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Age</th>
<th>Gender</th>
<th>Mobility when participating in physical activity</th>
<th>Manual Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jamal</td>
<td>12</td>
<td>Male</td>
<td>Walks with some limitations; specifically struggles with balance and coordination in sport</td>
<td>Handles objects easily and successfully</td>
</tr>
<tr>
<td>Kallie</td>
<td>12</td>
<td>Female</td>
<td>Walks using a walker</td>
<td>Handles objects with difficulty, needs help to prepare and/or modify activities</td>
</tr>
<tr>
<td>Angela</td>
<td>12</td>
<td>Female</td>
<td>Walks using a walker or uses powered mobility</td>
<td>Handles objects with difficulty, needs help to prepare and/or modify activities</td>
</tr>
<tr>
<td>Katherine</td>
<td>13</td>
<td>Female</td>
<td>Walks using a walker</td>
<td>Handles objects easily and successfully. Experiences some limitations in the ease of performing manual tasks requiring speed and accuracy</td>
</tr>
<tr>
<td>William</td>
<td>15</td>
<td>Male</td>
<td>Walks using a walker</td>
<td>Handles objects with difficulty, needs help to prepare and/or modify activities</td>
</tr>
<tr>
<td>Bergin</td>
<td>16</td>
<td>Male</td>
<td>Walks using a walker, self-propel using a manual wheelchair, or uses powered mobility depending on the activity</td>
<td>Handles objects easily and successfully</td>
</tr>
<tr>
<td>Marissa</td>
<td>17</td>
<td>Female</td>
<td>Walks using a walker</td>
<td>Handles most objects but with somewhat reduced quality and/or speed of achievement. May avoid some tasks or use alternative ways of performance</td>
</tr>
<tr>
<td>Rosanna</td>
<td>18</td>
<td>Female</td>
<td>Walks using canes, a walker, or uses powered mobility</td>
<td>Handles most objects but with somewhat reduced quality and/or speed of achievement. May avoid some tasks or use alternative ways of performance</td>
</tr>
</tbody>
</table>

**4.5.1 Interest and preferences**

Participants were diverse in their interests and preferences. Young people expressed some interest in each technology presented at the workshop with particular preferences for the active video games, social pedometers, and interactive exercise apps. Elements of YouTube, blogs, and Facebook also held interest for some members of each workshop. Factors that seemed to influence preferences included age, gender, novelty, and general interest in technology.
independent of physical activity. In terms of age, the 16 to 18 year olds were more focused on fitness and some of the practical factors related to technology such as cost, feasibility, and the reliability of information, whereas the younger age group focused more on the enjoyment factor. Male participants tended to prefer video games to a greater extent than female participants, who gravitated to the social pedometers and the apps. Participants emphasized that to address the diverse interests of users, technologies should link together, such as the connections between current social media sites (e.g. Facebook, twitter, Instagram). This design feature enables users to share the same information and experiences even if they do not subscribe to the same social media, as described in the following excerpt:

Bergin (16): Well basically anything nowadays has social media included. If you read anything online it says, post this on social media, post that on social media…

Rosanna (18): Or if someone can’t or doesn’t want to go on your blog, they could also see the stuff on Instagram…not everyone has all of social media. Like some people just have Facebook, some people just have Instagram, some people just have Twitter.

4.5.2 Informational support

Young people viewed social technology as an important medium for learning and information sharing with respect to physical activity and healthy lifestyles. Young people liked the idea of accessing and sharing accessible or modified tutorials or weekly challenges on blogs, Facebook, or apps. Participants commented on the current scarcity of information on physical activities tailored for people with physical disabilities and noted that it can be very discouraging for young people if the information they need is unavailable or inaccurate. This is illustrated in the following excerpt:

Rosanna (18): Okay, ‘cause like, uh, I was searching YouTube the other day and I only found two videos that were modified for people with disabilities. And for thousands of videos there were only two.

Marissa (17): You don’t necessarily have a lot of disabled friendly things.
Different media forms (i.e. videos, photos) were seen to have different benefits for information sharing and learning. For example, videos were regarded as more engaging when considering app design on technologies such as tablets or cell phones:

“.. add some videos, make it move, I don’t know. I mean, looking at a guy just standing there doing nothing, it gets boring.” (Bergin, 16)

However, breaking an activity into steps through pictures/photographs could also make it seem more manageable, providing cognitive support for learning an activity:

“But the pictures are also good too because then you can break it down slower…Like, some of the videos you can’t really slow it down that much.” (Rosanna, 18)

While young people emphasized the importance of information that is readily available and easily accessible, the need for tailored advice and access to experts and professionals online was also noted. One suggested strategy to achieve this was to use private messaging for specific advice or information that is unique to the needs of the user.

4.5.3 Equitable technology design

Young people were excited by the potential of social technologies to enable equitable participation for both users with and without physical disabilities through tailored menus/options and “smart” technologies, accessible physical design, and inclusive content. When discussing the design of an app that tracks physical activity, young people suggested tailoring it to different abilities by providing modified as well as “regular” options to accommodate users of varying abilities. For example, Jamal said:

“For the Nike one [referring to the app], like for the disabled, you could make it with subgroups. So even if you were going to say, like, I’m a wheelchair user, or I use canes, or a walker or something like that. So there’s different exercises.” (Jamal, 12)

Ideally, these apps would take into consideration the effort and energy expended regardless of how the exercise was performed. There was enthusiasm for smart technologies, or technologies that could learn the abilities of a user over time and make adjustments or recommendations accordingly. One young woman shared with the group an idea inspired by the challenges she
experienced attempting to play the motion sensor activated active video game from a seated position with her walker:

“My idea was that if it was an exercise type of game. Like if it was showing you what kind of exercises you could do and if you couldn’t do it, it would change to something that would be more, like, you would be more able to do it. Like, more modified to your needs.” (Rosanna, 18)

In the design of different social technologies, physical accessibility was also an important consideration. To accommodate the needs of mobility device users, hands free technology or technology that could be used when seated were suggested. Several participants expressed a preference for the social pedometers that attach to the wrist in comparison to other handheld social technologies because the wrist attachment would accommodate the use of a walker.

