THE EFFECTS OF AN AFTER SCHOOL PROGRAM ON LEISURE TIME PHYSICAL ACTIVITY BEHAVIOR OF ADOLESCENTS WITH VISUAL IMPAIRMENTS

DISSERTATION

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the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

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The Ohio State University
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ABSTRACT

The purpose of this study was to examine the effects of an after school physical activity program on the duration and intensity of leisure time physical activity behavior within social cognitive theory in adolescents with visual impairments. Four adolescents with visual impairments attending a Midwestern residential school for the blind served as participants. The study implemented a range bound changing criterion design and physical activity behavior was measured through the use of ActiGraph GT1M accelerometers. In addition to physical activity, questionnaires were used to collect data (i.e., change scores) on selected social cognitive theory constructs. Data were analyzed through visual analysis and descriptive statistics. Results showed that the intervention exerted functional control over the target behavior (i.e., time spent in a bout of leisure time physical activity). In addition, changes in time spent in total leisure time physical activity suggest that the intervention had positive effects on participants’ physical activity behavior. Similarly, changes in scores for selected social cognitive constructs, in particular for outcome expectancy value, may suggest a positive relationship between those constructs and physical activity behavior. With the paucity of physical activity research among youth with visual impairments and the continuous national efforts to promote physical activity among children and adolescents with disabilities, additional physical activity intervention research is warranted.
Dedicated to my family, to my adviser, and to those who directly or indirectly helped me become the professional I am today.
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CHAPTER 1

INTRODUCTION

The benefits of physical activity on physical and psychological health have been well
documented (Bauman, 2004; Bouchard, Shephard, & Stephens, 1993; Dunn, Madhukar,
& O’Neal, 2001; Sallis & Owen, 1999; United States Department of Health & Human
Services [USDHHS], 1996). Given the numerous health benefits associated with physical
activity participation (e.g., weight control, reduce risk for cardiovascular disease, reduce
risk for type 2 diabetes, improve mental health, reduce risk for some forms of cancer),
various guidelines for the amount and intensity of physical activity recommended to
achieve health outcomes among adults have been published (e.g., Haskell et al., 2007;
Pate et al., 1995). The American College of Sports Medicine and the American Heart
Association have recommended that healthy adults (i.e., 18 to 65) engage in moderate-intensity
physical activity for at least 30 minutes or more on five days each week or
vigorous-intensity physical activity for at least 20 minutes or more on three days per
week (Haskell et al., 2007). These recommendations have been adopted by the Healthy
People 2010 national health objectives for adults and adolescents (USDHHS, 2000).
Similar, guidelines have been published for children and adolescents (e.g., Corbin &
Pangrazi, 2003; Sallis & Patrick, 1994; Strong et al., 2005). The United States
Department of Agriculture (USDA) in collaboration with the United States Department of Health and Human Services (2005) has recommended that children and adolescents engage in at least 60 minutes of physical activity on most, but preferably all, days of the week as part of the dietary guidelines for Americans. Unfortunately, despite this evidence, a large portion of the non-institutionalized (i.e., not in the care of an institution such as a hospital or prison) population in the United States (U.S.) remains physically inactive (Centers for Disease Control and Prevention [CDC], 2001; Sapkota, Bowles, Ham, & Kohl, 2005).

Sapkota et al. (2005) used data from the Behavioral Risk Factor Surveillance System (BRFSS) surveys for 2001 and 2003 and reported that more than half of U.S. adults (54.1%) did not participate in recommended levels of physical activity to achieve health benefits. In addition, data from the Youth Risk Behavior Surveillance System (YRBSS) for 2005 revealed that only 35.8% of youth grades 9 to 12 have been physically active at recommended levels (CDC, 2006). While these trends are of concern for the general public, the situation for individuals with disabilities is even more troubling (Cooper et al., 1999; Rimmer, Braddock, & Pitetti, 1996; Rose, McDonnell, & Ellis, 2007). Of significance are the physical activity and health disparities observed between individuals with and without disabilities (USDHHS, 2000).

Compared to adults without disabilities, adults with disabilities have been demonstrated to be less physically active and have a higher prevalence of being overweight and obesity (Durstine et al., 2000; Frey, 2004; Health & Fentem, 1997; Kinne, Patrick, & Maher, 1999; Messent, Cooke, & Long, 1998; Temple & Walkley, 2003; USDHHS, 2000). Rimmer, Wolf, Armour, and Sinclair (2007) compared adults
with and without disabilities using data from the 2005 Behavioral Risk Factor
Surveillance System (BRFSS) and found that there were fewer adults with disabilities
who met recommended physical activity guidelines than adults without disabilities
(37.7% and 49.4%, respectively) and that there was a larger number of adults with
disabilities who were considered inactive compared to adults without disabilities (25.6%
and 12.8%, respectively). Data obtained from the Healthy People 2010 database revealed
that 53% of adults with disabilities do not engage in leisure time physical activity
compared to 36% of adults without disabilities (CDC, 2008). These data represent a
significant disparity on physical activity participation between people with and without
disabilities (USDHHS, 2000), which has placed individuals with disabilities at greater
risk for secondary health conditions related to physical inactivity (Kinne, Patrick, &
Lochner Doyle, 2004; Rimmer, 1999; Rimmer & Braddock, 2002). Weil and colleagues
(2002) associated physical inactivity with a higher prevalence of obesity among adults
with disabilities. Pooling data from the 1994-1995 National Health Interview Survey
(NHIS), the 1994-1995 Disability Supplement (NHIS-D), and the 1995 Healthy People
2000 Supplement, obesity was found to be more prevalent among adults with disabilities
(24.9%) compared to adults without disabilities (15.1%).

Similar to their adult counterparts, children and adolescents with disabilities tend to be
less physically active, less physically fit, and have higher prevalence of being
overweight/obesity than their peers without disabilities (Hogan, McLellan, & Bauman,
2000; Kozub & Oh, 2004; Longmuir & Bar-Or, 1994, 2000; Rosser-Sandt & Frey, 2005;
Steele et al., 1996; Suzuki et al., 1991; Whitt-Glover, O’Neill, & Stettler, 2006). Rimmer,
Rowland, and Yamaki (2007), in a secondary analysis of data from the 2005 YRBSS,
indicated a greater prevalence of overweight among adolescents with disabilities (16.7%) compared to age-matched adolescents without disabilities (12.8%). The need for individuals with disabilities to be physically active is even more important based on the paucity of research on physical activity interventions (Heller, Hsieh, & Rimmer, 2004; Taylor, Baranowski, & Rohm Young, 1998) and the lack of physical activity guidelines and recommendations for this subgroup of the U.S. population (Cooper et al., 1999).

A number of researchers have advocated for major attention to the health promotion needs of individuals with disabilities (Cooper et al., 1999; Hogan et al., 2000; Rimmer, 1999; Rimmer & Braddock, 2002; Steele et al., 1996), in particular the need to increase physical activity (Cooper et al., 1999; Durstine et al., 2000; Rimmer, Braddock, & Pitetti, 1996). To that end, the Healthy People 2010 (USDHHS, 2000) national objectives have been established to improve the health and wellness of individuals with disabilities. They include: (a) promoting health, (b) increasing physical activity, (c) reducing overweight and obesity, and (d) reducing health disparities between individuals with and without disabilities.

Adolescence is an important developmental period for developing and promoting health behaviors leading to quality of life among individuals with disabilities (Rimmer et al., 2007). More importantly, physical activity behaviors adopted early in life may continue into adulthood (Malina, 1996, 2001; USDHHS, 2000). Unfortunately, physical activity rates decline with age, and this decline has also been observed among children and youth with disabilities (Caspersen, Pereira, & Curran, 1999; Kozub, 2006; Kozub & Oh, 2004; Longmuir & Bar-Or, 2000; Pan & Frey, 2006; Rosser-Sandt & Frey, 2005; Sallis, Prochaska, & Taylor, 2000; Troiano et al., 2008). Increasing physical activity rates
during adolescence may be an important link to extending life expectancy, preventing disease, and delaying the onset of health-related conditions.

*Physical Activity and Health Promotion for Children and Youth with Disabilities*

Hogan, McLellan, and Bauman (2000) as well as Steele and colleagues (1996) have advocated for greater health promotion programs (e.g., physical activity, obesity prevention) among children and adolescents with disabilities. A paucity of research has been conducted on physical activity levels among individuals with disabilities (Rimmer et al., 1996). After a comprehensive literature review, Taylor and colleagues (1998) reported only four physical activity intervention studies targeting individuals with disabilities (i.e., low-back pain, cystic fibrosis, knee osteoarthritis, and chronic obstructive pulmonary disease). Only one of the four studies used children as participants. Taylor et al. (1998) commented that most of the interventions focused on exercise training and physical adaptations to exercise rather than leisure and/or lifelong physical activity.

To that end, Rimmer and colleagues (1996) suggested that future research on physical activity participation for individuals with disabilities should focus on identifying determinants (i.e., correlates) of physical activity among different subgroups of individuals with disabilities. In addition, Cooper and colleagues (1999) published a consensus statement advocating for research on physical activity and health for individuals with disabilities in which several research priorities were identified. Of special attention was the need for identifying physical activity determinants and physical activity patterns among specific groups of individuals with disabilities (Cooper et al., 1999; Rimmer et al., 1996).
Children and Youth with Visual Impairments: Physical Activity Needs

It has been documented that children with visual impairments can exhibit delays in their motor development, particularly those who are totally blind (Brambring, 2006, 2007; Heward, 2009). Due to the lack of visual input during early stages of development, these children may show marked delays in posture (e.g., trunk control, sitting, and standing), hand-eye coordination, spatial awareness, balance, and in developing self-initiated movements (Auxter, Pyfer, & Huettig, 2001; Bouchard & Tétrault, 2000; Houwen, Visscher, Lemmink, & Hartman, 2008; Sleeuwenhoek, Boter, & Vermeer, 1995; Snell, 1997). Snell (1997) suggests that an infant’s desire to reach and explore his/her surroundings is the primary motivator that eventually leads to gross motor development. The lack of this primary motivation is often times demonstrated as a fear and/or cautiousness to move and can negatively affect motor development (Ray, Horvat, Williams & Blasch, 2007; Sleeuwenhoek et al., 1995).

The lack of opportunities to explore and experience the environment (Craft & Lieberman, 2000; Lieberman & Houston-Wilson, 1999) as well as overprotection from parents and teachers (Lieberman & Houston-Wilson, 1999; Skaggs & Cooper, 1996; Sleeuwenhoek et al., 1995) may also become serious motor development inhibitors. Furthermore, children with visual impairments tend not to be provided with the same opportunities to participate in physical education or physical activities as their sighted peers; as a consequence, these children may not receive the benefits of being physically active (Lieberman & Houston-Wilson, 1999; Schneekloth, 1989; Sherrill, 1998).

Issues with motor functioning among youth with visual impairments become even more significant due to the associations between fundamental motor skills and habitual
physical activity among children and adolescents (Fisher et al., 2005; Okely, Booth, & Patterson, 2001). Recent evidence has indicated that children with visual impairments who engage in sports and physical activity tend to exhibit higher motor skill functioning than those who do not (Houwen, Visscher, Hartman, & Lemmink, 2007). As such, increasing physical activity participation may be significantly important for youth with visual impairments as reduced physical activity participation coupled with motor delays among children and adolescents with visual impairments may likely lead to higher risks for poor health and sedentary lifestyles (Houwen et al., 2007; O’Connell, Lieberman, & Petersen, 2006; Ray et al., 2007; Stuart, Lieberman, & Hand, 2006).

Children and adolescents with visual impairments are among the most sedentary groups of all individuals with disabilities (Longmuir & Bar-Or, 2000). And, when compared to children without disabilities, children and youth with visual impairments have demonstrated lower levels of physical fitness (Blessing, McCrimmon, Stovall, & Williford, 1993; Kobberling, Jankowski, & Leger, 1991; Lieberman & McHugh, 2001; Meek & Maguire, 1996; Seelye, 1983; Short & Winnick, 1986; Titlow & Ishee, 1986), lower levels of physical activity, and experience more perceived physical activity participation barriers (Longmuir & Bar-Or, 1994, 2000). Children and adolescents with visual impairments do not engage in sufficient physical activity to meet national recommendations (Kozub, 2006). In addition, when compared to children and adolescents without disabilities, youth with visual impairments tend to be less physically active, perceive more barriers to participation in physical activity, and exhibit more sedentary behaviors (Kozub & Oh, 2004; Suzuki et al., 1991). The same has been
observed when they have been compared to youth with hearing impairments or chronic medical conditions (Longmuir & Bar-Or, 1994, 2000).

There is also an age-related trend in physical activity participation where physical activity among children and youth with visual impairments decreases with age (Kozub, 2006; Kozub & Oh, 2004; Longmuir & Bar-Or, 2000). Capella-McDonnell (2007) argued that little appears to have been done to address the lack of physical activity and the increasingly sedentary lifestyles among these learners. Therefore, children and adolescents with visual impairments may be in as much or even greater need for intervention strategies to promote physical activity participation than youth without disabilities (Longmuir & Bar-Or, 2000).

*Schools and Physical Activity*

It is during school-age years that interest, skills, and confidence in physical activity is established (Strong et al., 2005). As such, schools have been identified as the place in which students may achieve recommended guidelines for physical activity (Strong et al., 2005). In fact, most children spend a significant portion of their weekly waking hours attending school (Dale, Corbin, & Dale, 2000; Fox, Cooper, & McKenna, 2004; Gazmararian & Oster, 2005). Second to homes, children and youth spend most of their time in schools (USDHHS, 2000; Ward, Saunders, & Pate, 2007). Data from the National Center for Education Statistics (NCES) revealed that over 49 million children (69.9% in pre-kindergarten to 8th grade) and adolescents (30.1% 9th to 12th grade) were enrolled in public elementary and secondary schools for the 2005-2006 school year (Sable & Garofano, 2007). The same federal agency reported that approximately 6,713,000 students with disabilities were enrolled in public schools, almost 13.8% of the student
population in U.S. public schools (United States Department of Education and NCES, 2007). If we think in terms of reach and impact, schools reach the majority of children and adolescents in the U.S. (USDHHS, 2000) and schools have trained personnel (i.e., physical education teachers, health educators) and physical facilities (Gazmararian & Oster, 2005) to provide opportunities to increase physical activity behaviors (Burgeson, Wechsler, Brener, Young, & Spain, 2001; Cale, 2000) and promote participation outside of school (Burgeson et al., 2001; Simons-Morton, Taylor, Snider, & Huang, 1993). In addition, physical education has traditionally been the school’s response to public health concerns (Fairclough & Stratton, 2005; Fox et al., 2004; McKenzie, 2001a; Sallis & Owen, 1999; Trost, 2006; Ward et al., 2007).

For children and adolescents with visual impairments, residential facilities (e.g., schools for the blind and visually impaired) may provide safe and accessible opportunities for engaging in physical activity, and participating in programs tailored to their needs (Kozub, 2006; Kozub & Oh, 2004). However, there is evidence to suggest that even when after school on-site programming has been made available and accessible to students with visual impairments, they tended to engage in moderate to vigorous physical activity (MVPA) levels below recommended levels and select inactive options to spend their leisure time, whether they were full-time residential or part time day students (Kozub, 2006; Kozub & Oh, 2004).

**Theoretical Framework and Purpose**

Biddle and Nigg (2000) argued that studying theory is an important first step to understanding and promoting physical activity and exercise. In order to develop or implement effective physical activity interventions for adolescents, it is important for
interventions to be based on theoretical models that have evidence supporting their adequacy in explaining and predicting physical activity among the group of interest (Baranowski, Anderson, & Carmack, 1998; Rovniak, Anderson, Winett, & Stephens, 2002). Social Cognitive Theory [SCT] (Bandura, 1989) has been one of the most widely used theories to design physical activity interventions and to explain physical activity behavior change among youth and adults (Biddle & Nigg, 2000; Cole, Waldrop, D’Auria, & Garner, 2006; USDHHS, 1996; Ward et al., 2007), and serves as the theoretical framework for this study. Particular attention to this theory may be a product of the proposed model of causation in which the theory was founded. Bandura’s (1989) SCT proposes a model of reciprocal causation known as triadic reciprocal determinism in which behavioral, cognitive/personal, and environmental factors affect one another (Baranowski, Perry, & Parcel, 2002). Ward et al. (2007) indicated that reciprocal determinism becomes useful in helping researchers understand the nature of physical activity among adolescents. A person’s experiences, current behavioral repertoire, and the context in which physical activity may be performed, may enhance understanding of what affects physical activity behavior and how to produce behavior change. However, even when all factors influence each other in this triadic reciprocality, it does not mean they all influence behavior to the same degree, nor at the same time (Bandura, 1989).

In many instances researchers have used SCT based on the triadic reciprocity concept. However, they have failed to fully use the theory which has led to inadequately designed interventions (Baranowski et al., 1998). Social Cognitive Theory (Bandura, 1989) goes beyond the triadic reciprocity to explain how behavior change occurs, suggesting that behavior change and maintenance are functions of a person's self efficacy.
In addition, outcome expectations stem from the beliefs about the relationship between the behavior and the outcome (Bandura, 1989, 2004). An individual's self efficacy will affect the effort placed on a task as well as the amount of time spent attempting to complete challenging tasks or when facing obstacles (Bandura, 2004).

In this study, a physical activity program based on an already existing program known as the *Plan for Exercise, Plan for Health* (Stevens, Mowad, Petosa, & Hortz, 2006) was used relative to the SCT constructs of self-efficacy for barriers, outcome expectancy value, social support, and self-regulation, with the expectation that positive changes in the constructs will lead to positive changes in leisure time physical activity. That is, the intervention was designed to positively change SCT constructs among the participants which would then lead to a positive change in physical activity behavior. It has been suggested that physical activity interventions work through mediating variables that are drawn from the theory (Baranowski et al., 1998; Baranowski & Jago, 2005; Bauman et al., 2002; Calderon & Varnes, 2001). Calderon and Varnes (2001) indicated that when interventions are designed to produce changes in potential mediating variables that they in turn, lead to changes in physical activity behavior. Thus, researchers can more strongly link physical activity behavior change back to behavioral theory.

In this study, changes in physical activity behavior were expected to be a result of changes in: (a) participants’ confidence to overcome barriers (i.e., self-efficacy), (b) their outcome expectancy value for changing physical activity behavior, (c) their ability to engage in physical activity, and (d) their enhanced social support, coupled with changes in self-regulation skills.
Statement of the Problem

Adolescents with visual impairments may be in greater need for intervention strategies to promote health and physical activity participation (Longmuir & Bar-Or, 2000), and specialized schools serving these students may play a central role in the provision of opportunities to engage in physical activity and positive health behaviors (Kozub & Oh, 2004; Kozub, 2006). Unfortunately, there is a lack of evidence for appropriate interventions promoting physical activity and health behavior among individuals with visual impairments, especially for adolescents (Kozub & Oh, 2004; Longmuir & Bar-Or, 1994, 2000). For these individuals, based on the relationship between age and reduced physical activity levels, there is a need for implementing physical activity programs designed to combat lower physical activity levels and to increase health behaviors that may be carried on into young adulthood (Crews & Campbell, 2001; Kozub & Oh, 2004; Longmuir & Bar-Or, 2000; Skaggs & Hopper, 1996). These adolescents are often more sedentary during their free time than their typically developing peers (Annie Tolle, physical education teacher at a school for the blind, personal communication, February 8th, 2008). Rose et al. (2007) maintain that adolescents with disabilities do not have the necessary skills or opportunities to seek and participate in physical activity during their free time. The need for implementing physical activity interventions to promote leisure time physical activity is warranted for these individuals who will soon transition from being in school to the community (Rose et al., 2007).
Purpose of Study

The purpose of this study was to assess the effect of a theory-based physical activity intervention on duration and intensity of daily after-school leisure time physical activity among adolescents with visual impairments attending a residential school.

Research Questions

1. What effects did the intervention have on the acquisition of time spent on leisure time physical activity among adolescents with visual impairments?
2. What effects did the intervention have on the acquisition of moderate to vigorous (MVPA) intensity leisure time physical activity among adolescents with visual impairments?
3. What effects did the intervention have on the maintenance of moderate to vigorous intensity (MVPA) leisure time physical activity among adolescents with visual impairments following intervention?
4. What effects did the intervention have on self-efficacy for perceived barriers, outcome expectancy value, social support, and self-regulation among adolescents with visual impairments?

Significance of the Study

This study was the first to implement and assess the effects of a school-based physical activity intervention based on social cognitive theory constructs among adolescents with visual impairments. Changes in social cognitive theory’s constructs and physical activity behavior may contribute to a better understanding of the constructs as they relate to physical activity behavior among individuals with visual impairments.
In addition, most of the research conducted on physical activity interventions among adolescents has used group designs (Kahn et al., 2002; Ringuet & Trost, 2001; Stone, McKenzie, Welk, & Booth, 1998). These designs become problematic when target participants are adolescents with disabilities (Rikli, 1997). Due to extreme heterogeneity, documented person-by-treatment interaction, and high within and between-individual variability that characterizes individuals with disabilities (Rikli, 1997; Watkinson & Wasson, 1984), group designs may be limited in their ability to appropriately detect the existence of participants with atypical responses (Edgington, 1987). In particular, high within and between-individual variability may be a source of error affecting both power and correlation-based analyses in such research designs (Bates, Zhang, Dufek, & Chen, 1996; Rikli, 1997). In addition to individual variability, power is also compromised by reduced sample sizes. In many occasions power can be increased by increasing sample size. However, in special populations such as individuals with visual impairments, increasing sample size is not a feasible venture (Bouffard, 1993; Rikli, 1997).

Group designs which emphasize the use of statistical analysis tend to focus on the aggregate of data (i.e., means) rather than the individual score; that is, the focus is on the average person within a study rather than the individual, which may lead to inaccurate conclusions about participants with disabilities (Bates, 1996; Bouffard, 1993; Rikli, 1997). Rikli (1997) maintains that at times it may be “pointless to generate knowledge through mean scores from large groups of participants” (p. 118). With that said, single subject research designs have been recommended as an alternative to traditional group designs when studying people with disabilities (Bouffard, 1993; Edgington, 1987; Rikli, 1997). Single subject research designs focus on the individual as his/her own unit of
analysis (Cooper, Heron, & Heward, 2007). Observations are taken on individual participants in order to determine functional relationships between an outcome measure and a treatment – participants are compared to themselves across the different phases of the study (Cooper et al., 2007; Rintala, Lyytinen, & Dunn, 1990).

With the recommendation of designing theory-based physical activity interventions, the use of single subject research designs are a tenable and potentially valuable approach to investigate the effects of such interventions. Bouffard (1993) and Edgington (1987) argued that most of the existing theories about human behavior (e.g., social cognitive theory) are concerned with individual behavior explaining phenomena in terms of processes within a single person. Therefore, research using existing theoretical models is intended to further our understanding of intra-individual processes (Bouffard, 1993; Edgington, 1987). Single subject research may allow researchers to distinguish how individuals respond and/or are affected by a particular intervention as well as detecting individual responses to treatments (Bouffard, 1993). Furthermore, single subject research may allow researchers to capture the underlying assumptions of existing theories (Bouffard, 1993). This study was the first in this line of research to use a single subject research design to document the effects of an after school physical activity program among adolescents with visual impairments.

**Delimitations and Limitations**

**Delimitations**

There were a number of delimitations in this study:

1. The data collection period ranged from 4:00 p.m. to 11:00 p.m. each day per week.
2. Data collection days consisted of four per week (Monday, Tuesday, Wednesday, and Thursday).

3. One school setting, purposely selected based on population of interest (i.e., adolescents with visual impairments) and its after school residential services, were used.

4. This study targeted leisure time physical activity of volitional nature. School-sponsored sports events were excluded.

5. The program consisted of nine sessions, ranging in time from 30 to 45 minutes long.

6. The study was delimited to four residential participants who attended all program sessions.

7. The study was delimited to after school leisure time physical activity and did not focus on leisure time activity during the weekend and/or at home.

Limitations

There were a number of limitations to this study:

1. There were two accelerometry-based instrument limitations. First, the accelerometers were unable to be used while participants were bathing or swimming (i.e., not waterproof). Second, the accelerometers were not able to accurately detect upper body movement activities (e.g., lifting weights, carrying heavy loads) and/or activity with minimal trunk action (e.g., bike riding).

2. One-minute epochs to collect physical activity counts were used which is commonly used in the literature. However, this may have underestimated and/or left undetected short bouts of moderate to vigorous physical activity.
3. Activity cut-points established with youth without visual impairments were used. Unfortunately, no accelerometer-based activity cut-points have been established for children and/or adolescents with visual impairments.

4. Seasonal factors associated with the fall season (e.g., weather conditions, wind, cold, rain) may have affected program results. The study was conducted from August to December, which corresponds to the season of autumn in the State of Ohio.

5. Unavoidable constraints imposed by the nature of the setting were evident. Among the most relevant were: (a) after school programming services, (b) the roles of youth leaders (i.e., after school employees), and (c) issues related to power outages and holidays.

Definitions of Terms

Accelerometer: mechanical device that measures body movements in one or more planes in terms of acceleration over a specific time period (Chen & Bassett, 2005; Dishman, Washburn, & Heath, 2004).

Activity count: raw outputs obtained from accelerometers which reflect the total volume of physical activity performed during a pre-determined measurement period (Chen & Bassett, 2005; Nilsson, 2008).

Adolescent: for the purpose of this study adolescent refers to high school students between the ages of 15 to 19.

Bout of physical activity: a period of time during which a person is physically active at some designated intensity level (Ward, Saunders, & Pate, 2007). For the purpose of this study, a bout of physical activity will consist of engaging in leisure time physical activity for at least 10 continuous minutes.
**Epoch:** a given time interval in which signals from an accelerometer are integrated, summed and stored (Rowlands, 2007). For the purpose of this study, epoch lengths were set at 1 minute.

**Exercise:** Exercise refers to planned and structured physical activity involving repetitive bodily movements with the purpose of improving or maintaining components of one’s physical fitness, which include cardiorespiratory fitness, muscular strength and endurance, flexibility, and body composition (Caspersen, Powell, & Christenson, 1985; CDC, 2007).

**Inactivity:** Not engaging in any regular pattern of physical activity beyond daily functioning (CDC, 2007).

**Physical Activity:** Physical activity refers to any voluntary health-related activity produced by skeletal muscles, regardless of intensity, resulting in an activity count as recorded by a one plane activity monitor and/or reported in a previous day physical activity recall.

**Physical activity cut-point:** research-based values representing specific physical activity intensity levels (e.g., light, moderate, vigorous). Usually used when calculating the time spent in physical activity at different intensity levels (Nilsson, 2008; Rowlands, 2007). For the purpose of this study, activity counts derived for children and adolescent from the work of Puyau, Adolph, Vohra, and Butte (2002) were used (i.e., sedentary $<800$ counts per minute; light $<3200$ counts per minute; moderate $<8200$ counts per minute; vigorous $\geq8200$ counts per minute).
*Leisure-Time Physical Activity*: Leisure-time physical activity refers to physical activity that is performed during the participant’s discretionary time (4:00 p.m. to 11:00 p.m.) that is not related to physical education class time and/or varsity sports.

