

Evaluating the Effectiveness of Group Oriented Interventions on
Physical Activity for College Age Students with Intellectual and
Developmental Disabilities (I/DD)

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Dedication

To Phyllis and Eleanor for introducing me to the beautiful world of diverse individuals at

Park Lawn

And to Freddy, for expecting the best from your children and grandchildren, not because
you demanded it, but because you knew we were worthy of it.

Acknowledgements

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Abstract

Engagement in physical activity can provide holistic social and health benefits for individuals with and without disabilities at all age levels. Individuals with intellectual and developmental disabilities report having limited social networks outside of immediate caregivers and family members as well as less involvement in community recreational activities. Also, this population has been identified as having increased health issues such as obesity, heart disease, and diabetes due to a more sedentary lifestyle. The purpose of this dissertation was to evaluate the use of group oriented interventions for college age students with intellectual and developmental disabilities (I/DD) to increase physical activity. Chapter I of this dissertation includes a discussion on of the benefits and barriers of engagement in physical activity for individuals with disabilities as well as effective practices to increase their social inclusion within society. Chapter II and III are comprised of two different single subject research designs implemented in a post-secondary education program (PSE) for college age students with I/DD to increase their level of physical activity. The first study applied a randomized interdependent group contingency and the second study analyzed the use of peer reinforcement through social media (Facebook) to increase physical activity. A discussion of the results from each study and the relevance of these results to the current literature is included in chapter IV of this dissertation.

The results from these two studies were mixed between group performance and the individual outcome of each participant. A social validity questionnaire was included in both studies, which contributed supplemental findings to these two studies. Information

included in this dissertation can be applied to further research that explores current barriers and inclusive practices for individuals of all ages with disabilities to pursue a healthier lifestyle.

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Chapter 1: Understanding the Benefits and Barriers to Physical Activity for Individuals with Disabilities

Problem Statement

Although there is growing research on the positive benefits of physical activity, individuals with intellectual, developmental, and physical disabilities are still reporting to be less physically active than their peers (Frey, Temple, & Stanish, 2017; Kosma, Cardinal, & Rintala, 2002; Sorenson & Zarrett, 2014; Srinivasan, Pescatello, & Bhat, 2014). Approximately 9.6% of adults with disabilities meet the recommended physical activity of 150 minutes of combined aerobic and strength building exercises per week in comparison to 23.6% of their peers without diagnosed disabilities (Office of Disease Prevention and Health Promotion, 2015). The Center for Disease Control and Prevention (CDC, 2016) reports that children with disabilities are 38% more obese than their peers without disabilities and adults with disabilities are three times more likely than their peers to have heart disease, a stroke, or diabetes. Physical activity for individuals with disabilities has been linked to positive long-term overall health outcomes and increased community participation, but this population faces many barriers to inclusion in community programs, events, and resources (Crawford, Hollingsworth, Morgan, & Gray, 2008; Murphy & Carbone, 2008; Srinivasan et al., 2014).

Organization of this Dissertation

This dissertation is divided into four chapters that includes two different studies examining the effectiveness of group interventions on physical activity for college age students with intellectual and developmental disabilities (I/DD). Chapter 1 of this

dissertation provides a theoretical framework that supports the construct of creating inclusive community environments that motivates individuals with disabilities to engage in more recreational physical activity. This chapter also discusses the benefits and barriers to physical activity, especially in the content of community participation and social inclusion. Chapter 2 includes the first of two studies that were conducted using a single-subject research design to evaluate the effects of group contingencies on physical activity for college-age students with I/DD. In the first study, the independent variable was a randomized interdependent group contingency using tangible rewards as reinforcements. The second study, included in chapter 3 examined the effects of peer support using social media on physical activity for college age students with I/DD. Chapter 4 of this dissertation includes a general discussion of the effectiveness of group interventions on physical activity for college age students with I/DD, the results from both studies, the social validity of measuring physical activity with wearable technology, limitations of both studies, and the implications for future research.

Purpose

The purpose of this dissertation was to examine the effectiveness of two different group interventions to increase physical activity for college students with I/DD. The first intervention implemented was an interdependent group contingency using randomized tangible rewards and second study analyzed the use of peer support through social media platform to increase physical activity.

Study 1. The purpose of this study was to evaluate the effect of a randomized interdependent group contingency using tangible reinforcements on the physical activity

level of college-age students in a post-secondary education (PSE) program for individuals with I/DD. A withdrawal single subject research design was used to analyze a functional relation between a randomized interdependent group contingency and duration of engagement in physical activity. Specific research questions included:

1. What are the effects of a randomized interdependent group contingency intervention using tangible reinforcements on physical activity of college students with I/DD?
2. What is the social validity of using interdependent group contingencies with tangible reinforcements for change in physical activity level for college ages students with I/DD?

Study 2. The purpose of this study was to evaluate the use of peer support using a social media platform to increase physical activity for college-age students in a PSE program with I/DD. An ABAB single subject research design was used to analyze a functional relation between peer support and the duration of engagement in physical activity. Specific research questions include:

1. What are the effects of using peer support through social media on increasing physical activity for college age students with I/DD?
2. What is the social validity of using peer support through social media to increase physical activity for college age students with I/DD?

Theoretical Framework

Advocates for disability rights visionary pursuits have been breaking down social-political barriers that obstruct access to full and effective inclusionary practices in society

for individuals with disabilities for decades. These actions have promoted respect of individual differences and acceptance for all citizens. The deinstitutionalization movement is one of the larger parts of a more complex socio-cultural jigsaw puzzle that had aimed to create more opportunities incrementally for individuals with disabilities within their communities (Neely-Barnes & Elswick, 2016; Thorn, Pittman, Myers, & Slaughter, 2009). Historical special education legislation and civil rights court cases have brought a change to segregation in society improving inclusionary practices for individuals with disabilities in the realm of physical representation in education, work environments, and community living, but individuals with disabilities are still facing barriers to social inclusion within their communities (Abbott & McConkey, 2006; Amado, Stancliffe, McCarron, & McCallion, 2013; Power, 2013; Sundar, Brucker, Pollack, & Chang, 2016; van Asselt-Goverts, Embregts, & Hendriks, 2013).

Introduction

Self-determination and social cognitive theories emerged during the 1960s with both theories supporting the belief that individuals are their own agentic player in their life roles. These theories maintained the idea that individuals are intrinsically motivated by values, learned experiences, and interactions with others within their social and cultural environments. The self-determination theory (SDT) roots trace back to the *Principle of Normalization* developed in Scandinavia and circulated through the writings of Nirge, Peske, and Wolfensberger during the 1970s. Their writings added to a shift in cultural change in the world of disabilities advocating for the creation of conditions that allow for a person with a disability to experience the respect that any human being is

entitled in all aspects of community and social life (Neely-Barnes & Elswick, 2016; Ward, 2005; Wehmeyer, 1998). Ryan and Deci (2002) further built on the concept of self-determination as defining autonomy, competence, and relatedness as fundamental to an individual's psychological well-being and vital human functioning. In social cognitive theory (SCT), Bandura (1999) posited that learning experiences are reciprocal relationships between the person, behavior, and environment. Increase in community inclusion through a focus on physical recreational opportunities for individuals with disabilities resonates the undertone of both theories. These opportunities can provide the essence behind creating social environments for all community members to share experiences that motivate individuals to explore different aspects of their local communities and further lead to the creation of new relationships.

Social Inclusion

Bandura (2001) indicated that individuals should not live their lives in isolation, but achieve personal goals that bring meaning to life through socially dependent efforts. Life goals and aspirations are achieved through social environments that support individual and collective autonomy, contributing to active performance for personal development and discovery (Bandura, 2001; Deci & Ryan, 2008). Participation in physical activities has social, emotional, and physical benefits that can develop new relationships within the community, increasing opportunities for social inclusion for individuals through shared experiences and interests (Deci & Ryan, 2008; Taheri, Perry, & Minnes, 2016). Social inclusion incorporates building interpersonal relationships through community involvement, fair access to community-based resources, a sense of

belonging to a group or a broader social network, and participation in different societal arenas, areas, and activities (Abbott & McConkey, 2006; Cobigo, Ouellette-Kuntz, Lysaght, & Martin, 2012; Hall, 2009; Hastbacka, Nygard, & Nyqvist, 2016; Simplican, Leader, Kosciulek, & Leahy, 2015). Social structures are created by human activity and these structures can impose constraints for some or opportunities for all by providing resources and equal access to further individual's personal development (Bandura, 2001; Dagnan & Waring, 2004; Ryan & Deci, 2002). Ryan and Deci (2000) indicated that people are inherently curious, vital, self-motivated, and inspired to learn, identifying social contexts or environments as the catalyst to foster positive human behavior. In SCT, Bandura (2001) states that people are producers as well as products of the environment they cultivate. Human action can bring positive change to inclusionary practices in community activities and social culture by understanding, addressing, and finding solutions of current barriers to social inclusion for individuals with disabilities.

Self-determination Theory

Through their writings, Wolfensberger, Nirje, Olshansky, Perske, and Roos (1972) expressed the fundamental right for individuals with disabilities to have control over their own lives and destinies. They believed that all members of society should be given opportunities to develop skills in choice making, self-advocacy, self-efficacy, self-regulation, and autonomy to prepare for life's unexpected moments and encourage all to be dignified risk takers as full standing members with in their communities (Wolfensberger et al., 1972). Educators and advocates for people with disabilities still use these original principles to empower individuals to be more self-determined in

controlling their lives and destinies (Wehmeyer, 1998). Physical activity and recreational sports can be one of many gateways to increased social inclusion for individuals with disabilities within their communities by giving opportunities to experience autonomy, competence, and relatedness, building on intrinsic motivation to achieve personal goals in health and well-being.

In 1941, Angryl described the essentialism of autonomy in all living organisms is to govern behaviors from inside interacting with in a heteronomous environment governed by external laws (Wehmeyer, 1998). Deci and Ryan (2008) further built on this notion with defining autonomy, relatedness, and competency as three basic human needs that are essential concepts in self-determination that move people from passive to active, indolent to constructive in their personal social-contexts (Deci & Ryan, 2008; Ryan & Deci, 2000). Their continuous research over the decades analyzed the interdependent relationship of these three basic needs with intrinsic and extrinsic motivation influencing a person's vitality and well-being cultivated in culture and social environments. Self-determination skills in individuals with disabilities have been correlated positively to quality of life, employment opportunities, recreation, leisure activities, and independent living, which are beneficial factors adding to a more inclusive society (Lachapella et al. 2005; Wehmeyer, Palmer, Shogren, Williams-Diehm, & Soukup, 2013). Providing more opportunities for individuals with disabilities to be active and constructive causal agents in society can be the catalyst within and between diversity of people that contributes to the personal growth of an individual and community.

Autonomy

Autonomy is the expression of the self, originating from one's own perception, coalescing individualized interest and values bestowed on a person by environmental experiences resulting in personal behaviors (Ryan & Deci, 2002). An autonomous individual's actions are self-regulated through identification of a conscious value system that leads to the development of personal goals and motivating behavior, which can be individualized or collective (Ryan & Deci, 2000; Ryan & Deci, 2002). A person's level of autonomy can be a predicting component for active engagement in physical activity factoring in affiliation with others, challenges set forth, and opportunities for social engagement (Ryan & Deci, 2002; Teixeira, Carraça, Markland, Silva, & Ryan, 2012). A supportive community with equal opportunities for individuals with disabilities to participate in physical recreational programs has potential to set a precedence of a collective, active, integrated society leading the way for more social inclusionary practices.

Competence

Ryan and Deci (2002) defined competence as feeling effective in one's ongoing interactions within the social environment, which is reinforced when individuals are given opportunities to express their personal capabilities. Social-context can have a detrimental or affirmative effect on an individual's competency, reflecting their personal image with reactions from others (Ryan & Deci, 2002). Increased opportunities for physical activity and community based recreational programs can contribute to the self-worth of an individual with disabilities through building up their physical strength,

endurance, self-esteem, self-efficacy, and competency (CDC, 2016; Guthrie, 1999; Kosman et al., 2002; Teixeira et al., 2012). An individual's sense of self-worth and competency within their community can lead to seeking out challenges, setting, and achieving goals that break through disability stereotypes and create a common bond between all community members (Cobigo et al., 2012; McConkey, Dowling, Hassan, & Menke, 2013; Simplican et al., 2015).

Relatedness

Relatedness is a tendency in life to feel connected to others, a community, basic sense of belonging, and acceptance (Ryan & Deci, 2002). Ryan and Deci (2000) indicated that the integrated nature of society can ascend the distress and disruption caused by lack of connectedness. Through the perception of personal connection with others, a positive environment for inclusive, competitive sports opportunities for individuals with disabilities can be created in communities (Teixeira et al., 2012). When the social climate provides support for autonomy through relatedness with people who share common goals and values, self-determination aspires through the positive experiences in the community.

Intrinsic and Extrinsic Motivation

SDT is an empirically-based theory used to describe the role of the environment and other predicting factors that contribute to intrinsic motivation guiding human behavior in personal development, wellness, and performance-based outcomes (Deci & Ryan, 2008). Ryan and Deci (2000) defined intrinsic motivation as “the inherent tendency to seek out novelty and challenges” that are satisfying and free of separable

consequences in comparison to extrinsic motivation, describing activity performed for instrumental value. This theory hypothesizes that intrinsically motivated people act because they are energized by curiosity and the fun aspects of a challenge. The theory also suggests that a person can initially feel externally propelled into action (extrinsic motivation) and later adopt this choice of action with volition (Ryan & Deci, 2000). An individual may not initially be motivated or have the resources to start the process towards becoming more physically active, but with a supportive community network and positive social experiences, the person can feel intrinsically motivated to engage in physical activity. Social inclusion and acceptance of individuals with disabilities within community recreational activities is a critical motivating factor in supporting sustained physical activity and participation in recreational sports (Heath et al., 2012; Teixeira et al., 2012). These experiences can establish a sense of self-worth and facilitate the natural process of self-motivation towards healthy development, adding to intrinsic motivation, self-regulation, and ultimately the well-being of the individual and community (Ryan & Deci, 2000).