The desire for inclusive technology also extended to the specific content of the media. Rosanna (18) shared how she would like to see blogs or other accessible physical activity promotion websites use advertisements that are appropriately targeted to individuals with physical disabilities as well as typically developing users. For example, a gym advertisement should foster inclusion by advertising a gym that provides accessible equipment and employs knowledgeable professionals who can give accurate advice to members with physical disabilities.

4.5.4 Motivation through competition and play

Young people identified the role of social technologies for nurturing environments for competition and play to incentivize participation in physical activity. Competition was viewed by some as a powerful motivator for physical activity participation using social technologies such as active video games, social pedometers, or computer apps. One young man described how he experiences motivation through competition in two ways, for the purpose of winning and for the purpose of social bonding:

“Being competitive I think provides an almost necessary aspect of this. Because for me it’s not about beating my own record and strengthening myself, but about competing with other people and trying to come out on top. I’m not—I’m not ridiculously competitive, but when it’s like physical activity, I like those kind of things, like competing with other
people. Not necessarily to win, but just to, like, doing something with other people is really important.” (William, 15)

Others preferred to be competitive with their own records or scores, using technologies such as the social pedometers to track personal accomplishments and set realistic goals. Young people reported feeling encouraged by looking back on their accomplishments using these technologies:

“It doesn’t have to be like, competitive, you can just do it because you want to get exercise…like maybe you can make yourself a chart and every day you can track how many steps you take a day…that would help you stay on track.” (Marissa, 17)

For some, it seemed that competition was only viewed as acceptable or desirable when using social technologies that include a play or gaming element, such as video games. For example:

“Ya, I think it’s acceptable in video games to be competitive because it’s just a game. It’s more, I guess, it’s more leisure than exercise when it’s in the form of a video game. But you can still have exercise with it…Uh, well I guess you can be more competitive in a game, whereas if it’s like, you can’t really be that competitive on [a social pedometer] as much ‘cause it’s not like a game really. I don’t know, it’s just kinda different when it’s a game.” (Rosanna, 18)

We also interpreted that through play, technology also has the potential to minimize boredom and disinterest in physical activity. It can make physical activity less intimidating and allow young people to think about physical activity differently. One social pedometer that included a gaming aspect where the users developed a city with their accumulated steps was seen as especially useful in providing incentives:

“It [the gaming social pedometer] would give you an incentive to start doing it and see your city grow, you’d have to keep doing it. So not only would it give you incentive to start, but it would also continually give you incentive to continue. And I know I’m using this word a lot, but typically exercise for me is all about incentive.” (William, 15)
4.5.5 Camaraderie and emotional support

Young people viewed social technologies to be a feasible way to develop an empathetic community and share or be inspired by successes and supportive comments that facilitate physical activity. In building a supportive social network, established relationships were discussed as ideal for facilitating online social interactions. Most young people preferred to interact with a friend they knew from school or elsewhere, however some were open to meeting people online. It was acknowledged that relationships developed solely online can be enjoyable and beneficial to one’s social engagement, but that they take a long time to develop. One advantage of online social communities was their capacity to extend beyond their geographical proximity or regular schedules. We interpreted that social technology was also seen as a tool to bring awareness of the abilities of people with physical disabilities on a more public platform, potentially contributing to the development of an empathetic community. For example, William said:

William (15): And I think how this ties into the whole exercise thing is...because not only do we want to do exercise and show people, we want to be recognized, included, accepted, because like you said, we are human too, okay...

Researcher: Can you tell me if that ties into social technology at all?

William: Yes definitely. Facebook—definitely. Blogs—definitely...I just ran a kilometer would be a huge thing, I just wheeled a certain amount would be a huge thing. Because it shows people that we can be physically active too.

We understood that young people want to feel inspired by their peers and they envisioned this to manifest in several ways. Seeing other people’s success stories and noticing similarities to themselves can make adherence to physical activity seem more feasible and can generate ideas for interesting ways to be active. One group discussed how it feels to read other people’s posts about their physical activity accomplishments:

It [other people’s posts] gets you to, like, it gets you motivated to do that stuff. (Marissa, 17)

Positive and encouraging comments from peers on blogs, Facebook posts, etc. can also be empowering, helping young people to persevere in the pursuit of their goals. However, the young
people in this study also expressed some concern that the public nature of social technology could potentially expose them to the threat of cyber bullying. Young people seemed to feel particularly vulnerable to cyber-bullying because of stigma and discrimination related to physical disabilities in the context of participation in physical activity. One suggested way to counteract this is to include a private message feature. Young people also discussed the option of having a separate space or closed environment for young people with physical disabilities to mitigate the potential for bullying:

“With some of the apps or even like a blog and stuff, you could have a specific, um, part or like theme for disabled so that people who are, like, people who don’t understand, you’re not like, wow that’s so easy, I could do that in two seconds, but you’d be talking to people who understand what you’re going through in a way.” (Kallie, 12)

Contrasting views noted that this approach may limit social opportunities:

“…We need to be careful about privatizing [or segregating] this, because we don’t want it to be so private that it can’t be social anymore, you know?” (William, 15)

4.6 Discussion

Our findings suggest that young people with physical disabilities see significant potential for social technologies to support their social and physical activity needs. Social technology can overcome many existing barriers to physical activity participation by:

