Increasing Physical Activity for People With Severe to Profound Intellectual Disabilities

DISSEPTION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By
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Graduate Program in Education: Educational Studies

The Ohio State University
2016

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Abstract

This dissertation consists of an introduction, followed by three, stand-alone papers, and concludes with a research statement. Chapter 1 is an introduction to the dissertation and a statement of the problem. Chapter 2 is a comprehensive literature review evaluating how physical activity is being used as an intervention and being taught to people with intellectual disabilities. Chapter 3 is a research study that evaluated the effects of simultaneous and least-to-most prompting package on teaching three adolescents with intellectual disabilities how to engage in three exercises. Chapter 4 is a practitioner paper that disseminates the findings from Chapters 2 and 3, and provides suggestions about how to increase the amount of physical activity in special education classrooms. Finally, Chapter 5 is a research statement summarizing my research to date and describing future directions for my research line.
This dissertation is dedicated to my grandfather, Edward T. Page, Sr., who taught me patience and the value of hard work.
Acknowledgments

This project would not be possible without the help and support of many talented individuals. First, I would like to thank my advisor Dr. Helen Cannella-Malone for her guidance, feedback, and constant support during my entire Ohio State career. I would also like to thank the other members of my committee, Dr. Mathew Brock and Dr. Dennis Cleary, who gave me critical feedback on my methods, and suggestions during the dissertation process. Their expertise greatly contributed to the success and completion of this document. A big thank you goes to Stephanie Lemut and Amy Heider who were a vital part of the data collection process.

I would also like to my family for the support whether it was by making sure I ate well, or a quick call to distract me and to remind me that I am smarter than I think I am. Deanna Leyh, who kept me focused on my goals, kept me calm no matter the problem, and her love and support. A thank you is also owed to my good friend Dr. Eliseo Jimenez. His guidance, unwavering support, and ability to make me laugh regardless of the situation was invaluable during this process.
Vita

2006................................................................. Trinity Area Senior High School

2010................................................................. B.S. Allegheny College

2012................................................................. M.A. The Pennsylvania State University

2013 to present ................................................. Graduate Trainee, Department of Special Education, The Ohio State University

Publications


Fields of Study

Major Field: Education: Educational Studies

Area of Emphasis: Special Education & Applied Behavior Analysis
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Chapter 1: Introduction

The objective of this dissertation was to evaluate the current literature on physical activity for people with intellectual disabilities (ID), increase physical activity using prompting strategies and reinforcement through an experimental study, and to prepare a practitioner paper related to these instructional strategies. It is important to note that this dissertation consists of three individual papers, which are designed for ease of publication. Throughout the dissertation, there is some redundancy related to overlapping topics, specifically in the introductions of each chapter.

Obesity, which occurs when a person’s weight is higher than what is considered healthy given their height, is an epidemic in the United States (Center for Disease Control and Prevention [CDC], 2015). People who are obese are at a higher risk for a number of problems, ranging from high blood pressure to cancer. Additionally, there are mental health problems associated with obesity, such as depression and anxiety. Furthermore, people who are overweight are often bullied or stigmatized (De, Small, & Baur, 2008). Obesity can also cause premature death due to the comorbid diseases associated with it. The CDC (2015) estimates that 17% of children and adolescents, and 34% of adults, are obese. Current data suggest that about only 21% of adults meet the physical activity guidelines, and under 30% of high-school-aged adolescents get 60 minutes of physical activity in a day (CDC, 2015). At a minimum, the CDC recommends 60 minutes per
week of moderate intensity aerobic activity. Draheim (2006) recommended that people should engage in 30 minutes of moderate to vigorous physical activity at least 5 times each week to reduce the risk of cardiovascular disease.

In addition to the impacts to an individual’s health, obesity has an economic impact on the individual as well as society at large. This impact is related to the costs of treatment and diagnostic testing for both obesity and any associated health problems. The CDC estimates that medical costs related to obesity and its secondary conditions are about $147 million a year. The other costs of obesity are less discernable, such as those related to death and the illnesses associated with obesity. There is also a cost related to productivity or people missing work due to illness related to obesity. One population that is at a higher risk for obesity are people with ID and associated disabilities (e.g., Down syndrome, traumatic brain injury).

One means of preventing and remediating obesity is through physical activity. For many, physical activity is a major part of life, and people engage in physical activity for the associated health benefits and leisure aspects. There are numerous benefits for school-aged children who engage in an average of 60 min of physical activity per day, including reduced feelings of depression, increased bone mineral density, reduced body mass index (BMI), reduced rates of high blood pressure, and reduced cholesterol (Janssen & LeBlanc, 2010).

Typically, school-aged children are introduced to various physical activities in school through sports teams or physical education class. For people with ID, physical activity is just as important. Bartlo and Klein (2011) found that adults with ID needed at least three modes of physical activity (i.e., aerobic training, resistance training, balance
training) to have positive outcomes such as strength, fitness, mobility, and a higher quality of life. However, when working with people with ID, specifically those with severe to profound ID, they often need additional supports to learn how to engage in physical activity (Lancioni & O’Reilly, 1998). Additionally, people with ID are at higher risk of diseases due to inactivity (e.g., obesity) than their peers who are typically developing, with the risk increasing as they get older (Casey & Rasmussen, 2015). Due to the number of barriers people with ID face when trying to engage in physical activity, their increased risk for obesity, and the shift of focus in the literature from this population to people with autism spectrum disorder, it is critical that researchers continue to conduct research on physical activity with this population.

**Prevalence of Obesity in People With Intellectual Disabilities**

Reported prevalence rates of obesity for people with ID vary greatly. Bandini, Curtin, Hamad, Tybor, and Must (2004) used national survey data from the U.S. from 1999–2002 with a sample population of 19,759 children to estimate the prevalence of overweight children who have a developmental disorder. Their results indicated that 29% of the children who had a physical limitation were overweight (Bandini et al., 2004). Furthermore, 33% of the overall sample received special education services and were at risk for being overweight, and 17% were overweight (Bandini et al., 2004). The authors reported that children with developmental disorders were at a higher risk of being overweight or were overweight when compared to children without these disorders. Casey and Rasmussen (2015), in a more recent study, confirmed that there is a higher incidence of obesity among people with ID. They reported that the prevalence of obesity
in adolescents with ID was 45% which is higher than those without ID, and the prevalence of obesity increased with age.

**Factors Affecting Obesity**

There are many factors that affect the prevalence of obesity in this population, including medication, genetic predisposition, physical inactivity, living arrangements, and nutrition (Casey & Rasmussen, 2015; Fox et al., 2013). Some of these factors, such as medication and genetic predisposition, are unique to this population. Many medications (e.g., antipsychotics, mood stabilizers, antidepressants) that are often used to treat people with ID have the side effect of weight gain (Casey & Rasmussen, 2015; Fox et al., 2013).

Another unique factor to people with ID is their genetics. Casey and Rasmussen (2015) discussed that some of the literature highlighted genetic predisposition as the reason for higher rates of obesity. They argued that this manifested itself by unusual body composition, such as people with Down syndrome having more fat distributed on their torso. Indeed, Casey and Rasmussen (2015) estimated that adults with Down syndrome were 10% more likely to be obese when compared with people who only had ID. The prevalence rate for obesity in people with Down syndrome was found to be 45% higher for females and 56% higher for males, compared to those with ID alone (Casey & Rasmussen, 2015). Furthermore, the authors highlighted that people who had a diagnosis of mild or moderate ID had a higher prevalence of obesity and being overweight when compared against people with profound ID. Although it is clear that genetics and other factors unique to people with intellectual and developmental disabilities has an impact on
the rate of obesity, other literature points to environmental factors as having a greater impact on rates of obesity in this group of people.

One of these environmental factors is inactivity (Casey & Rasmussen, 2015; Draheim, 2006; Fox et al., 2013; Rimmer & Rowland, 2008; Rimmer et al., 2007). Although all people are at risk for a sedentary lifestyle, people with disabilities have been found to be more sedentary and have more barriers to engaging in physical activities than their peers without disabilities (Draheim, 2006; Rimmer et al., 2007). Draheim (2006) reported that people with ID who participate in physical activity normally engaged in less vigorous forms of physical activity, such as walking or other low intensity activities. Draheim (2006) reported that people with ID who lived in the community engaged in less physical activity than their peers who were in institutions and were less active than the general population. Casey and Rasmussen (2015) reported that less than that 33% of individuals with ID do engage in physical activity for more than 30 minutes per day. They specifically highlighted that people with Down syndrome engage in less vigorous physical activity than people without Down syndrome. One explanation for this finding could be that there are many barriers that they must overcome to engage in both recreational and competitive physical activity.

**Purpose Statement**

Lancioni and O’Reilly (1998) provided an overview of the research on physical activity for individuals with severe to profound disabilities and highlighted effective strategies to increase physical activity, improve fitness, and reduce challenging behavior. To date there has been no direct update to their review. In an effort to further explore this research line, I will present an updated systematic and comprehensive review of the
literature in Chapter 2. This review included 19 articles and discusses how physical activity is being used both as dependent and independent variable.

One of the gaps in the literature is teaching people with severe to profound ID exercise routines that mimic what might be done in a gym or other community setting. By teaching routines that include a variety of exercises (e.g., aerobic exercises, balance training, and anaerobic exercises), a person could exercise their entire body, engage different muscle groups, and sample a variety of exercises. Furthermore, by developing routines that do not require specialized equipment, people with ID could access physical activity from any location—such as their home or school. In an attempt to fill a gap present in the literature, a multiple baseline across behaviors research design was developed with the purpose of teaching three adolescents with severe ID an exercise routine that consisted of three different exercises. The goal of the study was to increase the physical activity of the participants by having an impact of the amount of physical activity they engaged in not on a health outcome such as body mass. This study is presented in Chapter 3 of this dissertation.

In Chapter 4, I present a practitioner paper that disseminates the findings of chapters 2 and 3, focusing on how to bring physical activities into the classroom. The paper describes ways that teachers of students with significant disabilities could incorporate simple physical activities into their classroom routines. The exercises presented can help build a student’s strength, balance, and/or aerobic endurance. All of these skills were chosen because they help build skills that could help students perform better in more complex physical activities (e.g., basketball, soccer).
Finally, in chapter 5, I provide an overall conclusion of the previous chapters and a statement of future research interests extending from this topic. My plans for future research focus on how to increase participant responding so that they are more independent and less reliant on a physical prompt or model, assessing gross motor skills to see if the movements are in the participants’ behavioral repertoire before teaching the physical activity, adding compliance training as a prerequisite for the program, and training to fluency. I plan to extend the study presented in chapter 3 by adding these other assessments and trainings, as well as exploring alternate ways to collect heart rate data.
Chapter 2: Literature Review

In this chapter, a review of the physical activity literature for people with intellectual disabilities is presented. The first section describes the literature review methods to include search methods, article coding, and tabling. The second section displays the results of the literature review, followed by a discussion of the results, and implications of the literature review and suggestions for future research.
Abstract

Obesity is a disease that affects people with intellectual disabilities (ID) at a higher rate than the general population and can increase the risk for other diseases (e.g., cardiovascular disease, cancer) and could cause premature death. One way to prevent obesity is to be physically active. Physical activity has been shown to benefit not only health outcomes in people with ID but also reduce challenging behavior and increase on task behavior. The goal of this review is to update Lancioni and O’Reilly’s (1998) literature review of physical activity for people with severe to profound ID. Specifically, I sought to determine how physical activity was being used to increase health-related outcomes with people with severe to profound ID or related disabilities (e.g., Down syndrome, traumatic brain injury), and how physical activity was being used as an intervention. Findings from the review indicate that intensity of the physical activity used may have an effect on the reduction of challenging behaviors as well as learning the physical activity. Finally, this review highlighted the need for more research on physical activity for people with ID.
Literature Review of Physical Activity for People With Intellectual Disabilities

Physical activity is defined as any body movements intended to enhance the health of an individual (CDC, 2015). Current data suggest that only about 21% of adults meet the physical activity guidelines, and under 30% of high-school-age adolescents get 60 min of physical activity in a day (CDC, 2015). At a minimum, the CDC recommends 60 min per week of moderate intensity aerobic activity. Draheim (2006) recommended that people should engage in 30 min of moderate to vigorous physical activity at least 5 times a week to reduce the risk of cardiovascular disease. Physical activity is also used as both a recreation and leisure activity for many people, including playing sports with others to jogging alone.