Mini-Theories of SDT

Over the last 30 years, SDT has been broken down into four mini-theories: cognitive evaluation theory, organismic integration theory, causality orientation theory, and basic needs theory. These theories individually are composed of concepts developed through research to examine the effects of social environments on self-motivation and well-being across diverse settings, domains, and cultures (Ryan & Deci, 2002). Essences

of the individual theories are linked through the basic elements of the SDT framework: autonomy, competence, and relatedness.

The first of the mini-theories, cognitive evaluation theory, relates to the balance of extrinsic motivation and intrinsic motivation on the level of autonomy that drives a person's behavior within a social context. When people feel a sense of autonomy with respect to activity, they perceive themselves as competent within the social contexts (Deci & Ryan, 1985). In the cognitive evaluation theory, Deci and Ryan (2008) classified levels of intrinsic and extrinsic motivation as autonomous and controlled motivation stating that a combination of these types of motivation energizes and directs behavior.

The organismic integration theory posits that individuals adopt the values and morals of their social group and attend to supportive environments where social-context are motivating to their personal behavior (Ryan & Deci, 2002). Individuals will internalize the values of their group or culture, interplaying with extrinsic and intrinsic motivation. This combination of values and cultural influence plays a large role in persistence and performance in physical activity (Williams, Niemiec, Patrick, Ryan, & Deci, 2009).

The third theory in this series is the causality orientation theory, which addresses an individual's level of autonomy, motivation, and ability to initiate action in relations to a particular situation or social context (Ryan & Deci, 2002). In this theory, Ryan and Deci (2002) state that people view events as informational with opportunities to seek, create, and evaluate future actions based on their level of self-efficacy. This theory

explains how a person's perceived locus of control interacts with autonomy and competency (Deci & Ryan, 1975).

Basic needs theory is the last of the mini theories focusing on the role that cultural values play in relations to motivation and goals in the attainment of health and well-being. Deci and Ryan (2008) asserted that the fundamental concepts of autonomy, competency, and relatedness need to be satisfied for psychological well-being. Different cultures will foster individualized autonomy, where other cultures will have socio-structures that are centered on a collective autonomous society. Within these different cultures, there should be opportunities for all individuals to be motivated in reaching their full potential and securing competence through relationships formed in inclusive societies.

These four mini-theories incorporate the essential concepts that address the role of the social environment on an individual's autonomy, perceived competence, and motivation. The theories have underlying messages that can support all people to activate their inherent curiosity in exploring their community and motivate individuals to strive to learn new activities and master new skills. Socially inclusive and supportive environments can create fortuitous connections between community members of diverse experiences and backgrounds with similar interests and values (Perreault & Vallaerand, 2007; Ryan & Deci, 2000). Opportunities for individuals with disabilities to engage in more physical activities and recreational sports within their communities can lead to personal development for all members of the community and foster these relationships.

Social Cognitive Theory

SCT rests on the premise that people are agentic operators in their life course orchestrated by environmental events (Bandura, 1999). The person, behavior, and environment interact in a reciprocal relationship that creates opportunities in a social arena through a cognitive schematic processing (Bandura, 1999). The dynamic interplay of these opportunities lead to personal and situational influences that are motivating factors for individuals to pursue experiences that build their social, physical, and cognitive realms (Bandura, 1999).

Bandura (2001) expressed, that for individuals to successfully maneuver through the complex world full of challenges and hazards, agentic individuals need to be able to be fore-thinkers using insight into their own personal self-efficacy, setting goals centered on anticipation of future events, and evaluating course of action, giving shape to their life's destiny. These factors are the contributing motivators that shape behavior to achieve desired outcomes seizing on socio-structural opportunities and defying predetermined biological or environmental constraints. Bandura expanded the SCT of human agency to a collective agency acting on a common belief influencing communal, cognitive, affective, and biological events that shape behavioral patterns and create an environment's culture.

Person

Bandura (1999) described individuals as self-organizing, proactive, self-reflecting, and self-regulating, stating that these characteristics make up the agentic self in the socio-cognitive view. They set goals that are rooted in a value system guided by their personal

level of self-efficacy, intrinsically motivating behavior to employ strategies necessary in achieving health and fitness goals (Bandura, 1999, 2001; Clark & Zimmerman, 2014). In the context of SCT, Bandura developed three underlying models of agency: direct personal, proxy, and a collective agency. A collective agent or social network forms through melding diverse self-interest of agentic individuals towards a common goal developing through proxy with others that share similar interest (Bandura, 2001). As individuals discover their strengths through physical activity and socially inclusive communal recreational experiences, their self-efficacy can fortify an interdependent collective efficacy. The personal, proxy, and collective agents can make a proactive commitment to develop goals centered around change in societal barriers that individuals with disabilities face when trying to access more opportunities for physical fitness and recreation.

Behavior

Bandura (2001) expressed that pursuing an active life style can produce fortuitous events that make chance meetings happen between individuals with similar interests, but different backgrounds. Research has indicated that physical activity contributes to a wider range of work place opportunities, functional independence, community participation, and change in lifestyle habits for individuals with disabilities adding to opportunities to form new friendships and community relationships (Crawford et al., 2008; Murphy & Carbone, 2008; Srinivasan et al., 2014; Taheri et al., 2016). Physical activity also has been related to an increase in self-esteem, self-confidence, self-control, empowerment, strength, and endurance for individuals with disabilities. These positive

changes challenge disability stereotypes and contribute to the process of changing discriminating attitudes in society (CDC, 2016; Guthrie, 1999; Kosman et al., 2002). Based on the concepts in SCT, behavioral change in health and fitness comes through social modeling, supports, and feedback (Wallace, Buckworth, Kirby, & Sherman, 2000). Through social inclusion in more community experiences with supportive environments, a person can identify their strengths and limitations, building on their self-efficacy that guides them to develop fitness goals and regulate their behavior to create personal change in health, fitness, and social behavior (Bandura, 2001; Clarke & Zimmerman, 2014; Martin, McCaughy, Flory, Murphy, & Wisdom, 2011).

Environment

Discriminating attitudes in society, a lack of knowledge or information of resources, lack of social networks, and inaccessible environments are some of the identified barriers for individuals with disabilities for social inclusion in their communities (Abbott & McConkey, 2006; Hastbacka et al., 2016; Murphy & Carbone, 2008; van Asselt-Goverts et al., 2013). People evoke different reactions from social environments by their physical characteristics even before they do anything dependent on their socially-conferred roles, circumstances, and biological condition (Bandura, 1999). Misconceptions and attitudinal barriers of individuals with disabilities can be changed through social inclusion and access to community recreational events, offering equal opportunities to achieve mental and physical health (Murphy & Carbone, 2008). Human action is socially situated and can be motivated through activities, associates, social culture, and social networks that lead individuals pass perceived imposed constraints in

society to setting goals across life domains (Bandura, 1999). An individual with a disability perception of their physical ability and social circumstances can be positively developed through more supportive opportunities in community recreational activities, adaptive sports programs, and accessible resources in communities.

Social Cognitive Theory and Self-determination Theory

Nirje (1972) stated it is difficult to assert oneself into a social network especially for someone who has disabilities or is perceived as devalued in society (Wolfensberger et al., 1972). Nirje and his colleagues advocated for a wide range of action to empower individuals with disabilities with information to become choice makers across different life domains and full participants as decision makers and problem solvers, agentic players in change (Wehmeyer, 1998). Intrinsically motivated agentic selves produce change in their lives, adapt their behaviors to achieve goals, and are influenced by life experiences, which contributes to personal self-development (Bandura, 1999; Deci & Ryan, 2008; Wehmeyer, 2015). Bandura (2001) stated the capacity to exercise control over the nature and quality of one's life is the essence of humanness and is formed through experience and functional consciousness that puts meaning and purpose to life's pursuits. Societal events operate as interacting determinants to invite individuals into a broader network of people who have a hand in promoting continuity in strong communal ethics, creating beneficial social milieus that further welfare of the community (Bandura, 1999; Deci & Ryan, 1985). The underlying constructs in SCT and SDT support the concepts that building on a person's self-efficacy and a community's collective efficacy can lead to the

obstruction of socio-structural barriers and the creation of vested interests that value all individuals within a community.

In the world of disabilities, self-determination has been distinguished as an innate right with internal motivation that is shaped by an individual's values, learned experiences, and life opportunities (Wehmeyer, 1998). Communities around the world offer an array of outdoor and indoor physical activities that bring people together sharing a common social interest. Environmental issues, limited access, lack of information, and resources to support these social events for individuals with disabilities are initial barriers that can be addressed with in local communities through community-wide networking, policies, and planning that can lead to an increase in social inclusion (Heath et al., 2012). The overall health benefits received from active engagement in physical activity for individuals with disabilities can be natural solutions to disrupting the societal barriers that exist towards social inclusion.

Benefits of Physical Activity

The benefits of physical activity are universal for all individuals with and without disabilities (Murphy & Carbone, 2008). Physical activity is essential for providing individuals with opportunities to build endurance, muscle strength, flexibility, motor skills, and overall physical fitness (Blick, Saad, Goreczny, Roman, & Sorensen, 2015; CDC, 2016; Crawford et al., 2008; Guthrie, 1999; Kosman et al., 2002; Murphy & Carbone, 2008). Increased engagement in physical activity has been associated with improving self-esteem and self-efficacy, while decreasing anxiety, depression, and health conditions related to weight gain (Blick et al., 2015; CDC, 2016; Crawford et al., 2008;

Guthrie, 1999; Kosman et al., 2002). Positive change in social, cognitive, and motor functions have been observed in physically active individuals with autism spectrum disorder (ASD), especially when given opportunities to socialize with peers in community events (Lang, et al., 2010; Menear & Neumeier, 2015; Sorensen & Zarrett, 2014; Srinivasan et al., 2014).

Individuals with disabilities who were routinely physically active reported higher levels of community participation, travel, greater choice in activities, higher rates of employment, functional independence, engagement in social, and civic activities compared to their peers who were less physically active (Blick et al., 2015; Crawford et al., 2008). Also, participation in physical activities has resulted in building friendships and community relationships, enriching overall social and emotional well-being (Blick et al., 2015; James, Shing, Mortenso, Mattie, & Boriosoff, 2017; Taheri et al., 2016; Wilson, Jaques, Johnson, & Brotheron, 2017). Participation of children with disabilities in sports and recreational activities similarly has been reported to encourage inclusionary practices that optimize children's physical fitness and challenges disability stereotyping (Murphy & Carbone, 2008). Despite these findings, individuals with disabilities, especially children, encounter more restrictive access to environments considered essential to health and development than their peers due to biological, environmental, and institutional constraints (Abbott & McConkey, 2006; Cobigo et al., 2012; Murphy & Carbone, 2008; Stephens et al., 2017).

Barriers to Physical Activity

Some factors that can contribute to limited access to recreational activities for children and adolescents with disabilities include impairments in social, motor, communication, and sensory abilities and factors such as cognitive inflexibility, behavior problems, and weakness in muscular and skeletal structures (Frey et al., 2017; Golubovic, Maksimovic, Golubovic, & Glumbic, 2012; Guidetti, Gallotta, Emerenziani, & Baldari, 2010; Memari et al., 2017; Merrells, Buchanan, & Waters, 2017; Sorensen & Zarrett, 2014; Srinivasan et al., 2014). Apprehension on the part of caregivers also has played a role in children with disabilities not accessing community recreational programs with their peers (Blick et al., 2015; Stanish et al., 2015). These caregivers have recounted being wary of negative social repercussions for their children and concern of their child being vulnerable when exploring their communities (Blick et al., 2015). Other factors that have been identified as barriers for individuals with disabilities in pursuing an active lifestyle across all age groups are financial, health, discriminating attitudes, motivation, limited social networks, transportation, inaccessible environments, and lack of resources or information, (Abbott & McConkey, 2006; Blanck, 2016; Blick et al., 2015; Frey et al., 2017; Hall, 2017; Hastbacka et al., 2016; Jespersen et al., 2018; Murphy & Carbone, 2008; van Asselt-Goverts et al., 2013). Health professionals, non-profit, and advocacy organizations have also reported difficulty in managing the abundant availability of information on existing programs and services in an accessible form (e.g. website, central coalition hub) to disseminate to families and organize this information to meet the needs of their communities (Rimmer, Vanderbom, & Graham, 2016). Understanding the

benefits of physical activity and focusing on sustainable behaviors that improve outcomes in healthy living for individuals with disabilities can be a proactive goal for a community to address barriers that contribute to the gap in health disparities for these individuals compared to their peers (Blick et al., 2015).

Inclusion

Bigby (2012) stated that when people with disabilities are segregated from involvement in community activities, their social roles are diminished. Inclusion and participation in everyday community activities is essential to a person's development and quality of life (Hall, 2017; Jespersen et al., 2018; King et al., 2003; Simpican et al., 2015). Historically, individuals with disabilities were segregated from society with placement in institutions, residential facilities, and separate day schools with no real focus on integration into the community, which contributed to discriminating attitudes towards individuals with disabilities (Thorn et al., 2009). Advocacy in the realm of disability rights led to legislation that began to break down some barriers of segregation for individuals with disabilities, initially by developing inclusionary practices that changed public presence, participation, and integration in the community (Power, 2013; Thorn, et al., 2009). After de-institutionalization of residential facilities, people with disabilities were physically living and working in their communities, but were not experiencing a sense of belonging or building meaningful relationships within their communities (Amado et al., 2013). Inclusionary practices for individuals with disabilities have increased in the form of physical representation in the work place, education, and community living, but there is still a gap in social inclusion within communities for

individuals with disabilities to build relationships beyond their direct caregivers (Abbott & McConkey, 2006; Amado et al. 2013; Power, 2013; Sundar et al., 2016; van Asselt-Goverts et al., 2013).