1. Supporting young people’s exploration of physical activity interests and providing a space to share these interests with friends.
2. Providing an avenue for young people with physical disabilities to freely access and share information regarding physical activity goals and achievements.
3. Expanding opportunities for equitable participation in physical activities among young people of varying abilities through specialized technology design.
4. Providing an incentive for exercise through competition and play.
5. Supplying an accessible space to build and maintain supportive relationships that would otherwise be restricted by barriers such as geography and time, with the potential of building an active and inspiring community of peers who are relatable, understanding, and empathetic.
Young people identified specific design features of social technologies that would help to accommodate their differing physical abilities and needs. These suggestions can be viewed in the theoretical framework of self-determination theory (129) to support the creation of design guidelines for the development of social technologies that provide young people with opportunities to choose activities that they enjoy (autonomy); feel effective and competent in what they set out to accomplish (competence); and feel connected to and supported by a loving and caring community of peers throughout participation (relatedness). Self-determination theory is a theory of motivation in which these three basic psychological needs are required for intrinsic motivation and overall well-being (129). While promoting intrinsic motivation is a goal of many interventions targeting physical activity, social technologies and the virtual plane on which they exist present opportunities to create equitable opportunity environments that may not be feasible in the real world. The following describes the particular potential of social technologies to promote autonomy, competence, and relatedness for the purpose of physical activity promotion (See Figure 3 for theme alignment with three basic psychological needs in self-determination theory).

Figure 3. Theme alignment with three basic psychological needs in self-determination theory

Autonomy: Deci & Ryan (130) writes, “Intrinsic motivation involves people freely engaging in activities that they find interesting, that provide novelty and optimal challenge” (p 235). Allowing young people the freedom to choose how they will go about achieving their social and physical activity goals is empowering and can have positive effects on participation. Social technology has the potential to provide this kind of volition through variety of genre and within
genre, activities, competition, complexity, and modifiable activity alternatives. Employing these design elements will allow future social technologies to be tailored to suit users’ individual needs and preferences. Young people in this study had very diverse social technology preferences. Possible reasons for this may include that male young people tend to play more video games than their female counterparts (65% of male young people and 35% of females young people play video games daily) (131), a tendency to act out gender roles, and/or the extent of focus on weight management and tracking health for young women. Providing choices that are of interest to the user has the potential to inspire sustained engagement in physical activity behaviours (132).

Competence. Saebu et al. (133) asserts “people perceive themselves to be competent when they feel capable of attaining important health outcomes in a social setting, such as meeting a physical activity goal” (p 614). Readily available, easily accessible, and applicable physical activity information can support young people with physical disabilities in this way. To create optimally challenging environments for young people with varying abilities, social technologies must be designed with effort, mobility, and adaptability in mind. The design of smart technologies that integrate skills-balancing algorithms (124,134-136), dynamic difficulty adjustment (111,137), customizable settings, and/or can learn the abilities of the user over time are potential strategies to achieve equitable physical activity participation (138). These adaptable design elements can foster competence in physical activities by creating an environment that positions young people for success. Supportive, optimal environments should also allow individuals to experience challenges and failures, so that through these experiences they will develop determination, self-efficacy, and competence (103).

Relatedness. Receiving affirmation in physical activity pursuits alongside peers can reinforce self-determination in young people with physical disabilities (139). Social technology can provide opportunities for relationship development and community growth that in turn provide affirmation and encourage participation in physical activity. Allowing young people to determine their own communication and participation style is important. First, tracking and sharing physical activity achievements can provide an opportunity for young people to connect with their peers, opening them up to positive feedback and encouragement. However, the public nature of social technology also exposes young people to the risk of cyber bullying. Offering an optional private messaging feature or private section of social technology reserved for users with physical disabilities may prevent some risk. These features should be optional as to not restrict young
people with physical disabilities from opportunities to socialize with their typically developing peers. Second, this study also indicates that young people with physical disabilities would like to use social technology to raise awareness of their capacity for physical activity. To achieve this, social technologies must also allow options for inclusive and equitable participation for young people with and without physical disabilities. Equitable design can create a safe space for young people with physical disabilities to compete with others or strive for their personal best, depending on preference. Including an element of gaming or play can also enhance play opportunities with peers. Finally, young people’s relational security and belonging can be fostered through the emotional support of their peers, drawing similarities between themselves and the inspirational success stories of their peers’ participation in physical activities.

4.6.1 Implications for future social technology design

The following recommendations are made for future social technology intervention designs that facilitate the development of equitable opportunities and virtual environments that encourage self-determined physical activity participation.

1. Support autonomy
   - Offer a range of technologies to appeal to diverse preferences and interests.
   - Link technologies to each other to accommodate diverse preferences and maintain open communication between different technologies.
   - Create accessible interfaces and designs that can be operated with a high level of independence.

2. Support competence
   - Provide informational resources through readily available, easily accessible, and applicable content.
     - Make expert advice available to users.
   - Include modified options for physical activities and exercises that accommodate differing effort capacities and mobility levels and/or mobility devices (e.g. hands-free technology).
     - Consider smart technology design that learns users’ abilities over time and can make recommendations or modifications based on previous use.
     - Implement opportunities for intermittent encouragement en route to goal achievement.
3. **Support relatedness**
   - Consider inclusivity for all design features (e.g. advertising).
   - Provide options for tracking and posting physical activity achievements in public spaces.
   - Support a variety of competitive physical activity styles, encouraging play and enjoyment.
   - Provide private options for young people with physical disabilities only.
   - Supply ample opportunities for sharing stories, comments, posts, and discussions to facilitate inspiration and encouragement.