*Moderate-Intensity Leisure-Time Physical Activity*: Moderate-intensity leisure-time physical activity refers to any voluntary health-related physical activity produced by skeletal muscle (not including PE class time) in which the participant experiences increased breathing and/or heart rate for at least 10 minutes as recorded by a one plane activity monitor and/or reported in a previous day physical activity recall.

*Sedentary physical activity*: For the purpose of this study, it refers to a period of time in which a participant reported accelerometer activity counts below 800 counts per minute.

*Vigorous-Intensity Leisure-Time Physical Activity*: Vigorous-intensity leisure time physical activity refers to any voluntary health-related physical activity produced by skeletal muscle (not including PE class time) in which the participant experiences a significant increase in breathing and/or heart rate, unable to maintain a conversation, for at least 20 minutes as recorded by a one plane activity monitor and/or reported in a previous day physical activity recall.

*Visual Impairment*: Under IDEIA, visual impairments are defined as any impairment in vision, including partial sight and blindness, that even with correction, adversely affects a person’s educational performance. Students with visual impairments refer to those individuals in high school grades, ages 15 to 19 enrolled in a specialized school for students with visual impairments and who fall under the previously described definition.
This chapter provides an overview and critique of the literature related to physical activity among youth with visual impairments. It begins by presenting literature regarding physical activity for children and adolescents with disabilities in general and physical activity for individuals with visual impairments in particular. Following physical activity research on children and adolescents with visual impairments, a description and discussion of Social Cognitive Theory is provided. Then, literature on SCT constructs that have been identified as correlates, determinants, and/or mediators of physical activity among adolescents is reported. Finally, a chapter summary is provided.

Physical Activity among Youth with Disabilities

Compared to children and adolescents without disabilities, youth with disabilities have been shown to be less physically active. Data also show that age and disability type play a role in the patterns and lifestyle behaviors of this less physically active group (Longmuir & Bar-Or, 2000). For example, self-reported physical activity data on youth with disabilities have shown a tendency for less physical activity compared to typically developing peers. In a self-report study by Steele et al. (1996), the authors collected data using the Health Behaviors in School-aged Children questionnaire used by the World Health Organization. This questionnaire asked respondents (ages 11 to 16) who possessed
physical disabilities about various health behaviors such as: physical activity, leisure activity, diet, hygiene, drug use, and health status, among others. Respondents’ answers were compared to those of a national sample of Canadian youth of the same age range. It was found that 39% of the youth with physical disabilities indicated that they did not exercise as compared to only 6% of the national sample. They also watched more television than youth in the larger sample (39% and 13%, respectively). The authors concluded that youth with physical disabilities tend to be less active compared to the larger population of youth of similar age, which in turn places these individuals at a higher risk of secondary disabilities and/or other health conditions due to their sedentary lifestyles.

Similarly, Pan, Frey, Bar-Or, and Longmuir (2005) completed a secondary analysis from data collected previously on Canadian children and youth ages 6 to 18 years using a modified version of the Canada Fitness Survey. The purpose of their study was to examine the similarity between parent and youth physical activity; participants were 342 youth with physical disabilities and their families. Findings similar to Steele et al.’s (1996) study were reported – 30 to 40% of the sample reported that they were not active. Pan et al. found that individuals with cerebral palsy and muscular dystrophy were less active than those who had spina bifida or head injuries. The authors indicated that the youth in this sample tended not to be dependent on their parents to engage in physical activity as these youth tended to be more active in school than at home.

Self-reported physical activity data have been supported with the use of direct observation measures of physical activity. Faison-Hodge and Porretta (2004) used the System for Observing Fitness Instructional Time (SOFIT) to measure physical activity
levels of children (third, fourth, and fifth grade students) with and without mild mental retardation in two different settings: physical education and recess. In addition, the students without mental retardation were also categorized into high and low cardiorespiratory fitness categories based on their scores on the FITNESSGRAM PACER test. The authors found that moderate to vigorous physical activity levels for participants were significantly higher during recess than physical education (66% and 24%, respectively, \( p < 0.01 \)). In addition, the authors reported that the levels of physical activity between each group were similar within both settings. Interestingly, the authors reported that students with mild mental retardation and those with low cardiorespiratory fitness were similar in their PACER scores, in activity time during physical education and during recess, indicating that these two groups were similar. However, participants with mental retardation were considerably less active than those without disabilities who were categorized as having high cardiorespiratory fitness.

Accelerometers (or activity monitors) have been used to measure the physical activity patterns and levels of children and adolescents with Down syndrome, cerebral palsy, and spina bifida. Bjornson, Belza, Kartin, Logsdon, and McLaughlin (2007) used the Step Watch Monitor to measure the ambulatory activity (i.e. step frequency and patterns) of 81 youth with cerebral palsy ages 10-13 and 30 age matched youth without disabilities. In addition, Whitt-Glover, O’Neill, and Stettler (2006) also used accelerometers to explore the differences in physical activity levels in children with Down syndrome (\( n = 28 \)) and their siblings without disabilities (\( n = 30 \)). Finally, van den Berg-Emons, Bussman, Brobbel, Roebroeck, van Meeteren, and Stam (2001) explored the extent of physical activity engagement in a sample of 14 participants with meningomyelocele and 14
matched peers without disabilities using an activity monitor to measure physical activity each day for a 48 hour period of time. Although each of these studies used different populations of individuals with disabilities, the results have been similar- individuals with disabilities are significantly less active than their peers without disabilities.

Some researchers have used more than one form of data collection to measure physical activity among children and youth with disabilities (i.e., mental retardation, autism spectrum disorder, juvenile idiopathic arthritis). By using more than one measure, there is an expectation that the results will be more accurate than using only one form of data collection because one measure may compensate and be able to account for the weaknesses of another. In the studies that have used multiple physical activity measures, different combinations of accelerometers, interviews, questionnaires, fitness testing, and physical activity logs have been used (Kozub, 2003, Pan & Frey, 2005, 2006; Rosser-Sandt & Frey, 2005; Takken, van der Net, Kuis, & Holders, 2003).

In all of these studies, results have been similar- children and youth with disabilities engage in low amounts of physical activity daily (Kozub, 2003, Pan & Frey, 2005, 2006; Rosser-Sandt & Frey, 2005; Takken et al., 2003), and a relationship exists between increased age and decreased physical activity levels (Pan & Frey 2005; Takken et al., 2003). In some studies, parent involvement in and/or support and encouragement for physical activity have also been studied, but in the studies reviewed, parents did not have a significant effect on their children’s physical activity (Kozub, 2003, Pan & Frey, 2005).

Regardless of the physical activity measure, lower levels of physical activity have been reported for youth with disabilities when compared to youth without disabilities. Among these, children and adolescents with visual impairments have demonstrated less
physical activity and greater risk for health conditions related to sedentary lifestyles (Longmuir & Bar-Or, 2000).

*Physical Activity among Children and Adolescents with Visual Impairments*

Not all children with visual impairments are blind (Lieberman & Houston-Wilson, 1999). In fact, most children with visual impairments have some degree of vision. In schools for the blind and visually impaired, approximately 80% of the students have vision that could be used in daily activities (Best & Corn, 1993). Visual impairments are considered low incidence disabilities, with a rate of 12.2 per 1,000 among youth in the United States under the age of 18; with severe conditions such as total blindness occurring at a rate of .06 per 1,000 (National Dissemination Center for Children with Disabilities [NICHCY], 2004).

Compared to other children and youth with disabilities, the literature on the health-related issues of children and adolescents with visual impairments has received less attention (Capella-McDonnall, 2007). To date, only one review has been published on the psychomotor behavior of individuals with visual impairments (Skaggs & Hopper, 1996). Findings were discussed under three main categories: (a) physical fitness, (b) motor performance, and (c) measurement. Skaggs and Hopper argued that approximately half of the psychomotor research reviewed addressed physical fitness, often comparing individuals with and without visual impairments by gender and age. Based on their findings, it was observed that individuals with visual impairments scored significantly lower than individuals without visual impairments on most components of physical fitness. However, they raised questions about the validity of the tests used to measure fitness components. Individuals with visual impairments were found to score
significantly lower on tests of motor performance compared to people without visual impairments. Measurement issues were raised such as the validity of fitness batteries because these tests have been developed for individuals without disabilities. This is due to the less efficient locomotor pattern exhibited by people with visual impairments that may affect results on walking/running tests (Skaggs & Hopper, 1996). The authors concluded by identifying the lack of psychomotor research on people with visual impairments and recognizing the need for intervention studies. Unfortunately, Skaggs and Hopper’s review did not include research on physical activity. Therefore, an understanding of the existing literature on physical activity among children and youth with visual impairments is warranted.

One of the first studies on physical activity among children and youth with visual impairments was published by Suzuki and colleagues (1991). Suzuki et al. (1991) studied the daily physical activity, physical characteristics, and nutritional status of 2,222 individuals (1384 males, 838 females) with disabilities ages 3 to 22 from 17 specialized schools in Tokyo, Japan. These schools served students with mental retardation (six schools), visual impairments (three schools), deafness (three schools), and physical disabilities (five schools). Among the physical characteristics measured were height and weight along with skinfold measures. Daily physical activity was measured using pedometers for a period of one school day among a selected group of 802 participants (120 with visual impairments); however, of this number, 112 participants (55 males, 57 females) used an assistive device for walking so their data were not reported. Suzuki and colleagues used data from Japanese national surveys on the general population ages 7 to 17 and 14 to 19 for comparison with data obtained from their study. Results for personal
characteristics revealed that for participants with visual impairments or mental retardation, height was one standard deviation below that of those with no disability ages 5 to 17. Regarding body composition measures, mean values for skinfold measures for participants with visual impairments or mental retardation ages 14 to 19 were higher than those of age-matched youth without disabilities based on the national survey database. The authors reported that pedometer data revealed that mean step counts were higher for students with hearing impairments than mean step counts for any other group of students with disabilities, while step counts for students with visual impairments or students with physical disabilities were the lowest compared to youth without disabilities, students with hearing impairments, and students with mental retardation.

Kobberling, Jankowski, and Leger (1991) examined habitual physical activities of students with and without visual impairments to determine the intensity and duration of such activities and the relationship between activities engaged in and aerobic capacity. Participants were 30 (20 male, 10 female) students ages 12-18 who were legally blind. In addition, 30 age, gender, and height matched students were recruited from local public and special schools to serve as a control group. The authors measured the maximal oxygen consumption (VO2 max) of all participants. In addition all students completed a recall questionnaire. The intensity of the physical activities of the participants was estimated in metabolic equivalents (METs). The duration and intensity of the activities were then used to determine the weekly energy expenditure. Results revealed that the aerobic capacity of the boys without visual impairments was significantly higher ($p < .05$) than boys with visual impairments, and there were no significant differences between the two groups of girls. Girls with visual impairments tended to spend significantly less time
engaging in physical activity than girls without visual impairments (185 ± 80 min. and
267 ± 125 min., respectively), and the two groups of boys spent about the same amount
of time engaging in physical activity (296 ± 189 min., and 291 ± 169 min., respectively).
In addition, the average intensity for both groups of girls was similar, but differed
significantly for the groups of boys, and the energy expenditure for both boys and girls
with visual impairments was lower than that of the students without visual impairments.
It was apparent that the students with visual impairments had lower aerobic capacities
than the students without visual impairments. Of particular note was the fact that the
students with visual impairments tended to live more sedentary lifestyles.

Blessing, McCrimmon, Stovall, and Williford (1993) compared the effects of a 16
week endurance training program for students with visual impairments (n = 30, ages 8 to
18) with a traditional physical education program for children without visual
impairments. Of these students, ten were totally blind, 16 could see at a 20/200 level, and
four had visual fields of less than 20 degrees. These students were matched by age,
gender, and race with a group of students without visual impairments in a public school
physical education class. Data were obtained by a submaximal test on a cycle ergometer
and through anthropometric measures such as height, weight, and skinfold. All
participants were measured two times, once before training and once within one week
following training. The cardiovascular training sessions for the students with visual
impairments consisted of cycling and treadmill exercises three times a week for the
duration of the program at an intensity of 70 to 85% of the age predicted maximum heart
rate. The students without visual impairments engaged in their regular physical education
programs for the 16 week duration and took part in sports such as basketball, volleyball,
football, and soccer, among others. Significant differences between the two groups of students ($p < .05$) in their pre-intervention skinfold measurements were found, however, the exercise training group had reduced skinfold measures by 7.3%, while that of the physical education group did not change. For post intervention measurements, a significant decrease in heart rate was observed for the exercise training group ($p < .05$) as opposed to the physical education group. The authors concluded that an exercise training program for students with visual impairments can be effective in enhancing cardiovascular endurance and can also have a positive impact on body composition.

Using self-reported measures, Longmuir and Bar-Or (1994) collected data on physical activity patterns on a sample of 1,560 children and adolescents with disabilities. In addition, a sample of 135 volunteers (ages 6 to 20) with either physical disabilities, sensory impairments, or chronic illnesses was also included. The authors examined relationships between physical activity levels, gender, and age, while not taking into account type of disability or comparing the findings to children and adolescents without disabilities. The authors mailed to participants a questionnaire adapted from one used for the Canada Fitness Survey. The participant response rate was 55%, and when the 135 volunteer sample questionnaires were added, the response rate increased to 58%. Of the respondents, 342 had a physical disability, 374 had chronic illnesses, and 241 had sensory impairments.

Data were analyzed to determine the impact of participant characteristics on levels of physical activity; these data were analyzed separately for participants who were randomly selected and those who were nonrandom participants. The authors classified the participants as active, moderately active, or sedentary based on their questionnaire
responses. Of those who responded, 39% were classified as active, 32% as moderately active, and 29% as sedentary. In addition, activity levels for both males and females combined increased from ages 6 to 10, remained constant from ages 10 to 15, and then declined following age 15. For participants up to 17 years old, 37% to 49% were classified as active, and for participants ages 18 to 20, only 22% were active. Although identifying limiting conditions was not a purpose of this study, 52% of the participants reported some sort of limiting factor to their participation in physical activities. Data revealed that as participants with disabilities became older, their physical activity levels decreased and more individuals adopted sedentary lifestyles.

Longmuir and Bar-Or (2000) later re-analyzed their 1994 data to determine the influence of gender, disability type (physical disabilities, chronic medical conditions, hearing impairments, and visual impairments), age, and specific diagnostic category (e.g., cerebral palsy, muscular dystrophy) on physical activity, perceived physical fitness, and perceived limitations to physical activity participation. This secondary analysis revealed that the youth with physical disabilities and youth with visual impairments felt limited in their ability to participate in physical activities (78% and 84%, respectively). In addition, both youth with physical disabilities and visual impairments also engaged less in physical activities than the other participants. Thirty-nine percent of youth with physical disabilities and with visual impairments combined, 24% of youth with chronic disabilities, and 17% of youth with chronic conditions and hearing impairments were categorized as sedentary. Youth who were sedentary tended to be older than those who were active or moderately active. Finally, 85% of participants with physical disabilities indicated that they were either as fit (40%) or less fit (45%) than their peers, while 86%
of the participants with visual impairments believed they were as fit (49%) or less fit (37%) than their peers. Participants who had hearing impairments or chronic medical conditions tended to be more active and perceived themselves to be either as fit or more fit than their peers and experienced fewer barriers to physical activity participation than the participants with visual impairments or physical disabilities.

Sit, Lindner, and Sherrill (2002) examined sport participation of children with physical disabilities, visual impairments, hearing impairments, mild mental disabilities, and maladjustment. Participants were 237 children and adolescents (143 males, 94 females; ages 9 to 19). The authors used a questionnaire to examine sport participation and an analysis was conducted to compare frequency scores, participation scores, and motives for participation or non-participation and withdrawal among the different groups of participants. Results indicated that participants tended to engage in sport between one to two times per week and one to two times per month, with boys engaging in sport more than girls. In addition, participants with visual impairments, physical disabilities, and mental disabilities tended to engage in sport less than those with maladjustment or hearing impairments. Regarding membership in sport clubs, 13% of the participants indicated that they were active members of sport clubs and 83% of the participants engaged in at least one sport. However, participants with visual impairments tended to score lower on the extent of participation and most of the participants with visual impairments who participated in sport did so more frequently at what the authors mentioned was “other locations” and not at private clubs. For non-participation motives, the authors mentioned that the participants with visual impairments felt that they lacked the necessary skills. The authors concluded that their findings were similar to those of
Longmuir and Bar-Or (2000) in that the type of disability affected the participation patterns of the participants. Half of the participants in the study participated in sport outside the school setting, but the authors also stated that school was the second most common place to participate in sports. The authors also pointed out that special schools, such as the ones these participants attended, are more accessible to those who attend them and can meet the needs of students better than other schools. Interestingly, the authors found that those who lived at residential schools were not necessarily more physically active in sport, especially those with visual impairments or mental disabilities. In fact, these participants were less active than others.

Longmuir and Bar-Or’s (1994, 2000) as well as Sit et al.’s (2002) data were based on self-reported physical activity. A number of authors have raised concerns with the use of self-reported physical activity among children and youth (e.g., Dishman, Washburn, & Schoeller, 2001; Sallis & Saelens, 2000; Welk, Corbin, & Dale, 2000), arguing for the use of more objective means such as motion sensors or direct observation (Dishman et al., 2001; Sirard & Pate, 2001). Kozub and Oh (2004) sought to study physical activity among children and adolescents with visual impairments using RT3 accelerometers. Their goals were to use the accelerometer data to: (a) identify potential determinants of physical activity such as gender, residential status, age, degree of vision loss, and body composition among participants; (b) describe the rates in bouts of moderate to vigorous physical activity (MVPA) among the participants compared to that of previously published data on children and adolescents without visual impairments; (c) identify when the participants were most active; and (d) determine if age-related trends in physical activity were comparable to the general population.
Their sample consisted of 19 school-aged children and adolescents with visual impairments ages 6 to 18 who were attending a Midwestern school for the blind; for comparison purposes, participants were classified as full-time residential (FTR) or part-time day (PTD) students. The accelerometers were tested for validity and reliability during short-term physical activity bouts among a subset of participants; reliability and validity scores were reported elsewhere in Kozub, Oh, and Rider (2005). The researchers indicated that physical activity scores were calculated by totaling bouts of MVPA with the criterion of 4.5 MET values. Participants wore accelerometers for two week days and two weekend days. In addition to measuring physical activity, height and weight were obtained from school records as well as scores from the Brockport Physical Fitness Test (BPFT). This was used to calculate participants’ body max index (BMI) so participants were further subdivided into the healthy zone and those who were outside ideal values based on BPFT criterion standards. No significant differences were found in total bouts of MVPA based on either gender or BMI status. Similarly, no significant differences in total bouts of MVPA were found between FTR and PTD students, and vision did not correlate significantly with total bouts of MVPA among participants. Participants accumulated a mean of 29.26 bouts of MVPA over the four days of monitoring, which resulted in 7.31 bouts of MVPA per day lasting on average 3.77 minutes. Compared to bouts of MVPA among children and adolescents without disabilities published elsewhere, Kozub and Oh indicated that their participants accumulated significantly fewer bouts of MVPA. Frequency counts for bouts of MVPA during three time periods from the four days of data recording revealed that 48% of the bouts of MVPA among participants
occurred during the two weekdays (school days), while 24% and 28% of the bouts occurred during after-school hours and the weekend, respectively.

An age-related trend in physical activity was reported with an inverse relationship between age and total bouts of MVPA where younger participants recorded more bouts of MVPA than older participants. The authors concluded that vision level did not appear to affect bouts of MVPA among children and adolescents with visual impairments. Similarly, full-time residential status did not guarantee that participants would be more physically active than part-time day students, even when the school offered readily accessible facilities and specially designed programming during free time for this population. Participants accumulated significantly fewer bouts of MVPA when compared to previously published data among children and adolescents without disabilities, indicating participants were not accumulating recommended levels of physical activity to achieve health benefits. Of concern was the finding of no difference between full-time residential and part-time day students. The authors argued that even when residential schools offer leisure programming and accessible campus facilities, these participants chose sedentary options. However, when participants did engage in physical activity, most of the reported bouts of MVPA were accumulated during school days. Finally, the age-related declining trends in physical activity identified by Kozub and Oh supported previous findings for youth with disabilities (including youth with visual impairments) and without disabilities. However, among these participants physical activity declines were even greater, with the oldest participant (18 years old) accumulating 2.75 bouts of MVPA per day, while the youngest participant (6 years old) accumulated 13.5 bouts per day.
Other measures of physical activity, such as direct observation, have also been used to study physical activity among youth with visual impairments. Oh, Ozturk, and Kozub (2004) used the Children’s Physical Activity Form (CPAF) to measure the physical activity levels of 19 participants (10 girls, 9 boys; ages 6 to 18) with visual impairments (12 high vision, 4 low vision, and 3 blind). Oh et al. investigated the relationship between participants’ social engagement and physical activity during physical education class. The CPAF is a one-minute interval direct observation instrument consisting of four physical activity categories and an estimate of the intensity level of different physical activities. The authors indicated an overall interobserver agreement (IOA) of 81% for 25% of the recorded 19 cases. A Spearman Rank order correlation was used for relationships between level of vision loss, age, CPAF scores, and social engagement, while a Chi-square analysis was conducted to determine dependence of curricular offerings on CPAF scores. Data on physical activity levels revealed mean CPAF scores per minute ranging from 85.6 to 183.7 ($M = 119.4, SD = 27.5$). A significant negative association between age and physical activity ($r = -.70, p < .01$), indicated that older participants were less physically active during physical education than younger participants with visual impairments. Oh, Ozturk, and Kozub’s findings support those of Longmuis and Bar-Or (1994, 2000) and Kozub and Oh (2004) with regard to the inverse (negative) relationships between age and physical activity levels among children and adolescents with visual impairments. Oh et al. also identified the lack of recommended moderate to vigorous physical activity to attain health benefits to be a concern, arguing for the need for curricular revisions.
Lieberman, Stuart, Hand, and Robinson (2006) used a sample of 22 children (15 boys, 7 girls) with visual impairments (4 totally blind, 9 travel vision, and 9 legally blind), ages 9 to 13, to investigate the effects of talking pedometers as a motivational tool for increasing sport camp physical activity among youth with visual impairments. Prior to participation in the sport camp, participants wore a Brookstone Talking Pedometer for one week. Parents recorded step counts of each participant using a daily record log. Descriptive data revealed that prior to the one-week camp; participants walked an average of 9,743 steps per day, (range 3,436 to 16,166). Girls took an average of 9,686 steps per day (range 3,885 to 13,874), while boys took an average of 9,770 steps per day (range 3,437 to 16,166).

Prior to the start of camp, the seven day pedometer data represented a typical school week for participants. A difference between steps taken per day prior to the sport camp and during the sport camp among the participants as a group was observed. Participants walked an average of 15,793 steps per day (range 8,923 to 28,427), an increase of 6,050 steps per day. The girls recorded a mean of 14,663 steps per day (range 8,923 to 22,200), while boys recorded an average of 16,321 steps per day (range 9,752 to 28,427). Prior to camp, the average steps per day were below the recommended daily steps for both boys and girls (President’s Council on Physical Fitness and Sports, 2004; Tudor-Locke et al., 2004). During the camp the participants increased their average step counts to 15,793, above the recommended steps per day for both girls and boys.

These findings need to be taken cautiously due to the large variability in steps taken per day by participants prior to and during the camp. The use of aggregated data did not differentiate between those who did not achieve recommended steps per day from those
who increased step counts above the recommended count. The authors did not provide an indication as to whether the participants who reported levels below 4,000 steps prior to the camp were the same participants who recorded steps below the recommended number during the camp, or whether the degree of vision loss had an effect on the number of step counts prior to or during the sport camp on an individual basis. No evidence of the validity of the talking pedometer as a measure of physical activity was provided. Yet, findings provide evidence that youth with visual impairments may not be engaging in enough activity to achieve recommended daily steps.

Stuart, Lieberman, and Hand (2006) examined the relationship between specific parent (n = 25) and child (n = 25) variables and how these variables affected the physical activity participation of children with visual impairments. They also examined the perceived barriers to physical activity as identified by both the children and their parents. The children were identified as B1 (n = 13), B2 (n = 2), or B3 (n = 10); participants in the B2 group were added to the B3 group due to low numbers. Data were collected during a one-week sport camp; parents filled out their questionnaire and consent forms on the first day, while the children completed their survey with one of the researchers during the camp. Data gathered included parent and child demographics as well as a parent value and child value inventories. In addition, parents were asked to complete two more documents: an expectation for success inventory and a barriers inventory.

A significant difference was found between parent expectation for physical activity and child vision level, that is, parents of children who had more vision loss showed decreased physical activity expectations for their children. Children with more vision tended to rate physical activity as more important and helpful than did children with less
vision. There was a positive relationship between parent and child expectations for success (.43) indicating that as child expectations increased, so did parent expectations. A positive relationship was also found between the value of physical activity and parent expectations for success (.46), and between the value of physical activity and expectations for ability to take part in physical activity.

The parents of children who were in the B1 category perceived different barriers for their children than did parents whose children were considered B2 or B3. Parents whose children were completely blind believed the top barriers to participation were: (a) possibility of injury, (b) lack of appropriate activities, and (c) inability of the physical education teacher to adapt or modify activities. Parents whose children had low vision believed the top barriers to be: (a) physical education teacher’s lack of preparation to work with their children, (b) lack of peers to participate in activity with, and (c) lack of opportunities. The children who were blind perceived their top barriers to be: (a) peers making fun of them, (b) lack of opportunity/activities, and (c) lack of a peer with which to participate. The children with low vision considered their barriers to be: (a) not knowing what to do, (b) lack of a peer with which to participate, and (c) peers making fun of them. As the level of vision loss increased (i.e. B1), parent expectations for their children as well as the expectations the children had of themselves, decreased. In addition, these individuals tended to respond that physical activity was not as important to them as it was for individuals with more vision (i.e. B2 or B3) and their parents. These findings are consistent with those of Longmuir and Bar-Or (2000), indicating that children with visual impairments tend to recognize barriers to physical activity participation and perceive limitations in their abilities to participate.
Ayvazoglu, Oh, and Kozub (2006) examined the relationships between level of physical activity for children with visual impairments and physical activity of their parents and siblings by using RT3 triaxial accelerometers and Q-sort interviews. Participants (n = 6) were children with visual impairments from five different families, their siblings without visual impairments (n = 6), and their parents (n = 5). The children were classified as blind (n = 2), low vision (n = 1), or high vision (n = 3). Activity counts were taken using the accelerometers over a seven day period of time during summer. These counts were followed by Q-sort interviews by parents and open ended interviews with the children.

Participants whose physical activity levels were the highest also had the highest parent physical activity data. Also, an age related decrease in physical activity was observed as the participants became older. Examples of important factors from the Q-sort interviews were: (a) having transportation, (b) having other family members who participated in physical activity, and (c) safety. What also emerged was that physical educators should teach physical activity options that students could engage in outside the school setting. Most of the parents of the children in the Ayvazoglu et al. study were inactive, which could have contributed to the low levels of physical activity in some of the children with visual impairments. The authors indicated that there was a need to teach different physical activity-related skills to students with visual impairments so they would have them as adults.