**Benefits of Physical Activity**

There are numerous benefits to engaging in physical activity that range from weight control (Bailey, 2006; Bartlo & Klein, 2011; Janssen & LeBlanc, 2010) to improved academic achievement (Bailey, 2006; Bartlo & Klein, 2011). Physical activity, in combination with diet, can also help with weight control. The CDC (2015) recommends between 75 and 150 min of physical activity per week depending on the intensity (CDC, 2015). However, the exact amount of physical activity required varies greatly from person to person. Another benefit of physical activity is that it increases a person’s resistance to disease. Two serious conditions that occur less in people who engage in physical activity are heart disease and stroke (Draheim, 2006). By engaging in moderate aerobic activity, there is a lower risk of these diseases as well as reduced blood pressure and cholesterol levels (Janssen & LeBlanc, 2010). Furthermore, physical activity can reduce the risk of developing diseases such as type 2 diabetes and metabolic
syndrome (e.g., high triglycerides, high blood sugar). The CDC (2015) reported that reduction of risk for these diseases occurs when a person engages in moderate to intensive aerobic physical activity for at least 120 min a week. Additionally, engaging in regular physical activity can reduce the risk of colon and breast cancer. Other benefits of physical activity include protection and development of a person’s bones and muscles, which can reduce the stress and harm to joints. As a person ages, physical activity can relieve pain and inflammation related to arthritis and even extend life expectancy when compared to people who engage in little or no physical activity. Finally, physical activity can affect the mental health and mood of an individual; it has been shown to reduce the risk of depression and improve sleep. The CDC (2015) summarized the importance of physical activity by stating that people who are inactive have a higher risk for early death, heart disease, stroke, type 2 diabetes, depression, and some cancers.

**Health Concerns Related to Inactivity**

Obesity is an epidemic in the United States, which occurs when a person’s weight is higher than what is considered healthy given their height (CDC, 2015) and is commonly measured through body mass index (BMI). People who are obese are at a higher risk for a number of problems, ranging from high blood pressure to cancer. Obesity can also cause premature death due to the comorbid diseases associated with it. The CDC (2015) estimated that 17% of children and adolescents, and 34% of adults, are obese. This impact is related to the costs of treatment and diagnostic testing for both obesity and any associated health problems. The CDC estimates that medical costs related to obesity and its secondary conditions are about $147 million a year. The other costs of obesity are less discernable. These costs are related to death and the illnesses
associated with obesity. There is also a cost related to productivity, or people missing work due to illness related to obesity. One population that is at a higher risk for obesity are people with intellectual and developmental disabilities (e.g., Down syndrome, cerebral palsy, autism).

**Prevalence of obesity in people with disabilities.** Fox et al. (2014) discussed that a disproportionate number of people with disabilities were at risk for obesity compared to their peers without disabilities. Other reports that specifically examined athletes who participated in Special Olympics found that 30% were obese (Casey & Rasmussen, 2015). Additionally, within the population of people with intellectual disabilities (ID), there was a higher prevalence of obesity (29%) for people with mobility limitations (Rimmer et al., 2007). In adulthood, people with ID had a slightly higher prevalence rate of obesity than their peers without ID (Casey & Rasmussen, 2015). Some factors that affect the prevalence of obesity in this population include medication, genetic predisposition, nutrition, and inactivity (Casey & Rasmussen, 2015; Fox et al., 2014).

**Barriers to Physical Activity**

Although the benefits of physical activity are clear, people with disabilities face a number of barriers that limit their ability to engage in physical activity. Some of these barriers include accessibility to places like gyms (e.g., lack of consistent transportation, cost), lack of knowledge on the part of special educators and coaches, attitudes of others, and natural barriers such as physical disabilities or seizures (Block, Taliaferro, & Moran, 2013; Darcy & Dowse, 2013; Rimmer & Rowland, 2008). Rimmer and Rowland (2008) argued that people with disabilities were less likely to participate in school-based physical activities because they had fewer opportunities to participate in sports and
recreational physical activity at schools than their peers without disabilities. Moreover, those who did not engage in school-based physical activities were more likely to be sedentary.

**Past Reviews**

Lancioni and O’Reilly (1998) provided an overview of the research on physical activity for individuals with severe to profound disabilities and also highlighted effective strategies to increase physical exercise, improve fitness, and reduce challenging behavior. Their review included 33 articles published between 1980 and 1997, which they divided into three main groups: increasing independent physical exercise, improving physical fitness and performance, and reducing challenging behavior and increasing appropriate behaviors through brief vigorous, extended vigorous, and comparisons of the two types of exercise. The results indicated that it was possible to improve fitness of people with ID, to reduce challenging behavior through vigorous exercise, to make adaptations to instruments typically used for physical activity in order to accommodate people with severe ID, and that external controls (i.e., prompts, praise, token economies) were needed for these interventions to be successful.

In a more recent literature review, Sowa and Meulenbroek (2012) focused on the effects of exercise for people with autism spectrum disorder (ASD). Their review encompassed articles published between 1991 through 2011 that included people with ASD. They identified 16 articles that met their inclusion criteria, and the types of exercise examined were swimming, jogging, walking, horseback riding, cycling, and weight training. Furthermore, they estimated the improvement rates of variables like motor skills (40%), social skills (39%), and other variables (22%). Their results also indicate that
Individual interventions had a greater impact on variables such as social skills and motor skills than group-based exercise programs. The authors concluded their review by stating that the benefits of physical activity were robust in this population.

High obesity rates and their comorbid, often deadly, diseases continue to affect people with ID and other disabilities at a higher rate than that of the general population. Although other literature reviews have examined physical activity in other populations such as people with ASD (Sowa & Meulenbroek, 2012), few have examined the population of people with ID and other disabilities. Therefore, the purpose of this review was to update Lancioni and O’Reilly’s (1998) literature review. Specifically, this review sought to determine how physical activity is being used to increase health-related outcomes with students with severe to profound intellectual or related disabilities (e.g., Down syndrome, traumatic brain injury), and how physical activity is being used as an intervention. The efficacy of these treatments was also examined.

Method

Inclusion and Exclusion Criteria

Articles had to meet each of the following criteria to be included in this review: (a) the independent variable (IV) or dependent variable (DV) had to be related to physical activity, (b) the participant(s) had to have an intellectual or related disability (e.g., traumatic brain injury, Down syndrome), (c) the study used an experimental single-subject research design or was a controlled randomized trial group design, (d) the study was published in a peer-reviewed journal, (e) the study was published between January 1998 and May 2016, and (f) the study was reported in English. Studies that did not meet all eight inclusion criteria were excluded from this review. For the purposes of this
review, physical activity was defined as any bodily movement that was used to sustain or improve health and/or fitness (CDC, 2015).

**Search Methods**

To identify articles, an electronic search was conducted using EBSCOHost databases, including Educational Full Text (H. W. Wilson), Education Research Complete, ERIC, MEDLINE, Psychological and Behavioral Sciences Collection, and PsycINFO with a set time parameter of 18 years and three months (i.e., a range from January 1998 to May 2016). The beginning date of January 1998 was set because the last article that Lancioni and O’Reilly (1998) reviewed was dated in 1997. Other constraints put on the search parameters included that the studies had to be published in a peer-reviewed journal and reported in English. A search was conducted on 5/26/16 using the following search string: ("physical activity" OR "leisure" OR "recreat*") AND ("intellectual* disab*" OR "developmental* disab*" OR "autis*" OR "cerebral palsy" OR "cognitive* disab*" OR "traumatic brain injury" OR "mental* retard*" OR "angelman" OR "down syndrome") AND (intervention*). Following the electronic search, the reference section of each included article was hand searched. Additionally, forward searches were conducted using the cite forward feature of Google Scholar. The original search yielded 548 articles with duplicates removed.

**Coding**

**Screening.** Each of the 548 articles was screened based on the title and abstract. An article was screened out if it had no original data, it used a qualitative methodology, no intervention was used on a person with ID or related disability, or physical activity was not used as an independent or dependent variables. If a study included original data,
the study was not qualitative, the participant(s) had an ID or related disability, and the independent or dependent variables were defined as physical activity, the study was screened in for further review. The application of these criteria led to the initial inclusion of 110 articles. Upon closer examination, 95 of these articles were excluded because they did not meet all of the inclusion criteria, bringing the total to 15 articles. After citation harvesting the references and citing forward, an additional 4 articles were identified, for a total of 19 articles. A flowchart illustrating this process is presented in Figure 1.

**Study categorization.** The 19 articles were categorized by experimental design (i.e., single subject or group design). This review utilized the What Works Clearinghouse (WWC) standards when determining which group design articles to include. WWC is an initiative of the U.S. Department of Education with the goal of disseminating evidence-based practices in education for consumption by researchers, educators, policymakers, and the public (WWC, 2015). One factor that determines if a group design study meets the WWC standards without reservation is that it must randomly assign participants to each condition (WWC, 2015). This standard was adopted and then applied to group designs to determine if they would be included in this review. For example, MacDonald et al. (2012) was excluded from this review even though the purpose was bicycle training for people with ASD and Down syndrome, because they did not randomly assign participants to different conditions.
Figure 1. Study identification flow diagram.
One example of a group design study that met these criteria was a study conducted by Chen, Ringenbach, and Snow (2014), where the authors used treadmill training to increase the grip strength of young men with Down syndrome but also utilized a randomized controlled trial to divide their participants into the control or experimental groups. Sixteen group design studies were excluded from this review for not meeting the WWC standards.

For single-subject design studies to be included, they had to be experimental and follow the guidelines in Cooper, Heron, and Heward (2007). Therefore, any designs that did not demonstrate a functional relation between the independent and dependent measures (e.g., AB designs) were excluded from the study. No studies that used a single subject design were excluded from this review.

**Within category coding.** For all studies, each article was coded for the participants’ gender, number of participants, disability label, disability level, mean age or age range, each dependent variable, the independent variable, type of physical activity, the intensity of physical activity, where the intervention occurred, and who implemented the intervention. For group design studies, we also coded whether there was a statistical difference and the effect size. For single-subject design studies, success estimates were calculated (Reichow & Volkmar, 2010).

Where provided in the group-design studies, the participants’ age was coded by the mean age and range, and gender was coded by the number of males and females. If this information was not provided, only the total number of participants was listed. For single-subject design studies, each participant was coded individually.
For group design studies, the diagnosis of the entire group was reported. For single subject designs the disability diagnosis of each participant was reported. These disability labels included autism (ASD), emotional disturbance (ED), intellectual disability (ID), multiple disabilities (MD), learning disability (LD), traumatic brain injury (TBI), developmental disability (DD), cerebral palsy (CP), Down syndrome (DS), anxiety disorder (AD), health impairments (HI), and others. If a participant had two or more disability labels, then both were reported. The level of the participants’ disability was also coded as mild, moderate, severe, profound, or not reported. These levels were based on the authors’ reports. If a disability range was given (e.g., mild–moderate), the range was reported.

Next, the intensity of physical activity was coded based on its duration and frequency. In the group design studies category, the duration of each session in minutes, sessions per week, and number of weeks the intervention took place were recorded. The author’s description of the length of physical activity was recorded for each single subject design due to variability in author description. If the article did not report one of these items, it was coded as not reported.

Finally, the outcomes were coded in group designs by reporting if there was a significant statistical difference present at the p<.05 level and the effect size. Effect size was calculated as a standardized mean difference by dividing the difference between the post-treatment experimental and comparison group means by a pooled standard deviation. I multiplied the standardized mean difference by a correction factor to obtain Hedge’s g and correct for bias due to small sample size (Borenstein, Hedges, Higgins, & Rothstein, 2011). Single subject design outcomes were coded using success estimates.
Success estimates were determined by using visual analysis (i.e., inspection of the trend, variability, and level of the results), and a ratio of successful implementations of the independent variable to the total number of implementations attempted was reported (Reichow & Volkmar, 2010).

**Interobserver Agreement**

Interobserver agreement (IOA) data were collected by a second doctoral student trained to collect IOA for this review. He was given a template of all of the variables and provided examples of each type of study (i.e., group and single-subject design). I then modeled how to use the template and answered any questions. The training was completed in one 20 min session. Interobserver agreement was calculated for 36% of included articles by dividing the total number of agreements by the number of agreements plus disagreements and multiplying by 100. IOA was then calculated for each item that was within the category. Using this method IOA was 90% overall. For the group design studies, IOA was 93%, and 89% for single subject designs.

**Results**

Table 1 summarizes the relationships found between the independent and dependent variables that were found when reviewing the literature.