4.6.2 **Study considerations**

Most social technologies can be used either independently or together with other people. This study focused on the latter, which held varying value for different participants. This highlights the importance of flexible social technology design that can be tailored to suit the users’ needs. An important consideration is that the social technologies we chose to include in the design workshops influenced the feedback and experiences they chose to share with us. For example, one young man was frustrated with a fitness app we displayed because he was not capable of performing the app’s ‘beginner level’ physical activities. He found this discouraging and therefore made comments related to this experience during the group discussion. This comment inspired a conversation about modifiable technology to accommodate diverse abilities, which in turn shaped our findings. Another consideration is the homogeneity of the young people’s diagnoses in our sample. However, our sample was heterogeneous in every other sampling category, including mobility and manual ability. This should be considered as the applicability of these results is considered for other contexts. Another consideration was that one participant did not have the means to engage in social technology independently because of parental controls. This limited her ability to contribute to the design workshop and she shared that she had less interest in physical activity and social technology than what was expressed by the other young people. Five of the eight participants were originally recruited from a therapeutic physiotherapy group that uses social support to help motivate physical activity participation. This may have biased our sample towards viewing social technologies as supportive for physical activity. Our sample also may have been more interested in physical activity than the general population as a result of this recruitment strategy.
4.7 Conclusion

Social technology holds great promise for facilitating physical activity in young people with a range of abilities. Our findings revealed that adaptability is essential for encouraging intrinsic motivation for socially supported physical activity participation through the fulfillment of the three basic psychological needs defined by self-determination theory. Social technology may be the much-needed bridge to creating an equitable opportunities environment that capitalizes on needs- and preference-specific design. Some of the challenges experienced in the real world can be mitigated by the virtual world, opening up a new realm of possibilities in creating environments that are tailored to each individual and provide young people with physical disabilities the necessary support for physical activity participation.
Chapter 5

5 Creating supportive social environments for physical activity participation using tailored social technology design: Findings and recommendations

5.1 Introduction

This final chapter provides a summary of the key findings of this dissertation. We also present three hypothetical social technology intervention designs that incorporate the design recommendations identified in chapter 4 and facilitate supportive social environments as outlined in chapter 3. These hypothetical illustrations exemplify how this research contributes to the field and the implications this work has for future intervention design. We also review the considerations of this work and conclude the chapter with suggested directions for future research.

5.2 Summary of findings

This dissertation outlines how young people’s social environments and social networks can support physical activity participation, particularly through providing:

1) *Fair and equitable participation.* When young people lack socially supportive environments within which to participate in physical activity, it diminishes self-efficacy and enhances isolation. Environments that support fair and equitable participation can be achieved when accommodations are made to support young people with physical disabilities’ needs and abilities (e.g. by changing performance metrics associated with physical activity) and with significant change in the attitudes and approaches of typically developing peers (e.g. through educational programs).

2) *A sense of belonging through teamwork.* Emotional support through understanding and empathy can provide young people with a sense of belonging and thereby motivate them to participate in physical activity. Regardless of preference for competitive or cooperative engagement in physical activity, young people should be encouraged to pursue their personal best and create their own personal norms rather than comparing the success of their physical activity achievements to their peers.
(3) **Opportunities for interdependence.** *Interdependence* rather than *independence* leads to optimal functioning for young people with physical disabilities. Young people with physical disabilities can be supported by their social networks in their physical activity goal-setting through encouragement, sharing positive experiences, provision of resources, and freedom to make choices related to their participation in physical activity. Unobtrusive social support may have significant positive implications for young people with physical disabilities’ physical activity participation.

Both integrated & dedicated physical activity environments can have positive effects on young people with physical disabilities' participation, inclusion, and overall health and well-being. Therefore, we recommend that the focus be reallocated to promoting opportunities for equitable participation for young people with physical disabilities as described above.

We propose that social technologies can be used to promote equitable opportunities environments as outlined above by: 1) providing a virtual space for young people to explore and share their physical activity interests; 2) providing an avenue to access and share information regarding their physical activity goals and achievements; 3) supporting equitable participation using specialized technology design; 4) providing incentive for participation in physical activity through competition and play; and 5) removing barriers to participation in order to facilitate the growth of supportive relationships that inspire, understand and encourage.

Lastly, specific design considerations are suggested for the development of future social technologies that promote intrinsic motivation through feelings of autonomy, competence, and relatedness, in line with self-determination theory. These guidelines promote inclusive, tailored design that can support participation in physical activity for young people with physical disabilities.

### 5.3 Contributions and design implications

The contributions of the thesis are threefold:

- Increased understanding of what constitutes a socially supportive environment for promotion of physical activity as defined by young people with physical disabilities.
• Potential roles of social technologies in supporting physical activity as perceived by young people with physical disabilities

• Specific design recommendations for the design of social technologies to promote physical activity informed by young people with physical disabilities.

To illustrate how the new knowledge generated in this thesis could potentially be applied to the design of new social technologies to support young people with physical disabilities in meeting physical activity goals, the following three vignettes are presented. In section 5.3.1 to 5.3.3 italics are used to indicate the direct application of design recommendations.

5.3.1 Smart technology active video game

The objective of this “smart” active video game is to provide interest-specific, accommodated, and playful physical activity that young people both with and without physical disabilities can enjoy. This smart active video game includes sports games such as boxing or volleyball, alternative physical activities such as dance, and non-physical activities, for example, a spy game that requires an active criminal pursuit and the solving of clues. *The variety in game genre is intended to cater to young people’s diverse interests.* The active video game is motion sensor activated, *picking up on both the user and potential mobility devices, which are then integrated into the games.* For example, in the dance game, there are moves specially oriented to the use of canes, walkers, or wheelchairs.

*This “smart” active video game learns the abilities of the user over time,* for example, adjusting for balance requirements or upper or lower limb dominance. As the user continues to play, *the system makes recommendations on suitable games and strategies, tailored to the users’ abilities and needs.* The system also makes suggestions for how to strengthen certain abilities over time. For example, if the user is not able to play more than one game consecutively because of their endurance level, the system will suggest a game that requires less endurance and slowly help the player work towards games that require more endurance. The game also has customizable settings that are required to be filled out when the user creates their initial profile, such as difficulty level. These settings can be changed at any time. *The active video game’s high level of adaptability does not eliminate the challenge for users, but rather accommodates them so they can be challenged more optimally.*
Young people have several options for social play, including: independent play, play with a friend or family member in the same room, play online with peers who they know from school and the community, or play online with peers who they meet through the gaming system. This way young people with different social networks and social preferences are comfortably included. Young people also have the option to choose between multi-player cooperative or competitive games or single-player games.

The “smart” features of this active video game allow the young people to feel competent in their physical activity abilities, which leads to increased enjoyment of the activities. Through adapted play that accommodates the interests and abilities of all users, young people are not disadvantaged in their potential to contribute to an active social setting.