Social Inclusion

Social inclusion has been defined as building interpersonal relationships through community involvement, participation in different societal activities, fair access to community-based resources, a sense of belonging to a group, and a broader social network (Abbott and McConkey, 2006; Cobigo et al.; 2012; Hall, 2009; Hastbacka et al. 2016; Simplican et al., 2015). Social inclusion is a right and benefit for all individuals within a community that happens through increased opportunities to interact with each other through interplay between group and individual social roles that creates a common bond, identity, and shared value system (Cobigo et al., 2012; McConkey et al., 2013; Simplican et al., 2015; Wilson et al., 2017). Social inclusion has been described as an essential dimension of human functioning that promotes happiness, self-esteem, confidence, financial well-being, and mental health for individuals with disabilities (Buntinx & Schalock, 2010; Cobigo et al., 2012; King et al., 2003). Also, research indicates that being embedded in close quality relationships and feeling socially connected to people is associated with a decreased risk for disease related to early mortality (Holt-Lunstad, Robles, & Sbarra, 2017). Social inclusion leads to an increase in independent living, employment, civic activities, economic participation, access to health care, and direct contribution to society for individuals with disabilities (Hall, 2009; Hastabacka et al., 2016; Power, 2013; Simplican et al., 2015). Hastabacka and

colleagues (2016) spoke of the essence of social inclusion combating poverty and welfare issues for individuals with disabilities by providing supported opportunities to create economic equality to be active consumers within their communities. Community inclusion has been described by individuals with disabilities as involving more than being placed within an environment; it includes fitting within a specified place or role and being social accepted (Abbott & McConkey, 2006; Jessup, Bundy, Hancock, & Broom, 2018; Simplican et al., 2015). Identifying accessibility barriers to community activity is a prerequisite before social inclusion can happen, which can be productively facilitated by involving the input of individuals with disabilities to deepen the understanding of current issues (Jespersen et al., 2018; Kramer, Mermelstein, Balcells, & Liljenquist, 2012; Stephens et al., 2017).

Inclusionary Practices in the Community

The International Convention on the Rights of Persons with Disabilities (2007) calls for full and effective inclusionary practices in society with respect for differences and acceptance of individuals with disabilities. Stephens et al. (2017) stated that cumulative effect of inaccessible places such as rental homes, local parks, and businesses are not only physically debilitating, but are socially marginalizing for individuals to be confronted by multiple messages that they do not belong in places designed for people without disabilities. A change in accessibility and inclusion in society can begin through social networking that joins together knowledgeable members of the community to identify current barriers and resources that can act as solutions to these barriers (Power, 2013; Simplican et al., 2015). Urban and rural communities will encounter different

challenges in finding ways to foster and develop opportunities to strengthen social inclusion due to issues in infrastructure, resources, and supports (Heath et al., 2012). The socio-political climate of a community may also play a role in facilitating or hindering the progress of a community in developing supportive inclusionary practices for all community members (Simplican et al., 2015). Despite different challenges that communities may seemingly face, every community has the resources to create recreational programs that can provide social inclusion for individuals with disabilities through promoting inclusive opportunities for physical activity (Neumeier, Grosso, & Rimmer, 2017). Community recreational programs can facilitate a supportive culture for individuals with disabilities to flourish in physical and social domains through providing quality and quantity of participation in activities (Frey et al., 2017; Merrells et al., 2017). These programs can begin to break down discriminating attitudes within the community by creating experiences for interactions between community members of different backgrounds.

Rimmer et al. (2016) found that social engagement for individuals with disabilities with other community members in physical activity increased enjoyment, motivation, and improved long term commitment to physical activity. Increased collaboration among municipalities, children treatment centers, community agencies, school boards, educators, parents, and youth is integral in developing sustainable opportunities for physical activity (Gorter, Galuppi, Gulko, Wright, & Godkin, 2017; Neumeier et al., 2017; Stanish et al., 2015). Finding the balance in communities between offering specialized programs (e.g. Special Olympics) along with integrated opportunities (e.g. YMCA) can be developed

through the process of dialogue based on the collective knowledge amongst trained specialists working closely with the target population to form a coalition of informed decision planners at the community level (Rimmer et al., 2016). Through this coalition, Rimmer et al. (2016) suggested developing a gap analysis to evaluate accessibility issues and positive inclusionary practices at the community level discussing local facilities, trained fitness providers, inclusive health media communication, transportation, and other topics specific to each community. The gap analysis could be conducted through surveys, focus groups, public meetings, direct observations, and interviews with stakeholders to address proposed changes to community infrastructure that could develop long-term sustainable health improvements for the community (Amado et al., 2013; Gorter et al., 2017; Heller, Hsieh, & Rimmer, 2004; Neumeier et al., 2017; Rimmer et al., 2016; Wilson et al., 2017). The input from individuals with disabilities in this process will be the key to effective health promotion research in identifying the barriers to physical activity and social inclusion that can lead to the development of policy and supportive legislation towards a healthy, inclusive community (Abbott & McConkey, 2006; Curtin et al., 2016; Hall, 2017; Kramer et al., 2012).

Inclusionary Practices in Education

Community inclusion can be embedded in children's learning at a young age by introducing curriculum that addresses inclusion at the preschool and elementary level (Amado et al., 2013). Accessible lessons, pedagogy, and accommodating environments that support meaningful participation for all have been identified by students with disabilities as practices that can increase social inclusion within the school building

(Amado et al., 2013; Jessup et al., 2018; Kramer et al., 2012). Empowering children at a young age with skills to identify environmental barriers and being part of the conversation to create solutions to these barriers will help create awareness for universal supports towards inclusion (Jessup et al., 2018; Kramer et al., 2012). Youth involvement in decisions about accommodations and quality of service will assist professionals in being more attuned in their direction towards policy making (Hall, 2017; Jessup et al., 2018; Kramer et al., 2012). Teaching students community skills such as public transportation, money management, problem solving, and interpersonal communication will assist young adults with independently accessing their communities and increasing their opportunities for social interactions (Abbott & McConkey, 2006; Amado et al., 2013; Blick et al., 2015; Cobigo et al., 2012; Hall, 2017; Wilson et al., 2017). Also, building social connectedness goals into students' educational and transition plans can contribute to the student's repertoire of skills to increase their social inclusion in their postsecondary independent living, education, work, and community experiences (Abbott and McConkey, 2006; Amado, et al., 2013; Blick et al., 2015; Cobigo et al.; Hall, 2017; Wilson et al., 2017).

Inclusion in Physical Activity for School Age Students

Inclusionary practices for individuals with disabilities in community physical activity can begin at an early age by encouraging students to recognize their strengths, removing any discouraging dialogue, promoting a combined effort for all children in physical activity through appropriate programs, support, and equipment (Blick et al., 2015; Frey et al., 2017; Holt-Lunstad et al., 2017; Jessup et al., 2018; Murphy &

Carbone, 2008; Stanish et al., 2015; Thorn et al., 2009). In their research, Heller et al. (2004) found that age appropriate health education promotion programs based on the social learning model and delivered at the cognitive level of the participants helped develop a more positive perception of the benefits of physical activity for individuals with disabilities. They went on to identify individualized instruction, peer centered groups, and positive feedback as important components to developing self-efficacy in students. Healthy Weight Research Network, Health Matters Program, and Health U Curriculum are some examples of programs developed to teach healthy living habits to school-age students with intellectual and developmental disabilities (Neumeier et al., 2017).

In addition to classroom curriculum, a coalition of health care professionals can disseminate information to caregivers about the physical, mental, and long term risk factors associated with inactivity and benefits associated with physical activity; applying knowledge to behavior change that can promote healthy lifestyles for individuals with disabilities (Frey et al., 2017; Neumerier et al., 2017; Rimmer et al., 2016). Also, health care professionals can work with families in exploring opportunities and programs in their community for physical activity, which may help alleviate some initial hesitations that parents might experience about community recreational programs. Furthermore, they can work with educators to assist students with disabilities to be more active by promoting participation in community sports and recreational programs in the least restrictive environments with supports and accommodations (Amado et al., 2013; Cobigo et al., 2012; Hall, 2017; Murphy & Carbone, 2008). Siperstein, Glick, and Parker (2009)

found that including students with disabilities alongside of their non-disabled peers in inclusive recreational sports fostered social inclusion forming positive social relationships while participating equally and having fun supporting each other towards a common goal.

Social Groups for Individuals with Disabilities

A community-wide inclusive health and fitness concept can initially be developed as a social group program specifically geared towards individuals with disabilities that progresses towards quality relationships for all individuals involved in this program, including support staff and volunteers. Individuals with I/DD have reported having few friends outside of their disability service users, family members, and paid staff (Amado et al., 2013; Wilson et al., 2017). Wilson and colleagues (2017) found that social groups specifically designed for individuals with disabilities that incorporated community outings resulted in social connectedness for individuals by participating in different activities of choice and interest. Their research described the benefits of opportunities for indoor and outdoor activities such as nature walks, visiting different museums, joining a fitness center, or walks around a neighborhood, which are some of the conveniences available across different communities. Participants in these groups reported enjoying company to speak with and stated that they would resort back to a sedentary lifestyle if the social group and activities were not available. The participants described a healthier and active lifestyle with an increase in their social network as they explored fairs, festivals, movies, and museums together. In their research, James et al. (2017) discovered that outdoor activities in natural settings was beneficial for overall health and

well-being through creating a positive experience with unique social opportunities for participants and volunteers in an adaptive hiking program. This experience gave the participants an opportunity to explore areas that were previously inaccessible and volunteers the opportunity to socially engage and share their passion for hiking with participants that were experiencing this nature hike for the first time. Participants involved in different indoor and outdoor activities and opportunities reported a greater feeling of independence with social connectedness experienced through shared explorations that countered previously felt loneliness (Wilson et al., 2017). Hall (2017) speaks to these experiences as a chance to try something for the first time, that springboards individuals into other new adventures and opportunities. Gorter et al. (2017) proposed for supportive activities for individuals with disabilities to be on the radar in all community discussion initiatives, recognizing that these programs are a place for people to form friendships and flourish in creating a social group through shared experiences and interests.

Conclusion

Increase in social inclusion and physical activity both lead to the same results: increased in community participation, greater choice in activities, higher rates of employment, functional independence, engagement in social and civic activities, happiness, self-esteem, self-confidence, financial well-being, mental health, opportunities to build friendships, community relationships, overall social and emotional well-being, interpersonal relationship, a sense of belonging to a group, and a broader social network. The development of constructive inclusionary community practices can begin to develop

the public space in which recognition of each community member happens through brief verbal and non-verbal exchanges, which Hall (2017) defined as an important aspect of social inclusion. Social inclusion leads to opportunities for individuals with disabilities to participate in the social, economic, and political life of society, which gives opportunities for equal representation of disabilities rights and issues across local communities.

Chapter 2: Study 1-Randomized Interdependent Group Contingency Using Tangible Rewards to Promote Physical Activity in College Age Students with I/DD

Children with disabilities are at a greater risk for childhood obesity with a trajectory of adult related health problems due to sedentary lifestyles (Blick et al., 2015; Healy, Haegele, Greneir, & Garcia, 2017; Memari & Ziae, 2014; Shin & Park, 2012; Srinivasan et al., 2014; Walls, Broder-Fingert, Feiberg, Drainoni, & Merritt, 2018). The Center for Disease Control and Prevention (CDC, 2016) reports that children with disabilities are 38% more obese than their peers without disabilities, which can lead to teasing from others, low self-esteem, isolation, and can have detrimental impacts on quality of life in physical, psychological, and social domains (Memari & Ziaee, 2014; Toscano, Carvalho, & Ferreira, 2018). The CDC (2016) recommends regular physical activity for individuals with disabilities to benefit from important overall health related outcomes such as cardio vascular fitness, muscle strength, mental health, balance, and increased daily functional independence. These findings and recommendations highlight the necessity to intervene with preventative techniques that have demonstrated to be effective for behavior change in children and adolescents (Foote et al., 2017).

Group Contingencies

Contingent reinforcement is an effective intervention to promote behavior change (Foote et al., 2017; Skinner, Cashell, & Dunn, 1996). It is an operant technique that can be applied to group-oriented contingency programs with access to the reinforcement being contingent on the behavior or performance of the group (Litlow & Pumroy, 1975). Group contingencies have been used as an effective intervention for causing change

across a broad spectrum of behaviors, settings, and grade levels (Alric, Bray, Kehle, Chafouleas, & Theodore, 2007; Foote et al, 2017; Gresham & Gresham, 1982; Kelshaw-Levering, Sterling-Turner, Henry, & Skinner, 2000; Hartman & Gresham, 2016; Hastie, van der Mars, Layne, & Wadsworth, 2012; Maggin, Pustejovsky, & Johnson, 2017; Popkin & Skinner, 2003).