Kozub (2006) completed a study similar to Ayvazoglu et al. (2006) on motivation and physical activity participation for students with visual impairments. The first purpose of this study was to examine physical activity motivation and the differences between
students who met BMI criterion levels and those who fell outside the healthy BMI zones. A second purpose was to examine the differences between students who had healthy BMI’s and those outside healthy zones relative to the number of free time minutes in which students engaged in moderate activity. Participants were 31 students ages 12 to 21 who attended a residential school for the blind (11 female, 20 male). The Brockport Physical Fitness Test, the Free Time Motivation Scale for Adolescents, and RT3 Activity Monitors were used to measure BMI, motivation for physical activity participation, and physical activity levels, respectively. The students wore the activity monitors from Monday through Thursday during their after school hours and completed the Motivation Scale during their physical education classes. The majority of students in this study engaged in moderate to vigorous physical activity (MVPA), but there was a large variability in the amount of time spent engaging in MVPA. Although the students had been placed into groups based on their BMI scores, there were no significant differences found between the groups in their physical activity engagement. Differences existed in the motivation among the participants in this study.

Sit and colleagues (2007) examined physical activity levels of 172 elementary age children in five special education schools in Hong Kong. The purpose of their study was to determine physical activity levels of children with physical disabilities, mild intellectual disabilities, and hearing and visual impairments in physical education and during recess while also looking at the context of the physical education lesson and teacher behaviors. The authors sought to determine whether disability type was significantly related to physical activity levels and if lesson context and teacher behaviors influenced physical activity levels during physical education. The authors used the
System for Observing Fitness Instruction Time (SOFIT) and randomly selected four different students during each observation period during recess and physical education to ensure that different students were observed throughout the study.

During physical education, moderate to vigorous physical activity (MVPA) levels were at 41.9%, while MVPA levels during recess were at 58.2%. In addition, during physical education, teachers spent 32% of the class time on fitness activities, 27.5% on skill practice, and 24.5% on managing students. The teachers of students with visual impairments spent less time on fitness and more time on giving general instruction than the teachers of students with hearing impairments or physical disabilities. The students with intellectual disabilities tended to be the most sedentary, while the students with hearing impairments tended to be the most engaged in vigorous activities during recess. The students with physical disabilities and those with visual impairments rarely engaged in vigorous activity during recess. Due to the minimal amount of time students engaged in MVPA at recess and especially in physical education, the authors concluded that there was a need to develop interventions that can be used in schools and at home aimed at increasing physical activity levels among students with disabilities.

**Summary.** There is a paucity of research on physical activity among children and adolescents with visual impairments. The literature search in this area produced only 13 studies. Based on the reviewed literature, physical activity patterns among youth with visual impairments have been measured through self-report, direct observation, pedometers, and accelerometers, a trend that moves from subjective to more objective ways of monitoring. Unfortunately, across studies there was a lack of reporting the validity and reliability of the physical activity measure; in two studies, the authors
indicated validity and reliability estimates were reported elsewhere. However, in the remainder of the studies, no indication of the validity and reliability of the instrument were reported. Beyond the measurement issues, there were common findings across studies regardless of measure of physical activity. Children and adolescents with visual impairments were less physically active than children and adolescents without visual impairments (Longmuir & Bar-Or, 1994; Suzuki et al., 1991; Kozub & Oh, 2004). Similarly, when compared to children and adolescents with hearing impairments, children and adolescents with visual impairments were considerably less physically active (Longmuir & Bar-Or, 2000; Sit et al., 2007; Suzuki et al., 1991). No significant relationships were found between gender or level of vision and levels of physical activity (Longmuir & Bar-Or, 2000; Kozub & Oh, 2004). An age-related decreasing trend in physical activity was observed among children and adolescents with visual impairments, in which adolescents were found to be in greater need for physical activity interventions (Ayvazoglu et al., 2006; Longmuir & Bar-Or, 2000; Kozub, 2006; Kozub & Oh, 2004; Oh et al., 2004; Sit et al., 2007). Even in studies in which participants were divided into full-time residential and part-time day students, no significant differences were identified. Overall, these students are not engaging in enough physical activity to achieve health benefits, but instead are selecting more sedentary options (Kozub & Oh, 2004; Sit et al., 2007). Still, schools serving students with visual impairments appear as promising agents in the promotion of physical activity for this population.
The theoretical framework for this study is Social Cognitive Theory (Bandura, 1989). Social Cognitive Theory (SCT) has been one of the most widely used theoretical frameworks in explaining the acquisition and maintenance of health related behaviors such as physical activity and exercise (Baranowski, Perry, & Parcel, 2002; Biddle & Nigg, 2000; Motl, 2007). In SCT, individual learning is viewed as the process of acquiring knowledge through cognitive processing information, in which the social aspect refers to the social origins of human thought and action, while the cognitive aspect recognizes the influence of a person’s thought processes in regulating his/her motivation, attitudes, and actions (Bandura, 2001; Stajkovic & Luthans, 1998). In other words, SCT views humans as agents in control of their own lives (Bandura, 2001). Social Cognitive Theory (SCT) is based on the assumptions that: (a) behavior is purposeful or goal directed, (b) humans are self-reflective, capable of self-regulating their own behavior, and (c) behavior is influenced by the dynamic interactions between personal, environmental, and behavioral factors (Bandura, 1989). With regard to the third assumption, Bandura (1989) argued that SCT is founded on a model of causation known as triadic reciprocal determinism. In this triadic relationship, behavioral, personal, and environmental factors all operate upon each other in a bidirectional manner as represented in Figure 1 (Bandura, 1989).
According to Bandura (1989), the dynamic interaction between personal (P) and behavioral (B) factors represent the interplay between thought, affect, and action. An individual’s expectations, beliefs, self-perceptions, goals, and intentions shape and direct behavior; that is, what people believe, think, and feel will affect how they behave. Regarding the dynamic interaction between environmental (E) and personal (P) factors, Bandura (1989) suggests that an individual’s expectations, beliefs, and cognitive competencies are developed and modified by social influences and physical structures within the environment. For the bidirectional interplay between behavioral (B) and environmental (E) factors, Bandura (1989) proposed that people’s behaviors will determine the aspects of the environment to which they are exposed, and behavior is, in turn, modified by that environment. Moreover, SCT proposes that within this theory people are characterized in terms of their confidence in performing a behavior (including overcoming obstacles) and their capability to: (a) symbolize behavior, (b) anticipate the outcomes of a behavior, (c) learn by observing others, (d) self-determine or regulate their
own behavior, and (e) reflect on and analyze past and present experiences (Bandura, 1989; Baranowski et al., 2002). These five human capabilities are viewed under SCT as the means in which an individual will influence him/her self to initiate, regulate, or maintain behavior (Bandura, 1989).

In addition to reciprocal determinism and the environment, Bandura outlined the existence of a number of core theoretical constructs within SCT which fall into the three domains of the triadic reciprocal model: personal, behavioral, and environmental. Within the personal domain, the psychological constructs described in SCT include outcome expectations and outcome expectancies, self-control, emotional coping responses, observational learning, and self-efficacy. Constructs within the behavioral domain include behavioral capability. Constructs falling into the environmental domain include environment, situation, and reinforcements (Bandura, 1989; Baranowski et al., 2002). Following is a description of the SCT constructs that have been targeted for health promotion program and predicting physical activity behavior (Baranowski et al., 2002; Stevens, 2006).

*Environments and situations.* Environments in SCT encompass all factors that can influence an individual’s behavior but that are physically external to the person such as family, peers, friends, and the context in which behavior occurs (Baranowski et al., 2002). On the contrary, situation refers to the individual’s perceptions of the environment and his/her role in that environment (Baranowski et al., 2002). The cognitive or mental representation the individual makes about the environment will affect behavior (Bandura, 1989). Bandura (2004) indicated that the environment provides models for behavior.
**Behavioral capability.** Behavioral capability refers to the person’s knowledge and skill repertoire to perform a particular behavior (Baranowski et al., 2002). Bandura (1989) acknowledges that in order for an individual to be successful in performing a particular behavior, he/she must know what the behavior is and the required steps and/or skill sets needed to perform the behavior.

**Observational learning.** Observational learning occurs when a person observes another person’s behavior and the natural reinforcers that person receives for performing the behavior (Baranowski et al., 2002). Bandura (1989) has referred to observational learning as one of five human capabilities, also known as vicarious learning where the learner discovers through observing others.

**Outcome expectations and outcome expectancies.** People expect outcomes from engaging in a behavior (Baranowski et al., 2002). Bandura (2004) acknowledges outcome expectations as one of the core determinants underlying health behaviors. On the contrary, outcome expectancies relate to the value placed on particular outcomes (Baranowski et al., 2002). Outcome expectations and outcome expectancies are the anticipatory aspects of behavior and the values the person places on a particular behavior (Baranowski et al., 2002).

**Reinforcement.** Reinforcement refers to responses (rewards and consequences) to a person’s behavior that may increase or decrease the likelihood of the behavior to reoccur (Baranowski et al., 2002). Reinforcers under SCT are subcategorized as internal (own experiences and value placed on the occurrence of a behavior) and external (predictable reinforcement value placed on occurrences of the behavior) reinforcers (Baranowski et al., 2002).
Self-control. Self-control is an individual’s regulation of his/her own goal-directed behavior or performance (Baranowski et al., 2002). Self-control is among the human capabilities acknowledged by Bandura (1989) as essential to the process of behavior change. Self-control indicates a person’s ability to exert control over his/her own behavior while emotional coping responses are the different strategies that a person may use when dealing with emotional stimuli (Baranowski et al., 2002). Ward et al. (2007) indicated that self-control skills (i.e., self-monitoring, goal setting, problem solving, self-reward, self-adjusting) have been shown to be an important influence on behavior. When referring to physical activity, self-regulation involves the use of self-regulatory skills for planning, organizing, and managing physical activities (Rovniak, Anderson, Winett, & Stephens, 2002). Rovniak and colleagues (2002) argued that self-regulation for physical activity is important because motivation alone is not enough to succeed in maintaining regular activity behavior.

Self-efficacy. Self-efficacy refers to a person’s perceived confidence in performing a particular behavior and in overcoming barriers to performing the behavior (Bandura, 2001). Among the SCT constructs, self-efficacy is the strongest and most consistent predictor of physical activity behavior (Biddle & Nigg, 2000; Marcus et al., 2000; Sherwood & Robert, 2000). Bandura (2004) argued that self-efficacy affects the amount of time and effort an individual will invest in a particular task and the level of performance that would be attained. In fact, self-efficacy beliefs operate together with goals, outcome expectations, and perceived environmental impediments and facilitators in the regulation of human behavior. Self-efficacy is the focal determinant of behavior because it affects health behavior both directly and by its influence on the other
determinants (Bandura, 2004; Baranowski et al., 2002; Ward et al., 2007). Personal experiences have been identified as the largest influence on a person’s perceived self-efficacy (Bandura, 2004; Ward et al., 2007). A person with a higher level of self-efficacy is more likely to engage in physical activity and more likely to persevere when barriers may appear when compared to a person with low self-efficacy (Baranowski et al., 2002; Sallis & Owen, 1999; Ward et al., 2007). Furthermore, self-efficacy is characterized by three dimensions: (a) magnitude of self-efficacy, which is an individual’s perceived level of task difficulty he/she is capable of executing; (b) strength, which refers to whether the individual’s judgment about magnitude is strong or weak; and (c) generality (Stajkovic & Luthans, 1998).

In a paper on health promotion, Bandura (2004) argued that health behavior, including physical activity, is determined by:

Knowledge of health risks and benefits of different health practices, perceived self-efficacy that one can exercise control over one’s health habits, outcome expectations about the expected costs and benefits for different health habits, the health goals people set for themselves and the concrete plans and strategies for realizing them, and the perceived facilitators and social and structural impediments to the changes they seek (p. 144).

When compared to other common behavioral theories such as Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TpB), SCT has appeared to better explain and predict physical activity participation (Dzewaltowski, 1989; Dzewaltowski, Noble, & Shaw, 1990; Motl et al., 2002). Dzewaltowski (1989) compared the ability of SCT and TRA to predict exercise behavior among undergraduate students (136 males,
192 females). The SCT constructs of self-efficacy, outcome expectations, and self-evaluative dissatisfaction and TRA constructs of attitude, subjective norms, and behavioral intentions were measured using questionnaires. Results revealed that behavioral intention had a significant positive relationship with number of days per week of exercise; however, TRA explained only 5% of the variance in exercise behavior. On the contrary, the SCT constructs of self-efficacy and self-evaluated dissatisfaction explained 16% of the variance (Dzewaltowski, 1989). Social Cognitive Theory was better at predicting exercise behavior, with self-efficacy as the strongest explanatory variable.

Dzewaltowski, Noble, and Shaw (1990) used a similar group of undergraduate students (121 males, 133 females) to compare the ability of SCT, TRA, and TpB to predict future physical activity participation. Physical activity was measured through a 7 day physical activity recall (7DPAR), while theoretical variables were assessed through questionnaires. Data analysis revealed that the TRA construct subjective norm did not significantly explain physical activity intention; however, TpB perceived behavioral control increased TRA prediction of behavioral intention. Analysis revealed that the SCT constructs of self-efficacy and self-evaluation significantly explained physical activity participation, with self-efficacy being the most significant contributor. Further comparison of the main variables from each theoretical perspective [self-efficacy (SCT) and intention (TRA/TpB)], showed that self-efficacy had a direct effect on physical activity behavior.

More recently, Motl et al. (2002) evaluated the utility of TRA, TpB, and Self-Efficacy Theory (SET) in explaining physical activity behavior among African American and White American adolescent girls. The underlying analysis was to test a possible
theoretical relationship between main constructs of each theory which included: self-efficacy, attitude, subjective norms, and perceived behavioral control to intention and expectation. In addition, the authors sought to examine the relationships between self-efficacy, behavioral control, intention, and expectation to moderate to vigorous physical activity. Participants were 1,797 girls from 24 middle schools in South Carolina, with an ethnic distribution of 49.9% African Americans and 45.8% White Americans (Motl et al., 2002). Self-reported physical activity was obtained through a 3 day physical activity recall. Results showed a significant direct effect between (a) self-efficacy and intention, expectation, and moderate to vigorous physical activity (MVPA); (b) attitude, and intention and expectation; (c) subjective norm and intention; and (d) perceived behavioral control and expectation, and vigorous physical activity. In addition, it was reported that social cognitive variables explained a larger amount of variance in intention and expectation but only a modest amount of variance in MVPA (Motl et al., 2002). Their analysis posited perceived self-efficacy and perceived behavioral control as main correlates of physical activity among adolescent girls. However, comparing the three theories, Self-Efficacy Theory had the strongest support. Self-efficacy was related to MVPA, while also accounting for the effect of intention on physical activity among the participants.

**Determinants, Correlates, and Mediators of Physical Activity among Adolescents**

In order to maximize the effectiveness of physical activity interventions, it is important to understand and identify the variables that influence physical activity behavior among adolescents (Baranowski, Anderson, & Carmack, 1998). As such, physical activity interventions designed to target consistent modifiable correlates of
physical activity behavior among a target group will likely be more effective in changing
physical activity behavior (Baranowski et al., 1998; Sallis et al., 2000). The literature
review did not produce any study in which the purpose was to identify or test potential
correlates and/or mediators of physical activity behavior among youth with visual
impairments, nor the use of social cognitive theory to explain and/or predict physical
activity among this group. To that end, the evidence of social cognitive theory correlates
and/or mediators of physical activity among youth with and without disabilities were
used.

Few studies have been published on correlates [i.e., determinants] of physical activity
among adolescents with disabilities. While age and disability type have been shown to be
related to physical activity levels among youth with disabilities (Longmuir & Bar-Or,
2000), relatively little is known about the more modifiable theory-based psychosocial and
environmental variables that may predict increased participation among adolescents with
disabilities. An understanding of behavioral theory and the influences on, and correlates
and mediators of, physical activity levels among youth with disabilities needs to be well
understood in order to adequately design successful physical activity interventions
(Cooper et al., 1999; Rimmer et al., 1996). However, because there is no research among
youth with visual impairments in this area, a review of the research addressing youth
without disabilities may provide insight into potential correlates of physical activity
among youth of similar ages.

Reynolds and colleagues (1990) sought to identify psychosocial predictors of physical
activity in 743 tenth grade students. The predictors of physical activity included:
intention, self-efficacy, social influence, and stress, and were correlated with total
physical activity at four and 16 months after baseline. Data analysis indicated that psychosocial variables were significantly related to physical activity after controlling for baseline levels of physical activity and body mass index (BMI). At four and 16 months for males and females, significant associations with total physical activity were found for baseline activity, intention to exercise, self-efficacy, and direct social influence. At four months, results revealed that baseline physical activity, intention to exercise, stress, and social influence significantly predicted the variability in total physical activity among females. At four months for males, baseline physical activity and self-efficacy significantly predicted the variability in total physical activity. At 16 months for females, BMI, self-efficacy, and intention to exercise significantly predicted the variability for total activity, while for males baseline physical activity and intention to exercise significantly predicted the variability in total physical activity. The authors concluded that future physical activity interventions among adolescents should consider including program components that target self-efficacy, social influence, and intentions to exercise.

Based on the SCT concept of social support on behavior change, Anderssen and Wold (1992) investigated the effects of parental and peer influences on leisure-time physical activity among 904 adolescents. The authors indicated the use of self-reported leisure-time physical activity and measures of social influence, which included: (a) perceived leisure-time physical activity of parents and best friends, (b) perceived direct support for physical activity from parents and friends, (c) direct help from parents in exercising vigorously, and (d) perceived value of physical activity of parents and friends. Correlation analysis revealed that all four measures of influence were positively associated with the participants’ leisure-time physical activity levels (Anderssen & Wold,
The authors concluded that parental and peer leisure-time physical activity level and perceived parental and peer support for physical activity appeared to influence self-reported leisure-time physical activity. In addition, they argued that parents and friends are important in promoting physical activity among adolescents by serving as either role models or supports.

Zakarian et al. (1994) used Social Cognitive Theory to examine a model of potential psychosocial, social, and environmental determinants of exercise participation among an ethnically diverse group of middle and high school students ($N = 1,634$). The authors indicated that vigorous exercise performed outside of school physical education class was measured using self-report. Social Cognitive Theory variables included: (a) social (e.g., family support, peer support, teacher support), (b) cognitive (e.g., perceived barriers, self-efficacy, perceived benefits), and (c) physiological variables (e.g., BMI, body image, TV viewing, attitude). Results indicated that the mean frequency of vigorous exercise performed outside of school among the participants was 3.22 bouts per week. Approximately 55% of the participants reported engaging in vigorous exercise outside of school three or more times per week, while 20% of respondents did not engage in vigorous exercise outside of school. Gender and age-related differences were observed with boys exercising significantly more than girls and 9th graders engaging in more vigorous exercise than 11th graders. Results revealed that self-efficacy was the most significant independent variable associated with vigorous exercise. Further analysis using the overall measure of vigorous exercise (outside of school plus PE class) as the dependent variable, resulted in self-efficacy, grade level, friend support, and body image demonstrating a strong relationship with overall vigorous exercise among boys. For girls,
self-efficacy, family support, grade level, BMI, and perceived benefits were significantly associated with overall vigorous exercise. The authors concluded that their results provided evidence of the significance of self-efficacy in explaining vigorous exercise among boys and girls, as well as the influence of social support, providing evidence of the ability of SCT to explain and predict physical activity.

Sallis et al. (1999) used a national sample of 1,504 American children and adolescents from grades 4 to 12. Children and adolescents’ physical activity level was measured through self-report, which was completed by the child/adolescents and the parent. Potential correlates of physical activity were drawn from the literature, which included: (a) demographic variables (e.g., parent education, single-parent status, child’s ethnicity), (b) child variables (e.g., BMI, body satisfaction, enjoyment of PE), (c) social variables (e.g., parent physical activity index, importance of child’s physical activity), and (d) environmental variables (e.g., access to play space, play rules). Participants were further divided into three grade subgroups (grades 4-6, 7-9, and 10-12) and by gender. Results revealed that demographic variables did not significantly explained physical activity, accounting for less than 2% of the variance, and a similar case was observed with environmental variables. Child variables were significant, accounting for 8% to 42% of the physical activity variance. Among these, the use of afternoon time was significant across groups. For boys grades 10 to 12, time barriers were the strongest correlate of physical activity, while social variables explained an additional 1% to 17% of the physical activity variance. Family support was a significant correlate of physical activity across groups, with parents paying fees for physical activity as the variable with highest partial correlations for boys in grades 7-9 and 10-12. The authors pointed out the
significant independent associations of afternoon time use and family support with physical activity across grade levels and gender. The authors concluded that evidence supported the role of social support as an important correlate of physical activity among children and adolescents.

Allison, Dwyer, and Makin (1999) investigated the relationship between self-efficacy and participation in vigorous physical activity outside of school, physical education class (during school), or other school activity among a sample of 1,041 high school students from 9th (n = 688) and 11th (n=353) grades. In addition to self-efficacy, the researchers measured through self-report the effects of age, gender, and actual and perceived barriers on vigorous physical activity participation. Results revealed that participants engaged in vigorous physical activity an average of 2.9 days per week outside of school, while engaging in 2.2 days per week during physical education class. Regression analysis revealed an age-related trend in physical activity with 9th graders reporting being more active than 11th graders. In addition, gender differences were observed with boys reporting more vigorous activity in all three settings. Further, analysis revealed that self-efficacy regarding external barriers was a significant predictor of participation in vigorous physical activity in two settings: other school activity and outside of school activity. The authors concluded that self-efficacy is an important predictor of vigorous physical activity among high school students.

Trost, Pate, Ward, Saunders, and Riner (1999) used activity monitor technology to measure physical activity among 213 preadolescents (110 girls, 103 boys) from four public middle schools. The purpose of their study was to identify psychosocial and environmental correlates of physical activity derived from Social Cognitive Theory and
Theory of Reasoned Action. Rather than using self-reported physical activity, they used the Computer Science and Applications Inc. (CSA) 7164 accelerometer to record moderate and vigorous physical activity movement. Physical activity monitoring lasted one week, in which students also recorded through an activity log each time the accelerometer was not worn and the type and contextual information of physical activity that may have not been recorded by the accelerometer. Theory-derived potential correlates of physical activity were categorized into three main categories: (a) demographic, (b) psychosocial, and (c) environmental. Trost and colleagues reported that participants accumulated an average of 75 minutes per day of moderate physical activity, while accumulating only an average of 10 minutes of vigorous physical activity per day. Contrary to previous research, there were no significant differences between boys and girls for daily vigorous physical activity minutes. It was found that for boys, self-efficacy, social norms, perception of mother’s physical activity, and involvement in community-based physical activity organizations were significantly correlated with vigorous physical activity. In addition, social norms regarding physical activity, perceptions of father’s activity levels, and involvement in community-based physical activity organizations were significantly correlated with moderate physical activity for boys (Trost et al., 1999). For girls, physical activity self-efficacy and beliefs regarding physical activity outcomes were significantly associated with vigorous physical activity, while physical activity self-efficacy, beliefs regarding physical activity outcomes, and access to sporting and/or fitness equipment at home were significantly correlated with moderate physical activity.

Physical activity self-efficacy, social norms regarding physical activity, and involvement in community-based physical activity organizations were significant
correlates of daily vigorous physical activity participation among boys. In looking at moderate physical activity for boys, social norms regarding physical activity and involvement in community-based physical activity organizations were significant correlates accounting for 13% of the variance. For girls, the authors indicated that physical activity self-efficacy was the only significant correlate of daily vigorous physical activity. Trost and colleagues argued that their main finding was the significant associations between self-efficacy and physical activity behavior. Physical activity self-efficacy was the strongest independent predictor of daily moderate and vigorous physical activity among girls and vigorous physical activity among boys, supporting previous findings identifying self-efficacy as a significant predictor of physical activity among adolescents. These suggest that future physical activity interventions should target increasing physical activity self-efficacy among adolescents.

Bungum, Dowda, Weston, Trost, and Pate (2000) examined the relationships between psychosocial variables derived from Social Cognitive Theory and Theory of Reasoned Action and moderate to vigorous physical activity (MVPA) and vigorous physical activity (VPA) among adolescents ($N = 520; 8^{th}$ to $12^{th}$ grades). Psychosocial variables hypothesized to predict physical activity included: self-efficacy, subjective norms, attitudes, intentions, and enjoyment. Moderate to vigorous physical activity and vigorous physical activity were assessed through a previous day physical activity recall. Results demonstrated boys were significantly more active than girls for both MVPA and VPA. Correlation analyses revealed that among boys, subjective norms correlated with intentions to be active, while for girls subjective norms correlated with VPA and intentions to be active. For both genders, attitudes, enjoyment, and self-efficacy
significantly correlated with MVPA, VPA, and intentions to be active. Age appeared as a correlate of VPA among gender. Intentions also demonstrated to be a significant correlate of MVPA and VPA (Bungum et al., 2000). Findings further indicated that for gender, self-efficacy and enjoyment were significant predictors of intentions to be physically active. Moreover, self-efficacy was the strongest predictor of VPA among boys and girls and of MVPA among girls. Bungum et al. argued that a key finding from their study was that self-efficacy was a significant independent predictor of physical activity among adolescent boys and girls.

Using a combination of self-reports and accelerometers, Sallis, Taylor, Dowda, Freedson, and Pate (2002) examined correlates of vigorous physical activity among children and adolescents in grades 1 through 12. Similar to Sallis et al. (1999), participants were divided into grade groups (grades 1 to 3, grades 4 to 6, grades 7 to 9, and grades 10 to 12). The purpose of including age groups was to examine correlates specific to age and gender. Parents completed a survey containing items measuring 21 potential correlates of vigorous physical activity, in addition to items measuring time spend in vigorous physical activity during a typical week. Two hundred children from the sample were randomly selected from each grade group to wear CSA 7164 accelerometer for seven consecutive days.

Correlates of vigorous physical activity were categorized as: demographic, child, psychological / physiological, social, and environmental variables. Results showed that enjoyment of physical activity, perceived coordination, use of recreational time, family influences, and peer influences were significant correlates in five of the eight subgroups. For boys in grades 7 to 9, use of recreational time and peer support were significant
predictors of vigorous physical activity. For boys in grades 10 to 12, age and ethnicity were predictors of VPA. For girls, results revealed that for grades 7 to 9, use of recreational time and peer support were significant predictors of VPA, which is similar to that for boys in the same grade group. For girls in grades 10 to 12, use of recreational time and family support were the most significant predictors of VPA. Sallis et al. argued for the significance of social support, in the form of peer and family support, in predicting VPA, in particular for grade groups 7 to 9 and 10 to 12.

Although most of the research reviewed up to this point has sought to identify correlates of physical activity among adolescent youth, either by comparing theoretical frameworks or by selecting a wide range of variables, few have focused on testing constructs from a single theory in explaining leisure-time physical activity. To that end, Winters, Petosa, and Charlton (2003) evaluated the predictive ability of four SCT constructs: self-efficacy to overcome barriers, social situation, outcome expectation values and self-regulation, on discretionary leisure-time moderate and vigorous physical exercise. Moderate and vigorous physical exercise was measured through the Godin Leisure-Time Physical Activity Questionnaire (GLTPAQ) among 248 high school students (150 girls, 98 boys).