5.3.2 Yoga community blog

The purpose of this blog is to draw together a community of young people with varying abilities who share some interest in yoga. More specifically, this blog is a community blog, which is a blog set up so that multiple users can post on it. Both typically developing young people and young people with physical disabilities are welcome to participate on the blog, however there is a separate page that requires a private login reserved for participation from young people with physical disabilities. This option allows young people with physical disabilities to explore topics that cater to their unique challenges or successes in the presence of peers who can empathize with their experiences.

Yoga is the physical activity of choice for this blog as the nature of yoga makes it easily adaptable and it can accommodate diverse abilities as yoga can be practiced in standing, seated, supine, or prone positions. It is also an activity that emphasizes personal achievements and celebrates personal bests. Yoga is regularly practiced in groups, which has potential to promote a sense of belonging within community as young people approach challenges alongside each other.

One of the roles of this blog is to be an information resource that consolidates all information on yoga for young people with and without physical disabilities in one virtual location. Designated authors generate regular content for the blog that is informed by professional knowledge. Well-informed, regular blog posts provide a source of reliable information for young people. Young people are able to write and submit blog posts, but these posts are monitored and accepted by the
regular authors. This ensures the reliability and applicability of the information. Young people are also free to request relevant topics for posts authored by the main contributors. Some posts are created in video format to broaden the scope of impact to those who prefer to learn through listening or find videos more engaging. Videos are also posted showing registered yoga instructors demonstrating various poses. These poses are demonstrated in various postures that accommodate those who use mobility devices, experience difficulty with balance, or have other unique physical abilities that require accommodation. This blog also includes a feature where young people are able to submit questions to experts and receive educated advice according to their specific need and abilities.

This blog allows young people to build community and feel like they belong to a network of young people who share their interests and respect their diverse contributions. One section of the blog, entitled “testimonials”, is an open forum for young people to post their own stories about their experiences practicing yoga. Young people also use this forum to organize groups of young people to practice together and/or to share information on local classes. Other young people can respond to the posts with comments or questions in a discussion format. The blog authors monitor these discussion boards to ensure the content does not condone prejudice or discrimination. The testimonials and discussion boards are intended to empower young people through the sharing of mutual experience, to instill confidence through encouragement, and support camaraderie with peers.

This blog offers the option to sign up as an exclusive member in order to use the chat function on the site. The authors of the blog must approve members as a safety precaution as the chat function is not monitored. Members are required to create a profile when they join and they can choose to post this profile for other members to see. This is another method for creating social connections that can inspire greater participation. Profiles are also used to tailor advertisements and flag posts that may be of interest to the individual.

5.3.3 Heart rate monitor app

The goal of this app is to allow for equitable participation and fair competition in physical activities for young people with physical disabilities alongside their typically developing peers. This app can be used to compete with peers or it can be used to measure against one’s own achievements. Another purpose of this app is to help young people develop intrinsic motivation
to achieve their individual physical activity goals by providing social support in ways that are not always obviously apparent.

A unique feature of this app that plays a pivotal role in creating equitable participation experience for young people of all abilities is the method by which participation and performance are measured. *The app automatically uploads information from a heart rate monitor worn by the user and transfers that data to indicate light, moderate, or vigorous physical activity on a continuous scale. This information is the indicator by which physical activity achievements are measured.* By using a heart rate monitor, users with and without physical disabilities can participate competitively with each other. *Engagement in physical activity is tracked and individuals can use their data to compare their progress over time using progress charts.* Young people can also use this data to compete in different games against their friends. Avatars in the app are powered by real-time and tracked physical activity participation. Time spent being active can be used to purchase resources, power avatar energy levels, or gain special tools or abilities.

*Young people can share their progress by posting their physical activity levels or games completed on the app and/or other social media sites.* On the app, the young people can choose to share with friends only or with the public, depending on their privacy settings. *Sharing information is intended to inspire connection between peers and simultaneously increase the physical activity profile for young people with physical disabilities in the public eye.*

*This app also offers ideas for different physical activities or exercises the young people can engage in, including adapted versions of activities when necessary. These ideas are illustrated in step-by-step instructional photos and videos on the app.* Young people can flag illustrations or videos for future use or they can use the app’s calendar to assign activities to days of the week or month to create a weekly or monthly fitness plan. *Young people can request other users of the app to join their calendars or join certain events scheduled on their calendars.* They can also give or receive fitness challenges or set their own personal challenges using the app. Using these functions, young people are free to tailor their own fitness schedule and strategies. They are in control of the timing, location, intensity, and company they have when engaging in physical activity.
5.4 Considerations

The findings of this dissertation reflect the experiences and opinions of eleven young people with physical disabilities who were recruited from one urban pediatric rehabilitation hospital in Ontario, Canada. The young people were recruited from a Therapeutic Recreation and Life Skills program and a weekend physiotherapy group that supports participation in physical activity with peer and family support. Young people may have been sensitized to the topic of social networks as supportive for their participation in physical activity through their previous involvement in these programs. Although this was an asset for the depth of insight the young people were able to share on social environments, our sample represents a particular subset of the population of interest.

Ten of the eleven young people who participated in this research were diagnosed with cerebral palsy. The remaining participant had recently suffered from a spinal cord injury. We originally set out to purposively sample using a maximum variation sampling strategy. We intended to recruit a heterogeneous sample within the parameters of the inclusion criteria, specifically diverse in age, gender, diagnosis, mobility, manual ability, physical activity program participation, and technology usage. This sampling strategy was chosen to include varying perspectives on the role of social networks and social technology in promoting physical activity to achieve greater insight on the topic. Maximum variation sampling can evoke significant commonalities and patterns to be interpreted from a sample (140), leading to greater transferability of the study’s findings as it ensures that the sample is representative of the phenomenon of interest. However, although our sample was diverse on most of the criteria, it was not diverse in diagnosis, thereby limiting the transferability of our results to populations of diverse physical disabilities. This research still holds significant relevant implications for young people with physical disabilities age 12 to 18 of varying genders, mobility levels, manual ability levels, and interest in physical activity and social technology. These implications should not be restricted to young people with cerebral palsy, but should be considered in light of this.