There are three types of group contingency interventions: independent, dependent, and interdependent. Independent group contingencies are practiced and observed in classrooms and daily community settings. In independent group contingency programs, the same target behavior, criteria, and reinforcement are applied to the group, but applied on an individual basis (Kelshaw-Levering et al., 2000; Litlow & Pumroy, 1975; Little, Akin-Little, & O'Neil, 2015; Popkin & Skinner, 2003). The criterion for access to the reinforcement is the same for each person and is dependent on the individual's performance meeting the goal (e.g., grades for classroom work, pay checks for hours worked). Independent group contingencies provide reinforcement to members of the group who meet the criteria, but deny access to the reinforcement for individuals who do not meet the same criteria. This can be stigmatizing for students who repeatedly do not meet the set criteria in front of their peers (Campbell & Skinner, 2004; Kelshaw-Levering et al., 2000; Kuhl, Rudrud, Witts, & Schulze, 2015; Skinner et al., 1996). In dependent group contingencies, reinforcement for the group is based on the performance of an individual or selected members of the group meeting a criterion (Campbell & Skinner, 2004; Hartman & Greshman, 2016; Kuhl et. al., 2015; Litow & Pumroy, 1975; Popkin & Skinner, 2003). The direct desired consequence of a dependent group contingency is to

increase the behavior of an individual or selected few through peer support and a reinforcing contingency. This type of intervention can draw attention to the deficit areas of the targeted participant if their peers begin to monitor their behaviors (Skinner, Skinner, & Burton, 2009). This attention may add pressure to the participant(s) whose targeted behavior is expected to meet the set criteria (Kelshaw-Levering et al., 2000). The participant(s) may experience isolation by other group members if they do not achieve the set expectation, denying access for the group to the reinforcement (Litlow & Pumroy, 1975).

Interdependent Group Contingency

Interdependent group contingencies combine several aspects of dependent and independent group contingencies with removing some of the disadvantages of the other two interventions (Little et al., 2015). In interdependent group contingencies, all or none of the group members receive access to the reinforcement dependent on the group's performance in meeting the criterion (Campbell & Skinner, 2004; Hartman & Gresham, 2016; Kelshaw-Levering et al., 2000; Kuhl et al., 2015; Popkin & Skinner, 2003; Skinner et al., 2009). The contingency is in effect simultaneously for all members of the group and a cooperative group effort contributes to the achievement of meeting the criterion (Alric et al., 2007; Foote et al., 2017; Litlow & Pumroy, 1975; Little et al., 2015). Access to the reward is dependent upon each member's individual performance and behaviors of their peers (Alric et al., 2007; Little et al., 2015). The group's performance can be averaged between high, medium, and low achievers to account for the different abilities of the group, which may encourage individuals to do their best to contribute

towards the group goal (Skinner et al., 1996; Litlow & Pumroy, 1975). The total of the group's average is then used to determine if the group met the predetermined or randomly chosen criterion goal.

Some of the benefits associated with using an interdependent group contingency described in the literature are the supportive behaviors observed between participants with peer praise, shared excitement, and achievement that creates a collective motivation of the group working together towards a common goal (Kelshaw-Levering et al., 2000; Kohler et al., 1995; Kuhl et al., 2015, Skinner, Skinner, Skinner, & Cashwell, 1999). Rewarding all or none of the group members based on group performance meeting the goal eliminates the possible negative effects of some students receiving reinforcement based on performance and others not being able to meet the goal (Popkin & Skinner, 2003; Skinner et al., 2009). Students who are not rewarded frequently because of their ability level or other contributing factors, are still rewarded with the use of this intervention by accounting for their contribution to the group's effort (Kelshaw-Levering et al., 2000; Popkin & Skinner, 2003). Also, Skinner et al. (1996) described an increase in social interactions between participants during interdependent group contingencies that led to respect and understanding of individual differences amongst students.

Some limitations have been described when using interdependent group contingency intervention programs. In their research, using an interdependent group contingency to increase physical activity at recess, Foote et al. (2017) found that school-age students appeared more motivated by access to the reinforcement than the enjoyment of physical activity, but believed that sustained implementation of this intervention would

have an overall positive effect on behavior change in children's health. Kuhl et al. (2015) reported, when comparing the use of individual versus cumulative group feedback in physical activity, praise directed towards an individual in meeting a goal was more effective than targeting the group performance. Individual feedback can make a connection between the participant's performance in relations to the goal compared to providing feedback to a group's cumulative performance.

Another concern associated with the use of interdependent group contingency is the decrease in other positive classroom behaviors due to a concerted effort of the participants towards the group contingency (Popkin & Skinner, 2003). An example that Popkin and Skinner (2003) provided in their research was the possible decrease of students' performance in their math skills when the contingency was set on changing the group performance in spelling. Also, using the same consequence across the group can be reinforcing for some, neutral for others, and potentially have negative implications on one or more participants (Kelshaw-Levering, 2000; Popkin & Skinner, 2003). This can lead to participants sabotaging the performance of the group if the reinforcement is not stimulating or aversive (Skinner et al., 1996). Additionally, students who demonstrate high levels of achievement while the contingency is in place, but the group does not meet the goal, may feel discouraged for their performance not being reinforced (Skinner et al., 2009). Similarly, if other participants feel they cannot meet the goal, their performance may be low, causing a negative effect on behavior change (Popkin & Skinner, 2003). Randomizing components of group contingencies can compensate for the disadvantages

in the implementation of this intervention (Hawkins, Haydon, Denune, Lakin, & Fite, 2015; Kelshaw-Levering et al., 2000; Popkin & Skinner, 2003).

Randomized Interdependent Group Contingency

Randomization of multiple components in interdependent group contingency programs are valued as an effective class-wide behavior management strategy for improvement in daily academic performance across subject areas, grade levels, and settings (Popkin & Skinner, 2003; Kelshaw-Levering et al., 2000). In randomized group contingency programs, a criterion is not established prior to the implementation of the intervention. Instead several criteria are developed, behavior occurs, and a criterion is randomly chosen from the several developed criteria (Skinner, Williams, & Neddenriep, 2004). If the group meets or exceeds the randomly selected criterion or goal, the group receives a randomly-selected reinforcer. Murphy, Theodore, Aloiso, Alric-Edwards, and Huges (2007) referred to this randomization as “mystery motivators” discovering in their research anticipation and interest were maintained with the uncertainty of the reinforcer. The most powerful type of “mystery motivator” or random selected reinforcers are those chosen by the participants (Kelshaw-Levering et al, 2000.; Murphy et al, 2007; Popkin & Skinner, 2003). If the reinforcers included in the reward pool are chosen by the participants, there is a personal reward for everyone, which can motivate individuals to do their best, not knowing when their preferred reinforcer will be chosen (Kelshaw-Levering et al., 2000; Skinner et al., 2009). In their research, Kelshaw et al. (2000) found randomizing the behavior, criteria, and participant(s) very effective for reducing problem behavior in a second-grade classroom. Theodore, Bray, Kehle, and Jensen (2001)

implemented a similar experiment selecting random criteria and reinforcements for five students diagnosed with emotional behavior disorder that were receiving special education services in a self-contained classroom and found an immediate decrease in disruptive behavior. Popkin and Skinner (2003) applied interdependent group contingency with randomly selected components to increase academic performance with five middle school boys diagnosed with emotional behavior disorder in a self-contained classroom. Positive results in behavior change supported by research demonstrated the effectiveness of adding randomized components in interdependent group contingency programs.

Purpose of Study 1

The purpose of this study was to evaluate the use of randomized interdependent group contingency using tangible rewards on increasing physical activity with college-age students in a PSE program for individuals with I/DD. A reversal single subject research design was used to analyze a functional relation between randomized interdependent group contingency and duration of engagement in physical activity.

Research Questions

(1) What are the effects of a randomized interdependent group contingency intervention using tangible reinforcement on increasing physical activity for college students with I/DD? (2) What is the social validity of using a randomized interdependent group contingency to increase physical activity for college age students with I/DD?

Informed Consent

Prior to the study, support letters were obtained by the director of the PSE program and the main instructor for the Life Skills class in which this study took place. Full approval then was received by the University's Institutional Review Board. Finally, signed informed consent was obtained from each participant.

Method

Participants included four college-age students with I/DD who were enrolled in a PSE program at a large university in the Southeastern United States. Participant ages ranged from 20 to 24 years old, and pseudo-names were used to maintain confidentiality. Students enrolled in this program audited college courses not included in the PSE program and completed course work in Life Skills, Digital Literacy, and Career Planning that were required for the PSE program. This study took place in the Life Skills class where students were learning about setting goals based on seven areas of wellness (financial, spiritual, emotional, environmental, social, intellectual, and physical) introduced in the beginning of the semester. Students who chose physical wellness as one of their goals for the semester were recruited to participate in this study. Study data were collected by the main researcher, who was a doctoral student in the field of Special Education at the time of this study with 12 years of experience working in this field.

Participants

Marge. At the time of the study, Marge was a 24-year-old student who met eligibility under the disability category of Other Health Impairment (OHI) while in high school. Her Wechsler Adult Intelligence Scale, 4th ed. (WAIS-IV, 2008) full-scale IQ

was 71. She was moderately physically active at the beginning of this study and was enrolled in a dance class twice a week at the university that incorporated work outs with circuit weights into the classroom routine. She stated that working out made her feel good.

Matt. At the study's initiation, Matt was a 24-year-old student diagnosed with Autism Spectrum Disorder. His WAIS-IV full-scale IQ was 61. His adaptive behavior overall score was a 57 on the Scales of Independent Behavior Revised (SIB-R, 1996) and had a score of 96 on the Childhood Autism Rating Scale (CARS, 1986). Matt was enrolled in an adaptive physical education course at the beginning of this study and mentioned he enjoyed boxing, basketball, weight lifting, and running.

Kevin. When the study began, Kevin was a 24-year-old student diagnosed with an Intellectual Disability. His overall full scale IQ on the Wechsler Intelligence Scale for Children, 5th ed. (WISC-V, 2014) was a 45. His adaptive behavior on the Vineland, second edition (2005) home version was a 68 and 56 on the school version. He stated that he enjoyed running and working out with weights at his local gym.

Dave. At the time of the study, Dave was a 21-year-old student diagnosed with an intellectual and physical disability. Dave used a wheel chair for independent mobility. He had previously been active with Special Olympics during his high school years participating in basketball, bowling and soccer. He also participated in a local organization that sponsored wheel-chair soccer. He had not been attending local recreational events at the time of this study due to his school schedule. Dave enjoyed boxing on the Nintendo Wii game console and playing basketball. He described himself

as a sports fanatic and talked about hockey, football and car racing. He stated that he played football through watching the players. There were no formal records available with IQ scores, adaptive behavior scores, or present levels of academic performance.

Settings

This study began in a Life Skills college level classroom for students diagnosed with I/DD on a large public college campus in the Southeastern United States. The classroom was set-up with three tables in a u-shape design facing the instructor. Instruction was delivered through Power Point presentations with classroom discussions. Initial instruction focused on wellness goals in the areas of social, emotional, spiritual, financial, intellectual, environmental, and physical activity. The classroom staff included the main instructor who was a doctoral student in counselor education, the researcher who was a doctoral student in Special Education, a teacher assistant working on her undergraduate in special education, and three other peer mentors who were studying speech and language pathology. There were eight students in this class with diagnosis of intellectual or developmental disabilities and six of these students were interested in being part of the study. One student used self-report of her physical activity due to technology connection issues between the Fitbit or any other apps used to measure technology and her personal mobile devices, so the data were not included in the study, but she still gained access to the weekly reinforcers. Another student started with the study during baseline, but due to injury, was removed from the study. When this student recovered from his injury, he was included back into the weekly group contingency

reward procedure, but his data were not included as part of the average each session. Of the six students interested, four students' data were included in the current study.

The engagement in physical activity occurred on campus and in the participants' community. Two of the participants also were enrolled in an adaptive physical education course at the university and one student was enrolled in a dance class with circuit training. The fourth student reported walking around his community in the evening and lifting weights at a local fitness center.

Materials

The materials used in this study included (a) three Fitbits (wearable technology), (b) one Apple Series 3 watch, (c) four mobile phones, (d) the Fitbit app, (e) Apple Activity Data app, (f) two containers one labeled "goals" and one labeled "rewards" (g) 28 slips of paper with selected days of the week and numbers representing average group duration of exercise on that day (e.g., Monday 28 minutes), and (h) eight \$5 gift cards each from four different businesses selected by the participants: Starbuck's, Chipotle, Subway, and the University shop. In the beginning of the study, students were given a choice of technology methods to measure the duration of their physical activity (e.g., Map My Fitness App, Pacer App, Cyclemeter App, Fitbit wearable technology), and all four participants requested a Fitbit. One student's Fitbit would not accurately sync with his mobile device and he already had use of the Apple Technology, so this format was used to measure his physical activity. Data were collected and analyzed on campus, but students engaged in physical activity on and off campus measured seven days a week and 24 hours a day through using Fitbit and Apple Technology.

The Fitbit Blaze and Apple Series 3 are wrist watches used as wearable electronic devices to tell time and can measure an individual's physical activity in multi-sport modes. The Fitbit is paired with a mobile device (e.g., cell phone, tablet) by setting up an account through the Fitbit app and an email address (see Figure 1). Physical activity is measured by the Apple Series 3 by entering personal information (e.g., height, weight) into the app on the mobile device. Both devices measure physical activity in duration, steps, miles, floors, and heart rate. Statistics are displayed on a dashboard in the app on the paired mobile device (see Figure 2) and are accessible through weekly progress emails for the Fitbit technology (see Figure 3). The goals and individual physical activity can be shared through social networks and connected to multiple apps such as *Map My Fitness*, *Strava*, *Map My Walk*, and *Cyclemeter* (see Figure 4) that provides a visual map of location and other statistics of the chosen activity. Both devices can be paired with social media groups (e.g., Fitbit Community, Facebook, Instagram, etc.) to share daily physical activity (see Figure 5 and 6).