<table>
<thead>
<tr>
<th>IV</th>
<th>DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction</td>
<td>Independence with exercise</td>
</tr>
<tr>
<td>Physical activity</td>
<td>Challenging behavior</td>
</tr>
<tr>
<td>Contingent access</td>
<td>Engagement in physical activity</td>
</tr>
<tr>
<td>Engagement in exercise</td>
<td>Health outcome or increased engagement</td>
</tr>
</tbody>
</table>

Table 1. Relationship Between Independent and Dependent Variables.
Group Design Studies

The eight articles categorized as group design studies are summarized in Table 1. A total of 499 people were included who range in age from 3 to 60 years. A majority of these participants had comorbid diagnoses of intellectual disability, developmental disabilities, and autism spectrum disorder (46%), followed closely by intellectual disabilities only (37%). The only other population that was represented in these studies were people with Down syndrome (17%). Only four studies reported the severity of disabilities, which ranged from mild to severe. Five of the eight studies reported where the interventions took place (40% in a school setting, 40% in an institution, and 20% in the community). A majority (66%) of the interventions were conducted by staff at the institution or school. Other people who implemented the interventions were the authors (17%) and a team made up of the authors and staff members (17%). Across these eight studies, a total of 46 dependent variables were examined. Six studies reported statistical significance between the control and experimental groups per dependent variable. Only 38% of the variables reported had statistically significant scores when comparing between the control and intervention groups. The remainder did not report a significant difference. There were a total of 44 dependent variables that had data that could be used to calculate an effect size. Twenty of these variables had a large effect size (i.e., at or greater than .8), 10 variables had a medium effect size (i.e., at or greater than .5), and 14 had a small effect size (i.e., at or greater than .2).
<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Disability</th>
<th>Age Range</th>
<th>IV</th>
<th>DV</th>
<th>Type of Physical Activity</th>
<th>Statistical Significance</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chen et al. (2014)</td>
<td>20M</td>
<td>DS</td>
<td>14–31</td>
<td>Treadmill</td>
<td>Grip strength</td>
<td>Moderate to fast pace body locomotion</td>
<td>Y</td>
<td>0.43</td>
</tr>
<tr>
<td>Chen et al. (2015)</td>
<td>16M 4F</td>
<td>DS</td>
<td>15–30</td>
<td>Treadmill</td>
<td>Reaction time</td>
<td>Walking</td>
<td>N</td>
<td>-1.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Card sorting</td>
<td></td>
<td>N</td>
<td>0.80</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Knock-tap</td>
<td></td>
<td>N</td>
<td>0.86</td>
</tr>
<tr>
<td>Favazza et al. (2013)</td>
<td>186M 42F</td>
<td>ID, DD, ASD</td>
<td>3–5</td>
<td>Young athletes program</td>
<td>Object manipulation</td>
<td>Walking, running, balance, trapping and catching, jumping, throwing, striking, and kicking</td>
<td>Y</td>
<td>4.14</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td>Locomotion</td>
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<td>Stationary</td>
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<td>Fine motor</td>
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<td></td>
<td>Gross motor</td>
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<td>Y</td>
<td>1.84</td>
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<td>Giagazoglou et al. (2013)</td>
<td>14M 4F</td>
<td>ID</td>
<td>–</td>
<td>Trampoline exercise</td>
<td>Vertical jump (cm)</td>
<td>Trampoline exercise</td>
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<tr>
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<td>Broad jump (cm)</td>
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<td>Sit and reach (cm)</td>
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<td>CoPsd-M/L</td>
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<td>CoPmax- A/P</td>
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<td>CoPsd-A/P</td>
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<td>CoPmax- M/L</td>
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<td>CoPsd-A/P</td>
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<td>CoPmax- M/L</td>
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<td>CoPsd-M/L</td>
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<td>CoPmax- A/P</td>
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<td></td>
<td>CoPsd-A/P</td>
<td></td>
<td></td>
<td></td>
<td>-0.17</td>
</tr>
</tbody>
</table>

*Note. – = The author did not report the value. DS = Down syndrome. ASD = Autism spectrum disorder. ID = Intellectual disabilities. DD = Developmental disabilities.*

**Table 2. Summarized Group Design Studies.**
<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Disability</th>
<th>Age Range</th>
<th>IV</th>
<th>DV</th>
<th>Type of Physical Activity</th>
<th>Statistical Significance</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>González-Agüero et al. (2011)</td>
<td>13M 13F</td>
<td>DS</td>
<td>10–19</td>
<td>Conditioning and plyometric jump training</td>
<td>Whole body fat mass</td>
<td>Jumps, press ups on the wall, Elastic fitness bands, and adapted medicine balls</td>
<td>N</td>
<td>-1.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Trunk fat mass</td>
<td>N</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower limbs fat mass</td>
<td>N</td>
<td>-1.97</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Upper limbs fat mass</td>
<td>N</td>
<td>-2.18</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Whole body lean mass</td>
<td>Y</td>
<td>-2.23</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower limbs lean mass</td>
<td>Y</td>
<td>-2.12</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Whole body fat mass</td>
<td>N</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N</td>
<td>-1.79</td>
<td></td>
</tr>
<tr>
<td>Lotan et al. (2009)</td>
<td>31M 28F</td>
<td>ID</td>
<td>34–60</td>
<td>Virtual reality games</td>
<td>Wheelchair bound 12 minute walk/run</td>
<td>Gross motor movements</td>
<td>–</td>
<td>–</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wheelchair bound heart beat</td>
<td>N</td>
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<td></td>
<td></td>
<td></td>
<td>Wheelchair bound energy expenditure</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>12 minute walk/run</td>
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<td>–</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Heart beat</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Energy expenditure</td>
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<td></td>
<td></td>
<td></td>
<td>Step count per day</td>
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<td>-0.68</td>
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</tr>
<tr>
<td>Melville et al. (2015)</td>
<td>57M 45F</td>
<td>ID</td>
<td>31–60</td>
<td>Walk well program</td>
<td>Walking</td>
<td>Walking</td>
<td>N</td>
<td>-0.38</td>
</tr>
<tr>
<td>Shields, &amp; Taylor (2015)</td>
<td>8M 8W</td>
<td>DS</td>
<td>18–25</td>
<td>Walkabout program</td>
<td>Waist circumference</td>
<td>Walking</td>
<td>–</td>
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<td></td>
<td></td>
<td></td>
<td>Weight</td>
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<td></td>
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<td></td>
<td>Physical activity count</td>
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<td></td>
<td></td>
<td>Self selected walking</td>
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<td></td>
<td></td>
<td></td>
<td>speed</td>
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<td></td>
<td></td>
<td></td>
<td>Fast walking speed</td>
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<td></td>
<td></td>
<td></td>
<td>6-minute walk distance</td>
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<td></td>
<td></td>
<td></td>
<td>Exercise outcomes</td>
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<td>–</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Life satisfaction scales</td>
<td>–</td>
<td>–</td>
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</tr>
</tbody>
</table>

*Note.* – = The author did not report the value. DS = Down syndrome. ASD = Autism spectrum disorder. ID = Intellectual disabilities. DD = Developmental disabilities.
The use of physical activity was comparable between studies. The independent variable for almost all of the studies (75%) was some type of physical activity or physical activity program such as the Walk Well Program (Melville et al., 2015). Physical activity was used as an intervention to treat a number of variables. Many articles used physical activity interventions to focus on strengthening leg muscles, mobility, balance, and other anaerobic variables (Favazza, Siperstein, Zeisel, Odom, Sideris, & Moskowitz, 2013; Giagazoglou, Kokaridas, Sidiropoulou, Patsiaouras, Karra, & Neofotistou, 2013; González-Agüero, Vicente-Rodríguez, Gómez-Cabello, Ara, Moreno, & Casajús, 2011). One trend that was revealed from the data was that the intervention and physical activity used most often with people with Down syndrome was walking or using a treadmill, with 75% of the studies including participants with Down syndrome using this.

The type of physical activity chosen varied, even with similar dependent variables. Some examples of the topographies of physical activity included, but were not limited to, walking (Chen et al., 2014; Chen et al., 2015; Melville et al., 2015; Shields & Taylor, 2015), various exercises (e.g., a mixture of aerobic exercises, strengthening exercises) (Favazza et al., 2013; González-Agüero et al., 2011), and trampoline exercises (Giagazoglou et al., 2013). Another aspect of physical activity that varied greatly was intensity. Interventions ranged from one session per week with each session lasting 150 min (Shields & Taylor, 2015) to 5 sessions per week for 12 weeks lasting 20 min per session (Giagazoglou et al., 2013).
Single Subject Designs

The 11 single subject design studies are summarized in Table 2. A total 26 people were included, and their ages ranged from 3 to 20 years. Over half of these participants had a diagnosis of ID (62%). The remaining 38% of the studies included participants with ID and a comorbid disorder such as autism spectrum disorder, cerebral palsy, or developmental disabilities. Nine of the 11 studies reported the severity of these disabilities, which ranged from mild to severe. Interventions were mainly conducted within the school (90%). Only one study conducted the intervention in an institution. Just over half (55%) of the interventions were implemented by the authors of the study, with the other half completed by direct-care staff (i.e., teaching assistants, teachers, or therapists). A majority of the success estimates were 100% (73%), and the remainder ranged from 67% to 88%.

For the single subject studies, the use of physical activity differed from how it was used in the group designs category. The dependent variable for most of the studies (73%) was physical activity, which was taught using a number of different methodologies. Some of the most prevalent techniques included video modeling (Cannella-Malone, Mizrachi, Sabielny, & Jimenez, 2013; Lo, Burk, & Anderson, 2014), constant time delay (Zhang, Cote, Chen, & Liu, 2004; Zhang, Gast, Horvat, & Dattilo, 2000), and feedback provided through technology (Shih, 2011; Shih, Chung, Shih, & Chen, 2011; Shih, Shih, & Luo, 2013). When physical activity was used as an intervention, it was employed to reduce challenging behavior, such as aggression and stereotypy (Cannella-Malone, Tullis, & Kazee, 2011).
<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Disability</th>
<th>Age Range</th>
<th>IV</th>
<th>DV</th>
<th>Type of Physical Activity</th>
<th>Success Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adamo et al. (2015)</td>
<td>2M 1F</td>
<td>DS</td>
<td>3–5</td>
<td>Video modeling, prompting, and praise Class wide peer tutoring</td>
<td>Moderate to vigorous physical activity</td>
<td>Moderate to fast pace body locomotion Striking a ball</td>
<td>9/9</td>
</tr>
<tr>
<td>Cannella-Malone et al. (2013)</td>
<td>3M</td>
<td>ID, EBD, HI, ASD</td>
<td>8–11</td>
<td>Video modeling with 3 stages of error correction</td>
<td>Percentage of steps correct</td>
<td>Various exercises</td>
<td>3/3</td>
</tr>
<tr>
<td>Cannella-Malone et al. (2011).</td>
<td>2M 1F</td>
<td>MD, CP, DD, ID, ADHD</td>
<td>11–14</td>
<td>Video modeling with 3 stages of error correction</td>
<td>Percentage of steps correct</td>
<td>Various exercises</td>
<td>7/8</td>
</tr>
<tr>
<td>Chang et al. (2014)</td>
<td>1M 1F</td>
<td>ID</td>
<td>16–17</td>
<td>Air mouse controlling environment stimulation</td>
<td>Percentage of pedal activity</td>
<td>Stationary bike</td>
<td>6/6</td>
</tr>
<tr>
<td>Lo et al. (2014)</td>
<td>2M 1F</td>
<td>ID, DS</td>
<td>19–20</td>
<td>Progressive video prompting</td>
<td>Number of steps preformed correctly</td>
<td>Shooting a basketball</td>
<td>3/3</td>
</tr>
<tr>
<td>Shih (2011)*</td>
<td>2M</td>
<td>ID</td>
<td>17–18</td>
<td>Computer that played video or music based on movement</td>
<td>Frequency of responses</td>
<td>Walking and balancing</td>
<td>6/6</td>
</tr>
<tr>
<td>Shih et al. (2011)*</td>
<td>1M 1F</td>
<td>ID</td>
<td>17–18</td>
<td>Wii board and computer that played preferred stimulation</td>
<td>Mean frequency of responses</td>
<td>Walking and balance</td>
<td>6/6</td>
</tr>
<tr>
<td>Shih et al. (2013)*</td>
<td>2M</td>
<td>ID</td>
<td>16–17</td>
<td>Air mouse controlling environment stimulation</td>
<td>Mean timed duration of physical activity status</td>
<td>Gross motor movement</td>
<td>6/6</td>
</tr>
<tr>
<td>Zhang et al. (2004)</td>
<td>1M</td>
<td>ID</td>
<td>39</td>
<td>Constant time delay</td>
<td>Number of correct steps</td>
<td>Rolling a bowling ball</td>
<td>3/3</td>
</tr>
<tr>
<td>Zhang et al. (2000)</td>
<td>3M 1F</td>
<td>ID</td>
<td>16–19</td>
<td>Constant time delay</td>
<td>Number of seconds engaged in a physical activity</td>
<td>Bowling a ball, throwing a ball, and putting a ball.</td>
<td>8/12</td>
</tr>
</tbody>
</table>

*Note.* * = The dependent measure was the mean of multiple sessions. DS = Down syndrome. ASD = Autism spectrum disorder. CP = Cerebral palsy. ID = Intellectual disabilities. DD = Developmental disabilities. EBD = Emotional behavior disorder. ADHD = Attention deficit hyperactivity disorder.