Young people were also recruited depending on their ability to answer questions that required reflection and insight and their ability to communicate verbally using the English language. These criteria were included due to the timeline restrictions of this dissertation and the language abilities of the researchers. Recruiting young people who could communicate verbally may have
excluded young people who experience greater social isolation because of their use of communication aids. Young people who use communication aids may have great insight on the topic that differs from the young people who participated in this research. Social technology may also have particular relevance for young people who use communication aids as their primary way of communicating.

The concept of using social technology to promote physical activity through providing social support for young people with physical disabilities was introduced to the young people during the interviews in the first stage of the study. Examples of how social technologies could be designed and used in this way were also suggested. The co-constructive nature of interviews and workshops is a strength of this qualitative research methodology. However, it is possible that our suggestions and the social technologies we chose to demonstrate in the design workshops may have steered the results of our study in a favourable direction for this research.

During the design workshops, some participants did not speak up as much as other more talkative participants and therefore their opinions may not have been as well represented in the results. However, the rapport developed between the researcher and the young people during the interview stage of the study helped to support their involvement in the workshop. For example, one participant did not naturally join the discussion, but instead needed more time to formulate her response. The researcher requested at intervals that the other members of the discussion group pause to hear her response. Overall, the researcher helped to mediate the discussions, supporting each participant to make them feel comfortable within the group so that their opinions and experiences were heard by the group and were represented in the results.

Another consideration of this research is the lack of theory initially proposed to frame the work. As this work was explorative, frameworks and theories were found to be applicable for the study throughout the process of data collection and analysis instead. Specifically, LaGreca’s theory of social support was used to help define the role of the social environment in the first stage of this research and self-determination theory was applied to the results of the second stage of this research (85-87). In both cases, as we engaged in analysis and began to articulate our themes, we discovered that the way we interpreted the participant’s definition of the social environment aligned with LaGreca’s theory of social support and our interpretation of the roles of social
technologies to motivate physical activity aligned with self-determination theory. We then were able to use these theories to further inform our analysis.

Finally, it is important to interpret the findings of this study with an acknowledgment of the assumptions of self-determination theory. For example, self-determination theory assumes that autonomy, competence, and relatedness are *universal* psychological needs. There has been much debate in the scholarly field around the cross-cultural relevance of autonomy, especially to Eastern cultures. The critique is that Eastern cultures subscribe to a more collective, harmonious social system, whereas Western cultures, within which this theory was founded, emphasize independence and individualism (141,142). However, the concept of autonomy is often misinterpreted to mean independence rather than its intended meaning: freedom to choose to engage in activities that are interesting, fulfilling, and challenging (130). Furthermore, in order to support autonomy, it is necessary that individuals feel a strong sense of meaningful connection with others (130), highlighting that self-determination theory does not endorse individualism, but rather a social support system that may very well be transferable to a variety of cultures (143).

This research was conducted within a Western culture by researchers who have been educated by and currently live in Western societies. However, the participants in this study were highly diverse in ethnicity and live in a culturally diverse, metropolitan city. Therefore, the question of universality of self-determination theory’s psychological needs has significant relevance to the findings of this work. Future research directly related to technology-supported social networks to promote physical activity participation is needed as most research conducted to investigate the theory’s cross-cultural relevance is in the field of education.

In Chapter 3, we discuss the participants’ perspectives on the social change required to support equitable participation in physical activity. We briefly discuss how these findings align with the social model of disability—that young people with physical disabilities’ participation in physical activity can be facilitated by a change in attitudinal barriers such as prejudice and discrimination. This interpretation puts a great level of responsibility on the society within which these young people are situated. Alternatively, self-determination theory emphasizes the role of intrinsic motivation to engage in activities (e.g. health behaviours such as physical activity), implying personal responsibility, thereby revealing an apparent underlying tension between the social model of disability referred to in Chapter 3 and self-determination theory used as a framework in Chapter 4. We argue that intrinsic motivation is not something that an individual can conjure out
of free will, but that they must be supported by their familial and societal social supports (130). Although these two theories have significantly different histories and applications, they can be harmoniously married to support equitable physical activity participation for young people with physical disabilities.

5.5 Directions for future research

Our findings suggest several ways that social environments can support physical activity participation. One proposed strategy is the use of social technology. Further study of this topic with young people with a variety of experiences with social support and social technology would further enrich our understanding. For example, a population of interest may include young people involved in AbilityOnline, a community that operates using technology (a website) as a resource to enhance social support for young people with disabilities. Young people involved with this program are likely to have unique experiential knowledge and opinions specifically related to the aims of the study, with particular emphasis on social technology. Insights from these young people would provide an enhanced opportunity for rich, meaningful data. It may also be beneficial to investigate our research questions with a sample of young people who are specifically lacking in social support. Although young people with limited social supports may be more difficult to recruit, they are also a population that could potentially benefit the most from an intervention that uses social technology to support physical activity through social networks as they may have less access to physical activity programs.

This study focused on young people who were able to walk with or without the use of handheld mobility devices and who were able to handle objects such as a computer mouse or handheld controller with some level of independence. These inclusion criteria were set in order to narrow the scope for potential social technology design strategies. However, young people who are unable to walk or who perform manual tasks with continuous support, adaptation, and/or assistance may have an increased need for social support and could benefit significantly from social technologies to help increase their physical activity participation. Further research is required to investigate the unique needs and interests of these populations.

Young people in this study shared several insights into how they want to socialize and participate in physical activity alongside their typically developing peers. However, further examination of what typically developing young people think and believe about peers with physical disabilities
and the factors they perceive to determine fair and equitable physical activity environments could aid in the creation of more inclusive environments for young people of all abilities. Additional information could be gained by exploring the same research questions with a sample of typically developing young people, as the findings in this study may be similar to typically developing populations’ experiences, but amplified with young people with physical disabilities.