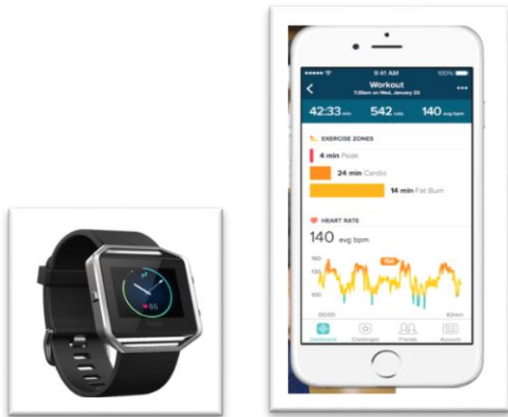
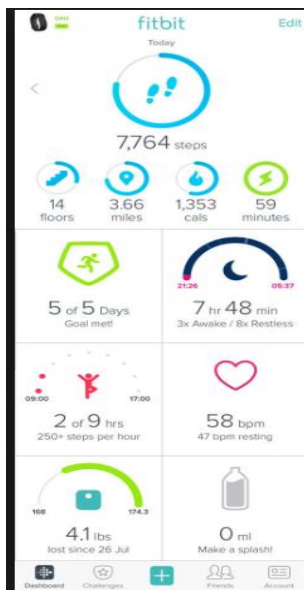


Figure 1. Fitbit wearable technology paired with mobile phone



Fitbit



Apple

Figure 2. Fitbit and Apple app dashboards displaying visual representation of percentage of goal step count, duration, and other information that monitors daily and weekly activity

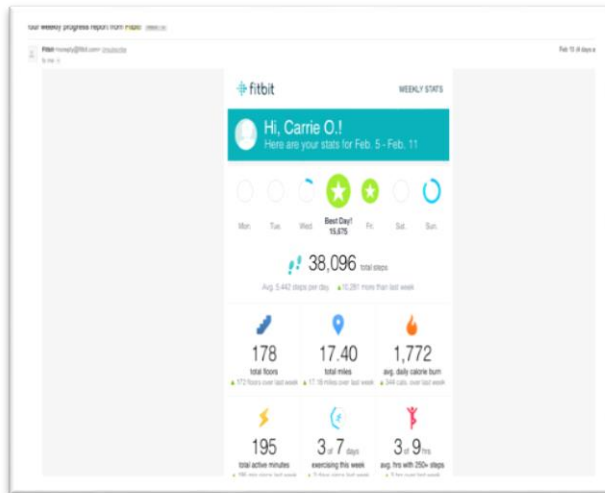


Figure 3. Fitbit email with dashboard displaying weekly progress measured in steps, miles, calories burned, duration, days of the week, average, heart beat, and weight change option

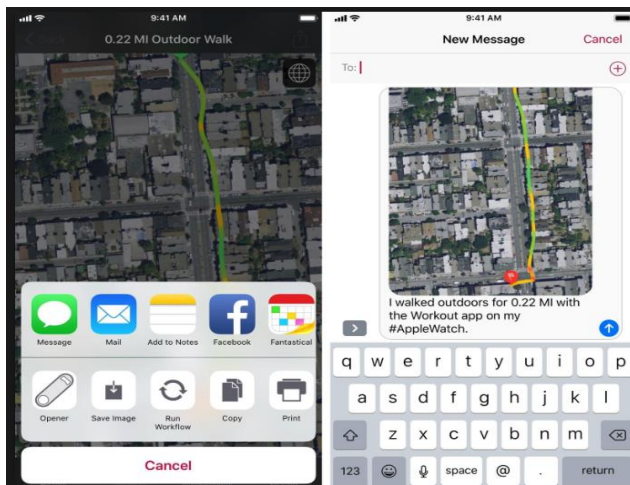


Figure 4. Pairing of Map My Run app with Fitbit technology to provide a visual display of activity route



Fitbit

Figure 5. Fitbit technology paired with social media



Apple

Figure 6. Apple technology paired with social media

Independent and Dependent Variables

The independent variable was an interdependent group contingency with randomized components: day of the week, criterion, and reward presented to the group. The dependent variable was the daily average of physical activity measured in minutes for the group. Each student's minutes were recorded daily and aggregated as a group average. Duration of physical activity was measured using three participants' Fitbit Blaze devices synchronized to a mobile device recording daily activity through the Fitbit app. The Fitbit Blaze records duration of movement that are step based or increase in heart rate using metabolic equivalents (METs) during strenuous activities that are continuous for 10 consecutive minutes of activity and 3METs or above as recommended by the CDC (2016), (Fitbit, 2018). The fourth student's duration was measured using Apple Watch Series 3, which is also synchronized to his phone measuring duration, intensity, heart rate, and distance of physical activity. Measurement of physical activity in duration was chosen over steps or miles because one student used a wheelchair for mobility and his choice of physical activity (e.g. Wii boxing, weight lifting) could not be measured in steps or miles. Also, the ultimate long-term goal of this study was to assist students in adopting a healthier lifestyle through physical fitness, which is recommended in the metrics of time, 2 hours and 30 minutes per week by the CDC (2016). The participant's physical activity was measured daily during the 24-hour time-period throughout a seven-day weekly period.

Design and Procedures

A withdrawal design was used to determine the effectiveness of an interdependent group contingency with randomized components intervention on duration of physical activity. This design permits for a clear demonstration of experimental control by implementing a system of repeated introduction and withdrawal of baseline and intervention phases (Gast & Leford, 2014). This type of design illustrates causality of behavior change using sequential replication of effects comparing the intervention phases with adjacent baseline phases (Horner et al., 2005). The study was conducted over a 12-week period and included seven phases alternating between no intervention (A_1 , A_2 and A_3), intervention (B_1 , B_2 and B_3) and maintenance two weeks later. During baseline and withdrawal phases (A_1 , A_2 and A_3), participants did not receive rewards based on group contingency or any feedback on performance. During intervention (B_1 , B_2 and B_3), participants earned rewards contingent on group performance and periodic positive feedback focused on their commitment to fitness.

Baseline Phase (A_1). Baseline data were collected daily by adding up the data recorded on the dashboard of the Fitbit and Apple apps for all students and then averaging the duration of physical activity tracked by each participant's wearable technology. Baseline data were collected until stability in data were determined and a downward trend of data points across sessions was observed through visual analysis for a minimum of five sessions as recommended by What Works Clearing House (Kratochwill, et al., 2010). The daily average minutes of activity was chosen over the group's total minutes of activity to counterweigh individuals who did not wear their Fitbits on certain

days. It was agreed upon that these participants still might or might not have engaged in physical activity, but it was not recorded due to the absence of the measuring device. Also, group contingency lends itself to averaging of all recorded performance when groups have members with varying abilities and in this case, access to physical activity or time built into their schedule (Litow & Pumroy, 1975). A data sheet (see Appendix A) was used to record daily duration and the average duration of exercise was calculated using an excel sheet (see Appendix B) across participants. The Participants were given their devices the first day of baseline and data collection began the next day. No instructions were provided on the multiple functions or modes accessible in a Fitbit device. The participants were encouraged and reminded to wear their technology, no contingency was set, and no feedback was delivered during baseline.

Group Pre-training. The researcher, instructor, and graduate assistant introduced the group contingency to the students during their Life Skills class the day after baseline ended. The SMART goals that were introduced in the beginning of the semester were reviewed with focusing on physical activity and fitness as an area for improvement. The group's overall average duration of physical activity per day (22 minutes) during the baseline period (two weeks) was shared with the group followed by a reminder of recommended activity time by the CDC (2016) of 2 hours and 30 minutes a week of aerobic exercise with a combination of strength training, which can be broken down to around 30 minutes a day five days per week. The researcher discussed with the group that some days maybe more active and other days less active, but as a group, they will motivate each other to increase their physical activity.

Next, the interdependent group contingency was introduced to the participants, explaining the group will earn rewards randomly throughout the week based on the average minutes of group's physical activity. The researcher explained that everyone or no one will receive the reward based on the average of the group's physical activity. Next, the participants were guided in checking their data and shown on their mobile device how to track weekly progress. Also, the three participants using the Fitbit technology were informed about the weekly progress emails they would receive from Fitbit. The participants were instructed individually in accessing these emails to track their data.

After the participants were instructed in using their technology to track and measure their physical activity, the researcher introduced the reward system. First, examples of possible rewards were shared with the group (e.g., \$5 Starbuck's gift cards). Next, each participant in the group chose a reward to work toward and these rewards were written on the classroom white board for group discussion. The students were also given the researcher's email address to send any further suggestions for rewards anytime during the study. The researcher informed the participants that these rewards maybe included and the group would receive an email if another reward was added to the box. From the list created by the group, the researcher selected rewards that were cost efficient, accessible within walking distance to campus, had potential for social activity for the students and considered healthy by the PSE program staff and researcher.

Next, the researcher explained how the interdependent group contingency would work by demonstrating the process to the participants. First, the researcher explained the

goal would be randomly selected from the goal bag. The researcher demonstrated the process by selecting a goal from the “goal” bag and read the duration criterion (e.g., Tuesday 29 minutes). The researcher then explained if the class average of every participant’s duration of activity met or exceeded this goal, a slip of paper with a random reward would be chosen from the “rewards bag” and all students would receive access to the randomly selected reward. The researcher reached into the rewards bag, chose a reward and read it out loud. The participants were informed that if the group did not meet the chosen criterion, a reward would not be selected, but there would be more opportunities to earn a reward the next time the group met. The researcher modeled the process three times and showed the participants the number of slips with different days and duration criteria included in the goal bag. The participants were informed that a chart would be placed in their program area with a list of the random goals, group average, goal met or not met on selected days, and rewards received. The participants were asked if they had any questions.

Group Contingency Intervention (B1). After baseline and group training, intervention began. Data were recorded daily and collected on varying days of the week by accessing the data tracking dashboard on both the Fitbit and Apple apps. The apps provided a permanent product allowing the researcher to interact with the participants on random days. The random scheduled interaction eliminated any compounding variable of patterned attention from the researcher to the participant that may add to change in behavior during intervention phase. Contingency for reward phases were broken into two-day periods and multiple physical duration criteria in minutes and days of the week

were written on different slips of white paper (e.g., Wednesday 32 minutes, Saturday 20 minutes). The duration criteria were chosen based on different duration data recorded during baseline. The slips of paper were put into an empty bag labeled “goals”. The first intervention for this study started on the Tuesday after baseline and group training. The first session was blocked as Tuesday and Wednesday and the group goal was pulled on Thursday for the random criterion matching group performance on Tuesday or Wednesday. This pattern continued with Thursday and Friday grouped, Saturday and Sunday through intervention phase. The slips were chosen between 9:00 a.m.-10:00 a.m. the day following the two-day session, which was a time the students were gathered in a common area. During this time, the researcher would announce the average group performance minutes for each day included in the selected sessions (e.g., Tuesday 27 minutes, Wednesday 35 minutes). A student was selected to pull a slip from the goals bag and read it to the group. If the average duration of physical activity for all students reached or exceeded the criterion on the chosen slip of paper selected displaying day and duration, then a reward was chosen by another student from the rewards bag. If the average minutes of physical activity was below the number pulled from the goal bag, then the group did not receive the reward and a new session started. A chart (see Appendix C) was constructed and placed in a public area tracking the date, average minutes of group activity during intervention, a space for the criterion that was drawn from the container, a space to mark if the criterion was or was not met and a space for the session’s reinforcement reward. The intervention phase continued until stability in data were established and an increasing trend in duration of physical activity towards a

therapeutic direction over five consecutive days was observed through visual analysis with a mean level of change between baseline and intervention (Gast & Leford, 2014).

No Interdependent Group Contingency (A2). After criteria were met in intervention phase, baseline conditions were reintroduced. During this phase, data were still recorded daily and collected on varying days of the week by accessing the data tracking dashboard on both the Fitbit and Apple apps. No feedback or rewards were provided during this phase. This phase continued until the mean level performance of the participants returned similar to baseline conditions and the trend turned towards a non-therapeutic direction, demonstrating a decrease in behavior when the intervention was withdrawn (Cihak, Fahrenkrog, Ayers, & Smith, 2010; Horner et al., 2005).

Interdependent Group Contingency Reinstated (B2). The interdependent group contingency was reinstated and data continued to be recorded daily on random days. The participants were asked again about preferred rewards for the group contingency. One new reward, payment for the end of the week ice skating activity was added to the reward pool.

After this phase, one more withdrawal (A₃) and intervention (B₃) condition were added following the same criteria of evaluating data for abrupt changes in behavior across adjacent phases with a difference in trend and mean level of performance demonstrating replication of effects of the intervention (Lane & Gast, 2014).

Maintenance Procedures. Maintenance of the independent variable on the dependent variable was measured two weeks after the last intervention phase by recording the average minutes of the group as well as collecting social validity data

gathered from student survey examining the importance of the goals, procedures and effects of change (Wolf, 1978). There was no contingency in place after the last intervention phase or during maintenance. Also, data were not collected from the participants' dashboards by the main researcher during the two-week period between the last intervention phase to maintenance.