Winters et al.’s results revealed that 36% of the participants reported engaging in moderate physical exercise on five or more days per week. On the contrary, a greater percentage (65%) reported engaging in three or more days of vigorous physical exercise during a typical week. Significant relationships between the four theoretical constructs and leisure-time moderate and vigorous physical exercise frequency were found. All four constructs explained 29% of the variance in frequency of discretionary leisure-time
vigorous exercise. Among these variables, outcome expectancy values was the most significant predictor accounting for 10% of the explained variance, followed by self-regulation which accounted for 8% of the variance (Winters et al., 2003). For leisure-time moderate physical exercise, all four SCT variables explained 11% of the variance; self-regulation accounted for 6% of the unique variance explained for moderate physical exercise. Winters et al. argued that their study was the first in reporting explanation of a significant amount of variance in adolescents’ self-reported moderate and vigorous leisure-time physical exercise, while referring to the utility of SCT as a guiding theoretical framework in explaining physical activity among adolescents.

Neumark-Sztainer, Story, Hannan, Tharp, and Rex (2003) examined factors associated with changes in moderate physical activity (MPA), vigorous physical activity (VPA), and moderate to vigorous physical activity (MVPA) among 201 adolescent girls (grades 9 to 12) who previously participated in a school-based obesity prevention program. Similar to previous studies, Neumark-Sztainer et al. used SCT to guide their selection of potential predictors of physical activity. Physical activity levels were measured through self-reports (Godin Leisure-Time Exercise Questionnaire). Correlation analysis showed an inverse relationship between age and physical activity levels. Among the explanatory variables, regression analyses showed that time constraints and social support were the most significant predictors of VPA and MVPA over time. In addition, time constraints and physical activity self-efficacy were significant predictors of changes in MPA over time. Neumark-Sztainer et al. supported previous research on the significance of social support and self-efficacy in predicting physical activity participation among adolescent girls.
Dishman et al. (2004) examined the relationships between self-efficacy, outcome expectancy values, goal setting, satisfaction, and physical activity as proposed by SCT among adolescent girls ($N = 2,087$). These authors designed a school-based physical activity program to increase physical activity and fitness among adolescent girls from different ethnic backgrounds. The intervention was hypothesized to lead to changes in the four SCT variables and physical activity. Physical activity was measured using a three day physical activity recall. Their analysis showed that at baseline, significant relationships were found between self-efficacy and physical activity, and satisfaction and physical activity. At follow up, significant relationships were observed related to self-efficacy, outcome expectancy values, and satisfaction to physical activity. Furthermore, their inspection of the path coefficients regarding the effects of the intervention on SCT mediating variables showed significant positive effect of the intervention on self-efficacy, outcome expectancy values, and physical activity. On the contrary, self-efficacy, outcome expectancy values, and satisfaction had statistically significant direct effects on physical activity. Dishman et al. concluded that the effect of the intervention on physical activity was partially mediated by self-efficacy. The role of SCT in explaining physical activity behavior among adolescent girls was supported by Dishman et al.‘s findings.

Petosa, Hertz, Cardina, and Suminski (2005) further examined the relationship of SCT variables (e.g., self-regulation, social situation, outcome expectations, self-efficacy) and frequency of physical activity on high school students ($N = 256$; grades 9 to 12). A previous day physical activity recall was used to measure days of physical activity. It was completed by the participants for seven consecutive days. Results showed that during the seven day period, 57.4% of the participants did not report engaging in any bouts of
physical activity; 18.8% reported engaging in one day of physical activity, and 8.6% reported engaging in physical activity of moderate to vigorous intensity two days per week. Only 5% of the participants reported engaging in recommended levels of physical activity on a weekly basis. Correlation analysis between SCT variables and physical activity demonstrated that all variables, with the exception of negative outcome expectations and social outcome expectations, were significantly correlated ($p = .01$). Negative outcome expectations and social outcome expectations were significant ($p = .05$) as well (Petosa et al., 2005). Among these, self-regulation for exercise had the highest correlation ($r = .52$), followed by self-efficacy for ability ($r = .43$), self-efficacy for barriers ($r = .47$), and social situation ($r = .39$). The SCT variables explained 31% of the physical activity variance. Petosa et al. argued that their findings provided further evidence to support SCT as a viable theoretical framework for studying physical activity behavior among adolescents.

Heitzler, Levin-Martin, Duke, and Huhman (2006) reported evidence supporting positive outcome expectations and social support as correlates of physical activity among preadolescents ages 9 to 13. Their main goal was to examine potential psychosocial and environmental variables as correlates of organized sports and free-time physical activity among a sample drawn from the Youth Media Campaign Longitudinal Survey (YMCLS). Heitzler et al. reported that the baseline survey data was obtained from 3,114 parent/child pairs. The variables included as potential correlates of physical activity, were: (a) demographic (e.g., age, sex, ethnicity), (b) psychosocial (e.g., perceived parental support, outcome expectations, parental beliefs), and (c) environmental (e.g., safety, environment, support for physical activity). These variables were then subgrouped as child variables.
and parent variables. Physical activity was self-reported using the seven days prior to the interview. Heitzler and colleagues found that approximately 39% of the participants ages 9 to 13 participated in one or more organized physical activities during a typical week. In addition, 65% reported engaging in three or more bouts of physical activity during their free time. Perceptions of parental support and having positive outcome expectations were significant correlates for organized physical activity. Regarding child correlates for free time physical activity, safety, positive outcome expectations, and opportunities to be active in the community were the most significant correlates. Heitzler et al. reported that parental correlates that were related to organized physical activity among participants included: importance of their child participating in sports or physical activity, parental beliefs about physical activity, attending their child’s events, transportation of the child to sport or physical activity events, and the importance of their children participating in physical activity during their free time. Heitzler et al. indicated that the regression analysis revealed that the strongest correlates for organized physical activity among the sample were parental perceptions of the importance of organized physical activity and the child’s perception of parental support, while the child perceptions for feeling safe and the parents’ perception of the importance of free time physical activity were the strongest correlates for youth free time physical activity.

Beets, Pitetti, and Forlaw (2007) tested two models of social support and three dimensions of self-efficacy and how they related to the physical activity of adolescent girls ($N = 259$) living in rural settings. The authors hypothesized that: (a) having social support and higher self-efficacy would positively affect physical activity levels, (b) increasing social support would influence self-efficacy and in turn physical activity, (c)
peer and parent support would influence physical activity, and (d) increasing self-efficacy would be positively related to increased social support. The authors used self-report questionnaires to determine physical activity levels and the social support participants received from their peers, mothers, and fathers. In addition, a self-efficacy questionnaire was also given. All data collection occurred in their physical education classes. Results showed that peer social support and overcoming barriers (self-efficacy) had direct and positive effects on physical activity levels of the participants, while parental support did not. By having peers who promote physical activity, participants were more likely to become more physically active, and overcome barriers to physical activity participation by having another person with which to participate.

Lubans and Sylva (2007) examined the mediating role of self-efficacy, peer social support, and outcome expectancy value (constructs derived from SCT) on changes in MVPA among high school students (N = 78; 48 girls, 30 boys) ages 16 to 18 after the implementation of a ten week conceptual physical education program. Because the program was based on SCT, Lubans and Silva selected self-efficacy, outcome expectancy value, and peer social support as potential mediators of the intervention’s effects on MVPA. Results indicated that there was a significant relationship between the conceptual physical education intervention and MVPA among girls (r = .31; p < .04). However, a marginally significant relationship was observed between the intervention and MVPA among boys (r = .32; p < .09). These findings supported the effects of the intervention on MVPA among girls (Lubans & Silva, 2007). Regression analyses revealed that only changes in self-efficacy among girls were significantly associated with the intervention.
Summary. The literature on factors influencing physical activity among adolescents has consistently demonstrated the significant association between social cognitive variables and physical activity among adolescents. Among the SCT variables identified in the literature, self-efficacy, social support (family and friends), outcome expectancy values, and self-regulation were cited the most as predicting correlates of physical activity among adolescents. In addition, age and gender were also identified as determinants of physical activity among adolescents; however, contrary to psychological variables or environmental variables, age and gender are not modifiable, limiting the ability to be affected through interventions. A common methodological approach to measure physical activity across studies was the use of self-reports, which may raise concerns with the adequacy of the data reported by children and adolescents. However, even when objective measures of physical activity were used, SCT variables were still significantly related to physical activity participation. In studies in which SCT variables were used to predict physical activity participation, regression models explained between 29% (Winters et al., 2003) to 31% (Petosa et al., 2005) of the explained variance in physical activity among adolescents, with self-efficacy as the strongest independent predictor of physical activity.

Social cognitive variables have consistently demonstrated positive relationships with physical activity among adolescents, which provides support to the utility of SCT. Self-efficacy, social support, outcome expectancy values, and self-regulation are among the SCT variables that should be considered targets for interventions designed to change physical activity behavior among youth (Reynolds et al., 1990; Winters et al., 2003). Unfortunately, among adolescents with visual impairments, only age and disability type
have been associated with physical activity participation (e.g., Kozub & Oh, 2004; Longmuir & Bar-Or, 2000). No research was found on theory-based, psychosocial, or environmental correlates of physical activity behavior among this group. Social Cognitive Theory may provide a useful framework to study physical activity among adolescents with visual impairments as has been conducted among adolescents without disabilities.

**School-Based Physical Activity Interventions**

A number of reviews have been published regarding the effectiveness of school-based physical activity interventions (e.g., Cale & Harris, 2006; Ringuet & Trost, 2001; Stone et al., 1998). Although each review has followed a different method to identify and examine each intervention, the authors of these reviews have suggested that school-based physical interventions have fallen under the following categories: (a) curriculum only, (b) curriculum and physical education, (c) curriculum, physical education, and environment, (d) augmented physical education only, (e) physical education and environment, (f) environment only, (g) activity breaks, (h) after-school, (h) school and family, and (i) school, family, and community (Cale & Harris, 2006; Salmon, Booth, Phongsavan, Murphy, & Timperio, 2007). This section will review and discuss school-based interventions designed for secondary school-aged students.

**Curriculum Only School-Based Interventions**

*Stanford adolescent heart health program.* The Stanford Adolescent Heart Health Program (SAHHP) is a high school-based program designed to: (a) increase knowledge about cardiovascular disease risk factors, (b) decrease risk behaviors for cardiovascular disease, (c) increase aerobic physical activity, and (d) lower heart rate, blood pressure,
and BMI among adolescents (Killen & Robinson, 1989; Killen et al., 1989). The SAHHP consists of 20 sessions delivered during physical education, covering topics on physical activity, nutrition, smoking, and stress. In addition, emphasis is added on the short and long-term benefits and consequences of changing health behaviors, increasing self-regulatory skills, and designing a plan of action for changing health behaviors. Using Social Cognitive Theory as the theoretical model underlying the intervention, Killen et al. (1989) applied SCT constructs in the development of the SAHHP. The SCT constructs targeted in Killen et al.’s SAHHP intervention included: self-regulation, social-environmental modeling, and self-efficacy. Participants in the program included 10th grade students ($N = 1,447$) from four high schools. Physical activity was measured through self-reports and data were collected during baseline and four months after baseline. Results showed that a greater proportion of students in the experimental group classified as non-regular exercisers became regular exercisers at follow-up compared to the control group. In addition, knowledge gains were significantly greater for the experimental group compared to control students for nutrition, physical activity, and cigarette smoking.

*Planet health.* Gortmaker et al. (1999) evaluated the impact of an intervention called Planet Health on obesity rates among 1,295 6th to 8th grade students from ten schools. Planet Health is a multi-component school-based intervention grounded in SCT and Behavioral Choice Theory, including focus on four behavioral changes: reducing TV viewing to less than two hours per day, increasing MVPA, decreasing high fat intake, and increasing the consumption of fruits and vegetables. Gortmaker et al. highlighted the interdisciplinary distinction of Planet Health, with intervention material embedded into
core academic subject areas and physical education. Specific to physical education, Planet Health materials focused on activity and inactivity as well as developing skills such as goal setting, self-assessment, and replacing inactive time with MVPA of the student’s choice. Physical activity was measured through self-report and for overweight/obesity measures, BMI and skinfolds were obtained. Results revealed that the prevalence of obesity among girls in the intervention declined from 23.6% to 20.3% after the two-year intervention while the prevalence of obesity increased from 21.5% to 23.7% in girls in the control group. Furthermore, Gortmaker and colleagues indicated that the prevalence of obesity among girls in the intervention schools was significantly reduced compared to girls in the control schools. There were no significant differences for obesity prevalence among boys in the intervention and control groups. Regarding physical activity, no significant differences were found between groups.

*Curriculum and Physical Education School-Based Interventions*

*Lifestyle education for activity program.* Pate and colleagues (2005) evaluated the effects of an intervention on the physical activity levels of a sample of 2,744 9th grade girls. The Lifestyle Education for Activity Program (LEAP) was designed based on an ecological model drawn from SCT, and consisted of six components: physical education, health education, school environment, school health services, faculty/staff health promotion, and family/community involvement. The physical education (LEAP PE) component was designed to: (a) enhance physical activity self-efficacy and enjoyment, (b) teach physical and behavioral skills needed to adopt and maintain an active lifestyle and (c) engage girls in MVPA during 50% or more of the class time. Because the target group consisted of girls, LEAP PE was oriented toward girls by allowing choice, building
skills, and reinforcing physical activity participation during physical education class and outside of class.

As part of the LEAP study, physical activity was measured through a 3-day physical activity recall. The main outcome variables for LEAP were: (a) percentage of girls in each school who reported participating in vigorous physical activity during an average of one or more 30-minute time blocks per day during the three-day reporting period, (b) participation in two or more 30-minute blocks per day of MVPA, and (c) the prevalence of overweight and at-risk for overweight. Results indicated that the prevalence of vigorous physical activity was significantly higher among girls in the LEAP intervention group when compared to girls in the control group. Pate et al. indicated that 45% of girls in the intervention group and 36% in the control group had participated in an average of one or more 30-minute blocks of vigorous physical activity per day during the previous three days. However, there were no significant differences between groups regarding participation in 30-minute blocks of MVPA. Interestingly, most girls in both groups engaged in daily 30 minute blocks of MVPA at both baseline and follow-up. No significant differences were observed in BMI between girls in the control and intervention groups. The authors concluded that LEAP was successful at increasing participation in vigorous physical activity among girls in the intervention group. They indicated that a major feature of LEAP was the modification of physical education classes to emphasize enjoyment, physical activity self-efficacy, and promoting participation in MVPA during class.
**Lifetime physical activity program.** Lubans and Sylva (2006) designed a school based physical activity intervention called the Lifetime Physical Activity Program (LPAP). The LPAP program is a ten week program based on the theoretical frameworks of SCT and self-efficacy theory, aiming to enhance social support and self confidence to encourage physical activity. The participants in this study were 78 males and females ages 16 to 18, and all were members of a high school course that focused on health and fitness. The program addressed socio-environmental as well as behavioral factors such as finding training partners and goal setting, and was designed for the participants to meet once a week for 90 minutes, in addition to encouraging the students to participate in moderate to vigorous physical activity each day throughout the week. Data were collected through two questionnaires, one of which the participants answered three times throughout the study to determine student responses to the different theoretical constructs, and the Oxford Physical Activity Questionnaire (OPAQ), a seven day physical activity recall.

Participants in the intervention group tended to have more peer and parent support following the intervention and higher self efficacy regarding exercise than the control group. Although the participants in the control group reported higher levels of moderate to vigorous physical activity at the end of the intervention (78 minutes more), these differences were not significant at the three month follow up. The authors concluded that an intervention such as this could be beneficial to participants on more of a short term basis because the changes were not significant in the three month follow up prior to the completion of the intervention.
Planning to be active. Hortz and Petosa (2006) reported the effects of a SCT-based intervention on frequency of leisure time moderate and vigorous physical exercise among high school aged students from a rural area. As part of the intervention, four SCT constructs were targeted: self-regulation, social situation, outcome expectancy values, and strength of self-efficacy. Students in the intervention group received the Planning to be Active program and met once a week, while students in the comparison school received traditional physical education. Planning to be Active is an 8-week program in which students were taught how to use self-regulatory skills to promote regular exercise participation during their leisure time. In addition, the curriculum also focused on increasing participants’ strength of self-efficacy, outcome expectancy values, and social situation. Leisure time moderate and vigorous physical activity was measured using a previous day physical activity recall for seven consecutive days.

Posttest data analysis indicated that the percentage of students getting less than five days of moderate physical exercise per week reduced from 100% to 81.1% in the intervention group and from 96.9% to 87.4% in the comparison group. Similarly, the percentage of students getting fewer than three days of vigorous physical exercise per week reduced from 86% to 77.6% in the intervention group, while it decreased from 88.7% to 70.2% in the comparison group at posttest. In addition, the percentage of students in the intervention group reporting no days of moderate physical exercise during their leisure per week decreased from 46.9% to 9.1%. On the contrary, the percentage of students in the comparison group reporting no days of moderate physical exercise during their leisure per week changed from 44.3% to 53.6%. Hortz and Petosa indicated that the intervention had no significant effects on increasing vigorous physical exercise.
Project active teens. Dale, Corbin, and Cuddihy (1998), examined the physical activity participation of high school students 1-3 years after they had been exposed to a 9th grade conceptual physical education program (Project Active Teens [PAT]). The goal of the program was to reduce the number of sedentary adolescents, while increasing moderate and vigorous physical activity participation. The program was offered for one semester for two consecutive years. To examine the effects of the program, Dale et al. compared the program to a traditional physical education curriculum. Students were assessed three years after completion of the program using self-reported physical activity questionnaires. National recommendations for youth physical activity were used to evaluate program effectiveness. Results revealed that students from the conceptual program met adolescent guidelines for physical activity, especially those who participated in the program in its first year. Females were significantly less likely to report sedentary behaviors if they had been exposed to the conceptual, rather than traditional, high school physical education program. Dale and Corbin (2000) further evaluated the effects of PAT on physical activity participation among participants after high school graduation. Their findings revealed that a greater percentage of males from the treatment group (65%) were vigorously active compared to males in the control group (29%).

Physical Education (PE) Only School-Based Interventions

M-SPAN. Sallis and colleagues (2003) reported the effects of intervention based environmental, policy, and social marketing strategies on middle school student physical activity levels and fat intake in 24 middle schools in San Diego, California. The Middle School Physical Activity and Nutrition (M-SPAN) study was designed to: (a) increase the
availability of low-fat food choices, (b) increase physical activity opportunities, and (c) promote healthful choices. M-SPAN is a multi-component intervention with a physical activity component and a nutrition component (McKenzie, 2001a; Sallis et al., 2003). The physical activity component is designed to increase physical activity within the existing physical education classes by modifying the lesson context and teacher behavior (Sallis et al., 2003). In addition, as part of the physical activity component, opportunities for students to engage in physical activity during the school day were also made available. What was unique about M-SPAN was that it used an ecological model of health behavior (McKenzie, 2001a; Sallis et al., 2003). As part of the ecological approach, M-SPAN implemented health policy changes among schools, created health policy meetings and committees, provided parental education and support, and offered school incentives for participating and adopting changes (Sallis et al., 2003).

The System for Observing Fitness Instruction Time (SOFIT) was used to measure physical activity during physical education classes while the System for Observing Play and Leisure Activity in Youth (SOPLAY) was used to measure leisure-time physical activity levels of students during the school day (Sallis et al., 2003). Results revealed that a time by condition interaction for the total population was significant. A large effects size was reported. Furthermore, gender-specific analyses resulted in a significant time by condition interaction for boys. There was no significant time by condition interactions for girls (Sallis et al., 2003). Significant BMI effects were found among boys but not among girls. Sallis and colleagues (2003) indicated that the intervention may have produced an impact on boys’ physical activity levels that led to physiologic effects on BMI. However,
while the intervention showed to be effective on boys, it did not produce significant
effects on girls.

*New moves.* Neumark-Sztainer, Story, Hannan, Stat, and Rex (2003) developed an
alternative physical education program called New Moves, a class developed for high
school girls who were at risk of overweight/obesity because of low engagement in
physical activity. The goal of this program was to bring changes in physical activity and
eating habits that would help the girls to lose weight and maintain weight loss. Eighty-
nine girls were in the intervention group and 112 girls in the control group (9th and 10th
grades). New Moves was designed around the theoretical framework of SCT, focusing on
socio-environmental, personal, and behavioral factors. The intervention consisted of
physical activity sessions offered four times per week as well as nutrition and social
support meetings offered every other week. During the physical activity sessions, one of
the four days was devoted to guest instructors, one to strength training, and two for
activities designed by the physical education teacher and New Moves coordinator. One of
the important aspects of this intervention was the link to the community. By having a
community guest speaker, students could experience a variety of special activities (such
as yoga and kick boxing) within their community. The girls were able to take field trips
to community centers and parks as a part of the intervention. Although the intervention
group had a slightly higher pretest BMI than the control group, post test and follow up
data showed no significant differences. Neumark-Sztainer and colleagues suggested a
need for an intervention that was longer and more intense as one way to better impact the
BMI of participants such as the girls who took part in this study.
One of the few recently published physical education interventions to target middle school-aged girls was conducted by Fairclough and Stratton (2006). Fairclough and Stratton sought to investigate if manipulating the physical education lesson context and teacher behavior would lead to increased physical activity levels among girls during physical education class without compromising other teacher-planned lesson objectives. The physical education classes were scheduled for one (1) two-hour weekly session with approximately 30-32 students taught by certified physical education teachers. Fairclough and Stratton decided to select a six-lesson unit of gymnastics based on the rationale that during gymnastics, students tend to engage in relatively lower levels of MVPA due to the nature of the activities. That led them to hypothesize that gymnastics would provide a suitable test of the teaching intervention. After the five-week gymnastics unit, Fairclough and Stratton introduced the teaching intervention. The intervention consisted of telling the intervention group’s teacher about the purpose of the study (i.e., increase levels of PA among girls) while keeping the control group’s teacher uninformed. The authors instructed the intervention teacher to use different strategies such as: maximizing groups, proper use of space and equipment, teaching approaches, lesson pace, emphasizing inclusion, minimizing teacher talking time, and student enjoyment, among others. Physical activity levels were measured using SOFIT. Results revealed that both intervention and control conditions spent most of the lesson time sitting and waiting, but the intervention group engaged in significantly more MVPA compared to the control group (18.5% versus 13.5%), which translates into approximately three more minutes of MVPA. Fairclough and Stratton indicated that the proportion of time allocated to management, general knowledge, and fitness activities was similar between conditions;
however, students in the intervention group had significantly more opportunities for skill practice (43.1% versus 34.1%). The authors commented that once MVPA data were converted into absolute values, the control condition accumulated approximately 11 minutes of MVPA during class while the intervention group accumulated 14 minutes of MVPA.

Schneider and colleagues (2007) indicated a need for interventions that target the downward trend in physical activity engagement seen in adolescent years. The authors designed a physical education based intervention to increase physical activity and physical fitness in adolescent females by combining physical activity in schools with an educational component to encourage out of school participation. This study was conducted during a three year period with 22 intervention and 21 control participants in the first year, 20 intervention and 19 control participants in the second year, and 21 intervention and 19 control participants in the third year. A final analysis was conducted for 63 intervention and 59 comparison participants. The intervention consisted of supervised in-class activities designed to increase physical activity levels, health education, and self monitoring activities. During the intervention, the females met five times per week, with one day focusing on education/lecture, supervised activities three times per week, and strength building sessions once a week. Physical activity was measured through a three-day recall. Improvements in cardiovascular fitness and vigorous physical activity levels were significantly higher for the intervention group. In fact, physical activity levels increased from 59% to 84% during the second semester, while time engaged in moderate activity remained stable in the intervention group and decreased in the control group. The results showed that it was possible to significantly
enhance physical activity and fitness levels through the use of an intervention focusing on these aspects.

**After School Interventions**

Wilson et al. (2005) designed a four-week student-centered after-school program intended to increase physical activity among 48 rural school-aged adolescents (ages 11-14). Based on SCT and Self-Determination Theory (SDT), the goal of the intervention was to increase moderate to vigorous physical activity to 60 minutes or more per day based on national guidelines. Wilson et al. stated that there were two novel strategies that were implemented in this intervention: (a) students were allowed to have a choice of the type of physical activities in which they would like to participate, and (b) students had the opportunity to develop their own coping skills for making physical activity behavior changes through the use of videotaped sessions. Wilson et al. indicated that the intervention was delivered three days per week for four consecutive weeks, with sessions lasting approximately two hours. In addition, during the session students had the opportunity to develop their own activity program, select activities of the preference, and develop coping skills for making physical activity behavior changes. The intervention consisted of three components: snack homework component, physical activity component, and SCT/SDT component. Wilson et al. indicated that measures of physical activity and psychosocial variables were conducted during baseline and during the four week period of the intervention. The authors indicated that the intervention was examined based on its physical activity effects as well as psychosocial variables derived from the two theoretical frameworks underlying the intervention. Wilson et al. used MTI accelerometers to assess participants’ time spent in moderate physical activity (MPA),
vigoruous physical activity (VPA), and moderate to vigorous physical activity (MVPA). The psychosocial variables were assessed through questionnaires. Results showed that students in the intervention school increased their time spent in MVPA (113.94±6.27 vs 78.78±6.27), MPA (99.36±5.88 vs 72.63±5.88), and VPA (11.33±1.07 vs 5.31±1.07). In addition, time spent in VPA among participants in the intervention school was greater during days in which the intervention was delivered as opposed to non-program days [16.34±14.02 vs. 8.13±5.49]. Students in the intervention school reported greater increases in motivation and positive self-concept compared to students in the comparison school. Results provided preliminary evidence of the feasibility of a four-week theory-based after school program in increasing and promoting physical activity behavior change among sixth grade students.

Summary. The literature review on school-based interventions has demonstrated small to moderate effects on changing physical activity behavior among adolescents (Baranowski et al., 1998; Ringuet & Trost, 2001). Greater effects were observed for interventions in which physical activity during physical education was the target. However, less favorable effects were observed on outside of school physical activity behavior. Social Cognitive Theory was the foundation upon which five of the nine interventions were designed, while theory constructs were targeted in others. The school has been acknowledged as playing a key role in promoting physical activity among youth (Bandura, 2004; Kahn et al., 2002; USDHHS, 2000). Based on the studies reviewed, it can be concluded that there is enough evidence supporting the effectiveness of school-based interventions to increase physical activity levels among youth. However, Kahn et al. identified the lack of evidence on their effects in increasing physical activity outside
of school. Given that physical activity levels decrease with age, particularly during adolescence (Caspersen et al., 1999; Sallis et al., 2000), the lack of physical activity interventions addressing the needs of youth with disabilities is disappointing. Stone et al. (1998) recognized the need for studies examining the effectiveness of physical activity interventions for diverse groups, including children and adolescents with disabilities. Interventions using SCT have showed promising results which provide support when designing school-based physical activity promotion programs for adolescents with disabilities, such as those with visual impairments.