One advantage to using social technology that the young people in this study identified was its potential to give them a platform to bring awareness to the abilities of young people with physical disabilities. Future research should explore young people’s perspectives on using social technology as an advocacy tool. This is a feasible strategy for reaching broader communities of peers and making social and cultural change in larger social networks.

This dissertation focused specifically on the social environment and its role in promoting physical activity participation for young people with physical disabilities. The barriers and facilitators for social support and physical activity participation within the physical environment as well as the intrapersonal factors have been extensively researched. The focus of this dissertation on the social environment was not intended to ignore the interactional importance of either the physical environment or the intrapersonal factors in the social and physical health and well-being for young people with physical disabilities, but rather to fill a gap in the current literature. However, these areas should be considered in future research and the implementation of the current findings, such as the design of social technologies and other physical activity promotion program and intervention designs.

Further investigation is needed into the role of social technologies that promote cooperative participation in physical activity. In the individual interviews, young people shared the importance of working together with other young people to achieve their physical activity goals. However, in the design workshops, cooperation was a less significant theme. There is published research that supports the value of social technology to create cooperative environments for young people with physical disabilities (111), and would therefore be an important area for further exploration for the design of social technology interventions.

This research has significant implications for future social technology design for young people with physical disabilities. This study required young people to use their imaginations to envision what they would find supportive in social technologies to encourage their participation in
physical activity. Interventions can be designed, produced, implemented and evaluated using the guidelines and suggestions from this work. Future research that employs young people with physical disabilities as design partners is required to create and evaluate effective interventions.

5.6 Conclusion

This dissertation contributes an in-depth understanding of the role that social networks and social environments play in promoting and sustaining physical activity for young people with physical disabilities. The social environment is highly influential for young people with physical disabilities’ health and well-being and can positively impact their participation in physical activity through providing fair and equitable opportunities, a sense of belonging through teamwork, and opportunities to explore interdependence. We recommend the use of social technologies as an innovative way to create equitable opportunity environments that satisfy these requirements for supportive social environments. Social technology can foster intrinsic motivation for participation in physical activity through the fulfillment of three basic psychological needs within self-determination theory: autonomy, competence, and relatedness. To achieve this, we propose that social technology interventions adhere to the detailed design recommendations made in this dissertation that fall under the following categories: appeal to diverse preferences and interests, provide informational support, consider equitable technology design, support motivation through competition and play, and provide camaraderie and emotional support. We have illustrated this using hypothetical intervention design examples that demonstrate how social technologies could be designed to provide equitable opportunity, supportive, social environments. This dissertation suggests that one of the strengths of social technologies that make it a feasible and powerful strategy for developing supportive social environments is the potential for adaptability and personal tailoring to individual preferences and needs. More broadly, our findings support the value of young people with physical disabilities’ perspectives in the design of their immediate environments and the importance of tailoring these environments to the individual.
References


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Appendices
**Appendix A.** Existing social technologies designed for typically developing young people and application for young people with physical disabilities (when available)

<table>
<thead>
<tr>
<th>Social Technology</th>
<th>Description</th>
<th>Benefits</th>
<th>Limitations</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active video games (AVG)</td>
<td>Video games that include some degree of physical activity</td>
<td>- Low cost, accessible (e.g. in the home, available during all seasons), enjoyable (43,144)</td>
<td>- For children with physical disabilities, AVGs and exergames focus on therapeutic effectiveness (e.g. motion (149) and balance (43,150))</td>
<td>- “Slow Fun” Catching Dishes game (138) - Purpose: To motivate young people diagnosed with cerebral palsy to slowly stretch to reach virtual dishes; helps with spasticity</td>
</tr>
<tr>
<td>&amp; exergames</td>
<td></td>
<td>- Self motivated and increase self-efficacy (145) and self-esteem (146)</td>
<td>- Existing games are designed for typically developing children and are not designed for maximum impact or enjoyment for children with disabilities</td>
<td>- The Liberi Exergame (111,124,125) - Purpose: To motivate young people to participate in physical activity and socialize with friends simultaneously using a stationary bike and game controller</td>
</tr>
<tr>
<td>Web</td>
<td>Personally tailored web-based social networking sites</td>
<td>- Makes information and interventions personally relevant to the user (151)</td>
<td>- Systematic review of interventions using the Internet, e-mail, or text messaging revealed only short term results for typically developing young people (&lt;3 months) (119)</td>
<td>- Weigh2Rock (<a href="http://www.weigh2rock.com">www.weigh2rock.com</a>) - Purpose: To provide social contact and education about fitness, weight management, and health by providing goal setting assistance, weight loss charts, contact information for health care professionals, chat rooms, boards, personal stories</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Can tailor interventions to suit preferences of child/youth (e.g. using text, sound, video, etc.)</td>
<td>- Unknown how effective these programs are for young people with physical disabilities</td>
<td>- Email intervention (18) - Purpose: To promote physical activity and healthy eating behaviour among typically developing young people through pedometers and e-mail support</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Personally tailored (e.g. aware of child’s weight status, physical activity self-efficacy, physical activity barriers, etc.)</td>
<td>- Resource intensive</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Accessible, engaging, immediate feedback</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile technology</td>
<td>Cell phones; text messaging</td>
<td>- Readily available</td>
<td>- Limited complexity</td>
<td>- Accelerometers &amp; cell phones - Purpose: account for time spent in physical activity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Easily modifiable</td>
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| Toys (120) | Designed to mutually encourage social interaction and physical activity | - Entertaining and attention-grabbing  
- Respond with visual or sensational feedback to users to help motivate activity  
- Users create rules to play games with toys  
- Open-ended concept inspires creativity and collaboration | - Intended for young children  
- Children must be geographically proximate | - “Feedback” - Purpose: Help children improve skills or encourage competition; A ball with an accelerometer and tilt sensor for children to throw or kick; Ball gives feedback on quality of pass  
- “Battle Bot” - Purpose: Inspire competition, flexibility, and movement; A car-like object that drives by following player’s movements while “shooting” at other battle bots with laser beams while hiding, seeking, & hunting |
Appendix B. Interview guide