Table 2. Summarized Single Subject Studies.
Similar to the group design category, the topography of physical activity varied across studies, however, a majority used some type of aerobic exercise, such as walking or jogging. Other topographies included cycling (Chang, Shih, \& Lin, 2014), shooting a basketball (Lo et al., 2014), and use of scooters (Cannella-Malone et al., 2013). Another aspect of physical activity that varied between studies was the intensity. For example, Cannella-Malone et al. (2011) had participants engage in two 20-min periods of exercise a day with six, 5-min exercise breaks each day, whereas Shih et al. (2011) utilized 3 to 6 3-min sessions a day.

**Discussion**

The purpose of this review was to determine how physical activity is being used to increase health-related outcomes for students with severe to profound ID and related disabilities, and how physical activity is being used as an intervention. Nineteen studies were included, and they primarily focused on increasing some aspect of physical activity (e.g., balance muscle strength, walking, aerobic exercises). One trend that emerged was that studies that taught or utilized multiple forms of physical activity had the largest effect size or a high success estimate (e.g., Cannella-Malone et al., 2013; Cannella-Malone et al., 2011; Favazza et al., 2013; González-Agüero et al., 2011). Whereas studies that focused only on walking, particularly group design studies, reported lower effect sizes (Chen et al., 2015; Melville et al., 2015; Shields \& Taylor, 2015). This may indicate that teaching multiple topographies of physical activity could lead to clearer outcomes for people with ID. However, this may also be due to the nature of the relationship between the independent and dependent variables. For example, dependent variables that targeted
reduction of body mass would be harder to have a large effect on when compared to teaching a topography of behavior.

Almost all of the studies that used single subject designs were successful in teaching people with ID, whereas studies that used group designs had mixed outcomes. By examining both categories of articles, trends in the literature began to emerge. A majority of literature in each category used aerobic exercises when implementing or measuring physical activity. Surprisingly, none of the included studies used a sport or group game (e.g., basketball, soccer). All topographies of physical activity could be done by oneself, without the need of a teammate or another person. However, teaching a group game would be difficult due to the complexity of not only the behaviors needed in the person’s repertoire but also the social skills and understanding of the rules that would be required. There may be some literature present that attempts to teach group games to other populations, but with the criteria that was used for this review there was none found. Finally, there were many variations on the intensity of physical activity, indicating that there is no consensus in the literature with respect to intensity related to the most effective and efficient way to increase physical activity.

Reducing Challenging Behaviors

One of the areas that Lancioni and O’Reilly (1998) identified in their literature review was the use of physical activity as an intervention to reduce challenging behavior. Their findings indicated that physical activity could be used to reduce instances of challenging behavior. This review found only one study that used physical activity to reduce challenging behaviors (Malone et al., 2011). Although, they were successful in reducing challenging behavior more research to replicate their findings is needed.
However, there are numerous studies dedicated to examining how physical activity can reduce challenging behavior among individuals with other types of disabilities (Folino, Ducharme, & Greenwald, 2014; Luke, Vail, & Ayres, 2014; Neely, Rispoli, Gerow, & Ninci, 2014; Baharmi, Movahedi, Marandi, & Abedi, 2012; Nicolson, Kehle, Bray, & Heest 2011; Oriel, George, Peckus, & Semon, 2011). These studies reduced a number of challenging behaviors ranging from aggression to stereotypy, indicating that physical activity could be used as an intervention for a range of topographies. One reason for the success of Malone et al.’s (2011) study in reducing challenging behavior and increasing desired responses may be related to the intensity of the physical activity. Their study exceeded the CDC recommended 60 min of physical activity per day for children and adolescents. Another example of a study that was successful and exceeded the CDC recommendations was Baharmi et al. (2012). They had their participants engage in 71 min of kata techniques, which resulted in a reduction of challenging behavior. Future researchers could focus on finding the minimum amount of physical activity that results in a reduction of challenging behavior.

**Teaching Physical Activity**

One prevalent topic in the reviewed literature was the teaching of physical activity. There was a clear difference between the two categories of literature, with single subject designs focusing more on teaching physical activity (Chang, Shih, & Lin, 2014; Lo et al. 2014; Malone et al., 2013), and group designs intervening to strengthen aspects related to physical activity (e.g., gait, walking, muscle strength). In the single subject design category, there were a number of effective modalities used to teach physical activity. Two effective teaching modalities were using video technology (Lo et al. 2014;
Malone et al., 2013), and technology to provide reinforcing stimuli to participants as they engaged in physical activity (Chang et al., 2014). More traditional approaches, such as constant time delay and classwide peer tutoring (Ayvazo, & Ward, 2010; Zhang, Cote, Chen, & Liu, 2004; Zhang, Gast, Horvat, & Dattilo, 2000) were used with success by a majority of the studies in this category. By using behavior modification techniques or technology, almost all of the participants increased their physical activity.

The body of group design studies mainly used physical activity as an intervention to strengthen muscles and increase factors essential to the performance of physical activity (e.g., gait, balance, walking, aerobic capacity). Indeed, only two studies tried teaching a new physical activity (Favazza et al., 2013; Lotan, Yalon-Chmovitz, & Weiss, 2009). Similar to the single subject studies, Lotan et al. (2009) used virtual reality games to try to increase walking and other physical activity. Favazza et al. (2013) attempted to increase domains of both gross and fine motor skills using a fitness program called the Young Athletes Program. Both methodologies proved successful in teaching their participants how to engage in physical activities.

**Health Outcomes**

Another important factor identified in this review was the measurement of health outcomes such as BMI and heart rate. As previously discussed, people with ID have a higher prevalence rate for obesity and its related diseases. Among the studies reviewed, only two directly measured the health outcomes of their participants. González-Agüero et al. (2011) measured the body composition, specifically lean and fat masses. After intervention, fat masses were not reduced, but there was an increase in lean masses in the participants’ lower limbs and whole body. Shields and Taylor (2015) used the walk about
program to decrease weight and waist circumference for 16 people with Down syndrome. Only small effect sizes were achieved, and they did not report if there were significant differences between the control and intervention groups. Surprisingly, no single subject designs used health outcomes as a dependent measure. This may be due to the difficulty in measuring health outcomes and the variability in the standards used to measure health outcomes (Casey & Rasmussen, 2015). In the future, health outcomes should be incorporated into studies that target increasing physical activity in people with ID.

**Physical Activity as Recreation**

One surprising finding of this review was that no study targeted physical activity in the context of a leisure or recreational activity. Often people who are typically developing use physical activities, such as soccer or a game of tag, for enjoyment or for its reinforcing properties. These activities can be reinforcing due to the social component of engaging in them with peers (i.e., both in cooperation and competition), or from engaging in the behavior by oneself (e.g., weight lifting, jogging, cycling) where there may be a reinforcing stimulus present (e.g., runner’s high). Other authors have attempted to teach physical activities as recreational activities with other populations but not with people with ID. For example, Miltenberger and Charlop (2014) taught participants to play four-square and hand ball. They successfully taught the participants to play these games using skills training. Additionally, Kaplan-Reimer, Sidener, Reeve, and Sidener (2011) taught physical activity in the form of a recreational activity, specifically indoor rock climbing. The authors used stimulus control to teach two people how to climb an indoor rock wall. Both articles present successful examples of teaching people with disabilities a type of physical activity that can be used for recreation or leisure. Both articles call for
future researchers to continue to teach physical activities as a recreation and suggested
generalizing these activities to group play behaviors with peers to increase the social
validity.

**Future Research**

The benefits of physical activity for people with ID and related disabilities are
important not only related to improving fitness and health, but also to increasing
independence and positive feelings of the individual (e.g., self-confidence, sense of
achievement, satisfaction, thrill of competition; Darcy & Dowse, 2013). Therefore,
research in this area is critical and should be continued. This review has identified gaps in
the current literature related to physical activity and people with intellectual and related
disabilities. First, future research should focus on finding an optimal duration or
vigorousness of physical activity that has socially significant effects on reducing
challenging behavior and increasing on-task behavior, including academic engagement.
One starting point would be to use interventions with people with ID that have been
published and found to be effective with other populations.

Another aspect of physical activity that future researchers could explore is the
type of physical activity that has an effect on these behaviors. There was an
overwhelming amount of literature focused on lower limb strengthening and walking. It
would be beneficial to extend the literature to examine different forms of physical
activity to examine what effect it may have on people with disabilities. Additionally,
shifting the concentration of interventions to forms of physical activity in groups or as
recreation is needed. There is not a large literature base on how to teach physical activity
as a recreational tool or to exercise in groups, such as playing a team sport. This area may
prove to be difficult to teach due to the nuances of group exercise, especially sports. Teaching a sport would require interventions for not only the physical activity, but also social skills and learning the rules of the sport. However, the benefits of teaching group exercise to people with disabilities are also great. Engaging in sports with peers not only would teach physical activity, but also provide new social opportunities, and a healthy leisure activity.

One gap in the literature that was identified was the measurement of health outcomes as the dependent variable for physical activity interventions. Few studies directly examined factors such as BMI and sedentary lifestyles of people with disabilities. Research has shown that obesity and the comorbid disorders associated with it are more prevalent in people with ID. Therefore, the effects of physical activity interventions need to be directly measured against health outcomes for this group. Furthermore, there is still limited research on the uses of and effects of physical activity for people with severe or profound disabilities. Although Lancioni and O’Reilly (1998) called for more research in this area due to the sedentary lifestyles of people with severe and profound intellectual disabilities, there appears to still be a gap in the literature. Few authors reported the severity level of the participants’ disability. Only a few participants included in this review had a severity level reported in the severe range. Future research should begin to generalize the findings of physical activity interventions into other groups of people with severe to profound disabilities, specifically those with ID. Finally, future researchers should attempt to identify preferences in physical activity among the people they work with. Again, Lancioni and O’Reilly (1998) proposed that exercise preference should be taken into account. It may be necessary to first expose people with disabilities to various
exercises or forms of physical activity; however this may make the chosen physical activity more reinforcing for that individual. Although preference of physical activity was not directly assessed in this review, future studies can include a preference assessment regarding physical activity to help select a more reinforcing form of physical activity.

Finally, future interventions in this area should involve multiple topographies of physical activity. As previously stated, there were more positive outcomes when authors implemented multiple forms of physical activity as compared to just one. One way this could be directly observed is through the use of an alternating treatment design. Furthermore, single subject research needs to examine more health outcomes and begin to generalize treatments that have been used with other populations (e.g., people with autism) to people with ID.

**Limitations**

Although this review was successful in including only studies that involved people with ID and updating the findings of Lancioni and O’Reilly (1998), it is narrow in scope. Indeed, there are many articles that were not included in this review because their study participants did not have an ID or related disability. These articles may address some of the gaps in the literature or extend the future research statements that were proposed here. This in turn can lead to fewer opportunities to engage in physical activities, while at the same time being at a higher risk for obesity and related diseases. Although much has been published in regards to increasing physical activity or using physical activities to reduce challenging behavior, future researchers need to begin to generalize these interventions to people with ID, specifically those with a severe to profound diagnosis.
Conclusion

Upon updating Lancioni, & O’Reilly’s (1998) original review, there has been some advancement in the field of physical activity for people with ID. There is still a focus on teaching physical activities and reducing challenging behavior. A majority of both single subject and group design studies reviewed successfully increased physical activity or using physical activity to reduce challenging behavior. Although there has been advancement in the field, there are still gaps in the literature that need to be addressed. Specifically, determining an optimal level of intensity of physical activity to reduce challenging behavior, measuring health outcomes, and teaching physical activities as a type of recreation for people with ID.
Chapter 3: Research Paper

This chapter is included as a stand-alone research paper. This section includes a brief literature review, a description of the method, a summary of the results, and a discussion of the findings and future directions for research and practice.

Abstract

Some people with intellectual disabilities may not engage in enough physical activity. Previous literature has shown that evidence-based practices are needed to teach them physical activities. This study taught three different exercises to three adolescents with severe to profound intellectual disabilities using simultaneous prompting and least-to-most procedures paired with reinforcement. Three multiple probe across behaviors designs were used. The results illustrate positive results for one participant and moderate results for the other two.
The Acquisition of Exercises in Adolescents with Severe to Profound Intellectual Disabilities

Physical activity is a major part of life that provides numerous health benefits that range from weight control to improved academic achievement (Janssen & LeBlanc, 2010). The CDC (2015) recommends, “150 minutes of moderate-intensity aerobic activity, 75 minutes of vigorous-intensity aerobic activity, or an equivalent mix of the two each week” in order to lose weight (CDC, 2015, “How Much Physical Activity Do Adults Need,” para. 2). Two serious conditions that have a reduced prevalence in people who engage in physical activity are heart disease and stroke. Furthermore, physical activity can reduce the risk of developing diseases such as type 2 diabetes, colon cancer, and breast cancer (CDC, 2015; Janssen & LeBlanc, 2010). Other benefits include protection and development of a person’s bones and muscles, which can reduce the stress and harm to joints as a person ages. Finally, physical activity can positively affect mental health, mood, and sleep (Janssen & LeBlanc, 2010).