Summary

The research has shown that physical activity levels among children and adolescents with visual impairments are considerably less physically active than adolescents without disabilities. Even when residential schools offer a number of after school programs tailored for their needs, adolescents with visual impairments engage in more sedentary activities (Kozub & Oh, 2004). Considering that adolescents with visual impairments will soon be transitioning from school to community living, increasing their physical activity levels as well as providing them with skills needed to initiate and maintain active lifestyles is warranted. Schools appear as the logical environment in which physical activity behavior can be fostered (Kozub, 2006). Unfortunately, there is no evidence of physical activity interventions specifically designed for these individuals.

School-based interventions for adolescents without disabilities have shown promising results in increasing physical activity levels, primarily on moderate intensity physical activity, either during physical education class or after school hours. Among the school-based interventions, SCT was the most common theoretical foundation. Even with the
lack of research evidence to date, it is plausible that SCT could be useful in explaining physical activity behavior among adolescents with visual impairments. With the age-related trend in physical activity among adolescents with visual impairments (Kozub & Oh, 2004; Kozub, 2006; Longmuir & Bar-Or, 2000), physical activity interventions targeting the social cognitive variables of self-efficacy, self-regulation, social support, and outcome expectancy values is warranted for individuals with visual impairments.
CHAPTER 3

METHOD

This chapter describes the methods used to study the effects of the intervention on the acquisition and maintenance of daily leisure time physical activity (i.e., duration and intensity) among adolescents with visual impairments. The chapter includes the following sections: pilot study, participant selection, description of the independent variable, definition and measurement of dependent variables, treatment integrity and reliability, experimental design, procedures, social validity, and data analysis.

Pilot Study

In order to evaluate the adequacy and viability of the intervention, a pilot study was conducted. The intervention was pilot tested during a four week period. The first week of intervention included lessons one to three with two lessons each week for the next three weeks. The intervention as piloted was based on the Plan for Exercise, Plan for Health program (Stevens et al., 2006). In its original form, the Plan for Exercise, Plan for Health program was implemented as a nine to ten week educational unit, with one lesson delivered per week. The program was implemented as part of the physical education curriculum at selected schools with the purpose to promote moderate to vigorous leisure time physical activity. As such, participants in studies using the Plan for Exercise, Plan for Health program were required to participate in moderate to vigorous physical activity
as part of their physical education course in which they earned a grade. However, in the pilot study participants were not required to participate in the study as part of a grading process. Rather, the program was offered as an after school option. The intervention was also condensed from the original nine to ten weeks to four weeks to maximize student reach and minimize overlapping with other after school programs. To that end, modifications made to the original *Plan for Exercise, Plan for Health* program were substantial enough to have made the revised intervention different from the original.

Instruction took place in a classroom, assigned to researcher by the after school administration. Residential school facilities were made accessible to all participants and professional adult supervision (i.e., youth leaders) was provided to ensure safety. Detailed intervention lesson plans were developed, with sessions lasting approximately 30-45 minutes. Lesson plans were provided to all students at the same time in a group setting. Immediately following instruction, students had the remainder of the after-school time to engage in activities of their choosing. In addition, as part of the pilot study all data collection instruments were examined for suitability, validity and reliability. Based on data gathered in the pilot study, including participant and after school staff feedback, procedural changes were made as needed to the subsequent dissertation study and the data collection instruments. All intervention sessions during the pilot study were videotaped for the purposes of program evaluation for needed procedural changes and observer training. Overall, the program was well-received by participants, after school staff, and parents.
Participants

Participants for the pilot study were three (3) adolescents with visual impairments (1 girl, 2 boys); ages 16 to 18 years of age (grades 10 to 11) from a residential state school for the blind in the Midwest. Participants’ visual conditions are presented in table 3.1.

After receiving approval from the university’s Institutional Review Board (Appendix A) and the school’s administration (Appendix B), participants were selected from a pool of potential students interested in the program and were recommended by after school staff.

Descriptions of each participant’s degree of vision loss was determined through accessible school information and the sport classification system for the United States Association for Blind Athletes (USABA). The USaba has established four distinct classifications to ensure equitable sport competition among athletes with visual impairments. The four classifications include: (a) B1, referring to individuals unable to perceive light in either eye to those who have light perception, but are unable to recognize the shape of a hand regardless of distance or direction; (b) B2, referring to individuals capable of recognizing the shape of a hand to a visual acuity of 20/600 and/or a visual field of less than 5 degrees in the best eye with the best practical eye correction; (c) B3, referring to individuals exhibiting a visual acuity above 20/600 and up to visual acuity of 20/200 and/or a visual field of less than 20 degrees and more than 5 degrees in the best eye with the best practical eye correction; and (d) B4, referring to individuals whose visual acuity is above 20/200 and up to visual acuity of 20/70 and a visual field larger than 20 degrees in the best eye with the best practical eye correction (USABA, 2007). The residential state school specializes in serving students diagnosed with visual impairments whose educational needs cannot be met in a public school setting. In
addition to having a visual impairment, participants were: (a) identified by after school residential program personnel as in need for physical activity behavior change, (b) residential students, (c) have returned consent/assent and parental consent forms; (d) not have any known physical or cognitive disability that would prevent enhancing physical activity behavior, and (e) not an active member of a school-sponsored athletic varsity team. All participants returned required consent forms (e.g., parental, assent) prior to the start of data collection. Pseudonyms were use to safeguard the privacy of each participant.

Setting

The pilot study was conducted in a state school for the blind located in Columbus, Ohio. The program was delivered during the after school hours in a classroom-like, well light room. School residential facilities include all school grounds (e.g., gymnasium, pool, track, open areas, cafeteria) as well as dorms. Some of the dorms are equipped with stationary bikes and treadmills. Similarly, the school’s gymnasium has available four treadmills, two stationary bikes and a small weight room. In occasions, students have also the opportunity to make use of the recreation facilities at the nearby state school for the deaf. As part of the residential program, students have available a number of programs of their choosing (e.g., swimming, video games, outings, vocational training, independent living skills) – a monthly schedule is made available to all cottages prior the beginning of each month. During program delivery, one member of the after school personnel was present at all times. Similarly, a number of professional staff is assigned to each cottage/dorm to supervise residential students. These youth leaders serve the role of
mentors, supervisors, and support to the residential students. The school serves approximately 126 students, only 43 are residents.

Data Collection and Analysis

In the pilot study, measures for physical activity and psychosocial constructs (based on Social Cognitive Theory) were used. The physical activity measures included: ActiGraph GT1M accelerometers and a previous day physical activity recall (PDPAR). The social cognitive theory constructs of self-efficacy for overcoming barriers to physical activity, social support for physical activity, self-regulation for exercise, and outcome expectancy value for physical activity were measured using already existing questionnaires. In addition, an additional questionnaire was designed to address barriers to physical activity specific to adolescents with visual impairments. This questionnaire was designed based on the existing literature on physical activity and youth with visual impairments as well as the participants and the professional opinion of school staff (e.g., residential staff, teachers, and school administration).

Data collected from accelerometers were downloaded into a computerized program and graphical view of participants’ physical activity levels prior, during, and after the intervention were created. The intent of the pilot study was not to establish a functional relationship between the program and physical activity behavior. Rather, the viability of the program and potential positive changes were the focus of the pilot study. Data were analyzed through visual analysis.

Procedural Changes

Based on data collected, it was decided that the student lesson workbook would be translated into Braille for those students who were totally blind. In addition, the
information would need to be downloaded into the participants’ Braille-Lite readers (for those totally blind) for practicality. It was found that the previous day physical activity recall (PDPAR) was not able to be used because participants had difficulty understanding it. Therefore, the recall data were judge to be inaccurate. Instead, activity logs were included into the students’ lesson workbook replaced recalls to provide information on type and context of physical activity during the study. In order to monitor participants and assure after school staff representation, one additional after school staff employee was assigned by the school – during this study two after school employees were always present.

**Participants and Setting**

*Participants*

Participants for the principal study were initially six adolescents (1 female, 5 males) with visual impairments attending the residential school for the blind located in the Midwest. However, due to absenteeism and problem behaviors (i.e., withdrawn from study by school administration), two students were withdrawn from the study. As a result, four participants (3 males, 1 female) completed the program and all data collection phases. Inclusion criteria and participant selection procedures used during pilot study were also used during the principle study. That is, after receiving approval from the university’s Institutional Review Board (Appendix A) and the school’s administration (Appendix B), participants were purposely selected based on after school staff recommendations. Potential participants were recommended based on the following selection criteria: (a) identified by after school residential program personnel as in need for physical activity behavior change, (b) residential students, (c) have returned
consent/assent and parental consent forms; (d) no known physical or cognitive disability that would prevent enhancing physical activity behavior, and (e) not an active member of a school-sponsored athletic varsity team. A description of each participant’s degree of vision loss was determined through accessible school information and the sport classification system for the United States Association for Blind Athletes (USABA). All participants returned required consent forms (e.g., parental, assent) prior to the start of data collection. No names were used to safeguard the privacy of each participant. Detail information and demographics of participants are reported in table 3.1.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Age</th>
<th>Grade Level</th>
<th>Visual Condition</th>
<th>USABA Class</th>
<th>Height</th>
<th>Weight (lbs)</th>
<th>Ethnicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 Male</td>
<td>17</td>
<td>12</td>
<td>Ocular Albinism</td>
<td>B4</td>
<td>5’10”</td>
<td>265</td>
<td>White American</td>
</tr>
<tr>
<td>#2 Male</td>
<td>16</td>
<td>11</td>
<td>Retinopathy of prematurity (ROP)</td>
<td>B1</td>
<td>5’7”</td>
<td>187.4</td>
<td>White American</td>
</tr>
<tr>
<td>#3 Male</td>
<td>19</td>
<td>12</td>
<td>Glaucoma, ROP with retinal detachment</td>
<td>B1</td>
<td>5’4”</td>
<td>162.4</td>
<td>White American</td>
</tr>
<tr>
<td>#4 Female</td>
<td>14</td>
<td>10</td>
<td>Anarid, cataracts, glaucoma</td>
<td>B3</td>
<td>5’3”</td>
<td>165.7</td>
<td>White American</td>
</tr>
</tbody>
</table>

Table 3.1: Participants’ Demographic Information.

Setting

Study was carried out at same residential school as the pilot study. The program was delivered during after school hours in a classroom-like, well lit room. School residential
facilities included all school grounds (e.g., gymnasium, pool, track, open areas, cafeteria) as well as dorms. Some of the dorms were equipped with stationary bikes and treadmills. Similarly, the school’s gymnasium had available four treadmills, two stationary bikes and a small weight room. In occasions, students had also the opportunity to make use of the recreation facilities at the nearby state school for the deaf. As part of the residential program, students had available a number of programs of their choosing (e.g., swimming, video games, outings, vocational training, independent living skills) – a monthly schedule was made available to all cottages prior the beginning of each month. During program delivery, two staff members of the after school services were present at all times.

**Description of the Independent Variable**

The independent variable was a theory-based intervention based on and adapted from a previously existing program known as the *Plan for Exercise, Plan for Health* (PEPH) program (Stevens et al., 2006). The program PEPH is a nine lesson unit of instruction that was initially designed to be used in a general physical education curriculum. Each lesson helps develop a person’s individual activity program while also addressing the Social Cognitive Theory constructs of self-efficacy, self-regulation, outcome expectancy values, and social support. Each lesson encompasses curricular concepts, in-class activities, and homework. The program covers topics such as social and health benefits of physical activity, social and long term outcomes of physical activity, trends in physical activity, self-regulatory skills (e.g., goal setting and developing strategies to overcome barriers to physical activity), and health risks associated with inactivity (see Table 3.2). The PEPH has been implemented in selected high schools resulting in significant increases in moderate intensity physical activity among adolescents categorized as inactive (Mowad,
2007; Stevens, 2006). It was originally designed to be delivered one lesson per week for a nine week period. For the purposes of this study, the topical outline and content of the PEPH was retained, however, the lesson delivery was condensed from nine to five weeks, the program was offered as an after school option rather than a curricular requirement (i.e., no grading involve). In this study the focus was increasing leisure time physical activity in terms of duration and intensity rather than solely on moderate to vigorous physical activity, as was the intent of the original PEPH (Stevens, 2006). As such, it was modified and pilot tested as a four-week after school program. The program modifications were designed to align with the nature of the setting (after school residential programming) and participants for which it was used.

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Lesson Title</th>
<th>SCT Construct Targeted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction and Completing Activity Logs</td>
<td>Self-Regulation</td>
</tr>
<tr>
<td>2</td>
<td>Physical Activity and Health</td>
<td>Outcome Expectancy Values</td>
</tr>
<tr>
<td>3</td>
<td>Goal Setting</td>
<td>Self-Regulation</td>
</tr>
<tr>
<td>4</td>
<td>Barriers to Physical Activity</td>
<td>Self-Efficacy</td>
</tr>
<tr>
<td>5</td>
<td>Tracking Physical Activity Behavior</td>
<td>Self-Regulation</td>
</tr>
<tr>
<td>6</td>
<td>Where to be Active and Activity Motivators</td>
<td>Outcome Expectancy Values</td>
</tr>
<tr>
<td>7</td>
<td>Friend and Family Support for Physical Activity</td>
<td>Social Support</td>
</tr>
<tr>
<td>8</td>
<td>Physical Activity Intensity</td>
<td>Outcome Expectancy Values and Self-Efficacy</td>
</tr>
<tr>
<td>9</td>
<td>Continuing Your Physical Activity Program</td>
<td>Self-Regulation</td>
</tr>
</tbody>
</table>

Table 3.2: Intervention Lesson Outline and Targeted SCT Constructs.
Lesson One: Program Introduction

During lesson one, participants learned about the program and expectations for completing it. In this lesson, participants learned how to complete a previous day physical activity recall (PDPAR). The instructor provided participants with a completed sample PDPAR and discussed the proper way to complete the recall questionnaire. In addition, participants were introduced to key terms (e.g., physical activity and physical fitness) associated with the Healthy People 2010 national physical activity objectives for adolescents. The participants discussed different physical activity options that were available to them in their residential school and the types of physical activity in which they would like to engage.

Lesson Two: Exercise and Health

During lesson two, participants reviewed their homework assignments to discuss the types of physical activities in which they engaged, discussed reasons why they should exercise, and why they did or did not choose to engage in physical activity following lesson one. In addition, participants also learned the benefits of engaging in physical activity as well as physical activity patterns and aging. For the homework assignment, participants interviewed three individuals about their physical activity habits in order to recognize the differences between physically active and physically inactive individuals.

Lesson Three: Goal Setting

Goal setting helps participants to set realistic short term physical activity goals in order to increase physical activity. Participants learned the seven components of setting a goal and learned to write their own goals. In this case, participants reviewed examples of goals and had the opportunity to write and discuss their own goals with other participants.
At this point, participants were able to determine a short term goal they would like to accomplish and started engaging in physical activity to work toward meeting their goal.

Lesson Four: Reasons Not to be Physically Active

At this stage in the program, participants identified the barriers they faced in order to be physically active. Participants discussed the barriers they experienced since last session. They provided each other with suggestions on how to overcome the barriers, and on how to work toward achieving their goals even when experiencing different obstacles. Participants learned to develop their own strategies to overcome any barriers they face to engaging in physical activity both during and after the program.

Lesson Five: Keeping Track of Your Physical Activity

Participants continued to track their own physical activity to ensure that information already learned and discussed was applied in their leisure time. Participants revised their goals and activity logs as needed. It was important that participants were able to accurately record their own physical activity and to set attainable goals in order to ensure the likelihood of engaging in physical activities following the end of the program. In this way, participants were able to track progress toward their pre-set goals and were able to determine when the goals were met and how to set the next reasonable goal in their physical activity program.

Lesson Six: Where to Exercise and Exercise Motivators

In this lesson, participants learned about the various activity settings accessible to them both within their school and the surrounding community. Participants also discussed motivators for being physically active and learned how to reward themselves for meeting their weekly physical activity goals.
Lesson Seven: Family and Friends Can Help

Lesson seven addressed the ways family, friends, and significant others could help participants become and remain physically active. Participants described ways that others could help them meet their goals. They also wrote a goal that included another person (such as a friend or family member) in their physical activity program.

Lesson Eight: Physical Activity Intensity

Participants learned about intensity levels (i.e. light, moderate, vigorous physical activity) and how to determine their intensity level while they work toward their goals. During physical activity, participants learned to take their pulse rates and were able to translate heart rates into a specific intensity category. Different activities (e.g., sitting, walking, jogging) were engaged in at a variety of intensity levels.

Lesson Nine: Plan to Keep Going

In lesson nine, participants utilized the previous eight lessons and developed a physical activity plan that they would potentially continue once the program ends. To enhance the likelihood that they would be physically active throughout their lives, participants learned about ways to continually challenge themselves and to avoid boredom when engaging in physical activity. Participants reviewed their previous activity goals to determine the progress they made throughout the program. Finally, each participant created a long-term physical activity plan based on available facilities and activities that are available year-round.
Definition and Measurement of Dependent Variables

There were a number of dependent variables in this study. However, the primary dependent variable was daily after-school leisure time physical activity. Duration (minutes) and intensity (accelerometer cut-off point) of leisure time physical activity were recorded through the use of a small, lightweight accelerometer. Activity logs were used as part of the program and they served to provide contextual data (e.g., type of activity) to support accelerometer data. In addition to leisure time physical activity, self-efficacy, self-regulation, social support, and outcome expectancy values for physical activity were measured through questionnaires (Coding guidelines for each scale are provided in Appendix E). The questionnaires were adapted based on participants’ degree of vision loss (e.g., large print, Braille, interviewer-administered).

Accelerometer. The GT1M ActiGraph accelerometer (The ActiGraph LLC, Fort Walton Beach, FL) was used in this study. The GT1M is a small and lightweight unit (1.5x1.44x.70 inches; approx. 1oz) that measures vertical acceleration, capable of collecting and recording physical activity data in terms of frequency, duration, and intensity (The ActiGraph, LLC). The unit has over 1MB of flash memory and connects to a computer with a USB 2.0 cable. It has a rechargeable Lithium Polymer battery capable of providing power for over 14 continuous days. The ActiGraph accelerometer has been one of the most widely used activity monitors (Rowlands, 2007; Trost, 2007). The ActiGraph has documented evidence of validity and reliability among youth (e.g., Freedson, Pober, & Janz, 2005; Trost, 2007; Trost, McIver, & Pate, 2005).

Accelerometers provide physical activity data in the form of activity counts, which are the accumulation of body accelerations recorded during a specified cycle period (epoch).
Activity counts represent a quantitative physical activity measure over a specified period of time (Rowlands, 2007). Accelerometer counts are linearly related to the intensity of an individual’s physical activity during the predetermined cycle period (Motl, McAuley, Snook, & Scoot, 2006). Cycle periods or epochs can range from one second to 10 minutes. For the purpose of this study, cycle periods were set at one minute. One-minute epochs have been used among similar aged participants with visual impairments (Kozub, Oh, & Rider, 2005). Participants wore the accelerometer on an adjustable elastic belt along the waistline at the right hip. Minute-by-minute activity counts were uploaded into ActiGraph-specific computer software. Accelerometer data were recorded through the entirety of the study.

Previous day physical activity recall (PDPAR). A self-reported physical activity measure which requires participants to recall the previous day’s activities for after school hours (3:30-11:30PM) and their perceived intensity (Weston et al., 1997), segmented into seventeen 30-minute intervals was used. The recall also included a list of physical activities in which adolescents commonly participated (Weston et al., 1997). However, due to the characteristics of the participants in this study, a number of activities common to adolescents with visual impairments were included without compromising the integrity of the instrument. The recall served to support data collected through objective physical activity measures. Reliability and validity of the PDPAR has been reported among adolescents in 8th to 11th grade (Weston et al., 1997). Weston et al. reported a high test-retest reliability score ($r = .98, p<0.01$) and validity estimates against pedometer step counts, accelerometer counts, and heart rate monitoring, ranging from $r = .77$ to $r = .88$. 

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**Self-efficacy for overcoming barriers to physical activity.** A seven item questionnaire developed by Saunders et al. (1997) and adapted by Winters (2001) was used to measure self-efficacy, which was defined as the participants’ ability to overcome specific barriers to engage in physical activity. Winters (2001) reported internal consistency (\( \alpha = .89 \)) and test-retest reliability (\( r = .82 \)). Internal consistency was further confirmed by Stevens (2006) among high school students (\( \alpha = .90 \) and \( \alpha = .92 \) for pre and posttest, respectively). Participants rated, based on a six-point Likert-type scale, how often they feel they could be physically active under specific challenging conditions (e.g., weather, homework). Individual scores were based on the summation of the scale’s seven items, at both baseline and post-intervention.

**Self-regulation.** A 25 item questionnaire developed by Petosa (1993) and revised by Winters (2001) and Winters, Petosa, and Charlton (2003) for use among adolescents and modified as needed for the participants in this study was used to measure self-regulation in the form of goal-setting, self-monitoring, gaining social support, planning to overcome barriers, and securing reinforcements. Petosa (1993) reported internal consistency values ranging from \( \alpha = .78 \) to \( \alpha = .94 \) for the subscales, and a test-retest reliability coefficient of \( r = .92 \). Internal consistency of the questionnaire was confirmed by Stevens (2006) among high school students (\( \alpha = .94 \) and \( \alpha = .96 \) for pre and posttest, respectively). As part of the questionnaire, participants answered questions about the frequency in which they have used self-regulatory skills in their physical activity behavior over the previous four weeks from the time they complete this questionnaire. Similar to the self-efficacy scale, students selected the most appropriate answer using a six-point Likert-type scale.
Self-regulation scores were based on the summation of the 25-item products, both at baseline and at completion of intervention.

_Social support for physical activity._ An eight item questionnaire developed by Saunders et al. (1997) and revised by Winters (2001) and Winters et al. (2003) and modified as needed for the participants in this study was used to assess social support. Social support was defined as the participants’ perception of support from peers, teachers, and parents. Winters (2001) reported internal consistency (α = .75) and test-retest reliability (r = .78). Stevens (2006) confirmed the internal consistency of the scale among adolescents (α = .85 and α = .89 for pre and posttest, respectively). The questionnaire was based on a six-point Likert-type scale in which participants responded to four questions regarding specific supports they may have received from family to engage in physical activity during the past two weeks. Subsequently, participants answered four questions based on support from friends. Each participant received a score, calculated as the sum of the eight-item scale, during baseline and at post-intervention.

_Outcome expectancy values._ A 23 item questionnaire developed by Winters (2001) and modified as needed for the participants in this study was used to assess outcome expectancy values. Outcome expectancy values was defined as the participants’ beliefs about the outcomes resulting from being physically active (outcome expectations) and the value participants place on the perceived outcomes of physical activity. The scale, as designed by Winters (2001), is a two-dimensional tool examining outcome expectancy-values (beliefs about outcomes that occur as a result of engaging in physical activity) and outcome expectancies (the value placed on perceived outcomes of engaging in physical activity). Winters (2001) reported internal consistency values ranging from α = .86 to α =
.94. Stevens (2006) confirmed the scales’ consistency among high school students (α = .85 and α = .89 for pre and posttest, respectively). Each participant first responded to items regarding their personal beliefs about the outcomes of physical activity. Subsequently, they responded to items regarding the value they place on the outcome statements. Participants responded to each item using a six-point Likert-type scale. Scores for each participant (at baseline and post-intervention) were derived from the sum of the belief-value products.

Self-efficacy for overcoming barriers to physical activity scale for adolescents with visual impairments. A ten item questionnaire developed specifically for use in this study was used to measure self-efficacy for overcoming barriers to physical activity specific to youth with visual impairments, which was defined as the participants’ ability to overcome specific barriers faced by adolescents with visual impairments to engage in physical activity. Initial set of survey questions (i.e., 16) were drawn from the literature on physical activity and youth with visual impairments. Similarly, input from the professional opinion of key school personnel was used in the development of questions/statements. After pool of questions was designed, a panel of experts from the residential school was identified to review scale and its content. The panel of key experts included: physical education teacher (one female), school’s director of athletics (one male), an after school residential coordinator (one female), two after school residential staff (one female, one male), and a sport’s coach (one male, totally blind). The latter was also a technology instructor for the school as well as band director. Initial questionnaire was sent out to panel of experts; these individuals reviewed the questions for their adequacy and rated their importance.
Once feedback from the experts was received, the questionnaire was sent out again to the panel for a second round of reviews. After this process, a final version of the questionnaire was developed, which included ten questions. Panel of experts considered tool to address common barriers to physical activity as experienced by youth with visual impairments attending the residential school for the blind in which study was conducted. Once revised questionnaire was obtained, it was presented to pilot study participants for their review, understanding, and rating. To assure completeness of questionnaire, it was decided to be administered by an interview technique. Participants rated, based on a six-point Likert-type scale, how often they felt they could be physically active under specific challenging conditions (e.g., homework, lack of support). Individual scores were based on the summation of the scale’s ten items, at both baseline and post-intervention.

**Treatment Integrity and Reliability**

Treatment integrity refers to the extent to which an intervention is delivered as intended (Cooper, et al., 2007). To ensure that the independent variable was applied in an accurate and consistent manner, a treatment integrity checklist (Appendix C) was utilized during each intervention session. Treatment integrity was calculated by the number of times the instructor implemented each of the components identified in the treatment integrity checklist divided by the total number of components for the lesson, multiplied by 100.

*Observer training.* Two independent observers were trained on how to use the treatment integrity checklist. Independent observers are recommended so that neither observer would influence the coding of the other while watching the videotaped sessions (Cooper et al., 2007). Observer training was conducted through watching videotaped
sessions from the pilot study with the researcher and both observers present. First, the researcher familiarized observers with the intervention and each lesson’s components, followed by the observers watching selected vignettes from different lessons highlighting the components included in the treatment integrity checklist. Subsequently, the observers watched a full videotaped lesson using the checklist. The observers and researcher coded the session and interobserver agreement (IOA) was calculated by dividing the number of agreements by the summation of agreements plus disagreements and multiplied by 100. Target IOA was set at 90% as suggested by Cooper et al. (2007).

**Experimental Design**

This study used a range-bound changing criterion [RBCC] design (McDougall, 2005) to examine intervention effects on after school leisure time physical activity behavior among adolescents with visual impairments. The RBCC, which has been successfully implemented by McDougall (2005), is an extension of the classic changing criterion design. In the classic changing criterion design as described by Hartman and Hall (1976), initial baseline observations on a target behavior are collected until stable baseline behavior is achieved. Baseline is then followed by the implementation of a treatment in a series of phases. Each treatment phase is associated with a stepwise change in criterion score for the target behavior (Hartman & Hall, 1976). Of importance, the initial criterion must be higher than baseline levels of responding (Schloss, Sedlak, Elliot, & Smothers, 1982) and this criterion should be based on each participant’s own baseline observations (De Luca & Holborn, 1992). Experimental control is demonstrated by the participant’s behavior continually exceeding the specified criterion within each intervention phase (Hartman & Hall, 1972; Schloss et al., 1982), but this may not allow for definite
conclusion about experimental control, especially when the target behavior surpasses the
criterion by a considerable amount. In the changing criterion design, internal and external
validity are demonstrated through manipulation of the length of the phases, the
magnitude of criterion changes, and the number of criterion changes (Hartman & Hall,
1972; Schloss et al., 1982).