“Thank you for talking to me today. There are two terms that I will use a lot in this discussion, and I want to make sure you understand what I mean by them before we get started. The first is ‘physical activity’. Physical activity is any play, game, sport or exercise that gets you moving, breathing harder, and your heart beating faster. The other term is ‘social technology’. Social technologies are any technologies that are used to talk to friends or family and share play, information, ideas, personal messages, and other content (e.g. photos, videos)’ (Prasad, 2013). Do you have any questions about what physical activity or social technology mean? We would like to hear about your experiences doing physical activity and things that make you want to do physical activity or make you not want to do physical activity. We would like to hear about who you like to do those activities with. We would also like to hear about your experiences using social technology. Finally, we want to know what you think about using social technology to help you be do more physical activity. I would like to record our conversation so that I don’t forget anything you say. We won’t tell anyone what you said who is not part of this study. No one else will know you took part.”

NOTE: Questions are just a guide and will be adapted depending upon the child’s development and cognitive ability.

Can you tell me a little bit about yourself? What types of activities do you like to do? Who do you usually do them with? Prompts: alone, friends, family

Can you share with me some of your personal goals? Prompts: physical activity, social

What things prevent you from being more physically active?

What helps motivate you to be physically active? Do you have any strategies that help you to be active?

Who do you spend most of your time with? What do you usually do together?
Can you share with me any experiences you have with doing physical activity with other people? Prompts: At school, with a friend. What did you enjoy or what didn’t you enjoy about those experiences? Would you like to have more opportunities to do physical activity with your friends? Why or why not?

Would you want to have a friend or family member help you to reach your physical activity goals? Why? Why not? How do your relationships help you reach these goals?

What are your experiences with using social technology? Prompts: e-mail, cell phones, online SNS (i.e. Twitter, Facebook, YouTube, etc.), gaming

What do you think about using social technology to help you reach your physical activity goals? Prompts: For example, an online group of friends, an active video game like Nintendo Wii or Xbox Kinect where you can play with other people, cell phones to keep track of yours and your friends activity levels, etc.
Appendix C. Design workshop discussion group guide

Introduction guide.

“Today we want to talk about a new idea. But before we get started, there are two terms that I will use a lot today, and I want to make sure you understand what I mean by them before we get started. The first is ‘physical activity’. Physical activity is any play, game, sport or exercise that gets you moving, breathing harder, and your heart beating faster. The other term is ‘social technology’. Social technologies are any technologies that are used to talk to friends or family and share play, information, ideas, personal messages, and other content (e.g. photos, videos).”

The new idea we want to talk about is that technology can be used to help youth like you to be more physically active through technology-assisted social support. We have had some youth tell us this is an idea that they want to explore. Today we want you to imagine how we can make this happen. We want to hear from you what is important and what isn’t important for designing a technology that can provide social contact and support as well as help youth like you to be active. We want you to be our partners in designing this technology. There are no right or wrong answers today. This isn’t a test. If you do not think it is a good or bad idea to use technology to be more social and more physically active, we want to know! Everyone’s opinions are very helpful and important. Your ideas will help other youth like you. We will video and audio record our activities and talk today so that we can remember and review everything you tell us. Does anyone have any questions before we start? (Wait for questions before moving on) Is everyone ready?”

Through talking to some youth we learned that using social technology to help youth like you be more physically active is an idea that you might want to explore. Before we start, I want to share with you some of the ideas that we were told about (presented on cards):

- Distract you from exercise, making physical activity more fun!
- Hang out with your friends and do physical activity at the same time
- Help make physical activity more exciting and less scary
- Connect you to other youth with similar disabilities who also want to be active
- Set goals and keep track of when you accomplish them
- Learn more about physical activities that suit your body and abilities
- Share what you know about physical activity with your friends
- Share your achievements and encourage other people to do their best

Some of the technologies you’ll use might not be fully accessible. But I want you to imagine that any technology or any idea you have today can be made to be fully suitable for your body and your needs.

**Discussion guide.**

This time is meant to discuss any ideas you have for new technologies or changes to already existing technology that you think are important for achieving greater social relationships and physical activity. Everyone’s ideas and opinions are important. This is a space without judgment. Try to say everything that comes to your mind, even if it does not seem to be relevant or important. Sometimes the ideas that don’t seem so important can help trigger another even greater idea. Feel free to dream big and outside of the box.

Before we get started…apply stickers to top three favourite technologies that you could see using in your life (don’t have to do three, but no more than three).

How do you think your online social networks can help you reach your physical activity goals? Prompts: Competition, encouragement to achieve personal best, goal setting around improvement or time spent active, draw on common interests [reference to particular technologies]

How do you see the role of competition or cooperation in this new technology? How would this affect your relationships?

[lead in to this... more general question] How hard do you want the technology and your social networks to push you? Prompts: Light, moderate, vigorous; At what point would you get frustrated if people were too involved/pushy or you got too sweaty for example?
What acknowledgment do you want to receive for physical activity participation? How do you want to receive acknowledgment? Prompts: Immediate or delayed conversation, chats or blogs, sharing pictures for people to look at later, etc.

Who do you want to communicate with using the technology? Prompts: Family, friends; How do you want to communicate? Prompts: teleconferencing, roleplaying video games

How can the technology make physical activity more fun? How can the technology distract you from the fact that you are getting exercise?

What will help you to keep active and keep using the technology for a long time? Prompts: Regular vs. irregular use, novelty (e.g. routine updates), achieve new levels, etc.

How should this technology be designed so it is accessible and disability-oriented?

Are there any other ideas that you have for a technology that will help you receive the support and friendship you want and to be physically active?

Do you have anything else to share?