Bartlo and Klein’s (2011) review of the literature described three modes of physical activity that benefit adults with intellectual disabilities—aerobic, resistance, and balance training. They found that these modes of physical activity had a significant positive impact on quality of life, fitness, strength, and mobility in adults with intellectual disabilities. Furthermore, they note that engaging in a physical fitness program has shown to improve the quality of life of individuals who participated (Bartlo & Klein, 2011). Their review of the literature revealed that physical activity “promoted an increased self-concept of well-being as well as functional performance leading to the improvement of quality of life in people with intellectual disability” (Barlo & Klein, 2011; p. 229).
Unfortunately, people with intellectual disabilities engage in less physical activity than their peers due to a variety of barriers including accessibility to places like gyms, lack of knowledge on the part of special educators and coaches, attitudes of others, and natural barriers such as physical disabilities or seizures (Block et al., 2013; Darcy & Dowse, 2013; Rimmer & Rowland, 2008). Darcy and Dowse (2013) reported that in 2006, 53% of people with any disability participated in sports at various levels (i.e., elite, competitive, recreational) compared to 68% of people without disabilities. Even if not engaging in a formal sport, people with intellectual disabilities should engage in at least the daily recommendations of physical activity because of a high prevalence of obesity, which has been estimated to be as high as 55% of this population (Draheim, 2006). There are many factors that affect the prevalence of obesity in this population including medication, genetic predisposition, levels of physical inactivity, living arrangements, and nutrition (Casey & Rasmussen, 2015; Fox, Witten, & Lullo, 2014).

Lancioni and O’Reilly (1998) provided an overview of the physical activity research for people with severe and profound developmental disabilities and found that it was possible to improve fitness of people with intellectual disabilities (ID). They also found that it was possible to reduce challenging behavior with vigorous exercise, but noted that behavioral reduction procedures should be used if the behavior was severe or life threatening (Lancioni & O’Reilly, 1998). Finally, they noted that participants had to be explicitly taught using evidenced-based practices (e.g., prompts, praise, token economies) was needed for it to be successful (Lancioni & O’Reilly, 1998).

Indeed, much of the literature published after Lancioni and O’Reilly’s (1998) review has focused on the reduction of challenging behavior and teaching physical
activity. Additionally, much of the recent research targets people with autism spectrum disorder and not people with intellectual disabilities. However, Maki, Rudrud, Schulze, and Rapp (2008) developed a 45-min fitness routine that consisted of 15 min each of stretching, aerobics, and weights for adults with a traumatic brain injury. Using a combination of reinforcement and self-monitoring techniques, the authors increased the amount of time participants spent exercising during the fitness routine. Due to time constraints, the intervention was not successfully faded and generalization did not occur.

In another study, Green and Reid (1999) attempted to reduce indices of unhappiness in people with profound and multiple disabilities by using preferred stimuli while engaging in a physical activity routine. The physical activity included arm stretches, raising and lowering limbs. Although not vigorous physical activity, the incidences of unhappiness were reduced during these routines for all three participants.

**Study Purpose**

Although successful, more research is needed that focuses on the teaching of exercise routines to people with intellectual disabilities. One gap in the literature is teaching an exercise routine that mimics what is typically done in a gym and that could be done in home, school, or other community settings. By teaching a routine that includes a variety of exercises (e.g., aerobic exercises, balance training, and anaerobic exercises), a person could workout their entire body, engaging different muscle groups and sampling a variety of exercises. Furthermore, by developing a routine that does not require specialized equipment, people could engage in physical activity in a number of settings such as their home or classroom. Therefore, the purpose of this study was to teach students with severe intellectual disability to engage in an exercise routine.
Method

Participants

Three students were recruited from a school in the Midwest that served only people with severe to profound intellectual, developmental, and physical disabilities. The school’s adapted physical education (APE) teacher referred all of the students to the researcher based on their IEP goals and limited gains in physical activity they had made working in a group setting with her. Victoria was a 12-year-old female with diagnoses of Angelman’s syndrome and seizure disorder. Victoria had braces on both lower legs, she shuffled when she walked, and did not have a typical gait. Her mother reported that when Victoria was not on stable or flat ground or on an outing that required a lot of walking (e.g., going to the zoo), she required a wheelchair to get around as she did not have much endurance. Victoria had no functional communication at the time of this study and had a history of biting others if she became distressed. Throughout the study, she was compliant and had a positive attitude (e.g., smiling and laughing when seeing people she knew in school, and when working with the first author).

Javier was a 13-year-old boy with diagnoses of traumatic brain injury, developmental disabilities, seizure disorder, and bilateral mesiosclerosis. Javier had no functional communication at the time of this study, and he exhibited challenging behavior in the form of elopement, spitting, self-injurious behavior, and aggression. During observations in the classroom, few demands were placed on him. Neither his classroom teacher nor the APE teacher had instructional control, and they often gained compliance through multiple verbal and physical prompts. Javier engaged in stereotypic behaviors
such as rocking and pacing the classroom. He also enjoyed wearing headphones when the
teacher and classroom paraprofessional made them available to him.

Finally, Jayden was a 13-year-old male with diagnoses of severe intellectual and
developmental disabilities, and autism spectrum disorder. He was blind in his left eye.
Jayden had no functional communication at the time of this study, and he engaged in high
rates of stereotypy in the forms of finger manipulation and challenging behavior in the
form of falling to the ground or walking on his knees when he did not want to engage in
an activity. Jayden was also observed to engage in masturbatory behavior (i.e.,
continually rubbing both hands on his groin). One of Jayden’s preferred activities
included physical interaction with teachers and aides. During classroom observations, it
appeared that Jayden was prompt dependent and the classroom teacher often delivered
multiple verbal prompts in a loud voice before Jayden complied with simple instructions
(e.g., go sit down, don't touch that).

**Setting and Materials**

The setting for this intervention was a fully segregated school in the Midwest that
served only students with severe to profound intellectual, developmental, and physical
disabilities. The participants were asked to engage in the routine in the school’s gym and
a conference room located in the administration area of the school when the gym was
unavailable. When working in the gym, the center of the gym was cordoned off to help
prompt the students to stay in the area and reduce elopement. This was done using
folding chairs placed in a square with caution tape tied between them. In order to reduce
elopement while in the conference room, the door was shut.
The materials included a stopwatch, a medium-sized beach ball, a rubber balance beam, and a rubber kickball. The rubber ball, balance beam, chair, and rubber kickball were used during the exercises. The stopwatch was used to record the duration of the each exercise. A Digit Finger Oximeter produced by Smiths Medical was used to gather the heart rate from participants when they assented. This device fits on the index finger and displays oxygen levels, pulse rate, and pulse strength on an LED display.

**Dependent Measures, Data Collection, and Exercises**

The primary dependent variable was the percentage of independent and verbally prompted steps completed correctly, which was calculated by dividing the number of steps completed independently and verbally prompted by the total number of steps and multiplying by 100. For the purpose of this study any step completed independently or with a verbal prompt was considered correct. Heart rate was collect before and after the exercise if the student assented to it. Target heart rate was calculated for each student in accordance with the CDC moderate intensity heart rate calculation (CDC, 2015). If the participant’s heart rate exceeded the 70% level (i.e., [220 – age] * 0.70), the session would be immediately terminated, though this was never necessary.

Data were collected in the school from April 11, 2016 to June 2, 2016. We attempted to run sessions daily. One session was equivalent to one individual exercise. Therefore multiple sessions occurred throughout the day or at different times during either the morning or afternoon time periods. The sessions labeled in the results are not continuous. Number of sessions conducted per day ranged between 1 and 5 sessions per exercise, with an average of 3 sessions a day for one exercise. These sessions were typically run in the morning after the students finished their walking group at 10:00 a.m.,
and with another set of sessions after their lunch period beginning at 1:30 p.m. We allocated each participant 15–20 minutes for the morning and afternoon time periods. If a participant refused to work during the morning, they were asked again in the afternoon to participate. There were instances during this study where participants refused to participate in one or both of these times.

Exercises were individualized to each participant based on whether they could already do the exercise, whether they could physically do the exercises, and how many repetitions of the exercise they could complete. Exercises were adapted in consultation with the school’s APE teacher for Victoria because of her poor balance. After consulting with the APE teacher, balancing on one foot was modified by allowing her to maintain her grip on the chair during the exercise.

Based on the APE teacher’s recommendation, the exercises taught included wall squats, arm circles with a ball, passing a ball back and forth, balancing on one foot, walking heel to toe on a balance beam, and heel raises. Task analyses were developed for each exercise. The task analysis for each exercise is located in Table 3. The wall squats and heel raises targeted the leg muscles. Arm circles with a ball were chosen to strengthen the biceps and triceps. Balancing on one foot and walking on a balance beam targeted strengthening the legs and balancing. Finally, passing a ball back and forth targeted aerobic activity and strength training of the arms. These exercises were adapted from the FUNfitness manual produced by the Special Olympics (2013) and are recommended for athletes wishing to compete in the Special Olympics and/or those who want to exercise in their homes.
<table>
<thead>
<tr>
<th>Wall Squats</th>
<th>Arm Circles with a Ball</th>
<th>Passing a Ball</th>
<th>Balancing on One Foot</th>
<th>Walking Heel to Toe on Balance Beam</th>
<th>Heel Raises</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Stand with back and feet against the wall</td>
<td>1. Sit in chair</td>
<td>1. Stand across from other person</td>
<td>1. Stand in front of chair</td>
<td>1. Walk to edge of chair</td>
<td>1. Walk to chair</td>
</tr>
<tr>
<td>2. With back still against the wall take one step forward</td>
<td>2. Pick up weighted ball with both hands</td>
<td>2. Pick up the ball</td>
<td>2. Lift your arms into the air so they are straight out to the sides</td>
<td>2. Putting one foot in front of other, step heel to toe</td>
<td>2. Place one hand on chair to balance</td>
</tr>
<tr>
<td>3. With feet forward and back against the wall, bend knees to a seated position</td>
<td>3. Extend arms out while holding the ball</td>
<td>3. Pass the ball to the other person</td>
<td>3. Lift your right foot off the ground and hold for 5 seconds</td>
<td>3. Putting one foot in front of other, step heel to toe</td>
<td>3. With both feet, lift heels in the air and stand on toes</td>
</tr>
<tr>
<td>4. Hold for 5 seconds</td>
<td>4. Rotate both arms right in continuous circle motion until back at starting position</td>
<td>4. Put your hands in front of your body and catch the pass</td>
<td>4. Touch chair if needed</td>
<td>4. Putting one foot in front of other, step heel to toe</td>
<td>4. Relax feet so they are flat on the ground</td>
</tr>
<tr>
<td>5. Take a step back to the wall</td>
<td>5. Stand up straight</td>
<td>5. Pass the ball to the other person within 3 seconds of catch</td>
<td>5. Put your right foot down to the ground</td>
<td>5. Putting one foot in front of other, step heel to toe</td>
<td>5. With both feet, lift heels in the air and stand on toes</td>
</tr>
<tr>
<td>6. Stand up straight</td>
<td>6. Lift your arms into the air so they are straight out to the sides</td>
<td>6. Put your left foot down to the ground</td>
<td>6. Step off the balance beam</td>
<td>6. Putting one foot in front of other, step heel to toe</td>
<td>6. Relax feet so they are flat on the ground</td>
</tr>
<tr>
<td>7. Set the ball on the floor</td>
<td>7. Lift your left foot off the ground and hold for 5 seconds</td>
<td>7. Put your left foot down to the ground</td>
<td>7. Step off the balance beam</td>
<td>7. Step off the balance beam</td>
<td>7. Let go of chair</td>
</tr>
<tr>
<td>8. Place the ball on the floor</td>
<td>8. Put your left foot down to the ground</td>
<td>8. Put your left foot down to the ground</td>
<td>8. Step off the balance beam</td>
<td>8. Step off the balance beam</td>
<td>8. Relax feet so they are flat on the ground</td>
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<tr>
<td>9.</td>
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</table>

Table 3. *Task Analyses of Exercises.*
By teaching skills that are endorsed and screened by the Special Olympics, the participants could use them in the community or to participate in the Special Olympics. Although the level of all of the exercises was low (i.e., short duration or few repetitions), if a participant engaged in any challenging behavior, the session was terminated and the student returned to the classroom.