The RBCC adheres to all requirements of the classic changing criterion design, but is
different because it establishes a criterion range (lower and upper boundaries) within a
specific intervention phase (McDougall, 2005). Leisure-time physical activity must
match or exceed the lower bound criterion of performance and, concurrently, match or be
less than the upper bound criterion of performance. The lower and upper criteria define a
bounded range of expected performance (McDougall, Smith, Black, & Rumrill, 2005).

In the RBCC design, experimental control is demonstrated when target behavior falls
within the range between the upper and lower bounds of the established criterion levels
during each intervention phase (McDougall, 2005). By establishing a lower (minimum
performance level) and upper (maximum performance level) range bound criterion, the
RBCC design may allow for more definitive conclusions about experimental control
compared to the traditional changing criterion design (McDougall, 2005; McDougal;
Hawkins, Brady, & Jenkins, 2006).

The appropriateness of using a RBCC design is based on the rationale that increases in
physical activity behavior can be approached gradually (DeLuca & Holborn, 1992). This
minimizes the likelihood of participants being unsuccessful in meeting the criterion level
and the target behavior is already within the participants’ behavioral repertoire lending
itself to stepwise modifications (Cooper et al., 2007). The classic changing criterion
design has been successfully used in increasing physical activity (Taggart, Taggart, & Siedentop, 1986) and exercise (De Luca & Holborn, 1992; Fitterling, Martin, Gramling, Cole, & Milan, 1988), while the RBCC has been successfully implemented by McDougall (in review) in increasing daily exercise behavior.

**Procedures**

Once IRB approval was granted and prior to the baseline data collection, an open session was held at the school to present the program to potential participants. During the presentation, a description of the goal and process of the program were detailed to attendees. Students who were identified and/or recommended by after school staff as in need for physical activity behavior change and/or who may be interested in participating were given assent, individual consent, and parental consent forms (based on the participants’ ages) that needed to be returned prior to baseline data collection. School residential staff were informed on the nature and purpose of the study, the various tools used to gather data, and the extent to which the staff could participate in the intervention. Once parental consent forms were returned and assent/consent forms were secured, a day was scheduled to meet with participants who have met all criteria for inclusion in the study.

**Physical activity measurement**

Prior to distributing accelerometers to participants, each unit was initialized using ActiGraph-based software to collect data starting at 4:00 p.m. to 11:00 p.m. on day of data collection. This was done across all phases of study (e.g., baseline, intervention, maintenance). Accelerometers were distributed to each participant (i.e., face to face) at 3:15 p.m. each day of data collection. Participants were informed on how to properly use
the accelerometers, while also being instructed to wear units during after school hours except when bathing or swimming. In addition, two youth leaders (i.e., after school staff) were instructed on proper placement and wear of accelerometer to support and/or remind participants as needed. Units were set to collect and record data at 1-minute time intervals (i.e., epoch) each day, the four days per week of data collection. For consistency, participants wore same accelerometer unit each day of data collection. Participants wore accelerometers on an adjustable elastic belt along the waistline in front of right hip. Units were tightly secured against participant’s body to minimize extraneous movement produced from bouncing device. The following day of data gathering, units were retrieved and data collected was downloaded and stored for analysis. Once accelerometer data was downloaded, units were initialized and distributed to participants.

Baseline

Baseline data were collected for each participant until physical activity behavior remained stable. Prior to the first day of baseline collection, participants were trained on how to use the accelerometer. In addition, participants completed the four social cognitive scales. No further information and/or prompts were given to participants about study incentives or rewards, only encouraging them to do what they regularly do in the after-school hours for that week. As indicated previously, accelerometers were programmed to start recording data during participants’ leisure time (4:00 p.m. to 11:00 p.m.). Accelerometer data were collected daily. Following a day of data collection, accelerometers were collected and data were downloaded into a computer. Once data were downloaded, units were initialize and then distributed to participants. Residential
students regularly return to school on Sundays and return home on Fridays. A typical week at the residential school is Monday to Thursday.

**Intervention Phases**

Data collection procedures during baseline were the same during intervention phases. The initial criterion change was set by each individual participant in collaboration with the researcher which allowed for their decision but also assured consistency. A range bound of ± 10% with the criterion being the midpoint of the range was used across phases. McDougall (2005) used a ± 10% range bound based on the daily average of an overweight adult. McDougall used 10% as a criterion because this percentage was considered to be a reasonable deviation from the daily average of physical exercise for the participant he studied. This was based on the fact that the participant may have needed to exercise for different amounts of time due to muscle soreness or other factors affecting the ability of the participant to exercise. A similar rationale was used as sedentary individuals may have a tendency to experience muscle soreness and/or injury due to changes in their activity levels, therefore the ± 10% minimizes the chance of this occurring, while still providing the researcher with experimental control over the physical activity behavior.

Once the initial range bound criterion was met and stable responding was achieved, the second intervention phase was introduced. Following the second intervention phase, when daily physical activity criterion was met and stable responding was achieved, the third intervention phase was introduced. Intervention phase four followed similar procedures as previous phases. It was expected that each intervention phase would last approximately one week. However, if stable responding was not achieved within a one
week period, then the intervention phase and criterion would continue until stable responding was achieved. For each phase, individual participant’s changing criterion were increased only when his/her physical activity behavior consistently met the established criterion for a particular intervention phase, that is, when at least the last three data points of responding were stable within a specific range and/or visual inspection of data indicated no trend (Fitterling et al., 1988). Gradual and systematic criterion changes were established based on previous criterion phases in order to manipulate the magnitude of the changes, until participants reach the minimum program goal of 30 minutes daily of moderate to vigorous intensity physical activity during their leisure time. During the last day of data collection of final intervention phase, participants completed once again the social cognitive scales as well as the social validity questionnaires.

*Program Delivery*

Program sessions took place during intervention phase as following: lessons 1 and 2 during first intervention phase; lessons 3 and 4 during second intervention phase; lessons 5 and 6 during third intervention phase; lessons 7 and 8 during fourth intervention phase and lesson 9 during final intervention phase. Each program session lasted between 30 to 45 minutes. During each session, two paid school employees were present. Program sessions were videotaped for treatment integrity analysis. During first lesson, participants received their program manual in one of two formats: large-printed or Braille.

Each session started with an introduction of the topic to be discussed, followed by in-class discussion and/or main activity, and concluding with a description of the homework assignment. Prior ending each session, students were reminded about proper use and care of accelerometers. For students who were totally blind, the manual was also downloaded
into their Braille-Lite readers by a technology instructor at the school. Starting at session three, participants began to establish weekly physical activity goals which served as foundation for their respective criterion changes during intervention phases. Goals were written in each participant’s manuals and/or made explicit prior ending session. Also, goals were negotiated with each participant to assure consistency and gradual systematic increases. As part of the program delivery, each participant was given a talking wrist watch (New Age 4 Alarm Talking Watch, Independent Living Aids, NY) to allow for tracking of time spent in physical activity at single instance, which enabled them to know when mean value for criterion change was achieved for a given intervention phase.

**Maintenance**

Maintenance was assessed for one week and then three weeks following intervention. Procedures during this phase were the same as those during the preceding intervention phase for each participant. Therefore, the performance criterion for the phase was expected to be the same as the last session or the last intervention phase. That is, a set number of minutes of daily physical activity during leisure time with a range bound of ±10%.

**Social Validity**

Following the intervention, a social validity questionnaire was administrated to individuals selected based on their status as direct and/or indirect consumers of the program and their influence on the viability of the intervention (Schwartz & Baer, 1991). These individuals included: (a) the participants, (b) after-school residential personnel, and (c) the parents of the participants. The questionnaires (Appendices D to F) were
administered to determine their perceptions about the social importance of the study (Cooper et al., 2007; Wolf, 1978).

**Data Analysis**

Duration and intensity of daily after school leisure time physical activity behavior was evaluated through visual analysis of graphical records (Cooper et al., 2007). Baseline, intervention, and maintenance data were compared. In addition, mean scores and the percentage of conforming data (PCD) index was calculated as recommended when using the RBCC design (McDougall, 2005). The PCD is a simple index to supplement visual analysis when evaluating the effects of an intervention (McDougall et al., 2005). It is calculated by adding the number of data points within intervention phases that fall within criterion ranges for respective intervention phases, divided by the total number of data points within all range-bound intervention phases and then multiplied by 100 (McDougall, 2005; McDougall et al., 2005). Social cognitive questionnaires data were analyzed by comparing change in individual scores from baseline to post-intervention.

**Accelerometer Data Output Interpretation and Analysis**

The accelerometer output was used for calculating: (a) time spent in a single bout of leisure time physical activity, (b) total time spent in leisure time physical activity, (c) time spent in a bout of moderate to vigorous physical activity, (d) total time spent in moderate to vigorous leisure time physical activity, and (e) mean time spent in leisure time physical activity within conditions. Strings of 10 or more continuous zero counts were defined as missing data, sleeping time, or non-wear time (e.g., bathing, swimming) and were excluded from accelerometer output analysis. This was done to ensure that only data related to time participants were wearing accelerometers was used. To calculate time
spent in physical activity, some form of count to activity threshold had to be used (Esliger, Copeland, Barnes, & Tremblay, 2005). In this study, activity cut-off points established by Puyau, Adolph, Vohra, and Butte (2002) were used. These count cut point values place activity intensities into four categories: sedentary (<800 counts per minute), light (800 to <3200 counts per minute), moderate (3200 to <8200 counts per minute) and vigorous (≥8200 counts per minute). Puyau et al.’s cut-off points were chosen because of the age range of participants (approximated the participants in this study) and the nature of the activities in which cut points were established (e.g., video game play, aerobic activity, walking, jogging).

A bout of physical activity consisted of being actively engaged for at least 10 minutes at/or above 800 counts per minute. This bout of activity had to have occurred during after school hours and had to be a volitional act, thus school-sponsored sports participation was not counted. The 10 minute limit was chosen to align with recommended national guidelines for physical activity (USDHHS, 2000). Time spent in leisure time physical activity was calculated by summing the minutes of light to vigorous activity for each day. A similar procedure was used to calculate time spent in leisure time MVPA and time spent in sedentary activity, but using cut points specific for each intensity level.
CHAPTER 4

RESULTS

This chapter presents the results of the effects of the intervention on the acquisition and maintenance of leisure time physical activity among adolescent students with visual impairments during after school hours. In the first section of this chapter, treatment integrity results are reported. In the second section, data for all participants are presented followed by a summary of results. In the last section, results from the social validity questionnaires are presented and discussed.

**Treatment Integrity and Reliability**

Table 4.1 summarizes the treatment integrity scores for all sessions during program implementation. Treatment integrity was established by the use of a checklist (Appendix J). Three independent observers were used to ensure the intervention was applied as intended and in a consistent manner. The observers coded each session and interobserver agreement (IOA) was calculated by dividing the number of agreements by the summation of agreements plus disagreements and multiplied by 100. The target IOA was set at 90%. Agreement was assessed across all video-taped program sessions. The overall mean score among observers and the researcher for all sessions was 97% (range, 91% - 100%) which was above the pre-established IOA percentage. The first and second independent observers had a mean of 100% for all program sessions. The first and third observers had
a mean of 95%. Second and third observer had a mean of 95%. Based on the obtained mean scores, treatment integrity was found to be acceptable.

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Observers 1 and 2</th>
<th>Observers 1 and 3</th>
<th>Observers 2 and 3</th>
<th>All Observers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100%</td>
<td>86%</td>
<td>86%</td>
<td>91%</td>
</tr>
<tr>
<td>2</td>
<td>100%</td>
<td>94%</td>
<td>94%</td>
<td>96%</td>
</tr>
<tr>
<td>3</td>
<td>100%</td>
<td>93%</td>
<td>93%</td>
<td>95%</td>
</tr>
<tr>
<td>4</td>
<td>100%</td>
<td>94%</td>
<td>94%</td>
<td>96%</td>
</tr>
<tr>
<td>5</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>6</td>
<td>100%</td>
<td>95%</td>
<td>95%</td>
<td>96%</td>
</tr>
<tr>
<td>7</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>8</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>9</td>
<td>100%</td>
<td>93%</td>
<td>93%</td>
<td>95%</td>
</tr>
<tr>
<td>Total Mean</td>
<td>100%</td>
<td>95%</td>
<td>95%</td>
<td>97%</td>
</tr>
<tr>
<td>Range</td>
<td>100%</td>
<td>86%-100%</td>
<td>86%-95%</td>
<td>91%-100%</td>
</tr>
</tbody>
</table>

Table 4.1: Treatment Integrity Percentages

**Leisure Time Physical Activity Behavior**

*Bouts of Leisure Time Physical Activity*

Data in Figures 4.1 through 4.4 and Tables 4.2 through 4.5 indicate that time spent in a single bout of leisure time physical activity (LTPA) improved with few exceptions from baseline through each of the five intervention phases for all participants during the implementation of the intervention.

*Participant 1.* Baseline data taken over a two-week period (i.e., eight days), exhibited a stable pattern of responding in which participant 1 was not engaging in any bouts of leisure time physical activity. Once intervention was implemented, participant 1 systematically began to increase his time spent in a single bout of leisure time physical activity.
activity across each of the five intervention phases. During intervention, participant 1 systematically increased the average time spent in a bout of physical activity over baseline (17.0 minutes – phase 1; 20.5 minutes – phase 2; 23.0 minutes – phase 3; 31.7 minutes – phase 4; and 33.3 minutes – phase 5). Participant 1 achieved all established criteria and percentage of conforming data (PCD) reached 50% or greater for intervention phases two through five. That is, four out of four data points (100%) resided within the range bound for phase 2. Two out of four data points (50%) resided within the range bound during phase three, while two out of three data points (67%) resided within the range bound during phases 4 and 5, respectively. Only during intervention phase 1, did one out of three data points (33%) resided within the range bound. However, data points that did not conform to the pre-established range bound were in a positive direction (i.e., increasing time spent in bout of physical activity), exceeding the maximum range bound. Overlapping data points were also observed. On phase 3, the third data point fell below the minimum range bound and equaled the last data point of phase 2. An overlapping data point was also observed in phase 5, in which the first data point of the phase equaled the first and second data points of the previous phase. During phase 4 (i.e., session 24) the last data point dropped to baseline levels. However, on that particular day participant 1 attended a school-sponsored event which prevented him from meeting criterion. As such, a decision was made to do not include that data point as it did not refer to voluntary physical activity, rather an activity the participant was required to attend (not under control of researcher and/or the participant). During the maintenance phase, the time spent in a single bout of LTPA regressed to baseline levels. Table 4.2 summarizes mean
scores and ranges for time spent in a bout of LTPA and PCD by participant 1 across all phases.

Figure 4.1: Changing Criterion Bouts of LTPA (Minutes) for Participant 1.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Within-phase criteria</th>
<th>Actual performance</th>
<th>PCD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td>Baseline</td>
<td>None</td>
<td>None</td>
<td>0.0</td>
</tr>
<tr>
<td>Intervention phase 1</td>
<td>13.5</td>
<td>15.0</td>
<td>15.3</td>
</tr>
<tr>
<td>Intervention phase 2</td>
<td>18.0</td>
<td>20.0</td>
<td>18.5</td>
</tr>
<tr>
<td>Intervention phase 3</td>
<td>22.5</td>
<td>25.0</td>
<td>20.7</td>
</tr>
<tr>
<td>Intervention phase 4</td>
<td>27.0</td>
<td>30.0</td>
<td>28.5</td>
</tr>
<tr>
<td>Intervention phase 5</td>
<td>31.5</td>
<td>35.0</td>
<td>30.0</td>
</tr>
<tr>
<td>Maintenance</td>
<td>None</td>
<td>None</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Table 4.2: Changes in Time Spent in a Bout of LTPA (Duration) Conform to Changes in Performance Criteria for Participant 1.
Participant 2. During baseline, participant 2 exhibited a stable pattern of responding. In the subsequent intervention phases, participant 2 began to increase his time spent in a bout of LTPA. Criterion changes for each intervention phases were somewhat met except for phase 5. During intervention, participant 2 increased the average time spent in a bout of physical activity over baseline (15.3 minutes – phase 1; 26.7 minutes – phase 2; 43.0 minutes – phase 3; 51.5 minutes – phase 4; and 40.0 minutes – phase 5). However, the minutes accumulated for phase 5 did not meet pre-established criteria (i.e., 60 minutes). The percentage of conforming data (PCD) did not reach 100% for any phase; rather, it ranged between 67% to 75% from phase two to phase four (Table 4.3). Overlapping data points were also observed. In phase 2, the third data point overlapped with phase 2. Participant 2 did not reach criterion during phase 5.

Remarkable data points were observed for participant 2. During phase 2 (session 14) and phase 5 (session 28), participant 2 was advised by a youth leader not to be active on those particular days. The leader suggested that the participant could complete his minutes of activity the following day. During phase 3 (session 18) and phase 5 (session 27) participant 2 was involved in school-related activities (e.g., field day, dance) which required him to complete tasks assigned by the after school staff, as such it was not voluntary physical activity (not under control of researcher and/or the participant). Similar to that of participant one, these data points were not included into participant’s graphical representation. During maintenance, the time spent in a single bout of LTPA regressed to a mean of 10.5 minutes. Table 4.3 summarizes mean scores and ranges for time spent in a bout of LTPA and PCD by participant 2 across all phases.
Figure 4.2: Changing Criterion Bouts of LTPA (Minutes) for Participant 2.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Within-phase criteria</th>
<th>Actual performance</th>
<th>PCD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td>Baseline</td>
<td>None</td>
<td>None</td>
<td>0.0</td>
</tr>
<tr>
<td>Intervention phase 1</td>
<td>18.0 – 22.0</td>
<td>20.0</td>
<td>13.7 – 16.8</td>
</tr>
<tr>
<td>Intervention phase 2</td>
<td>27.0 – 33.0</td>
<td>30.0</td>
<td>24.0 – 29.4</td>
</tr>
<tr>
<td>Intervention phase 3</td>
<td>36.0 – 44.0</td>
<td>40.0</td>
<td>38.7 – 47.3</td>
</tr>
<tr>
<td>Intervention phase 4</td>
<td>45.0 – 55.0</td>
<td>50.0</td>
<td>46.4 – 56.7</td>
</tr>
<tr>
<td>Intervention phase 5</td>
<td>54.0 – 66.0</td>
<td>60.0</td>
<td>36.0 – 44.0</td>
</tr>
<tr>
<td>Maintenance</td>
<td>None</td>
<td>None</td>
<td>9.5 – 11.5</td>
</tr>
<tr>
<td>Maintenance</td>
<td>None</td>
<td>None</td>
<td>7.9 – 9.6</td>
</tr>
</tbody>
</table>

Table 4.3: Changes in Time Spent in a Bout of LTPA (Duration) Conform to Changes in Performance Criteria for Participant 2.
Participant 3. During baseline, participant 3 averaged 5.2 minutes on a bout of LTPA. Although stable responding was not fully achieved, levels for time spent on a bout of LTPA were below that of the operational definition. Figure 4.3 represents data points across all phases. During intervention, participant 3 met criterion for phases 1 to 4. On phase 5 however, criterion levels were not met. Participant 3 increased the mean time spent in a bout of physical activity over baseline (18.3 minutes – phase 1; 29.8 minutes – phase 2; 42.3 minutes – phase 3; 50.0 minutes – phase 4; and 33.0 minutes – phase 5). Percentage of conforming data (PCD) ranged from 67% (phase 2) to 100% (phase 4). No data point resided within the criterion change range during phase 5. A downward trend was observed at end of phase four which continued through phase 5. During maintenance weeks 1 and 2, the mean time spent in a bout of LTPA was 13.0 minutes and 12.8 minutes, respectively. Overall, during maintenance, participant 3 averaged 12.9 minutes of time spent in a bout of LTPA. Similar to participants 1 and 2, participant 3 did not maintain levels of performance similar to those reported during intervention (Table 4.4). Similar to that of participant 2, data points not associated with voluntary physical activity were observed, representing the effects of the youth leader as well as school-related events on participant three’s ability to meet criterion set for that particular phase. During phase 3 (session 20), phase 4 (session 24), and phase 5 (session 26), participant 2 was involved in school-related events (e.g., independent living skills outing, school voting) in which he was assigned responsibilities and/or tasks to complete. During phase 5 (session 28), participant 2 did not meet criterion because he was advised by his youth leader to complete missed activity minutes the following day.
Figure 4.3: Changing Criterion Bouts of LTPA (Minutes) for Participant 3.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Within-phase criteria</th>
<th>Actual performance</th>
<th>PCD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td>Baseline</td>
<td>None</td>
<td>None</td>
<td>0.0</td>
</tr>
<tr>
<td>Intervention phase 1</td>
<td>18.0 – 22.0</td>
<td>20.0</td>
<td>16.5 – 20.1</td>
</tr>
<tr>
<td>Intervention phase 2</td>
<td>27.0 – 33.0</td>
<td>30.0</td>
<td>26.8 – 32.7</td>
</tr>
<tr>
<td>Intervention phase 3</td>
<td>36.0 – 44.0</td>
<td>40.0</td>
<td>38.1 – 46.5</td>
</tr>
<tr>
<td>Intervention phase 4</td>
<td>45.0 – 55.0</td>
<td>50.0</td>
<td>45.0 – 55.0</td>
</tr>
<tr>
<td>Intervention phase 5</td>
<td>54.0 – 66.0</td>
<td>60.0</td>
<td>29.7 – 36.3</td>
</tr>
<tr>
<td>Maintenance</td>
<td>None</td>
<td>None</td>
<td>11.7 – 14.3</td>
</tr>
<tr>
<td>Maintenance</td>
<td>None</td>
<td>None</td>
<td>11.5 – 14.0</td>
</tr>
</tbody>
</table>

Table 4.4: Changes in Time Spent in a Bout of LTPA (Duration) Conform to Changes in Performance Criteria for Participant 3.
Participant 4. During baseline, participant 4 accumulated a mean time spent in a bout of LTPA of 25 minutes. Even though stable responding during baseline was not achieved, intervention was implemented. A decision was made to initiate intervention because the last data point for the extended baseline phase showed a downward trend. During intervention phase 1, participant 4 exceeded the criterion range for the last two data points. Similarly, she exceeded the criterion range during phase 2 and for three out of four data points for phase 3. She met criterion for three out of the four data points in phase 4 as well. While the criterion set for phase 5 was not met, the mean time increased. Across all intervention phases, participant 4 demonstrated an ascending trend, but this dropped once the intervention was removed. During the second week of maintenance, participant 4 did not engage in any bout of LTPA. In fact, maintenance data show levels below that observed during baseline. Consistent with that observed for all other participants, time spent on a bout of LTPA increased during the onset of the intervention but regressed following its removal.

Figure 4.4: Changing Criterion Bouts of LTPA (Minutes) for Participant 4.
<table>
<thead>
<tr>
<th>Phase</th>
<th>Within-phase criteria Range</th>
<th>Actual performance Range</th>
<th>PCD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>None</td>
<td>0.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Intervention phase 1</td>
<td>18.0 – 22.0</td>
<td>19.8 – 24.2</td>
<td>22.0</td>
</tr>
<tr>
<td>Intervention phase 2</td>
<td>27.0 – 33.0</td>
<td>34.1 – 41.5</td>
<td>37.8</td>
</tr>
<tr>
<td>Intervention phase 3</td>
<td>36.0 – 44.0</td>
<td>36.0 – 44.0</td>
<td>40.0</td>
</tr>
<tr>
<td>Intervention phase 4</td>
<td>45.0 – 55.0</td>
<td>43.1 – 52.5</td>
<td>47.8</td>
</tr>
<tr>
<td>Intervention phase 5</td>
<td>54.0 – 66.0</td>
<td>48.0 – 58.6</td>
<td>53.3</td>
</tr>
<tr>
<td>Maintenance week 1</td>
<td>None</td>
<td>22.5 – 27.5</td>
<td>25.0</td>
</tr>
<tr>
<td>Maintenance week 2</td>
<td>None</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Table 4.5: Changes in Time Spent in a Bout of LTPA (Duration) Conform to Changes in Performance Criteria for Participant 4.

Total Minutes Spent in Leisure Time Physical Activity

Data in Table 4.6 and Figures 4.5 through 4.8 indicate that time spent in LTPA increased with the implementation of the intervention for all participants, with substantial increases for participants 1, 2, and 3. Following removal of the intervention and the criterion change requirement (i.e., maintenance phase), time spent in total LTPA dropped for all participants. Participant 4 exhibited maintenance levels below that of baseline.

For participant 1, mean time spent in LTPA during baseline was 22 minutes per week; during intervention the mean time spent in LTPA was 47.7 minutes per week, a 116.8% increase over baseline. However, mean time spent in LTPA during maintenance was 18.9 minutes, a 60.4% decrease from intervention. Participant 2 had a baseline mean time spent in LTPA of 22.9 minutes, while his mean time during intervention was 50.2 minutes per week – a 119% increase. Similar to participant 1, participant 2 reduced his mean time spent in LTPA from 50.2 minutes during intervention to 35.8 minutes per
week during maintenance, which corresponded to a 28.7% decrease. Similar to participants 1 and 2, participant 3 also obtained substantial gains in mean time spent in LTPA from baseline to intervention. During baseline, participant 3 had a mean of 23.9 minutes compared to 49.4 minutes during intervention, which corresponded to a 106.6% increase. During maintenance, mean time LTPA decreased from 49.4 minutes to 42.5 minutes, a 13.9% decrease. Lastly, participant 4 who had the highest mean time spent in LTPA during baseline, increased from an average of 65.9 minutes to 82.8 minutes during intervention (25.8% increase). Similar to the other participants, the mean time spent in LTPA for participant 4 dropped from 82.8 minutes during intervention to a mean of 64.7 minutes during maintenance. These data support the notion that increased time spent in total LTPA was attained while participants were undertaking the intervention.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Participant 1 Mean LTPA (min)</th>
<th>Participant 2 Mean LTPA (min)</th>
<th>Participant 3 Mean LTPA (min)</th>
<th>Participant 4 Mean LTPA (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>22.0</td>
<td>22.9</td>
<td>23.9</td>
<td>65.9</td>
</tr>
<tr>
<td>Intervention</td>
<td>47.7</td>
<td>50.2</td>
<td>49.4</td>
<td>82.8</td>
</tr>
<tr>
<td>Maintenance</td>
<td>18.9</td>
<td>35.8</td>
<td>42.5</td>
<td>64.7</td>
</tr>
</tbody>
</table>

Table 4.6: LTPA Means in Minutes for Baseline, Intervention and Maintenance Phases for All Participants.
Figure 4.5: Participant 1’s Total Time Spent in LTPA Across Phases.

Figure 4.6: Participant 2’s Total Time Spent in LTPA Across Phases.
Figure 4.7: Participant 3’s Total Time Spent in LTPA Across Phases.