Inter-observer Agreement (IOA)

Inter-observer agreement (IOA) was collected by the primary researcher and undergraduate students studying in the fields of audiology/speech pathology or special education. The undergraduate students worked as peer tutors and mentors for the students in the PSE program and were each familiar with extracting data from the Fitbit and Apple technology through personal use of more than a six-month period. The participants' duration data from their mobile dashboards were recorded onto a data sheet for each participant by the main researcher and checked for IOA with one of the peer mentors by comparing each student's dashboard data to the information recorded on the data sheet by the main researcher. The IOA data were collected over 100% baseline and 100% intervention conditions across participants by dividing the number of interval agreements by the number of agreements plus disagreements and multiplying by 100. A continuous record and permanent product was available in the app and could be accessed using the calendar icon by choosing the backward or forward arrows to select different days of the week. The percentage of IOA was checked twice a week by an undergraduate peer mentor across participants for correct recording of data from the device to the data sheet. This process assisted with checking any recording mistakes made by the primary

researcher during the daily recording process. When a mistake was found on the original recording of data, the researcher crossed out the wrong number and recorded the correct duration. The assistant initialed and dated the section checked on the original data collection sheets. Prior to the beginning of the study, the primary researcher and peer mentors checked for consistency of extracting data from both forms of technology over three consistent trials. The following IOA percentages for each participant were collected across phases.

The IOA data collected during baseline for Marge was 100%. During the first intervention phase, the IOA was 91% and 100% during the first withdrawal phase. During the next intervention phase, withdrawal phases, and final intervention phase, the IOA data collection remained 100% accurate. Data were not collected for Marge during maintenance.

The IOA during baseline for Matt was 94%. During the first intervention phase, the IOA was 91% and 100% during the first withdrawal phase. During the next intervention phase, withdrawal phase, final intervention phase, and maintenance, the IOA remained 100% accurate.

The IOA data collected during baseline for Kevin was 100%. During the first intervention phase, the IOA was 81% and first withdrawal phase the IOA was 89%. During the next intervention phase, IOA was 80% and withdrawal phase was 100%. During the final intervention phase, the IOA was 80% and 100% during maintenance.

The IOA for Dave across all phases was 100%.

After the initial IOA, the raw data was cleaned and recorded into excel sheets. The next part of IOA was collected between the primary researcher and another graduate research assistant doctoral student in the field of Special Education. During this process, the graduate research assistant and main researcher recorded IOA by checking the accuracy of information transferred from the data sheets to an excel sheet that was used to calculate average of daily physical activity and graph the information. The data were calculated in the excel sheet using a sum function and then divided by number of participant's data that exceeded zero on each session. The research assistant checked for accurate summation of the duration of activity and correct average calculated per session. (Appendix D). The IOA data were collected over 40% baseline and 40% intervention conditions across participants. The IOA across phases and participants was 100%.

Treatment Integrity

Treatment integrity data were collected with checklists (see Appendix E) containing information for the researcher during intervention of charging, wearing, and collecting participants' data. The data were recorded on a weekly basis during baseline and intervention with assistance from the instructor of the Life Skills class. Treatment integrity was defined as 90% or better and was calculated by classroom instructor agreement of observed procedures adhered to by the researcher on the treatment integrity worksheet during this seven-week study. Treatment integrity was met with 100% accuracy.

Data Analysis

Visual analysis was used to demonstrate evidence of a functional relation between the independent variable (interdependent group contingency) and dependent variable (group average duration of physical activity) by assessing the (1) level, (2) trend, (3) variability, (4) immediacy of effect, (5) overlap, and (6) consistency of data patterns with-in and between conditions as recommended by What Works Clearinghouse (Kratochwill, et al., 2010). Within-phase comparison was evaluated to assess replicated patterns of data and adjacent phases were evaluated to assess if a change in the dependent variable was due to the independent variable. Next, the effect size was calculated to estimate the magnitude of the intervention on the desired outcome. This was determined by calculating the percentage of data points exceeding the median (PEM). There are many different methods for calculating effect size in single subject design research with each having advantages and disadvantages based on the variability of the data set and other factors such as outliers that can compromise a more precise calculation of intervention effect. The use of PEM is recommended when there are outliers in the baseline and variability of data overtime, which was representative of this data set (Lenz, 2013). The scale used to determine effect size for PEM is 0-1 with $\geq .9$ being considered highly effective, .7-.9 as moderately effective, and $< .7$ questionable or not effective (Ma, 2006).

Results

Overall, the group increased their average duration of physical activity levels during intervention days over the eight-week period (see Figure 7). The CDC (2016) recommends 150 minutes (2 hours and 30 minutes) a week of moderate to intense physical activity for adults or 300 minutes (5 hours) per week of vigorous to intense activity with a mix of two or more days a week of muscle strengthening activities. This recommendation can be broken down into 30-60-minute time periods five-days a week.

The group's physical activity per phase data were reported by calculating the average of minutes per day during each phase. Also, the participants' individual average minutes of physical activity was calculated and reported during each phase (see Table 1). The group's average was determined by adding individual's total minutes of physical activity from the dashboard of their mobile devices that measured above zero minutes per session and dividing by the number of participants who participated during that session. For example, if three individuals' minutes measured above zero on Tuesday, their minutes would be totaled and divided by three with the fourth individual's score of zero not calculated into that day's session. The totals for each day during the different phases of baseline, intervention, withdrawal, and maintenance were then added together and divided by the amount of days per phase to calculate an average per phase. The participants' average minutes of physical activity per phase was calculated by totaling all days during each phase and dividing this number by the number of days in that phase.

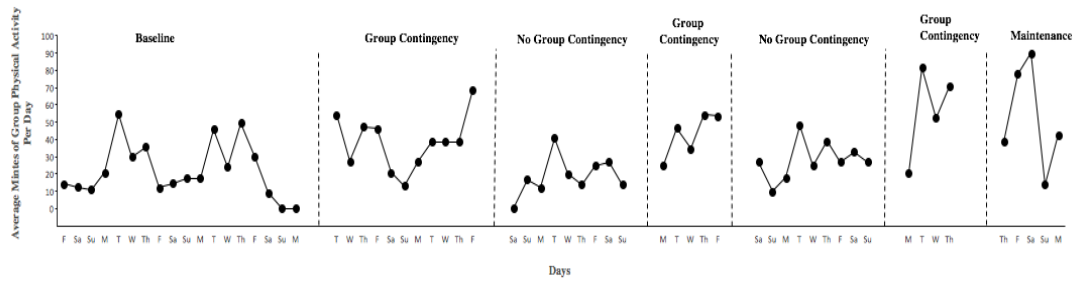


Figure 7. Groups average minutes of physical activity per day

Table 1. Group and Student Average Minutes of Physical Activity Per Phase Including Weekdays and Weekends

	Baseline (A ₁)	Group Contingen cy (B ₁)	No Group Contingen cy (A ₂)	Group Contingen cy (B ₂)	No Group Contingen cy (A ₃)	Group Contingen cy (B ₃)	Maintenan ce
Group	22(16) 0-50	38(16) 13-69	19(12) 0-41	43(13) 25-54	28(11) 10-48	57(27) 21-82	53(30) 14-90
Marge	10(18) 0-68	35(27) 0-76	.33(1) 0-3	38(20) 10-63	13(22) 0-51	29(34) 0-62	NA
Matt	23(31) 0-109	34(26) 0-79	3(9) 0-27	50(23) 14-75	14(24) 0-72	59(61) 0-144	45(45) 0-89
Kevin	28(17) 0-67	46(29) 0-86	16(14) 0-41	49(8) 39-60	27(8) 10-37	60(41) 29-118	63(42) 14-120
Dave	13(18) 0-64	14(19) 0-51	1(4) 0-12	17(25) 0-59	6(19) 0-57	38(51) 0-112	7 0-24

All data, including zeros, were included on the group and individual visual analysis, but were noted with a square marker instead of round if the participant did not wear their technology on that day. As noted earlier, the wearable technology only records duration of physical activity over 10 continuous minutes, which was evident on each of the participants' dashboards. During the study, some days would register miles and steps in a 24-hour period, but no duration. The distance accumulated with routine movements of the day that did not include intentional physical activity.

The group's average physical activity minutes per day during the baseline period when calculated seven days per week (A_1) was 22 minutes and 15 seconds and increased to 38 minutes and 31 seconds per day during the first intervention phase (B_1). The intervention was withdrawn and the group's average minutes of physical activity per day during this phase (A_2) returned to below baseline of 19 minutes. Once the intervention was reintroduced (B_2), the group's average duration of physical activity increased to 43 minutes per day. This pattern continued during the last two phases with the group's physical activity decreasing to an average of 28 minutes and 22 seconds per day during withdrawal (A_3) and increasing to an average of 56 minutes and 45 seconds per day during the group's final intervention phase (B_3). Data were collected two weeks after the last phase to check for maintenance and the group's average minutes of physical activity for this phase was 53 minutes per day. The group's average physical activity per day during each intervention phase was above the daily recommended amount of physical activity of 30 minutes by the CDC (2016) and below this recommended amount during baseline and withdrawal phases.

The group and individual total minutes of physical activity per phase were also calculated seven days per week (see Table 2). The group's total physical activity was calculated by adding each averaged day during the different phases and was reported in measurement scales of hours and minutes. Totals during longer phases, for example baseline, were broken down and reported as a total over a seven-day week period. These seven-day periods began on the day of the week that the phase began. Some phases did not have equal seven-day periods, so the length of time periods was noted when reporting weekly totals. For example, baseline (A₁) including weekend data were collected over an 18-day period, so the phase was broken down into two-week periods with four remaining days. During the first week of baseline, the total of the days for this time-period was 2 hours and 59 minutes and during the second week of baseline, the total was 3 hours and 1 minute with the four remaining days of this period totaling 39 minutes. During the first intervention phase (B₁), the group's total of physical activity across days was 3 hours and 56 minutes during the first week period. The intervention phase spanned an 11-day period with the total minutes of physical activity over the remaining four-day period equaling 3 hours and 05 minutes. The intervention was withdrawn and the group's total minutes of physical activity decreased to 2 hours and 09 minutes during the first seven-day period and 41 minutes during the two remaining days in this phase (A₂). Once the intervention (B₂) was reintroduced, the groups' total of averaged days over a five-day period-of-time was 3 hours and 35 minutes. This pattern continued during the last two phases decreasing to a week's total average of 3 hours and 14 minutes during the first seven-day week period and 60 minutes during the last two days of the final

withdrawal phase (A₃). The group's total average of physical activity per session during the final intervention phase (B₃) was 3 hours and 46 minutes over a four-day period. Data were collected two weeks after the last phase to check for maintenance and the group's total week average was 3 hours and 11 minutes over a five-day period. The group's total of average of physical activity per week was above the recommended amount of 2 hours and 30 minutes during all phases except the first withdrawal phase.

Effect size was calculated using PEM and analyzed based on a 0-1 scale (see Table 3). The effect size between baseline (A₁) and the first intervention phase (B₁) for the group data average was .90, which is determined highly effective based on the PEM scale (Ma, 2006). The effect size calculated between the first withdrawal phase (A₂) and second intervention phase (B₂) was calculated as 1 again considered highly effective based on the PEM scale, but was only .75 between the last withdrawal (A₃) and intervention phase (B₃), which is considered moderately effective. The decrease in effect size might have been caused by end-of-semester scheduled activities, which altered the routine schedule that allotted students time in their schedules to dedicate to physical activity.

Table 2. Group and Participants' Total Minutes of Physical Activity Over Seven Day Periods of Time

	Baseline (A ₁)	Group Contingen cy (B ₁)	No Group Contingen cy (A ₂)	Group Contingen cy (B ₂)	No Group Contingen cy (A ₃)	Group Continge ncy (B ₃)	Maintenan ce
Group	2:59 hrs. 3:01 hrs. :39 mins (4-day period)	3:56 hrs. 3:05 hrs. (4-day period)	2:09 hrs. :41 mins. (2-day period)	3:35 hrs. (5-day period)	3:14 hrs. 1:00 (2- day period)	3:46 hrs. (4-day period)	3:11 hrs. (5-day period)
Marge	2:12 hrs. :54 mins. 0 mins. (4-day period)	3:02 hrs. 3:23 hrs. (4-day period)	0 mins. :03 mins. (2-day period)	3:08 hrs. (5-day period)	1:58 0 (2-day period)	1:57 hrs. (4-day period)	NA
Matt	3:35 hrs. 2:35 hrs. :43 mins. (4-day period)	3:34 hrs. 2:38 hrs. (4-day period)	0 mins. :27 mins. (2-day period)	4:11 hrs. (5-day period)	1:48 hrs. 0 (2-day period)	4:53 hrs. (4-day period)	2:25 hrs. (5-day period)
Kevin	3:12 hrs. 3:08 hrs. :26 mins. (4-day period)	3:58 hrs. 3:28 hrs. (4-day period)	1:57 hrs. :25 mins. (2-day period)	4:04 hrs. (5-day period)	3:05 hrs. 1:27 hrs. (2-day period)	3:58 hrs. (4-day period)	5:15 hrs. (5-day period)
Dave	1:23 hrs. 2:32 hrs. 0 mins. (4-day period)	1: 20 hrs. 1:02 hrs. (4-day period)	12 mins. 0 mins. (2- day period)	1:27 hrs. (5-day period)	:57 mins.	2:30 hrs.	:37 hrs. (5- day period)

Table 3. Group and Individual Calculated PEM Effect Sizes Across Phases

	Intervention phase (B ₁)	Intervention phase (B ₂)	Intervention phase (B ₃)
Group	.90 (highly effective)	1.0 (highly effective)	.75 (moderately effective)
Marge	.82 (moderately effective)	1.0 (highly effective)	.50 (moderately effective)
Matt	.90 (highly effective)	1.0 (highly effective)	.80 (moderately effective)
Kevin	.81 (highly effective)	1.0 (highly effective)	1.0 (highly effective)
Dave	.36 (questionable or not effective)	.60 (questionable or not effective)	.75 (moderately effective)

The individual participants' average physical activity per phase and total physical activity per phase was also calculated. The average of physical activity for the individual participant's data were calculated by totaling up their data per day during each phase and dividing this total by number of days during that phase. Their total physical activity per phase was calculated by summing up each day per phase.