**Interobserver Agreement and Procedural Fidelity**

Secondary observers were trained to collect interobserver agreement (IOA) and procedural fidelity data by providing them a copy of the data sheet and reviewing it with the first author. After explaining the data sheet, movements were modeled for the secondary observers to provide examples of the topography of each exercise. The secondary observers were graduate students in a special education program. IOA data were collected for 35% of the sessions for Jayden, 31% of the session for Victoria, and 38% of the session for Javier to maintain internal validity. IOA was calculated using a trial-by-trial method by dividing the number of trials in agreement by the total number of trials and multiplying by 100 (Cooper, Heron, and Heward, 2007). Procedural fidelity data were collected for 37% of the sessions for Jayden, 39% of the sessions for Victoria, and 35% of the sessions for Javier. Procedural fidelity was calculated in the same manner as IOA. Interobserver agreement results were high across all participants. Average IOA for Jayden was 99% (range: 89–100%) across all exercises. Average procedural fidelity was 100% for all behaviors. Victoria’s IOA was an average of 90% (range: 0–100%). The 0% score was based on Victoria’s performance during baseline sessions where she completed a step in the task analysis out of order, and it was marked incorrect by the second data collector. This was discussed after the session and a decision was made that
if a participant engaged in the behavior out of order it but it was functionally appropriate
for the exercise then it would be scored as independent. Procedural fidelity scores for
Victoria ranged from 84% to 100% with an average score of 99%. Finally, Javier’s
average IOA was 93% with a range of 0% to 100%. Again the 0% occurred for the same
reasons described above. Procedural fidelity scores for Jayden ranged from 81% to 100%
with an average of 99%.

**Experimental Design**

A multiple probe across behaviors design was used (Gast & Ledford, 2014). The
exercise routine consisted of three individually-determined exercises that were taught one
at a time within the context of the experimental design. An exercise was placed into
intervention based on the stability, trend, and level of baseline responding for five
sessions (i.e., data points). All participants were taught a total of three exercises. The next
exercise was put intervention after the student engaged in 40% of the exercise’s steps
independently or with a verbal prompt for three consecutive sessions.

**Procedures**

*Preference assessment.* Before beginning intervention, a multiple stimulus
without replacement (MSWO) preference assessment (DeLeon & Iwata, 1996) with all
tangible items was conducted with each participant to identify potential reinforcers. Both
Jayden and Victoria were given free time to engage in stereotypic behavior and praise.
Javier enjoyed playing with a slinky and play dough. He also enjoyed goldfish as an
edible reinforcer. If the gym was available, Jayden and Javier could walk on a treadmill
or ride an adapted bicycle after working with the researchers. Items included in the
MSWO included toys (i.e., a small bouncing ball, play dough, a wand with water and
glitter, a slinky, and a blue bead necklace) and edibles (i.e., chocolate chips, goldfish, and cinnamon flavored teddy graham).

**Baseline 1.** During the first baseline condition, all students continued to engage in their daily morning walking group. Before the session, participants were asked if we could take their heart rate using the heart rate monitor described above. We then attempted to place the heart rate monitor on the participant’s finger three times. After recording heart rate, or if the student refused three times (this was done both at the beginning and end of every exercise), they were asked to engage in the exercise (e.g., “Begin sit ups”). A single opportunity method was used during baseline. If the student did not complete the correct topography, engaged in challenging behavior, left the area, or did nothing for 5 s, the session was terminated. The student was thanked for participating and given noncontingent access to the tangible item or a desired activity in the gym (e.g., walking on a treadmill, riding an adapted bicycle) for 1 min.

**Baseline 2.** The second baseline phase was identical to the first except a verbal prompt for each step of the exercise as written on the task analysis was given (i.e., the students received a verbal prompt to engage in each step of the exercise). This was done for all students except Javier, who had already met the criterion to begin intervention for his second exercise (i.e., one foot balance). Therefore, he only experienced baseline 2 for his third exercise (i.e., pass the ball).

**Simultaneous prompting.** After five sessions with stable responding were observed and no evidence of an increasing trend, the first exercises were moved into intervention. The first phase of intervention consisted of simultaneous prompting, which included a model of the exercise, then verbal explanations of the movements while
physically prompting the participant through the exercise. A discriminative stimulus of
the exercise name (e.g., “Pass the ball”) was given once before the model and again
before prompting. If the participant engaged in the behavior independently before the
simultaneous prompt was given, then they were scored as completing that step. After
successfully completing five consecutive sessions of simultaneous prompting, the
prompts were faded to least-to-most prompts. Similar to the baseline phase, students
continued to earn noncontingent access to reinforcers and praise for participating at the
end of the session.

**Least-to-most prompting.** During this phase, the students were given 5 s to
begin engaging in the target behavior. If the student did not engage in the behavior or
made an error, the first tier of prompting was initiated. If the student still did not engage
in the behavior or incorrectly engaged in the step, the next tier was initiated. Three tiers
of prompting were used. The first tier was a verbal prompt in which we repeated the
discriminative stimulus as a verbal instruction to the student (e.g., “Pass the ball”). The
second tier consisted of a verbal prompt paired with a model. Finally, the third tier was a
verbal prompt and model paired with a physical prompt. After completing the exercise,
students continued to earn noncontingent access to reinforcers and praise for
participating.

**Results**

Three multiple probe experiments were conducted across three different types of
exercises with three adolescents with intellectual disabilities, allowing for nine
opportunities to demonstrate experimental effects. Through visual analysis of the data
(see Figures 2–4), we identified 8 experimental effects for simultaneous and least-to-most
prompting out of 9 opportunities. Below, we describe visual analysis of all opportunities by focusing on the trend, level, and variability of the data. We define these results as “moderate” because although there is an effect through visual analysis, not all of the participants met the pre-set criterion of three successive sessions of 80% correct response for all exercises. In this study independent and verbally prompted steps were counted separately during data collection but graphed as an aggregated total.

**Jayden**

Results for Jayden are presented in Figure 2. The first exercise Jayden was taught was arm circles. During baseline, Jayden did not engage in any arm circles. After completing five sessions with simultaneous prompting, arm circles were moved into the least-to-most prompting phase. During this phase, Jayden correctly completed each step of the exercise with an average accuracy of 20% (range: 14–29%). Due to the low percentage of steps completed correctly, reinforcement was increased by providing a reinforcer after each step of the exercise he completed. This increased the range of correctly completed steps to as high as 43%. His performance plateaued here, so a shaping procedure was implemented wherein we held the selected reinforcer directly in front of his hands and he was to follow it. The goal of this was to have him follow the path of the reinforcer. Although he did follow it with his eyes, he did not follow the motion with his arms.

During baseline with heel raises, Jayden performed an average of 2% of the steps correctly (range: 0–11%). After five sessions with simultaneous prompting, least-to-most prompting was introduced. Jayden quickly learned this exercise (M = 71%; range: 56–78%).
Figure 2. Results for Jayden across independent and verbally prompting responses (squares) and modeled and/or physically prompted responses (triangles) for arm circles, heel raises, and passing the ball.
During the first baseline phase for passing the ball, Jayden did not perform any of the steps correctly. When verbal prompts were given in the second baseline, his correct responding increased (M = 3%; range: 0–22%). Once a decreasing trend in the second baseline condition was observed, simultaneous prompting was introduced. Following five sessions with simultaneous prompting, least-to-most prompting was introduced. During this phase, Jayden correctly completed an average of 53% (range: 22–78%) of the exercise correctly, ending this condition completing 67% of steps correctly.

Victoria

Results for Victoria are presented in Figure 3. The first exercise Victoria was taught was balancing on one foot. During baseline, Victoria did not consistently engage in any of the steps, so the exercise was moved into the simultaneous prompting phase. In this phase, Victoria completed two of the steps independently during four of the five sessions. The step she consistently completed was putting her foot back on the ground after raising it in the air for 5 s. After completing five sessions with simultaneous prompting, balancing on one foot was moved into the least-to-most prompting phase. In this phase, she performed an average of 65% of the steps correctly (range: 29–100%).

During baseline with arm circles, Victoria performed an average of 6% of the steps correctly (range: 0–29%). After five sessions of with simultaneous prompting, where she completed 0% of the steps correctly, the exercise was moved into the least-to-most prompting phase. She had early success learning this exercise, quickly meeting the criteria of 40% correct (allowing the next exercise to move into intervention), however there was high variability in her performance especially toward the end of the study (M = 44%; range: 0–71%).
This may have been due to the longer amount of times spent working on exercises (i.e., the increased task demand that naturally occurred from adding additional exercise to each session).

During baseline for walking on a balance beam heel to toe, Victoria had very low levels of correct responding, and she displayed no correct responses during the
simultaneous prompting phase. Victoria required high levels of physical prompting (i.e., tier 3 prompting) during the least-to-most prompting phase for this exercise. Towards the end of the study, an increase in the percentage of correct responses began (M = 25%; range: 14–86%), and she ended the study performing 71% of the steps correctly.

**Javier**

The results for Javier are presented in Figure 3. During baseline for wall squats, Javier performed an average of 7% (range: 0–17%) of the steps correctly. In the simultaneous prompting phase, Javier performed an average of 36% (range: 33–50%) of the steps correctly across five sessions. After completing five sessions with simultaneous prompting, wall squats were moved into the least-to-most prompting phase. During this phase, Javier’s performance varied during the first 26 sessions, ranging from 33–100% correct responding (M = 67%). In session 27, the reinforcer was changed to an edible as Javier was engaging in high rates of challenging behavior or refusing to participate. After changing the reinforcer to an edible, he completed an average of 89% (range: 67–100%) of the steps correctly.

For his final exercise, pass a ball, Javier displayed low levels of correct responding in the first baseline phase (M = 5%; range: 0–27%). However, when verbal prompts were given in the second baseline phase, there was an increase in behavior (M = 29%; range: 11–33%). The steps he completed correctly were picking up the ball and standing across from the person. Javier did not consistently pass or catch the ball, and once a decrease in trend was observed, the exercise was moved into the simultaneous prompting phase. Javier quickly learned this behavior, preforming an average of 71% (range: 56–78%) of the steps correctly.
Figure 4. Results for Javier across independent and verbally prompting responses (squares) and modeled and/or physically prompted responses (triangles) for wall squats, one foot balance, and passing the ball.
Discussion

Results of this study indicate that using a prompting package consisting of simultaneous and least-to-most prompting had a moderate effect on teaching three adolescents with intellectual disabilities how to engage in various physical activities. The intervention had the greatest impact on increasing the percentage of correct steps for every exercise that Javier was taught, while the other two only had moderate gains in their behavior. This study extends past research by focusing on teaching different types of exercises that target different areas of fitness (i.e., balance, hand eye coordination, and muscle strengthening) outside of just aerobic activity. This study also extends the research by working with adolescents with severe to profound intellectual disabilities, whereas much of the current research focuses on people with autism spectrum disorder or cerebral palsy. This also included some adaptations to the exercises in order for Victoria to participate. The adaptations made for Victoria were based on her physical disabilities. Standing on one foot was adapted to allow her to continue to grip the chair so that she would not fall. This adaptation was recommended by her APE teacher who had been working to strengthen Victoria’s legs and increase balance. Victoria also needed assistance in maintaining her raised foot while balancing. She would lift her foot and hold it in the air for a few seconds, but her raised leg would shake and she put her foot down. We adapted the exercises by providing a physical prompt only after she lifted her foot in the air and maintained the position for a few seconds. At the end of the study, this prompt was faded out and she could maintain the 5 s count independently.

Although there was no pattern present for the time of day when the sessions were run, there was a pattern for running the sessions back-to-back during the 15–20 min time
period. For example, Victoria had worse scores when sessions were run back-to-back and towards the end of the 15 min period. This may account for some of the variability in responding for both Victoria and Jayden.

One major strength of this intervention was that it did not require specialized equipment. All of the equipment used for this intervention can be found in any classroom, gymnasium, or easily substituted with another item (e.g., using a desk instead of a chair to steady students, using tape in a straight line instead of a balance beam). Another strength of this study was that all of the skills taught are skills these students need in order to participate in other physical activities. For example, increasing the leg strength and balance of Victoria will improve her walking ability and allow her to spend more and more time outside of a wheelchair. Focusing mainly on balance and leg strength will also help her gait and walking ability, which was listed as an IEP goal for her. By teaching Jayden and Javier how to pass a ball back and forth creates social opportunities for them to engage in a game of catch with their peers or staff members. Furthermore, if either of them decides they would like to play a sport such as basketball, the topography of passing a ball is now in their repertoire. Each skill taught increases an aspect of fitness that will be necessary for more difficult types of physical activity and in everyday life.

The findings from this study are very similar to other studies where multiple exercises were taught (Adamo et al., 2015; Cannella-Malone et al., 2011). Both Adamo et al. (2015) and Cannella-Malone et al. (2011) successfully increased physical activity for a similar population, and had high success rates for their participants. Adamo et al. (2015) had high success estimates 9/9, as well as Cannella-Malone et al. (2011) with a 7/8 success estimates. One of the differences between their studies and this study was that
they both used video modeling to teach physical activity instead of the prompting strategies presented here. These effects may align to the effects here because of the similar population that was used, and that various exercises were taught instead of just one.