Figure 4.8: Participant 4’s Total Time Spent in LTPA Across Phases.
Bouts of Moderate to Vigorous Leisure Time Physical Activity (MVPA)

Data for bouts of MVPA are displayed in figures 4.9 through 4.12. Following the implementation of the intervention, participants 2, 3, and 4 engaged in bouts of MVPA, while participant 1 did not engage in any bouts of MVPA. Participant 2 (Figure 4.10) engaged in a bout of MVPA in every intervention phase, each bout lasting 20 minutes (phase 1), 25 minutes (phase 2), 40 minutes (phase 3), 25 minutes (phase 4) and 29 minutes (phase 5). During maintenance, participant 2 engaged in two bouts of MVPA lasting 29 and 25 minutes, respectively. Participant 3 (Figure 4.11), engaged in a bout of MVPA during intervention phases 2 (33 minutes), 3 (38 minutes), 4 (29 minutes), and 5 (30 minutes). Similarly, he engaged in two bouts of MVPA during maintenance which lasted 32 and 35 minutes, respectively. Participant 4 (Figure 4.12) engaged in a bout of MVPA during baseline which lasted 21 minutes. During intervention phases, she engaged in two bouts of MVPA during intervention phase 2 (11 and 10 minutes), one bout of MVPA during subsequent phase 3 (36 minutes), and then one during intervention phase 5 (10 minutes). During maintenance, participant 4 engaged in one bout of MVPA which lasted 21 minutes. Based on these data, it appeared that during and following intervention phases time spent in bouts of MVPA were more evident for participants 2 and 3. However, one bout of MVPA during a week appears not to be enough for physical activity health-related benefits. No participant engaged in bouts of vigorous intensity during LTPA.
Figure 4.9: Time Spent in Bouts of MVPA Across Phases for Participant 1.

Figure 4.10: Time Spent in Bouts of MVPA Across Phases for Participant 2.
Figure 4.11: Time Spent in Bouts of MVPA Across Phases for Participant 3.

Figure 4.12: Time Spent in Bouts of MVPA Across Phases for Participant 4.
Total Minutes Spent in Moderate to Vigorous Leisure Time Physical Activity

Data for total time spent in moderate to vigorous intensity LTPA are displayed in Table 4.7. Consistent with data regarding bouts of MVPA, participants 2 and 3 appeared to increased intensity of physical activity at onset of the intervention. As represented in Table 4.7, these two participants engaged in substantially greater minutes of MVPA during intervention compared to their respective baseline data. Interestingly, participants 2 and 3 were totally blind. Participant 1 did not engage in enough MVPA conducive to health-related benefits. Participant 4, engaged in MVPA across all phases, but during baseline, intervention (phases 2 and 3), and maintenance (first week) is where she accumulated most of her MVPA time.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Participant 1</th>
<th>Participant 2</th>
<th>Participant 3</th>
<th>Participant 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Total Time Spent in MVPA (minutes)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>6.5</td>
<td>17.5</td>
<td>3.0</td>
<td>57.0</td>
</tr>
<tr>
<td>Intervention 1</td>
<td>3.0</td>
<td>41.0</td>
<td>4.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Intervention 2</td>
<td>3.0</td>
<td>39.0</td>
<td>45.0</td>
<td>63.0</td>
</tr>
<tr>
<td>Intervention 3</td>
<td>0.0</td>
<td>59.0</td>
<td>55.0</td>
<td>75.0</td>
</tr>
<tr>
<td>Intervention 4</td>
<td>2.0</td>
<td>48.0</td>
<td>31.0</td>
<td>26.0</td>
</tr>
<tr>
<td>Intervention 5</td>
<td>1.0</td>
<td>39.0</td>
<td>36.0</td>
<td>18.0</td>
</tr>
<tr>
<td>Maintenance week 1</td>
<td>1.0</td>
<td>52.0</td>
<td>38.0</td>
<td>71.0</td>
</tr>
<tr>
<td>Maintenance week 2</td>
<td>1.0</td>
<td>55.0</td>
<td>41.0</td>
<td>21.0</td>
</tr>
</tbody>
</table>

Table 4.7: Total Time Spent in Moderate to Vigorous Intensity Leisure Time Physical Activity.
**Summary**

Visual inspection of graphed data (Figures 4.1 through 4.4) show that time spent in a bout of LTPA increased from baseline to intervention for all participants. Functional control was established at onset of intervention compared to baseline. Similarly, total time spent in LTPA was significantly higher during intervention compared to baseline for most participants. During maintenance, time spent in single bout of LTPA dropped for all participants, most notably for participants 1 and 4. Similarly, total LTPA dropped notably for participant 1 – returning to baseline levels. For participant 4, stable baseline was not achieved before introducing intervention – which may have weakened experimental control. However, a decision to introduce intervention was based on practical rather than procedural considerations (i.e., school agreements).

**Social Cognitive Scales**

*Participant 1.* Table 4.8 illustrates pre and post intervention scores from the social cognitive theory questionnaires for self-efficacy, self-regulation, social support, and outcome expectancy value. For self-efficacy for overcoming barriers (SES), the pre and post intervention scores were the same (36), indicating no change as a result of the program. Similarly, no changes were observed on the self-efficacy to overcome barriers to exercise for adolescents with visual impairments (SES_VI). For the self-regulation for exercise (SRS) questionnaire, pre and post intervention scores were 107 and 129, respectively (21% increase). For the social support questionnaire (SSS), pre and post intervention scores were 20 and 41, respectively (105% increase). Finally, for the outcome expectancy value questionnaire (OEVS) pre and post intervention scores were 425 and 640, respectively (51% increase).
<table>
<thead>
<tr>
<th>Social Cognitive Theory Construct</th>
<th>Baseline</th>
<th>Post</th>
<th>Change</th>
<th>Score Attainable (min – max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Efficacy to Overcome Barriers (SES)</td>
<td>36</td>
<td>36</td>
<td>0 (0%)</td>
<td>7 – 42</td>
</tr>
<tr>
<td>Social Support (SSS)</td>
<td>20</td>
<td>41</td>
<td>21 (105%)</td>
<td>8 – 48</td>
</tr>
<tr>
<td>Self-regulation (SRS)</td>
<td>107</td>
<td>129</td>
<td>22 (21%)</td>
<td>25 – 150</td>
</tr>
<tr>
<td>Outcome Expectancy Value (OEVS)</td>
<td>425</td>
<td>640</td>
<td>215 (51%)</td>
<td>23 – 828</td>
</tr>
<tr>
<td>Self-efficacy for overcoming barriers – visual impairments (SES_VI)</td>
<td>51</td>
<td>51</td>
<td>0 (0%)</td>
<td>10 – 60</td>
</tr>
</tbody>
</table>

Table 4.8: Baseline, Post-Intervention and Change Scores of Participant 1 on the Social Cognitive Theory Questionnaires.

Participant 2. Table 4.9 illustrates the pre and post intervention change scores from the social cognitive theory questionnaires for self-efficacy, self-regulation, social support, and outcome expectancy value. For SES, the pre and post intervention scores were 31 and 34, respectively (10% increase). For the SRS scale, pre and post intervention scores 70 and 119, respectively (70% increase). For the SSS scale, pre and post intervention scores were 33 and 47, respectively (42% increase). For the OEVS scale, pre and post intervention scores were 453 and 668, respectively (48% increase). Finally, for the SES_VI scale pre and post intervention scores were 43 and 58, respectively (45% increase).
increase). Contrary to participant 1, changes in scores across all questionnaires were observed for participant 2.

<table>
<thead>
<tr>
<th>Social Cognitive Theory Construct</th>
<th>Baseline</th>
<th>Post</th>
<th>Change</th>
<th>Score Attainable (min – max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Efficacy to Overcome Barriers (SES)</td>
<td>31</td>
<td>34</td>
<td>3 (10%)</td>
<td>7 – 12</td>
</tr>
<tr>
<td>Social Support (SSS)</td>
<td>33</td>
<td>47</td>
<td>14 (42%)</td>
<td>8 – 48</td>
</tr>
<tr>
<td>Self-regulation (SRS)</td>
<td>70</td>
<td>119</td>
<td>49 (70%)</td>
<td>25 – 150</td>
</tr>
<tr>
<td>Outcome Expectancy Value (OEVS)</td>
<td>453</td>
<td>668</td>
<td>215 (48%)</td>
<td>23 – 828</td>
</tr>
<tr>
<td>Self-efficacy for overcoming barriers – visual impairments (SES_VI)</td>
<td>43</td>
<td>58</td>
<td>15 (45%)</td>
<td>10 – 60</td>
</tr>
</tbody>
</table>

Table 4.9: Baseline, Post-Intervention and Change Scores of Participant 2 on the Social Cognitive Theory Questionnaires.

Participant 3. Table 4.10 illustrates the pre and post intervention change scores for participant 3 on the social cognitive theory questionnaires. Similar to participant 2, changes in all scales were observed for participant 3 from baseline to post-intervention. For the SES scale, pre and post intervention scores were 26 and 36, respectively (39% increase). For the SRS questionnaire, pre and post intervention scores were 69 and 130, respectively (88% increase). For the SSS scale, pre and post intervention scores were 31 and 46, respectively (48% increase). For the OEVS scale, pre and post intervention scores were
were 344 and 623, respectively (81% increase). Finally, for the SES_VI scale pre and post intervention scores were 40 and 56, respectively (40% increase).

<table>
<thead>
<tr>
<th>Social Cognitive Theory Construct</th>
<th>Baseline</th>
<th>Post</th>
<th>Change</th>
<th>Score Attainable (min – max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Efficacy to Overcome Barriers (SES)</td>
<td>26</td>
<td>36</td>
<td>20 (39%)</td>
<td>7 – 42</td>
</tr>
<tr>
<td>Social Support (SSS)</td>
<td>31</td>
<td>46</td>
<td>15 (48%)</td>
<td>8 – 48</td>
</tr>
<tr>
<td>Self-regulation (SRS)</td>
<td>69</td>
<td>130</td>
<td>61 (88%)</td>
<td>25 – 150</td>
</tr>
<tr>
<td>Outcome Expectancy Value (OEVS)</td>
<td>344</td>
<td>623</td>
<td>279 (81%)</td>
<td>23 – 828</td>
</tr>
<tr>
<td>Self-efficacy for overcoming barriers – visual impairments (SES_VI)</td>
<td>40</td>
<td>56</td>
<td>16 (40%)</td>
<td>10 – 60</td>
</tr>
</tbody>
</table>

Table 4.10 Baseline, Post-Intervention and Change Scores of Participant 3 on the Social Cognitive Theory Questionnaires.

Participant 4. Table 4.11 illustrates the pre and post intervention change scores for participant 4 on the social cognitive theory questionnaires. For the SSS questionnaire, pre and post intervention scores were the same. There was a decrease in SES and SRS scores of 3% and 6%, respectively. However, for the OEVS scale pre and post intervention scores were 364 and 483, respectively (33% increase). Finally, for the SES_VI scale pre and post intervention scores were 42 and 49, respectively (16% increase).
<table>
<thead>
<tr>
<th>Social Cognitive Theory Construct</th>
<th>Baseline</th>
<th>Post</th>
<th>Change (%)</th>
<th>Score Attainable (min – max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Efficacy to Overcome Barriers (SES)</td>
<td>34</td>
<td>33</td>
<td>-1 (3%)</td>
<td>7 – 42</td>
</tr>
<tr>
<td>Social Support (SSS)</td>
<td>27</td>
<td>27</td>
<td>0 (0%)</td>
<td>8 – 48</td>
</tr>
<tr>
<td>Self-regulation (SRS)</td>
<td>68</td>
<td>64</td>
<td>-4 (6%)</td>
<td>25 – 150</td>
</tr>
<tr>
<td>Outcome Expectancy Value (OEVS)</td>
<td>364</td>
<td>483</td>
<td>119 (33%)</td>
<td>23 – 828</td>
</tr>
<tr>
<td>Self-efficacy for overcoming barriers – visual impairments (SES_VI)</td>
<td>42</td>
<td>49</td>
<td>7 (17%)</td>
<td>10 – 60</td>
</tr>
</tbody>
</table>

Table 4.11 Baseline, Post-Intervention and Change Scores of Participant 4 on the Social Cognitive Theory Questionnaires.

**Summary.** Participants 2 and 3 reported pre and post intervention changes in scores on all social cognitive scales. Interestingly, these two participants were totally blind. More importantly, these two participants worked together to meet their physical activity criteria. That is, participants 2 and 3 supported each other’s efforts. However, for participant 1 (low vision) notable changes in scores were observed for the social support and outcome expectancy value scales only, while for participant 4 change scores were for the outcome expectancy value scale only. Caution should be noted when summarizing test scores changes as a percentage of prior performance (Russell, 2000). This is because percent change may be deceiving when initial performance is low, producing a statistic
that is difficult to interpret and potentially misleading due to insensitivity to the measurement scale in which scores are expressed (Russell, 2000a, 2000b). However, due to the nature of the study’s design other recommended methods that yield standardized estimates of change scores which have the same meaning at all points on the measurement scale such as effect size and standardized growth estimates (Russell, 2000b) could not be implemented. Still, percent change score percentages provided a representation that changes in social cognitive constructs may have occurred due to program implementation, particularly for those participants who were totally blind.

Physical Activity and Social Cognitive Theory Scales: Bringing Results Together

Table 4.12 provides an illustration of changes in leisure time physical activity along with change scores from the social cognitive theory scales. It can be observed that changes in physical activity behavior occurred along with changes in social cognitive theory constructs, supporting the notation that it is plausible that change in social cognitive theory constructs may have led to changes in physical activity behavior.
<table>
<thead>
<tr>
<th>Participant</th>
<th>Physical Activity Bout (mean min.)</th>
<th>Baseline</th>
<th>Intervention</th>
<th>Direction Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant 1</td>
<td></td>
<td>0</td>
<td>24</td>
<td>↑</td>
</tr>
<tr>
<td>Social Cognitive Scales (score)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Self-Efficacy</td>
<td></td>
<td>36</td>
<td>36</td>
<td>-</td>
</tr>
<tr>
<td>• Self Regulation</td>
<td></td>
<td>107</td>
<td>129</td>
<td>↑</td>
</tr>
<tr>
<td>• Social Support</td>
<td></td>
<td>20</td>
<td>41</td>
<td>↑</td>
</tr>
<tr>
<td>• Outcome Expectancy</td>
<td></td>
<td>425</td>
<td>640</td>
<td>↑</td>
</tr>
<tr>
<td>• Self-Efficacy Visual Impairment</td>
<td></td>
<td>51</td>
<td>51</td>
<td>-</td>
</tr>
<tr>
<td>Participant 2</td>
<td></td>
<td>2</td>
<td>30</td>
<td>↑</td>
</tr>
<tr>
<td>Social Cognitive Scales (score)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Self-Efficacy</td>
<td></td>
<td>31</td>
<td>34</td>
<td>↑</td>
</tr>
<tr>
<td>• Self Regulation</td>
<td></td>
<td>70</td>
<td>119</td>
<td>↑</td>
</tr>
<tr>
<td>• Social Support</td>
<td></td>
<td>33</td>
<td>47</td>
<td>↑</td>
</tr>
<tr>
<td>• Outcome Expectancy</td>
<td></td>
<td>453</td>
<td>668</td>
<td>↑</td>
</tr>
<tr>
<td>• Self-Efficacy Visual Impairment</td>
<td></td>
<td>43</td>
<td>58</td>
<td>↑</td>
</tr>
<tr>
<td>Participant 3</td>
<td></td>
<td>5</td>
<td>27</td>
<td>↑</td>
</tr>
<tr>
<td>Social Cognitive Scales (score)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Self-Efficacy</td>
<td></td>
<td>26</td>
<td>36</td>
<td>↑</td>
</tr>
<tr>
<td>• Self Regulation</td>
<td></td>
<td>69</td>
<td>130</td>
<td>↑</td>
</tr>
<tr>
<td>• Social Support</td>
<td></td>
<td>31</td>
<td>46</td>
<td>↑</td>
</tr>
<tr>
<td>• Outcome Expectancy</td>
<td></td>
<td>344</td>
<td>623</td>
<td>↑</td>
</tr>
<tr>
<td>• Self-Efficacy Visual Impairment</td>
<td></td>
<td>40</td>
<td>56</td>
<td>↑</td>
</tr>
<tr>
<td>Participant 4</td>
<td></td>
<td>25</td>
<td>40</td>
<td>↑</td>
</tr>
<tr>
<td>Social Cognitive Scales (score)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Self-Efficacy</td>
<td></td>
<td>34</td>
<td>33</td>
<td>↓</td>
</tr>
<tr>
<td>• Self Regulation</td>
<td></td>
<td>68</td>
<td>64</td>
<td>↓</td>
</tr>
<tr>
<td>• Social Support</td>
<td></td>
<td>27</td>
<td>27</td>
<td>-</td>
</tr>
<tr>
<td>• Outcome Expectancy</td>
<td></td>
<td>364</td>
<td>483</td>
<td>↑</td>
</tr>
<tr>
<td>• Self-Efficacy Visual Impairment</td>
<td></td>
<td>42</td>
<td>49</td>
<td>↑</td>
</tr>
</tbody>
</table>

Table 4.12 Summary of Directional Changes of Baseline and Intervention Mean Scores of Physical Activity Bouts and Social Cognitive Scales.
Social Validity

Social validity questionnaires were developed and administered to relevant consumers of the program to assess their perceptions about the social validity of the intervention. Schwartz and Baer (1991) indicated the purpose of social validity assessment is to evaluate the acceptability or viability of an intervention, often accomplished by asking all relevant consumers to complete some form of questionnaire. For this study, three categories of program consumers (Schwartz & Baer, 1991) were used: (a) direct consumers (i.e., participants), (b) indirect consumers (i.e., parents), and (c) members of the immediate community (i.e., youth leaders and after school administration). Wolf (1978) suggests that social validity assessment should answer the following questions: (a) were the goals of the procedures important and relevant to the desired behavior changes? (b) Were the techniques acceptable to the consumers and the community or did they cost too much? And (c) were the consumers satisfied with the outcome, both with the predicted behavior changes and with any unpredicted side effects? The questionnaires were distributed to a total of 13 individuals (4 participants, 4 parents, and 5 after school personnel). Questionnaires were completed and returned by 12 of these individuals (92%). The only person who did not return a questionnaire was a parent.

Direct Consumers: Participants

The social validity questionnaire for participants consisted of seven questions (Appendix D). The items centered on perceived outcomes and benefits of participating in the program. Responses to each question are described below:
Question #1: Did you enjoy monitoring your own free time physical activity behavior? All participants responded positively to this question (i.e., yes), indicating they all enjoyed participating in the program.

**Question #2: Do you think the lessons helped you become more confident in becoming more physically active during your free time?** When asked this question, all participants agreed the intervention helped them become more active. Participant 2 followed up by stating “by increasing walking it helped me the most because it made me feel part of the program.”

**Question #3: Did you enjoy monitoring your own free time physical activity behavior?** All participants responded “yes” to this question, indicating they enjoyed having the opportunity to monitor their own physical activity patterns.

**Question #4: Do you think the lessons helped you become more confident in becoming more physically active during your free time?** All participants responded “yes” to this question, indicating the program’s content may have positively affected their perceived confidence by their ability to be active during after school leisure time.

**Question #5: Will you continue using the skills you acquired while participating in the program to continue being physically active during your daily living?** All participants agreed they would continue using the skills taught during the program to continue being physically active.

**Question #6: Will you make physical activity an important part of your lifestyle?** When asked this question, all participants answered “yes”. However, participant 4 followed up by stating that although she recognized the importance of physical activity as
part of one’s lifestyle, sometimes it would be hard to be as active as one may expect due to all the school responsibilities and the requirements of residential school life.

*Question #7: Which lesson did you consider helped you more? Why you think it helped you more?* When asked this question, participant 1 indicated that social support and goal setting were the most helpful topics/lesson. He followed up by stating “it helped me to be more active by giving me support and a reason to be physically active”.

Participant 2 indicated all lessons were helpful and followed up by stating “by increasing walking it helped me the most because it made me feel part of the program,” which may point out to goal setting. Participant 3 indicated that lesson topics dealing with overcoming barriers and motivators were the most helpful to him. He followed up by stating “it makes me realize how I could overcome barriers I thought I was not able to overcome and it motivated me to continue working toward my goals… rewards were great.” Lastly, participant 4 considered goal setting to be the most helpful. She followed up by stating “it helped me make goals and to try to achieve them – kind of an own challenge.”

*Indirect Consumers: Parents*

The social validity questionnaire for parents consisted of three questions and a section for additional comments (Appendix E). Responses to each question are detailed and discussed below:

*Question #1: Did you see a positive difference in your child’s leisure time physical activity behavior at home while he/she was participating in the after school physical activity program?* When asked this question, two parents responded to having seen positive changes in their child’s leisure time physical activity patterns at home. One
parent abstained from answering the question stating that “she has not been home for over 6 weeks so I cannot comment on her activities over the weekends… this would better be filled out by one of her house parents (i.e., youth leaders) at school.”

Question#2: Did you see a positive difference in your child’s confidence and/or attitude toward participating in physical activities during his/her free time? Similar to the previous question, two parents indicated to having seen positive changes in their children’s confidence and/or attitude toward participating in physical activity during their leisure time. One parent followed up by commenting “he has always wanted to lift weights and exercise… they are mostly [at school] inside and listening to the radio, etc.”

Question #3: Would you consider the use of after school interventions designed to increase physical activity participation valuable for adolescents with visual impairments? When asked this question, all parents responded “yes,” indicating valuing the implementation of school-based intervention designed to increase physical activity participation among youth with visual impairments.

Members of Immediate Community: Youth Leaders and After School Staff

The social validity questionnaire for after school staff consisted of four questions and a section for additional comments and recommendations (Appendix F). Responses to each question are detailed and discussed below:

Question #1: Do you think there is a need for programs specifically designed to increase physical activity among adolescents with visual impairments? When asked this question, all respondents selected “yes” – indicating the need for specially-designed programs to increase physical activity among youth with visual impairments.
Question #2: Do you believe the after school physical activity program produced positive outcomes for the participants? All respondents agreed that the intervention led to positive outcomes among the participants. One youth leader followed up by stating “students were able to add to their independence by taking control of their own physical recreational activities.” Another after school staff indicated that the intervention appeared to have produced “better physical, mental, and emotional health.”

Question #3: Do you think this type of program could have promise as part of the school offerings for adolescents with visual impairments? When asked this question, all respondents agreed (by responding “yes”) that this type of intervention could be promising as part of the after school programming for youth with visual impairments.

Question #4: Do you believe the participants enjoyed the physical activity program? When asked this question, respondents indicated by answering “yes” that they believed all participants enjoyed participating in the intervention. One of the respondents stated that students appeared to have enjoyed trying new activities as well as finding activities they enjoyed.

Additional comments: What do you consider were the benefits of the physical activity program? Some of the comments regarding the benefits of the program as reported by the respondents included: “small group size,” “1-2 adults attending,” “students were able to add to their independence by taking control of their own physical recreational activities,” “better physical, mental, and emotional health,” “learning to become physically active,” and “for students just getting to try new activities… they had to find activities they enjoy.”
Recommendations: What could have been improved? When asked this question, respondents indicated that using a one-on-one approach as well as adding a section on proper nutritional habits could improve the intervention. Additional comments included: “options for snacks at meetings could be healthier (e.g., fruits vs. cake),” “there were time constraints,” “communication of what is going on in the program [with other youth leaders],” “more options [activities] talked about,” among others.

In summary, results from the social validity questionnaires administered to participants, parents, and after school staff provided support for the implementation of the intervention. Both parents and after school staff observed positive changes in physical activity participation among participants as a consequence of participating in the intervention, while participants enjoyed their participation in the intervention. After school staff as well as parents supported the implementation of specially-designed interventions to increase physical activity among youth with visual impairments. In particular, respondents believed positive outcomes occurred for participants’ related to increased physical activity participation and perceived confidence. Table 4.13 provides a summary of participants’ comments from informal interviews conducted after administering the social validity questionnaire.
Sample Comments

“I enjoyed it…”

“I enjoyed meeting different people”

“I liked the rewards and doing something different”

“It helped me and supported me doing things”

“I got exercise”

“Helped me with my goals and to get around barriers”

“I liked the accelerometer”

“It allowed me to get more energy and helped me not get as tired”

Table 4.13: Sample Comments from Participants’ Informal Interviews.
This chapter provides a discussion of the results of the effects of the theory-based physical activity intervention on after school leisure time physical activity among adolescents with visual impairments attending a residential school. The discussion focuses on each of the research questions, perceived and observed limitations of the study, implications for practice and suggestions for future research. Finally, a summary of the study is presented.

**Research Questions**

**Question 1:** What effects did the intervention have on the acquisition of time spent on leisure time physical activity among adolescents with visual impairments?

Visual analysis of graphed data suggested that the intervention demonstrated functional control over participants’ target behavior (i.e., time spent in a bout of leisure time physical activity). To demonstrate the effects of the intervention, a range bound changing criterion design was implemented. Participants 1, 2 and 3 had the fewest minutes of time spent in a bout of leisure time physical activity (LTPA) at baseline, averaging only 0, 3.33 and 5.2 minutes per day, respectively – which did not approximate the operational definition of a bout of physical activity (i.e., 10 or more continuous minutes of activity). Participant 4 was the most active at baseline, averaging 25 minutes
of LTPA per day. Once intervention was implemented, participants 1, 2 and 3 increased their time spent in a bout of LTPA during treatment phases with participants 1 and 3 showing most consistent criterion changes in the expected direction.

For participant 1, changes in mean performance across phases were observed. Similarly, changes in levels (i.e., shift in performance from last session of one phase to first session of next phase) were observed across phases. Data points for participant 1 followed an increasing trend with minimal data overlapping. Using baseline logic, it would have been predicted that if intervention would have not been implemented, participant 1 would not have engaged in a bout of LTPA. Verification was demonstrated when changes occurred when intervention was introduced and replication achieved in each subsequent criterion phase. Experimental control was demonstrated for participant 1, but percent of conforming data (PCD) only reached 100% during intervention phase 2.

For participant 2, changes in mean performance across phases were observed. Changes in levels (i.e., shift in performance from last session of one phase to first session of next phase) were observed across phases, with some overlapping data points during phase 2 and phase 5. Data points for participant 2 followed an increasing trend. However, participant 2 did not meet criterion for phase 5. For time spent in a bout of leisure time physical activity, a number of data points were eliminated (Figure 4.2). A decision was made to exclude certain data points because they did not represent voluntary physical activity. The excluded data points were related to instances in which the set criterion for a given phase was not met due to school-related responsibilities or due to the influence of youth leaders on the participant’s ability to meet the criterion for that particular session. Unfortunately, the study design and procedures did not take into consideration the
potential effects of youth leaders on the participants’ ability to engage in physical activity and/or to meet physical activity goals for a given day. A similar situation was observed for participant 3, where an increasing trend and observed changes in mean performance across phases were evident up to intervention phase 4. At end of phase 4, a decreasing trend was observed and the criterion set for phase 5 was not met. Data points were also excluded from Figure 4.3 relative to time spent in a bout of leisure time physical activity due to factors similar to those experienced by participant 2. Interestingly, these two participants were assigned to the same dorm at the residential school.