Marge. Marge increased her physical activity during the intervention phases (see Figure 8). Her average daily physical activity during baseline (A₁) was 10 minutes and 33 seconds, which is a third of the daily recommended amount of moderate physical activity per day of 30 minutes by the CDC (2016). Her total amount of physical activity during the first week of baseline was 2 hours and 12 minutes as measured when wearing her Fitbit. Her total amount of physical activity during the next week of baseline measured 54 minutes and her total minutes of physical activity during the last four days of the phase totaled zero. Her physical activity increased from an average of 10 minutes and 33 seconds per day during baseline to an average of 35 minutes during the first intervention phase that used interdependent group contingency (B₁). Her first week total

of physical activity during this phase was 3 hours and 2 minutes which is above the recommended total of 2 hours and 30 minutes per week by the CDC (2016) and her total duration of physical activity during the last four-days of this phase was 3 hours and 23 minutes. During the first withdrawal phase (A_2), Marge's physical activity decreased to an average of 33 seconds per day with a total of three-minutes during one day in this phase. Her average minutes of exercise during the second intervention phase (B_2) increased to 38 minutes, with a total of 3 hours and 8 minutes over a five-day period. Again, during the last withdrawal phase (A_3), her physical activity decreased to an average of 13 minutes and 11 seconds with a total of 1 hour and 58 minutes the first week and a total of 0 minutes during the two remaining days of this phase. Marge's physical activity increased from the last withdrawal phase of 13 minutes and 11 seconds to an average of 29 minutes and 25 seconds per day during the last intervention phase (B_3) with a total of 1 hour and 57 minutes during this four-day period-of time. Marge was not on campus by the end of the semester due to alternative activities, so maintenance data were not collected.

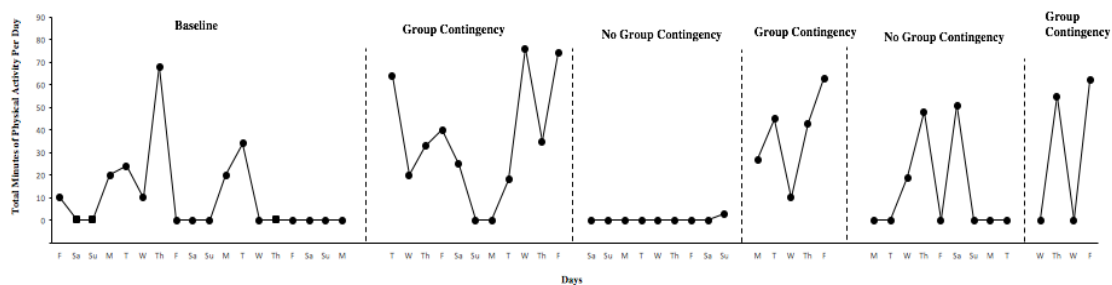


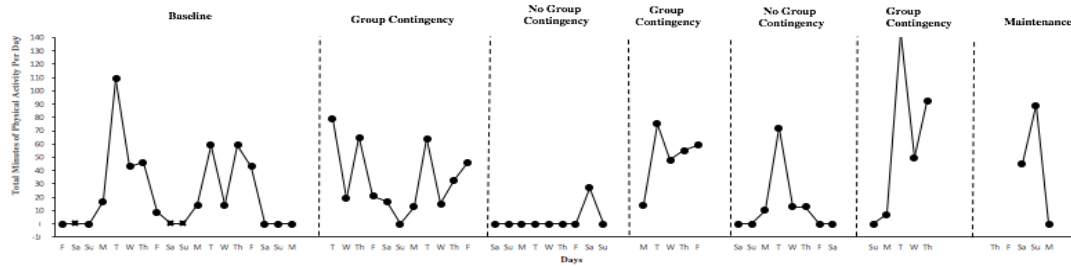
Figure 8. Marge's total minutes of physical activity per day.

Effect size was calculated using PEM and analyzed based on a 0-1 scale. The effect size between baseline (A_1) and the first intervention phase (B_1) was .82, which is determined moderately effective based on the PEM scale (Ma, 2006). The effect size calculated between the first withdrawal phase (A_2) and second intervention phase (B_2) was calculated as 1 considered highly effective based on the PEM scale, but was only .50 between the last withdrawal (A_3) and intervention phase (B_3), which is considered questionable or not effective. This participant was involved with different campus activities towards the end of the semester as well as preparing for finals. During this last intervention phase, Marge did exercise two out of four days for 55 minutes on one day and 62 minutes on the other day.

Matt. Matt also had increased his physical activity levels during the intervention phases (see Figure 9). Matt's average daily physical activity during baseline (A_1) was 23 minutes per day with a total of 3 hours and 35 minutes the first week, 2 hours and 35 minutes the second week of baseline, and 43 minutes during the last four-day period of this phase. His physical activity increased from baseline to the first intervention phase using an interdependent group contingency (B_1) to an average of 34 minutes per day with a total of 3 hours and 34 minutes the first week and 2 hours and 38 minutes during the last four-day period of this phase. His physical activity decreased during the first withdrawal phase (A_2) with an average of 3 minutes per day of physical activity. During this phase, his total minutes of physical activity was 0 during the first seven-day period. He engaged in physical activity only one day during this phase for 27 minutes. His average minutes of physical activity during the second intervention phase (B_2) was 50

minutes and 20 seconds and his total minutes of physical activity was 4 hours and 11 minutes over a five-day period. His minutes of physical activity decreased to an average of 13 minutes and 50 seconds during the last withdrawal phase (A₃) with a total of 1 hour and 48 minutes during the first week of this phase and no recorded physical activity during the last two-days of this phase. His physical activity increased during the final intervention phase (B₃) to an average of 59 minutes per day with a total of 4 hours and 53 minutes over this four-day period. Matt's average physical activity per day during maintenance was 45 minutes and 7 seconds with a total of 2 hours and 25 minutes over this five-day period. It must be noted that this individual showed an inconsistency with wearing his Fitbit during baseline, especially on weekends, but was consistent as the study progressed.

Effect size was calculated using PEM and analyzed based on a 0-1 scale. The effect size between baseline (A₁) and the first intervention phase (B₁) was .90, which is determined highly effective based on the PEM scale (Ma, 2006). The effect size calculated between the first withdrawal phase (A₂) and second intervention phase (B₂) was calculated as 1.0 again considered highly effective based on the PEM scale, but was only .80 between the last withdrawal (A₃) and intervention phase (B₃), which is considered moderately effective.



Kevin. Kevin also demonstrated an increase in physical activity from baseline (A_1) to final intervention phase and maintenance (see Figure 10). His average daily physical activity during baseline was 27 minutes, and 55 seconds, which is just slightly below the daily recommended amount of moderate physical activity of 30 minutes by the CDC (2016). His total amount of physical activity during the first week of baseline was 3 hours and 12 minutes and 3 hours and 8 minutes during the next week of baseline. His total minutes of physical activity during the last four-days of baseline were 26 minutes. His weekly total of physical activity was a above the total recommendation of 150 minutes per week of moderate to intense aerobic activity by the CDC (2016). During the first intervention phase (B_1), his average minutes of physical activity increased to 46 minutes per day with a total of 3 hours and 58 minutes the first week and 3 hours and 28 minutes during the final four-days of this phase. His physical activity decreased during the first withdrawal phase (A_2) to an average of 16 minutes per day with a total of 1 hour and 57 minutes during the first week and 25 minutes during the last two days of this phase. His average minutes of physical activity during the second intervention phase (B_2) was 49 minutes, with a total of 4 hours and 4 minutes over a five-day period. During the last withdrawal phase (A_3), his physical activity decreased to an average of 27 minutes

and 22 seconds with a total of 3 hours 5 minutes the first week of this phase and 60 minutes during the last two days of this phase. His physical activity increased back to an average of 59 minutes and 50 seconds per day with a four-day total of 3 hours and 58 minutes during the last intervention phase (B₃). Kevin's average minutes of physical activity per day during maintenance was 63 minutes with a total of 5 hours and 15 minutes over a five-day period, which exceeds the CDC (2016) recommendation of intense to vigorous activity per week.

Effect size was calculated using PEM and analyzed based on a 0-1 scale. The effect size between baseline (A₁) and the first intervention phase (B₁) was .81, which is determined moderately effective based on the PEM scale (Ma, 2006). The effect size calculated between the first withdrawal phase (A₂) and second intervention phase (B₂) was calculated as 1.0, which is considered highly effective based on the PEM scale, and again was 1.0 from the last withdrawal (A₃) and intervention phase (B₃).

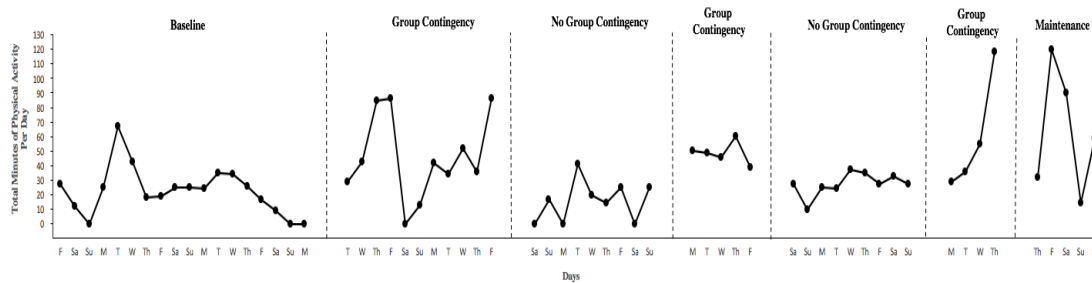


Figure 10. Kevin's total minutes of physical activity per day

Dave. Dave demonstrated a small increase in physical activity during the intervention phases as measured by the Fitbit technology (see Figure 11). At the time of this study, he used an electric wheelchair for mobility and the version of Fitbit Blaze technology used for this group was not designed with specific technology to measure wheel chair activity. Dave's average daily physical activity during baseline (A_1) was 13 minutes and 6 seconds with a total of 1 hour and 23 minutes the first week of baseline and 2 hours and 32 minutes during the second week of baseline. Dave did not engage in physical activity during the last four-days of baseline. His total minutes of physical activity during the second week of baseline meets the weekly recommended minutes of physical activity by the CDC (2016). During the first intervention phase (B_1), his average minutes of physical activity per day remained within the same range of baseline of 13 minutes per day with a total of 1 minute and 20 seconds during the first week of intervention and 1 hour and 2 minutes during the remaining four-days of the baseline period. His physical activity average per day during the first withdrawal phase (A_2) did decrease from intervention to an average of 1 minute and 30 seconds per day with physical activity only being recorded during one day of 12 minutes. The second intervention phase (B_2) showed an increase and change in physical activity compared to baseline with an average of 17 minutes and 40 seconds per day and a weekly total of 1 hour and 27 minutes over a five-day period. Again, his average physical activity decreased during the next withdrawal phase (A_3) to 6 minutes and 30 seconds per day with activity only reported on one-day of 57 minutes. Dave's average physical activity per day dramatically increased during the last intervention phase (B_3) to 37 minutes and

50 seconds per day with a total of 2 hours and 30 minutes over a four-day period, exceeding the weekly recommendation for moderate to intense activity by the CDC (2016). During maintenance, his average physical activity per day returned to slightly above baseline of 7 minutes and 40 seconds per day with a total of 37 minutes over a five-day period.

Effect size was calculated using PEM and analyzed based on a 0-1 scale. The effect size between baseline (A_1) and the first intervention phase (B_1) was .36, which is considered questionable or not effective based on the PEM scale (Ma, 2006). The effect size calculated between the first withdrawal phase (A_2) and second intervention phase (B_2) was calculated as .60 again considered questionable or not effective on the PEM scale, but the effect size increased to .75 between the last withdrawal (A_3) and intervention phase (B_3), which is considered moderately effective.

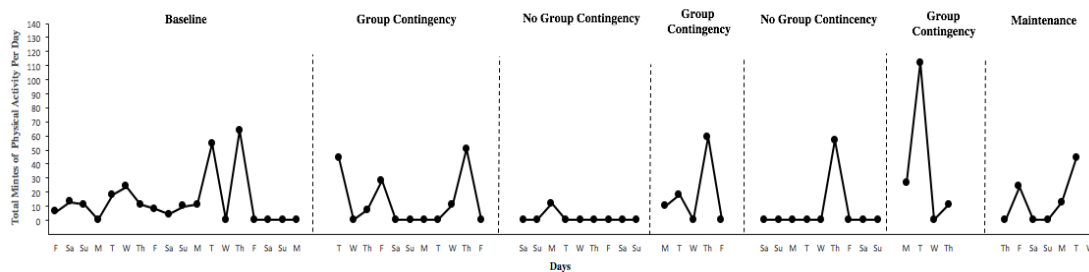


Figure 11. Dave's total minutes of physical activity per day.

Social Validity

During the maintenance phase, social validity data were collected using a 5-point Likert-type survey (1-strongly disagree, 2-slightly agree, 3-neutral, 4-agree, and 5-strongly agree) created by the main researcher (see Appendix F). The survey was used to assess the use of Fitbit and Apple technology in conjunction with daily/weekly physical activity and the participants' opinion of using interdependent group contingency to increase physical activity. The survey addressed the complexity and interest of keeping track of daily activity, pairing devices, and the change in behavior due to intervention. There were four open ended questions at the end of the survey addressing physical activity, the Fitbit experience, and any lifestyle change.

The results of the social validity questionnaire indicated that using a group contingency and measuring physical activity with wearable technology was socially acceptable across all participants. All four participants answered strongly agree to each question (see Table 4). A table also lists the answers each participant provided for the open-ended questions (see Table 5). The students liked working in a group, wearing technology to track their activity levels, and reported a change in their physical activity level due to the group effort and keeping track of their daily physical activity.