**Limitations and Future Research**

First, the rationale for calculating both verbally prompted and independent steps together was that it mimics what may be done in a gym when working with an APE teacher or personal trainer. Therefore, these results do not represent only independent responses, rather the percentage of independent and verbally prompted responses. Future research can work to fade the verbal prompts so that students are more independent. One area to explore would be to incorporate a self-monitoring or a self-prompting procedure, such as video prompting.

Although there are numerous benefits to the study and students were reinforced for participation, there were a number of challenging behaviors that occurred. All of the participants displayed low levels of aggression (i.e., trying to hit the data collectors, scratching, kicking), property destruction, and general noncompliance (i.e., students would refuse to engage in the exercise). Although no data were collected on challenging behavior, we can anecdotally note that students engaged in higher levels at the beginning of the study. One possible explanation for the occurrence of challenging behavior may be related to the increase in work demands that we placed on the students. All of the students were in classrooms where work demands were very low. The increase in task demand during the 15–20 min sessions may have caused increases in challenging behavior in order to escape. Even with all of the students in this study displaying different
topographies of challenging behavior, the school had not established any behavior plans for them, so specific interventions were not used to address the challenging behavior. Pairing the increased task demand with asking a student to engage in mainly novel behaviors would also explain the high rates of challenging behavior at the beginning of the study. The reduction of challenging behavior over the course of the study may be due to a variety of factors. Increased levels of reinforcement were introduced for compliance with the task demand while exhibiting challenging behavior terminated the session and opportunity for that unique reinforcer. Also, engaging in the physical activity itself may have become reinforcing over the course of the study. Although, this was not examined in this study, future research could examine if a preference for physical activity developed after teaching people to engage in physical activity.

General compliance was also a prevalent problem throughout this study. Jayden and Victoria particularly struggled to comply with one-step task demands, or would resist physical prompts. On numerous occasions, Jayden refused to participate and bounced on a chair or lay on the floor, refusing to leave the area and return to the classroom. Victoria would attempt to elope from the area or play with items (e.g., blinds on a window, pull books from a shelf) while being instructed to engage in the exercise. Future researchers may consider adding a compliance-training component prior to teaching the physical activity. By increasing compliance and building stimulus control, there may be an increase in learning the exercises, with a decreased need for the model or physical prompts in the least-to-most prompting phase. It might also be easier to direct the participants to watch the model.
Related to compliance, the students refused to wear the heart rate monitors in the majority of sessions. An attempt to check each participant’s heart rate was made at the beginning and end of every session. Although they were reinforced for putting it on, the students pushed the monitor off their finger, and refused to wear it for more than a few seconds. Also, the heart rate monitor used often took a long time to process information, sometimes upwards of 60 s. This could be due to the small size of the students’ fingers or them playing with the monitor by pushing down on the sensor. Future researchers wishing to collect heart rate data should consider using a different type of heart rate monitor that does not use the finger to collect data (e.g., a hand grip or chest strap monitor) or include acceptance of wearing the monitor in initial compliance training sessions.

Finally, Jayden required some changes in the instructional process and Victoria needed adaptations made to an exercise. Jayden was not motivated to engage in arm circles, reinforcement was increased. He was also offered other potentially reinforcing items identified through the MSWO, but it did not greatly impact his behavior. One of the difficulties working with Jayden was that he engaged in high rates of stereotypy and seemed to enjoy the physical prompts. In some sessions, he crossed his arms refusing to engage in the behavior but was compliant when a physical prompt was used. From observations in his classroom, he would only play with a “bead curtain” (i.e., a plastic square standing vertically with a mirror embedded, that had beads draped over the top edge) or engage in hand stereotypy given free time. Thus, the rate of reinforcement was first increased for every step, then in the following phase, the reinforcer he selected was held by the researcher while modeling the step. The only effect that was visible was a
decrease in the variability of responding. Future studies could try to incorporate similar topographical exercises related to the participant’s stereotypy and examine if this has an effect on how quickly that participant learns the exercises. Another possibility would be to add a preference assessment for physical activities. Sampling the movements/physical activities and then allowing the participant to choose which exercises they wish to engage in could determine preference and increase the likelihood of success.

Additional Areas for Future Research

In addition to the aforementioned directions, future researchers should continue to develop best practice techniques for teaching people with intellectual disabilities to engage in physical activity. Furthermore, they should begin to adapt interventions that were successful with people with autism spectrum disorder to this population. Other researchers could examine the benefits of assessing both compliance and gross motor skills, and increase these skills before teaching physical activity. Conducting this research would help determine the benefits or necessities of these skills to a prompting intervention like the one presented in this study. Finally, applying fluency-training research to the field of physical activity may be beneficial. By training participants to fluency, this may allow for more independent responses as well as help with generalization of skills to group settings, such as an APE class, where trainers may not be able to work one-on-one with students.

Implications for Practice

One of the benefits of this study is that it lays additional groundwork for future research, as well as provides implications for practice. A challenge that was encountered when first determining the intensity (i.e., duration or number of repetitions of an exercise)
of the physical activities was that the participants did not have much endurance. We had to reduce intensity to very low levels and focus on teaching the topography of the exercises with minimal intensity. Practitioners and researchers wishing to teach exercises to participants should start with low intensity and gradually build up as they master the topography. Another implication for practice is that the program presented here is easier to implement with two people. Although this program was run at times with only the first author present, it was more difficult to implement the prompting procedure alone, especially with exercises that require two people (e.g., passing the ball). It is also more difficult to perform a simultaneous prompting phase without another person as the model. Having a team of two people makes it easier to deliver the prompts and reduce the time it takes to run the sessions themselves.

**Conclusion**

People with intellectual disabilities are at higher risk for obesity and associated disease. Often they do not engage in enough physical activity. By teaching people with intellectual disabilities how to engage in physical activity, there are not only health benefits but also the potential to develop a new leisure activity. The purpose of this study was to teach three adolescents with a severe to profound intellectual disabilities how to engage in three different exercises using simultaneous and least to most prompting. Results indicate that using this prompting package was only moderately successful. Future research is needed to find best practice techniques for teaching physical activity to people with intellectual disabilities. Furthermore, examining the effects of fluency training, compliance training, and gross motor assessments has on teaching physical activities to this population would be beneficial.
Chapter 4: Practitioner Paper

This chapter contains a practitioner paper that is intended to disseminate the findings of Chapters 2 and 3 to teachers. The following paper includes strategies for special education teachers and practitioners to incorporate physical activities in their classroom that would benefit their students.

Abstract

Engaging in physical activity can increase our health and provide social and recreational opportunities. Unfortunately, people with intellectual disability encounter many barriers precluding them from more vigorous types of physical activities. One way to overcome these barriers is by teaching basic skills in the classroom. This article provides examples of different exercises that can be incorporated into the classroom that can help build a student’s strength, balance, and/or aerobic endurance. Prompting techniques that may be used to teach these skills are outlined.
Let’s Get Moving: Bringing Physical Activity Into the Classroom

*Rodney is an adolescent with intellectual disability (ID) who attends middle school in a multiple disabilities classroom. Rodney hopes to attend Special Olympics in the fall to play basketball, but he has poor muscle tone and limited balancing skills. Although he participates in a daily walking group, Rodney only works with the adapted physical education teacher once a week during gym where he works to develop balance and coordination, as well as build strength and increase endurance. Rodney’s special education teacher, Mr. Parker, knows that giving all of his students more opportunities to engage in physical activity will help them develop the skills needed to engage in other team-based sports, and possibly compete with Special Olympics. Mr. Parker wants to incorporate some type of physical activity into his classroom as his students spend most of their day sitting. Unfortunately, Mr. Parker is unsure of what types of physical activity he should include, and he is unsure how to teach his students to perform the exercises.*

Physical activity is a major part of life that impacts people’s physical and mental health, quality of life, and social opportunities. When people with intellectual and developmental disabilities (IDD) engage in physical activity they experience positive outcomes in overall quality of life, strength, and mobility, particularly when they engage in resistance training, aerobics, and balance training (Bartlo & Klein, 2011). Beyond the benefits to the development of prerequisite physical activity skills, there a number of benefits that physical activity can have on the behavior of students in the classroom. Physical activity has been shown to reduce challenging behaviors and stereotypy (Cannella-Malone et al., 2011; Folino et al., 2014; Neely et al., 2015). Conversely, there is research that demonstrates increases in academic engagement and on task behaviors
In both cases, there are benefits for students to be engaging in physical activity within the classroom. Unfortunately, students with IDD may not be getting any physical activity outside of the scheduled adapted physical education (APE) time during the school day. Numerous barriers, such as accessibility to places like gyms, lack of equipment, lack of knowledge on the part of special educators and coaches, and attitudes of others, impact access to physical activity (Bartlo & Klein, 2011; Block et al., 2013; Darcy & Dowse, 2013; Rimmer & Rowland, 2008). Furthermore, physical activity programs outside of schools are generally short-lived and difficult to maintain by nonfitness staff (Bartlo & Klein, 2011). These barriers are further impacted by the fact that children with disabilities are 38% more likely to be obese than their peers without disabilities, and this gap grows to 58% for adults with disabilities (CDC, 2015). Although special educators cannot control the barriers outside of their own schools, they can help break down barriers to physical activity by increasing the amount students engage in.

To improve physical outcomes for students with ID, it is essential to begin breaking down these barriers. Therefore, the purpose of this paper is to provide people who work with individuals with IDD some guidance for incorporating physical activity—specifically related to strength and balance—into the classroom. By developing these skills, it could have a profound impact on their ability to participate in more rigorous physical activities (e.g., Special Olympics). In addition, these more rigorous physical activities can provide students with more social opportunities, which could lead to the activity being a preferred leisure activity.
What Does the Research Say?

Current research is focused on teaching people with IDD the movements involved in physical activities rather than on general fitness (e.g., increasing distance walked, muscle strengthening). Techniques using technology, such as video modeling, computer games, and technology that provide sensory input for engaging in physical activity, were successful ways to increase physical activity in people with IDD (Chang, Shih, & Lin, 2014; Lo et al., 2014; Cannella-Malone et al., 2013). More traditional approaches, such as constant time delay and class wide peer tutoring (Ayvazo & Ward, 2010; Zhang, Cote, Chen, & Liu, 2004; Zhang, Gast, Horvat, & Dattilo, 2000), have also been shown to increase physical activity for people with IDD. A number of different types of physical activities including aerobic activities, such as running and cycling, striking a ball, shooting a basketball, and balancing activities have been taught to students with IDD.

Figure 5. What Does the Research Say?

Choosing Classroom Physical Activity Through Collaboration

Collaborating With Your APE Teacher and Families

The physical activity you choose does not have to be a sport or vigorous activity. Instead, focus on basic skills that your students may be having difficulty with or those that are not yet developed. If you are unsure of the types of skills your students need, consult with an APE. Klein and Hollingshead (2015) describe the need for collaboration with physical educators when it comes to students with disabilities and provide ideas and practical solutions to apply during the collaboration process. Another resource that is useful for finding types of physical activity that would be beneficial to teach students is located in FUNfitness: Learn How to Organize, Promote and Present produced by the Special Olympics (2013). Within this manual are skills that they screen for and assess, with the ultimate goal being “to improve each athlete’s ability to train and compete in
Special Olympics as well as in life” (Special Olympics, 2013, p. 5). Information from the assessments can help guide your decision of what your students’ needs are. For, example if a student does not get balance on one foot, or has poor balance, you could provide opportunities to develop this skill in the classroom by choosing exercises that target balancing.

**Purpose of Physical Activity**

As you work in collaboration with the APE teacher and students’ families, the first consideration is the purpose of the targeted physical activity. It is likely that strengthening (i.e., muscle tone; some examples of this exercise include thera-band curls), balance (e.g., balancing on one foot at a chair or desk, walking heel to toe in a straight line), and aerobics (e.g., quickly passing a ball back and forth, dancing to music, passing a ball back and forth quickly, etc.) will be appropriate targets as they are often limited in students with IDD (Bartlo & Klein, 2011; Special Olympics, 2013).