For both participants 2 and 3 criterion changes during phase 5 were not met, which may indicate that the 60-minute bout goal may have been too high and/or unrealistic for them. Interestingly, participants 2 and 3 were the ones who had total blindness which may have reflected their dependency on the need of the youth leaders in order to meet their physical activity goals. The effects of the youth leaders for these two participants were most evident during intervention phase 5. Still, for both participants 2 and 3 increased time spent in a bout of LTPA was observed during intervention. For participant 4, stable data during baseline was not achieved which may have raised questions on whether or not the intervention should have been initiated. As such, due to high levels of activity during baseline it may be that her physical activity could have been maintained or increased if the intervention was not implemented. Data points for participant 4 showed an increasing trend but due to high levels of time spent in a bout of physical activity during baseline it is difficult to established functional control. For participants 2 and 4, PCD was low which reflected that most data points did not conform to the pre-established range-bounds. This can be interpreted as limited experimental control under the range-
bound changing criterion design. However, if data were viewed based on a traditional changing criterion design, experimental control would have been evident.

Data were also collected via the accelerometers to ascertain total time spent in LTPA. For participants 1, 2 and 3 it was evident that time spent in LTPA was influenced by the implementation of the intervention with percent changes from baseline to intervention of 117%, 119% and 107%, respectively. For participant 4, only a 21% change from baseline to intervention was observed for total time spent in LTPA (mean 66 minutes to 83 minutes). As indicated previously, participant 4 was the most active participant during baseline. Based on these observations it appears that intervention worked best for those participants who were least active during baseline. This is consistent with previous studies in which the Plan for Exercise, Plan for Health program has been used (Mowad, 2007; Stevens, 2006), in which the intervention yielded significant effects among participants who were classified as sedentary. Stevens (2006) found that previously inactive adolescents were able to significantly increase physical activity levels (moderate intensity) following the implementation of the Plan for Exercise, Plan for Health intervention. Mowad (2007) also found the Plan for Exercise, Plan for Health had significant effects on moderate physical activity among participants classified as sedentary at pre-test. Mowad further argued that the main purpose of the Plan for Exercise, Plan for Health was to target physically inactive youth with the goal of enabling them to evaluate, monitor and reinforce the importance of being physically active and promote regular physical activity participation.
The intervention in this study led to physical activity behavior changes while it was implemented. For youth with visual impairments, the associated mobility deficiencies coupled with minimal activity participation could lead to health issues and poor quality of life during adulthood. As such, increased physical activity behavior as seen in this study as a result of the intervention is important for the participants as it may be a first step in promoting physically active lifestyles, resulting in overall quality of life.

Question 2: What effects did the intervention have on the acquisition of moderate to vigorous (MVPA) intensity leisure time physical activity among adolescents with visual impairments?

Visual inspection of the data did not show any effects (increase) on participant 1 relative to time spent in a bout of moderate to vigorous physical activity (MVPA). However, participants 2, 3, and 4 did show increased time spent in bouts of MVPA during intervention. During intervention, participant 2 engaged in one bout of MVPA during each intervention condition. Bouts ranged from 20 – 40 minutes. Participant 3 engaged in a bout of MVPA during intervention phases 2 (33 minutes) through 5 (30 minutes); while participant 4 engaged in a bout of MVPA during phases 2 (11 minutes), 3 (36 minutes) and 5 (10 minutes). Although time spent in a bout of MVPA was observed for these participants, one bout of MVPA during a week may not lead to associated health benefits of engaging in long lasting bouts of MVPA on a regular basis such as higher levels of cardiorespiratory fitness, increased muscle strength, reduced body fatness, bone health, reduced symptoms of anxiety and depression, and a greater likelihood to lead a healthy adulthood (Strong et al., 2005; USDHHS, 2008).
For total time spent in MVPA, participants 2, 3, and 4 were again the ones showing changes from baseline to intervention. In the cases of participants 2 and 3, visual inspection of the data show they were the ones who may have benefited the most regarding total time spent in MVPA. During baseline, participants 2 and 3 engaged in 20 or less minutes of total MVPA time (Table 4.7), but during intervention phase 4 both participants doubled their total time spent in MVPA, reaching average times of 59 (participant 2) and 55 (participant 3) minutes. Participant 1 did not engage in total MVPA time. Although participants 2 and 3 increased their average time spent in total MVPA time during intervention, neither participant achieved activity levels comparable to those recommended by the United States Department of Health and Human Service’s physical activity guidelines for American youth (USDHHS, 2008) which is 60 or more minutes of MVPA during most days of the week. This is consistent with other studies among school-aged youth with visual impairments (Kozub & Oh, 2004; Kozub, 2006). Kozub and Oh (2004) and Kozub (2006) measured physical activity, using triaxial accelerometers, in youth with visual impairments from residential schools for the blind. In both studies, reported mean MVPA values were below recommended levels (i.e., 60 minutes of MVPA). Kozub and Oh reported mean values of 29.26 bouts of MVPA over a four-day period (7.31 bouts per day) lasting on average 3.77 minutes. In the 2006 Kozub study, mean values of 26.80 minutes of MVPA per day were reported. Similar to Kozub and Oh and Kozub’s studies, participants in the present study did not reach recommended levels of MVPA, which indicate youth with visual impairments are at risk of not meeting daily recommend MVPA values (Kozub, 2006; Kozub & Oh, 2004; Longmuir & Bar-Or,
2000). As such, there is a need for more intervention research among this group, in particular at residential schools for the blind.

Schools have been identified as places in which physical activity promotion among youth may take place (USDHHS, 1999). In particular, it has been suggested that specialized schools for the blind offer barrier free opportunities for students with disabilities to engage in physical activity during school (i.e., PE) and after school (Kozub, 2006; Kozub & Oh, 2004). In the present study, it was found that although after school programming was made available for adolescents with visual impairments to engage in activity, this programming emphasized more independent living skills (e.g., shopping, socialization, and self-care) and academics rather than leisure and the benefits of physical activity participation. Additionally, available leisure programming comprised activities such as video games, movies, bowling and one-day a week at the nearby school for the deaf fitness facility. In certain instances, participants’ after school schedules were so busy that it was almost unfair to ask of them to take time from their after school schedule to engage in physical activity. In order for physical activity to be part of after school options and potentially be a feasible residential-student lifestyle choice, physical activity must be an integral part of the after school schedule, not just an available option. When physical activity has been optional, youth with visual impairments have consistently shown to select sedentary activities (Longmuir & Bar-Or, 2000; Kozub, 2006; Kozub & Oh, 2004).

It is important to note that physical activity intensity levels are based upon either cut-point (as in this study) or MET values (e.g., Kozub & Oh, 2004). METS and cut-points have been developed using samples of individuals without disabilities, which may raise concerns on how useful they may be for those with disabilities. Similarly, no study to
date has evaluated the dose-response relationship between physical activity and health-related benefits among youth with visual impairments, which may provide evidence on the amount of physical activity and the intensity of the activity that, would lead to health benefits and sustained physical activity participation. While future researchers engage in such venture, efforts should be placed on encourage youth with visual impairments to engage in MVPA, at least, similar to that recommended for youth without disabilities.

Question 3: What effects did the intervention have on the maintenance of moderate to vigorous intensity (MVPA) leisure time physical activity among adolescents with visual impairments following intervention?

During maintenance, time spent in a bout of LTPA returned to baseline levels for participant 1. For participant 4, time spent in a bout of LTPA dropped below that of baseline levels. For participants 2 and 3, time spent in a bout of LTPA was below that of intervention condition, but did not fall below baseline levels. However, the prediction of future responding may indicate that participants 2 and 3 will not achieve times similar to those achieved during intervention. Unfortunately, the limited intervention time may not have been sufficient for maintenance to fully occur. However, increased physical activity behavior was observed when compared to baseline levels for participants 2 and 3. These observations indicate that in the absence of the intervention, participants exhibited more naturally occurring behavior.

For time spent in a bout of MVPA, only participants 2 and 3 showed similar responding to that achieved during intervention, but participant 1 continued to demonstrated lack of involvement in any MVPA while participant 4 returned to baseline levels. That lack of influence over patterns of responding of physical activity behavior
during maintenance may be due to the limited intervention time. Due to the limited time of the study there may not have been sufficient time for participants to experience and/or fully achieve levels of responding that would have enabled them to achieve appropriate maintenance levels which would result in making physical activity part of their lifestyles. As such, intervention appeared to have no effect on the maintenance of MVPA following intervention.

However, when data were analyzed as total time spent in MVPA it was evident that participants 2 and 3 were able to continue engaging in minutes of moderate-intensity physical activity greater that those reported during baseline. For participant 4, total minutes of moderate-intensity physical activity during maintenance were similar to those obtained during baseline. Similar to that reported for bouts of MVPA, participant 1 did not engage in any total minutes of MVPA at maintenance. Results from previous studies using the Plan for Exercise, Plan for Health program have also yielded similar results indicating that upon follow-up, participants did not maintain levels of MVPA that were observed during intervention (Mowad, 2007; Stevens, 2006).

During the informal interviews at the end of the study, participant 1 raised an interesting point. He indicated that a major barrier for him to engage in physical activity of higher intensity was his willingness to do activity. In his own words “will power”, actually wanting to do physical activity. Although he increased leisure time physical activity, it appears that for MVPA to have been affected other contingencies and/or reinforcements would have needed to be in place. It is important to note that participant 1 had the highest body weight (Table 3.1) which may have also influenced his ability to
engage in physical activity of moderate to vigorous intensity within the time frame allocated to the study.

Question 4: What effects did the intervention have on self-efficacy for perceived barriers, outcome expectancy value, social support, and self-regulation among adolescents with visual impairments?

With the recommendation of designing theory-based physical activity interventions, the use of single subject research designs are a tenable and potentially valuable approach to investigate the effects of such interventions. Bouffard (1993) and Edgington (1987) argued that most of the existing theories about human behavior (e.g., social cognitive theory) are concerned with individual behavior explaining phenomena in terms of processes within a single person. Therefore, research using existing theoretical models is intended to further our understanding of intra-individual processes (Bouffard, 1993; Edgington, 1987). Single subject research may allow researchers to distinguish how individuals respond and/or are affected by a particular intervention as well as detecting individual responses to treatments (Bouffard, 1993). Furthermore, single subject research may allow researchers to capture the underlying assumptions of existing theories (Bouffard, 1993). This study used a single subject research design to document the effects of an after school physical activity intervention based on and modeled after the *Plan for Exercise, Plan for Health* program among adolescents with visual impairments.

When compared to all four participants, participants 2 and 3 showed the greatest positive changes regarding social cognitive theory constructs with changes in scores for all constructs from baseline to post-intervention (Table 4.9 and Table 4.10). Participant 1 showed positive changes for social support and outcome expectancy values (SES: 20
points at baseline and 41 points at post-intervention, 105% change; OEVS: 425 points at baseline and 640 points at post-intervention, a 51% change), while participant 4 accrued greater changes in the outcome expectancy values scale (364 points at baseline and 483 points at post-intervention, a 33% change). Interestingly, in studies in which the effects of the Plan for Exercise, Plan for Health have been used on social cognitive theory constructs, the intervention has shown significant effects on social support and self-regulation (Hortz, 2005; Mowad, 2007; Stevens, 2006). These studies used regression modeling which allowed them to weight the effects of the intervention on each theoretical construct as well as to identify the extent to which each construct may have influenced physical activity behavior change. The nature of the present study did not allow for discriminating the impact of each individual lesson in the program. However, the intervention appeared to have enhanced physical activity behavior and promoted positive changes on selected social cognitive constructs (i.e., self-efficacy, social support, self-regulation and outcome expectancy values).

In this study, the intervention appeared to have a positive effect on social support and outcome expectancy values for participant 1 and outcome expectancy values for participant 4. For participants 2 and 3, changes were observed on all constructs with notable changes for self-regulation and outcome expectancy values. It is important to note that participants 2 and 3 supported each other’s efforts during the intervention. As part of the intervention, these two individuals worked together (as part of the social support component of the program) to accomplished their activity goals and set criteria. In addition, both appeared to have received the most benefits from the intervention (i.e., increased physical activity and changes in theoretical constructs). Outcome expectancy
value was the only social cognitive construct that changed for all participants. Bandura (2004) has argued that health behavior is also affected by the outcomes people expect their actions to produce. It appears that in this study, participants expected outcomes may have been affected by their participation in the program. Unfortunately, the nature of the study did not allow for the analysis of the individual lesson effects on either physical activity behavior or social cognitive constructs. For example, while lesson 2 targeted outcome expectancy values through discussing the benefits of physical activity on health it is not possible to weight the extent to which the actual lesson affected physical activity behavior nor what effect each lesson had on each other. On a whole, however, the intervention appeared to have positive effects on the theoretical constructs.

Once intervention was implemented, changes in physical activity behavior were observed. When post-intervention social cognitive scores were obtained, change in scores for participants 2 and 3 were observed for all theoretical constructs, changes in scores for SSS, SRS, and OEVS were observed for participant 1 and changes in scores for OEVS and SES_VI for participant 4. It is plausible that changes in social cognitive theory constructs may have led to changes in physical activity behavior and/or vice versa (Table 4.12).

Limitations

When evaluating the results of this study a number of limitations are readily apparent. The first limitation was changing phases based upon time rather than solely upon the participant meeting the set criteria. When using changing criterion designs, it is expected that criteria change be based on a participant’s achievement of the criteria and subsequent changes be based on behavior stability rather than a pre-determined time limit (Cooper et
al., 2007; McDougall, 2005). While behavior stability was somewhat achieved, the high variability observed for participant 2 could have been reduced if longer intervention phases were implemented. Unfortunately, the researcher had little control over time the amount of time the intervention was to take place. The school administration essentially determined the length of time the study was to be implemented. It is plausible that with additional intervention sessions, more stable responding could have been achieved within phases and experimental control could have been established more convincingly by manipulating the length of the phases, the magnitude of the criterion changes and the number of intervention phases (Cooper et al., 2007; Hartman & Hall, 1976). It can be concluded that limited functional control was more evident for participants 1 and 3, than for participants 2 and 4, relative to the time spent in a bout of leisure time physical activity.

The after school programming options in place at the time the program was implemented could be another limitation. As part of the residential program at the Midwestern school for the blind, paid staff are assigned to develop activities as well as to plan events for students. At times these events provided constraints to the participants after school responsibilities such as completion of academic homework and cottage assignments (e.g., laundry, grocery shopping, cooking). Although some participants were successful at overcoming those barriers to engage in leisure time physical activity and meet their set criterion for a given phase, it can be argued to what extent we can ask participants fulfill all their after school responsibilities (e.g., academics, cottage tasks) and still find time to be physically active. An alternative approach would be to design after school activities that are conducive to moderate to vigorous activity. Unfortunately,
most of the after school leisure hours were composed of low-intensity, mostly sedentary activities such as video gaming, board games, movies and computer usage, among others. In addition to the after school programming, it was found that youth leaders had an effect on the ability of participants 2 and 3 to meet their set criteria at specific intervention phases. This should not necessarily be seen as negative as youth leaders can and do play an important role in after school residential life.

A third possible limitation was the time of the year in which the study was conducted (i.e., fall). While there were a variety of indoor activity opportunities (e.g., treadmill, stationary bike), lower outdoor temperatures associated with the fall season in the Midwest reduced the overall number of activities that participants could engage in. Although the effects of seasonality were not examined, they cannot be ruled out as a potential extraneous variable in inhibiting the ability of participants to meet their physical activity goals. For example, at the beginning of the study participants spent most of their activity time using the school’s track for walking. However, this option may have not been an alternative when temperatures were low and/or outdoor conditions were not pleasant (i.e., wind, ice, rain). Therefore, due to seasonal effects it is possible that participants did not exhibit higher activity patterns during latter stages of the study. Rather, they may have chosen more sedentary options. It is possible that less demanding leisure activities and/or sedentary options could have been more attainable during periods of unbearable weather conditions than physical activity of moderate to vigorous intensity. Esliger and colleagues (2005) have suggested that research describing seasonal variation in activity patterns is among the future areas of research for accelerometer-based physical activity.
A fourth limitation in this study was measuring physical activity under free living conditions. Physical activity behavior in this study was measured through the use of ActiGraph accelerometers which provided objective monitoring. However, there were two limitations when measuring physical activity by accelerometers. First, the accelerometers were not worn while participants were bathing or swimming (i.e., not waterproof). Second, the accelerometers were not able to accurately detect upper body movement activities (e.g., lifting weights, carrying heavy loads) and/or activity with minimal trunk action (e.g., bike riding). Measurement of physical activity remains a challenge under free living conditions (Dishman et al., 2001; Reilly, Penpraze, Hislop, Grant & Paton, 2008; Sirard & Pate, 2001; Taylor et al., 1998; Trost, 2007) especially when individuals with disabilities are participants (Rimmer, 2006). However, despite their known limitations accelerometers provide an objective measure of physical activity and are able to collect and store data for extended periods of time while resulting in a minimal burden to participants (Chen & Bassett, 2005; Rowlands, 2007).

Along with the use of accelerometers to measure physical activity is the use of epochs to record activity counts and the use cut-points to classify intensity of physical activity. In this study, a one-minute epoch was used to collect physical activity counts – this was chosen based on the literature (Kozub, 2006; Kozub & Oh, 2004; Kozub, Oh, & Rider, 2005; Reilly, Penpraze, Hislop, Davies, Grant, & Paton, 2008; Rowlands, 2007). However, this may have underestimated and/or left undetected short bouts of moderate to vigorous physical activity.
Implications for Professional Practice

Bandura (2000) has argued that schools have a vital role in promoting health behavior, including physical activity, as they are the only place where most youth can be reached. That is also the case for specialized schools for the blind in which the needs of youth can be met in a barrier free environment. These schools offer opportunities for youth with visual impairments to engage in activity without concerns of safety and/or accessibility (Kozub & Oh, 2004; Kozub, 2006). However, for physical activity behavior change to be realized it requires a collaborative approach. A collaborative approach would be for youth leaders, after school personnel and school administration to work together to design after school schedules that place emphasis on providing physical activity opportunities that are moderate to vigorous in nature. Based on the findings of this study, a specially designed physical activity program can benefit youth who are known to be sedentary. Youth leaders can be instrumental in helping youth with visual impairments engage in physical activity. Finally, even with the short duration of the study it appears that an intervention based on a sound theoretical framework can be practically implemented to affect positive change in physical activity behavior in a residential school.

Suggestions for Future Research

While this study has shown that a school-based physical activity program based on social cognitive theory can have varying degrees of functional control over physical activity behavior change among adolescents with visual impairments, there is still a need for additional intervention research. It is suggested that future research should:
1. Examine the role of school-related factors (e.g., physical education, after school programming, youth leaders) potentially influencing physical activity behavior among school-aged residential youth with visual impairments.

2. Implement interventions with a longer period of time to ascertain its plausible effects on maintenance of physical activity behavior among youth with visual impairments.

3. Design school-based physical activity intervention based on sound theoretical frameworks, and attempt to provide evidence of the applicability of such theories on promoting physical activity behavior change among youth with visual impairments and those with disabilities in general.

4. Examine the applicability of recommended physical activity guidelines for children and adolescents (i.e., 60 minutes of MVPA all days of the week) as well as Healthy People 2010 national objectives for youth among youth with visual impairments, and those with disabilities in general. That is, does it take 60 minutes or more of moderate to vigorous physical activity on a regular basis for youth with visual impairments to obtain health-benefits and/or acquired physically active lifestyles? Or is it less or more activity? And/or is it moderate to vigorous or just simply being active?

5. Examine the dose-response relationship between physical activity and health-related benefits among youth with visual impairments, and those with disabilities in general. Such research would provide evidence of the amount of physical activity needed for youth with visual impairments to obtain health benefits.

6. Attempt to establish accelerometer cut-points specific to youth with visual impairments. Cut-points should reflect the unique characteristics of the target group for which they are meant to be used.
7. Examine the use of multiple measures of physical activity (e.g., accelerometer and self-reports to collect physical activity data) as a possible alternative to enhanced the validity of the obtained data and to provide a better understanding of the physical activity patterns of youth with visual impairments and those with disabilities.

**Summary**

The purpose of this study was to examine the effects of an after school physical activity intervention on the duration and intensity of leisure time physical activity behavior among adolescents with visual impairments. This study was the first to use an intervention based on social cognitive theory with the purpose of changing physical activity behavior among youth with visual impairments. Participants in the study were four adolescents with visual impairments attending a Midwestern residential school for the blind. The study implemented a range bound changing criterion design and physical activity behavior was objectively measured through the use of ActiGraph GT1M accelerometers. In addition to physical activity, questionnaires were used to collect data (i.e., change scores) on selected social cognitive theory constructs. The changes in time spent in physical activity by participants suggest that the intervention had positive effects on physical activity behavior, resulting in functional control. Similarly, positive changes in scores for selected social cognitive constructs, in particular for outcome expectancy value, may suggest a relationship between changes in theoretical constructs and increased physical activity behavior. With the paucity of physical activity research among youth with visual impairments and the continuous national efforts to promote physical activity behavior in the general population, including those with disabilities in physical activity intervention research is warranted.
REFERENCES


Winters, E. (2001). *Test of a social cognitive theory-based educational treatment to increase the frequency of voluntary moderate and vigorous physical exercise among adolescent school students*. Unpublished doctoral dissertation. The Ohio State University, Columbus, OH.


APPENDIX A

IRB HUMAN SUBJECT REVIEW APPROVAL
May 5, 2008

Protocol Number: 2008BB000

Protocol Title: THE EFFECTS OF AN AFTEERSCHOOL INTERVENTION ON THE LEISURE TIME PHYSICAL ACTIVITY LEVELS OF STUDENTS WITH VISUAL IMPAIRMENTS, David Perretta, Carlos Corvantes, Physical Activity and Educational Services

Type of Review: Expedited

HS Staff Contact: 

Jill Johnson, Expedited Review

June 6, 2008

Dr. Perretta,

The Behavioral IRB has APPROVED BY EXPEDITED REVIEW the above referenced protocol. The Board was able to provide expedited approval under 45 CFR 46.101(b)(3) because the research poses minimal risk to subjects and satisfies the expedited review category listed below:

Date of IRB Approval: May 2, 2008

Date of IRB Approval Expiration: April 29, 2009

Expedited Review Category: 7

In addition, the protocol was approved for the inclusion of children (permission of one parent sufficient).

If applicable, informed consent (and HIPAA research authorization) must be obtained from subjects or their legally authorized representatives and documented prior to research involvement. The IRB-approved consent form and process must be used.

Changes in the research (e.g., additional procedures, advertisements, contact numbers, etc.) or informed consent process must be approved by the IRB before they are implemented (except when necessary to eliminate immediate hazards to subjects).

This approval is valid for one year from the date of IRB review when approval is granted or modifications are required. The approval will no longer be in effect on the date listed above as the IRB expiration date. A Continuing Review application must be approved within this interval to avoid expiration of IRB approval and cessation of all research activities. A final report must be provided to the IRB and all records relating to the research, (including signed consent forms) must be retained and available for audit for at least 3 years after the research has ended.

It is the responsibility of the investigator to promptly report to the IRB any serious, unexpected and related adverse events or potential unanticipated problems involving risks to subjects or others.

This approval is issued under The Ohio State University ORRRP Federal Assurance HHS0102578. All forms and procedures can be found on the ORRRP website: www.orrrp.org. Please feel free to contact the IRB staff contact listed above with any questions or concerns.

Sara R. Spear, Ph.D., Chair
Behavioral and Social Sciences Institutional Review Board
APPENDIX B

SCHOOL APPROVAL FOR RESEARCH STUDY
LETTER OF SUPPORT FOR PARTICIPATION

To the Ohio State University's Institutional Review Board:

This letter is written in support for the research project titled “Effects of an After-School Leisure Time Physical Activity Program on Free Time Physical Activity Behavior of Adolescents with Visual Impairments”. This project will be conducted by individuals from the Sport and Exercise Education Department at The Ohio State University (Dr. David L. Porretta [PI] and Carlos M. Cervantes [Co-PI]).

The researcher(s) have discussed the project with me and I understand that its purpose is to have adolescent students develop and plan physical activity opportunities outside of school in an effort to increase free time physical activity behavior, thus leading to healthier lifestyles.

I understand that this project requires informed consent procedures, that forms will need to be filled out by the students and their parents, and that the entire project will involve regular visits to the school. I also understand this project will involve student written assignments. I understand that this program will involve completion of questionnaires, and data collected through the use of accelerometers. I am in full support of this project.

Should you have any questions regarding our involvement with this research project please do not hesitate to contact me.

Sincerely,

[Signature]
Gerard Marcom
Principal
Ohio State School for the Blind
Phone: (614) 752-1359
Email: gmarcom@ossb.oh.gov
<table>
<thead>
<tr>
<th>Lesson Component</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduce lesson topic: physical activity and fitness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Introduce selected components of fitness: aerobic endurance, muscular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>strength, and muscular endurance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Discuss what is aerobic endurance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Discuss what is muscular strength</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Discuss what is muscular endurance</td>
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<td></td>
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<tr>
<td>6. Discuss improving fitness components through physical activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Class activity: how do I do it?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Homework assignment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Participant Social Validity Questionnaire

Please answer each question. Mark an “X” on the line for the answer that best fits each question.

1. Did you enjoy participating in the after school program?
   ____ Yes
   ____ No

2. Do you think the after school program helped you to become more physically active during your free time?
   ____ Yes
   ____ No

3. Did you enjoy monitoring your own free time physical activity behavior?
   ____ Yes
   ____ No

4. Do you think the lessons helped you become more confident in becoming more physically active during your free time?
   ____ Yes
   ____ No

5. Will you continue using the skills you acquired while participating in the program to continue being physically active during your daily living?
   ____ Yes
   ____ No

6. Will you make physical activity important part of your lifestyle?
   ____ Yes
   ____ No

7. Which activity or lesson did you consider helped you more? Why you think it helped you more?
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
APPENDIX E

PARENT SOCIAL VALIDITY QUESTIONNAIRE
Parent Social Validity Questionnaire

Based on your child’s participation in the after school physical activity program and the outcomes from his or her participation, please answer the following questions by marking an “X” on the line to indicate the best answer.

Note: Leisure time physical activity refers to activity that is performed during your child’s free time after school hours. In your case, over the weekend.

1. Did you see a positive difference in your child’s leisure time physical activity behavior at home while he/she was participating in the after school physical activity program? ____ Yes
   ____ No

2. Did you see a positive difference in your child’s confidence and/or attitude toward participating in physical activities during his/her free time? ____ Yes
   ____ No

3. Would you consider the use of after school interventions designed to increase physical activity participation valuable for adolescents with visual impairments? ____ Yes
   ____ No

Comments:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
APPENDIX F

AFTER-SCHOOL RESIDENTIAL PERSONNEL

SOCIAL VALIDITY QUESTIONNAIRE
After-School Residential Personnel Social Validity Questionnaire

Please mark an “X” on the line for each question to identify the best answer.

1. Do you think there is a need for programs specifically designed to increase physical activity among adolescents with visual impairments?
   
   _____ Yes
   _____ No

2. Do you believe the after school physical activity program produced positive outcomes for the participants?

   _____ Yes
   _____ No

3. Do you think this type of program could have promise as part of the school offerings for adolescents with visual impairments?

   _____ Yes
   _____ No

4. Do you believe the participants enjoyed the physical activity program?

   _____ Yes
   _____ No

Please use the following space to provide comments on the following:

I. What do you consider were the benefits of the physical activity program?

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

II. What could have been improved?

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________