**Feasibility**

Table 3 describes the feasibility and difficulty of specific physical activities that can be done in the classroom. The constraints of the classroom are much different than the gym where an APE teacher will likely conduct class. Therefore, it is important to consider the type of equipment necessary for particular physical activities, whether there is enough space in the classroom, and if additional staff will be needed to support engagement in physical activity. Certain types of physical activities presented here, such as wall squats or a one-foot balance, do not require extra space or equipment, or a high staff to student ratio. Other activities, such as a ball toss, will require more space and equipment, and potentially more staff to help the students. Time may also be a constraint,
however the physical activities presented here can be done quickly and during transition periods during the day.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Feasibility</th>
<th>Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strengthening Exercises</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heel raises</td>
<td>Easy</td>
<td>Easy</td>
</tr>
<tr>
<td>Wall squats</td>
<td>Easy</td>
<td>Moderate</td>
</tr>
<tr>
<td>Chair squats</td>
<td>Easy</td>
<td>Moderate</td>
</tr>
<tr>
<td>Sit-ups</td>
<td>Easy</td>
<td>Hard</td>
</tr>
<tr>
<td>Ball circles</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Band curls</td>
<td>Moderate</td>
<td>Hard</td>
</tr>
<tr>
<td>Balancing Exercises</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One foot balance</td>
<td>Easy</td>
<td>Moderate</td>
</tr>
<tr>
<td>Heel-to-toe walk</td>
<td>Moderate</td>
<td>Hard</td>
</tr>
<tr>
<td>Aerobic Exercise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Going for a Walk</td>
<td>Easy</td>
<td>Easy</td>
</tr>
<tr>
<td>Passing a ball</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

Table 4. Degrees of Feasibility and Difficulty for Physical Activity in the Classroom.

Mr. Parker just finished his math lesson and has 5 minutes before he has to take his students to the cafeteria for lunch. With these few minutes, he decides to have them practice their balance. He has them stand behind their chairs and stand on one foot, using the chair for support for 10 seconds. He will have the students balance on each foot. As students use the chair less, he will increase the time they balance on each foot up to 30 seconds. Following this short activity, he will have his students line up for lunch.

**Difficulty of Physical Activity**

In addition to considering the feasibility of engaging in particular physical activities within the classroom, it is important to consider the difficulty of the physical activities. For younger students or those who have limited strength or balance, the skill should be easy to do with few movements, short durations, and few repetitions. As students develop their skills, the duration, number of movements, or number of repetitions of the physical activities can be increased. As students master the simpler activities,
skills, more complex and compound skills can be introduced. A sample fitness routine can be found in Table 4.

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Activity</th>
<th>Intensity</th>
<th>Estimated time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>After breakfast</td>
<td>Wall squats</td>
<td>5 seconds</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Transition to art class</td>
<td>One foot balance</td>
<td>5 seconds</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Transition to lunch</td>
<td>Ball circles</td>
<td>3 circles</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Transition from recess</td>
<td>Balance beam walk</td>
<td>5 steps</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Before going to bus</td>
<td>Passing a ball</td>
<td>10 seconds</td>
<td>10 minutes</td>
</tr>
</tbody>
</table>

Table 5. Sample Classroom Fitness Routine.

Mr. Parker has consulted the school’s APE teacher and determined that it would be beneficial to introduce physical activities that target balance and muscle strengthening. He has enough room in his classroom for students to engage in physical activity but not a lot of additional equipment or staff. He decides to teach his student how to balance on one foot and to do a wall squat. Now that he has chosen which types of physical activity to do, he needs to identify the best and most effective way to teach his students how to complete them.

**Teaching Strategies**

Not unlike other skill training, systematic instructional procedures will be needed to teach students to engage in new physical activities. When teaching a student how to engage in a physical activity the first time, it is important that the skill is broken down into simple movements. After breaking down the exercises, prompting will likely be needed to teach the students the new movements. Finally, make sure to reinforce your students for engaging in physical activity. Specific praise statements are an excellent way to reinforce them, but any current reinforcement plan can be used to reinforce them. In
the remainder of this section tiers of prompting will be outlined, and strategies for fading the prompts and reinforcement schedule will be described.

**Simultaneous Prompting**

Simultaneous prompting is a prompting procedure in which you prompt the students through the movements immediately after asking them to engage in the physical activity thus preventing errors from occurring. By immediately providing the prompt, you eliminate an opportunity for one of the students to practice an incorrect movement. This prompting technique is most useful when students are first learning to engage in an exercise and need more guidance. Begin with a model of the correct exercise, then provide verbal explanations of the movements while physically prompting the student through the exercise. Make sure to tell the students what exercise you want them to do before providing the prompting.

*Mr. Parker begins by telling his students that he wants them to balance on one foot. Because this is the first time he has asked them to do this, most do not know what to do. Mr. Parker demonstrates what he is asking of them, then he and his paraprofessionals help students who do not engage in the exercise through the movements, while explaining what to do.*

**Least-to-Most Prompting**

After five sessions of using simultaneous prompting to a least-to-most prompting strategy should be introduced to replace the simultaneous prompting. By transitioning to least-to-most prompting you are giving your students an opportunity to respond independently and naturally reduce how many prompts the students receive. If your students do not engage in the physical activity within a few seconds after asking them to
begin, then you may need to use simultaneous prompting first to help them learn the movements. Least-to-most type of prompting should be used after your students have mastered most of the movements involved with the physical activity you are asking them to engage in. Using least-to-most prompting, the students will have between 3 and 5 seconds to engage in the target behavior. If the student does not engage in the behavior or does it incorrectly, the first tier of prompting will be initiated. If the student still does not engage in the behavior or incorrectly engages in the step, you will prompt them. Least-to-most prompting typically contains different tiers of prompting that are more intrusive depending on what the student needs. For this population, three tiers of prompting are recommended. The first tier is a verbal prompt in which the teacher provides a verbal instruction about the movement to the student. The second tier consists of a verbal prompt paired with a model. The third tier consists of a verbal prompt paired with a physical prompt. Table 5 describes how someone would use either simultaneous or least-to-most prompting when working with their students.

**Reinforcement**

Remember to reinforce your students after they complete the exercise! When first having students engage in physical activity, it is best to provide reinforcement for simply participating in the physical activity—regardless of accuracy. This will help make the physical activity more fun for the students. As time progresses and the students begin to master the movements, try making the reinforcers contingent on correct steps that were independent or correct steps that were only verbally prompted. However, if a student is not progressing, increasing the rate of reinforcement contingent on each step of the physical activity is likely to improve their performance.
### Prompting Level

<table>
<thead>
<tr>
<th>Prompting Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simultaneous Prompting</td>
<td>Immediately after asking the student to begin, provide a model, followed by a physical prompt with verbal prompt of each movement.</td>
</tr>
<tr>
<td>Least-to-Most Prompting</td>
<td>Give students 5 seconds to engage in the behavior, or if they make a mistake:</td>
</tr>
<tr>
<td></td>
<td>1. Tier 1: Give verbal prompt of movement.</td>
</tr>
<tr>
<td></td>
<td>2. Tier 2: If tier 1 did not work, give verbal prompt while modeling movement.</td>
</tr>
<tr>
<td></td>
<td>3. Tier 3: If tier 2 did not work, give verbal prompt with physical prompt.</td>
</tr>
</tbody>
</table>

Table 6. *Levels of Prompting.*

### Increasing Intensity

If you are considering increasing the duration or number of repetitions that you are asking your students to complete, they should be able to perform the exercises independently or with few verbal prompts to complete the exercise. When considering increasing the intensity of the exercises your students are going to do, it is important to consider their physical limitations and endurance. By increasing the intensity in small increments, you will ensure that you are not putting too much strain on the student.

Incrementally increasing the number of repetitions by 1 or 2, for time based exercises increase by 2–3 seconds, is an easy way to add intensity without injuring your students. Additionally, it is important to keep the maximum number of repetitions or time low. Repeated exercises should not exceed 10 repetitions in a set and exercises that are time based should not exceed 30 seconds. If you see that your students are short of breath, red in the face, and or struggling with the exercise, stop what you are doing and reduce the
intensity of the exercise. By following these guidelines you will reduce the risk of injury occurring.

Mr. Parker has been teaching his students some exercises using least-to-most prompts. He has successfully developed a small fitness routine within his classroom that consists of six different exercises that they do twice a day. Rodney has developed his balance and strengthened his leg muscles thanks to the programing of Mr. Parker, and he is learning to play basketball during his gym class. Rodney’s parents, seeing that Rodney loves to play basketball, signed him up for a youth league where Rodney has gone on to make new friends.

Final Thoughts

Physical activity is a part of our lives that we often take for granted. People with IDD face many more barriers to overcome when learning to engage in physical activity and having opportunities to engage in physical activity. By providing more opportunities to develop some of the basic skills that target strengthening, balance, and aerobics, we can have an impact on our students’ health, social life, and leisure skills. Encouraging and teaching our students about physical activity in the classroom can have long lasting effects and provide them many opportunities that they may be denied simply due to a lack of skill. With all the challenges that our students face in their lives, this is one that we, as special educators, can help them overcome.
Chapter 5: Discussion

In this dissertation project, I examined ways to increase physical activity in people with severe to profound intellectual disabilities (ID). In chapter 2, I reviewed the published literature on physical activities for people with ID. In chapter 3, I extended the literature by evaluating the effects of a simultaneous prompting procedure faded to a least-to-most prompting procedure on the acquisition of physical activities for people with ID. In chapter 4, I used the findings from chapters 2 and 3 to develop a practitioner paper. In the remainder of this chapter, I will present my research aims and future directions.

In the research paper (Chapter 3), I described the effects of simultaneous and least-to-most prompting procedures on the acquisition of three physical activities in three adolescents with severe to profound ID. Although the intervention did not have a large impact on the acquisition of these skills, there were gains made throughout all of the participants’ behavior. If anything, this research demonstrated that additional supports, beyond prompting procedures, may be needed for people with severe to profound ID. It may be necessary for the trainer to develop stimulus control, as well as gain compliance from the students. If necessary, the students may need compliance training, and have behavior plans if they engage in challenging behavior, in order for them to better follow
the prompts given by the trainer. This may not be the case for every student but it is an important factor that contributed to the mixed results of this study.

In the future, I plan to continue working on this line of research. I will start by extending the study presented in Chapter 3 with added components of compliance training and training of general gross motor skills before moving into the simultaneous prompting intervention. By teaching participants using evidenced based practices to be compliant and systemically teaching the individual motor movements, there may be a possibility that chaining the movements into exercises would easier for the participants and the trainers. I expect that by adding these components, the prompting procedure presented in Chapter 3 will have a greater effect. Another method that may be effective in training students is precision teaching. By cultivating fluency of the behavior and teaching component skills, it may help the students learn the behaviors faster and maintain them over longer periods of time (Johnson & Street, 2013).

After optimizing how to train students with ID to engage in physical activity, the next study would attempt to assess their preference for multiple physical activities and then teach them how to engage in those activities for recreation and leisure. After reviewing the literature, I found a lack of studies that taught people with ID physical activities to use as a leisure activity. By teaching people to engage in preferred physical activities, this would allow people to have an alternative to other sedentary leisure activities (e.g., TV, video games). Once the activity is taught, it could be generalized to different environments, such as the home and community. Teaching people to engage in their preferred physical activities in different environments would help them overcome some of the barriers they face when trying to access opportunities to engage in physical
activities in the community. Future research may also investigate if there is a shift of preference as they learn how to engage in the physical activities. Researchers could examine if people with ID prefer physical activity over more sedentary behaviors after they are taught to engage in the physical activity.

Another avenue of research I am interested in pursuing is teaching people with ID how to participate in small and large games. Often games played on the playground (e.g., four square) require physical activity combined with social cues and rules. Extending the literature in this way allows for replication of the intervention to teach physical activity, and also adds new elements in the form of social skills teaching. By beginning with research on how to engage in single-person games without a team, this removes the social intricacies of a team, but allows for interaction with others. This line of research can have a direct and lasting impact for this population by allowing them to engage in recreational activities with their peers with and without disabilities. Additionally, by expanding this research to more complicated team sports (e.g., basketball, soccer), this would eliminate barriers that are present such as trainers not knowing how to teach sport skills to people with ID. Again, this would provide people with ID access to and experience of different types of physical activities. A study would be designed around teaching the physical topographies needed to engage in the sport, social skills training, and training on the rules of the game.

Finally, I would like to extend my research improving the fitness of people with ID by directly assessing the impact of the interventions presented above on specific health outcomes, such as BMI. This portion of my research could easily be added to any of the aforementioned study proposals or stand as a study itself. This study could consist
of training in fitness (i.e., physical activities that focus on learning the topography but also increasing the intensity over time) and training in nutrition. Furthermore, I would like to compare different intensities of physical activity to find what the optimal intensity is to reduce challenging behaviors and to have an impact on health outcomes. My ultimate goal is to develop a line of research that promotes physical activity for this population so that people with ID have more opportunities to engage in physical activities in their homes, schools, and communities. By extending this area of the literature for this population, it allows practitioners to figure out the most effective way to increase physical activities and help them overcome barriers that they may experience. I hope this research also has an impact on people with ID by allowing them to experience new activities that they can engage in with their friends and families.
Asterisks indicate the article was included in the Chapter 2 literature review.


References