Table 4. Student Social Validity Survey Responses

Students	I liked wearing a watch that tracks my activity level	Using this watch was helpful in keeping track of my activity levels.	I liked wearing the watch every day.	The app was easy to use.	Working as a group was encouraging for me to be physically active because everyone was rewarded for how well the entire class did.	I liked the rewards.	I am interested in continuing to track my activity through a watch or mobile app.	This study encouraged me to increase my physical activity.
Marge	5	5	5	5	5	5	5	5
Matt	5	5	5	5	5	5	5	5
Kevin	5	5	5	5	5	5	5	5
Dave	5	5	5	5	5	5	5	5

Note. 1=strongly disagree, 2=slightly disagree, 3=neutral, 4=agree, 5=strongly agree

Table 5. Individual Participant Responses to Social Validity Questionnaire

Student	Questions			
	Open-ended Question 1	Open-ended Question 2	Open-ended Question 3	Open-ended Question 4
	Which physical activity is preferable for you?	Are you more interested in increasing your physical activity through group or individual activities?	What did you like or not like about the Fitbit and the Fitbit app?	Did your daily or weekly lifestyles change (exercise, new interest, etc.) due to using a Fitbit? Yes or No. Please explain?
Marge	Walking and going to TREC to workout	Yes, to help increase my physical activity and to be healthier.	I liked that it tracked the days that I exercise and I could log in my with a intake	Yes, I did a lot more exercise with it.
Matt	(no answer)	Group	Every	More
Kevin	Because do watch can use	Work at in group	We check on my Apple Watch Health App	Yes
Dave	All of them.	Group, because if I slack off, someone will pick me up.	I like everything	Yes

Discussion

The purpose of this study was to assess the effects of a randomized interdependent group contingency on physical activity for college age students with I/DD. Overall, the results from this single subject research design study suggest that a randomized interdependent group contingency was an effective intervention to increase the average minutes of physical activity and total average of weekly minutes of physical activity during intervention for the group as a single unit. Also, each participant demonstrated an increase in their average minutes of physical activity from baseline to the last intervention phase. Maintenance was recorded two weeks after the last phase and the group's average minutes of physical activity remained above baseline with the week's total average of 191 minutes, which exceeds the minimum amount of 150 minutes per week recommended by the CDC (2016). Also, during maintenance, three participants' average minutes of physical activity was above their baseline measurement and one participant's weekly total measured at 315 minutes (5 hours and 15 minutes) exceeding the recommended time of 300 minutes of vigorous to intense physical activity per week. Another participant minutes of physical activity during the maintenance phase was 145 minutes, which is in close range of the weekly recommendation of moderate physical activity of 150 minutes by the CDC (2016). Maintenance was recorded at the end of the semester and one participant was not present for data collection.

Kuhl et al. (2015) indicated that physical activity benefits students' learning, physiological health, and anxiety, asserting the need for proactive efforts geared to younger individuals to help prevent chronic diseases that are correlated with low activity

in adulthood. Individuals working together as a group to motivate each other in physical activity can bring out natural positive social exchanges, which has been described by Kohler et al. (1995) as vital for community integrations for persons with disabilities. In their research, they reported that group-oriented reinforcement contingency was a viable method for creating a supportive network that is widespread and effective for numerous behaviors. Washington, Banna, and Gibson (2014) indicated that physical activity is sensitive to the consequences that follow, supporting the potential use of group contingencies as low cost operant intervention techniques to increase physical activity as a prevention or treatment tool for obesity. The results from this current study reflects this concept.

Independent, dependent, and interdependent group contingencies have been effective for addressing behavior change within the classroom and school environment over the last 40 years (Little et al., 2015; Maggin et al., 2017). Interdependent group contingencies have been used as an intervention from the preschool setting to the high school classroom to increase academic performance, reduce classroom disruption, and transition time (Alric et al., 2007; Campbell & Skinner, 2004; Hartman & Gresham, 2016; Hawkins et al., 2015; Theordore et al., 2001). The use of interdependent group contingency to increase physical activity in the P-12 environment is emerging in the literature, but is limited in comparison to the use of this intervention applied towards academic and disruptive behavior change. This study continues the line of research from previous studies that implemented group contingencies to increase physical activity levels for individuals, but maybe the first study to use this intervention with students diagnosed

with I/DD at the college level enrolled in a PSE program. Studies using group contingencies at the higher education level, including PSE programs for individuals with I/DD, were not found during the initial literature search for this study.

Interdependent group contingencies can be effective for increasing physical activity for college-age students with disabilities who are balancing busy class, work, and family schedules. Each student may have barriers on some days that prevent access to physical activity and have other days when activity is built into their schedules. The leveling of participant's performance in interdependent group contingencies will account for the different abilities, fitness levels, and accessibility to physical activity, while encouraging individuals to do their best to contribute to the group goal.

Limitations

Limitations to this study are important to acknowledge as they can affect the interpretation of the results. First to note, information of each participant's past-experience using wearable technology and being involved in any type of physical activity interventions prior to this study was not collected before the study, which excludes information if each participant was equal in their experiences at the beginning of this study. Secondly, wearable technology can provide an estimate of the overall amount of physical activity that the participants engage in, but accuracy of measurements of physical activity can be effected by multiple variables. For example, the consistency in which participants wore their Fitbits in the beginning of this study, the intensity of the activity, and type of activity chosen are all factors that can impact the accuracy of the results. Additionally, three participants were measuring their physical activity using

Fitbit technology and one participant used Apple technology. There can be a discrepancy in measurement between the two different devices. Also, the social validity questionnaire did not focus on the participants' interest in receiving a tangible reward in exchange of their physical activity, so there is not enough evidence in this study linking the importance of an initial reward program to increase physical activity. Finally, due to the small number of participants and homogeneity of the participants, generalizability of the results of this study is not guaranteed.

Future Studies

The results indicate the effectiveness of using interdependent group contingency to increase physical activity for college age students with I/DD. Further research on the use of interdependent group contingencies to increase physical activity could be a powerful tool for grade school and high school age students with disabilities to begin early intervention as a preventive tool for individuals that are susceptible to adopting a more sedentary lifestyle. Also, there has been an increase in PSE programs across the country over the last decade. Future research can focus on combining efforts and connecting the students from these programs to motivate each other in building on their physical activity levels and routines through social media groups.

Chapter 3: Study 2-Using Peer Support Through Social Media to Promote Physical Activity for College Age Students with I/DD

Physical activity for individuals with disabilities has been linked to positive long-term overall health outcomes and increased social inclusion within communities (Crawford et al., 2008; Murphy & Carbone, 2008; Srinivasan et al., 2014). As research is growing on the positive benefits of physical activity, individuals with I/DD and physical disabilities are still reporting to be less active than their peers with a lower participation rate in community recreational programs and fewer friends or social contacts outside of their direct caregivers (Blick et al., 2015; Frey et al., 2017; Golubovic et al., 2012; Healy et al., 2017; Kosma et al., 2002; Memari & Ziae, 2014; Shin & Park, 2012; Sorensen & Zarrett, 2014; Srinivasan, et al., 2014; Walls et al., 2018). Supportive social environments can contribute to the motivation of individuals with disabilities to adopt a more physically active and healthy lifestyle (Gill et al., 2018; Knibble, Biddiss, Glasdstone, & McPherson, 2017).

Social Support and Physical Activity

A decrease in physical activity during adolescences has been related to the causation of an increase in obesity in youth (Gill et al., 2018). Kuhl et al. (2015) indicated that physical activity benefits students' learning, physiological health, and anxiety, asserting the need for proactive efforts geared to younger individuals to help prevent chronic diseases that are correlated with low activity in adulthood. Social support from peers has been identified as a key motivating factor to promote physical activity in youth (Gill et al., 2018; Salvy et al., 2008; Silva, Lott, Mota, & Welk, 2014).

In their research, Salvy et al. (2009) found that youth increased in frequency and duration of their physical activity in the presence of a friend or with peer support. Shields, van den Bos, Buhkert-Smith, Predergast, and Taylor (2018) conducted a study using peer-mentors in a community-based exercise programs for 18-year old individuals with I/DD and physical disabilities. In their findings, Shields et al. reported that a student mentored community-based exercise program increased the engagement of young adults with disabilities in physical activity. Reciprocal social relationships developed during this 12-week program and the participants reported feeling motivated to exercise with a skilled friend in a social context. Supportive social environments with peer encouragement can be shaping mechanisms for motivating individuals in pursuing a more active lifestyle (Gill et al., 2018; Knibble et al., 2017; Salvy et al., 2009). As the use of social networking sites continue to grow, individuals are finding support and motivation in on-line fitness communities through the shared interaction of seeking and receiving compliments and social support in a computer-mediated environment (Stragier, Merchant, Marez, & Cardon, 2018).

Peer Support Through Social Media

In SCT, Bandura (1999) indicated that changes in human behavior are rooted in a social system, with personal agency operating in a broader network of sociocultural influences that make individuals producers as well as products of their social system. These structures can provide opportunities for personal development through the triadic relationship of self, causation, and social structures provided with in a community (Bandura, 1999). Social networking sites provide opportunities for individuals to create a

sense of community through supportive interactions that develop interpersonal relationships between friends, family members, co-workers, and other daily acquaintances. In a study using internet chat rooms over a 4-8-week period, Shaw and Gant (2002) found that loneliness and depression decreased in the participants, while at the same time self-esteem and the sense of social support increased. In more recent studies, individuals connecting in virtual communities on social networking sites have reported positive emotional effects immediately following interactions, a sense of belonging, a feeling of invested social capital within the group, and increased self-esteem from supportive interactions (Lin, Fan, & Chau, 2014; Munzel, Galan, & Meyer-Waarden, 2018; Oh, Ozkaya, & LaRose, 2014; Shaw & Gant, 2002; Shpigelman, 2016).

Social-networking and Physical Activity

Individuals have used social networks to monitor, record, and share their physical activity, allowing them to receive and provide support with other physically active peers within these virtual communities. In a study using self-monitoring, the social networking platform of Facebook, and pedometers to measure physical activity, Maher et al. (2015) found that interactions through this platform positively influenced health behavior in adults who were previously insufficiently active (self-reporting less than 150 minutes of activity per week). In this study, participants were split into friendship groups consisting of 3-8 members. They were provided a calendar to record daily steps and a tally board for self-monitoring as well as team-monitoring. The friendship groups used a team message board to provide daily physical activity tips, engage in friendly rivalry, and offer peer support. Over a 50-day time-period, the participants' step count significantly

increased. In another study, looking at the efficacy of using social media to influence physical activity amongst graduate students, Zhang, Brackbill, Yang, and Centola (2015) created peer groups on a social network site that shared their personal on-line profile and progress in workout classes through postings and self-report. The participants' engagement in physical activity, enrollment in group activity classes, and self-report of physical activity within the peer groups significantly increased over a 13-week period. Another study involving young cancer survivors and their use of Facebook for social support as an intervention for physical activity, also found that postings and discussions initiated by peers were effective on behavior change in their physical activity (Valle & Tate, 2017). The participants in this study reported feeling motivated to become more physically active when peers provided support through encouraging interactions (Valle & Tate, 2017). In this study, Valle and Tate (2017) suggested participant-led discussions on Facebook can encourage physical activity amongst peers through supportive interactions.

Social Media Use and Individuals with I/DD

Adolescents with disabilities have been noted to interact less frequently with their peers and struggle to make social connections (Brock, Biggs, Carter, Cattey, & Raley, 2016). Shpigelman and Gill (2014) indicated that social networks have the potential to empower individuals with intellectual disabilities. Social network sites support social relationships that build on self-determination by providing an environment for individuals with disabilities to keep close relationships, give and receive social support (Shpigelman & Gill, 2014^b). Individuals with disabilities using social network sites have reported

forming meaningful relationships that foster their self-autonomy to project their own personal identity and become visible to others (Holmes & Lauglin, 2012; Shpigelman, 2016). These sites allow individuals to share mutual hobbies through public postings and have reported to contribute to an increase in self-esteem and psychological well-being (Holmes & Lauglin, 2012; Shpigelman, 2016). Social networks can bridge the absent feeling of friendship for individuals with intellectual disabilities by creating opportunities for online social interaction with peers and colleagues from their community; providing a platform to strengthen these relationships through shared interactions (Shpigelman & Gill, 2016; Shpigelman, 2018). Individuals with intellectual disability have reported using social network sites to stay updated with friends, share opinions, upload photos, videos, comment on friends' posts, share posts, find new activities, and join groups with common interests (Shpigelman, 2018). The continued use of social networks for individuals with disabilities shapes their sense of belonging to a community and social capital, expands social interactions, and promotes social inclusion through the extension of friendships formed on social networks (Shpigelman & Gill, 2016; Shpigelman, 2016).

Supportive Environments: PSE Programs

In the current practices of providing peer mentorships in established PSE programs, students with I/DD have shared developing strong bonds and relationships with their peer mentors (Griffin, Wendel, Day, & McMillan, 2016; Rillotta, Hutchinson, Arthur, & Raghavendra, 2018). The mentors have also reported developing a bond with their peers who have I/DD and have described this as a learning experience (Griffin et al., 2016; Rillotta et al., 2018). Peer mentors and students in the PSE programs found this

relationship extended their social networks, which created a more natural inclusion for students with I/DD on a university campus (Griffin et al., 2016; Rillotta et al., 2018). Students with I/DD additionally reported having more confidence in working towards goals with support from their peer mentors (Rillotta et al., 2016). Current PSE programs have been incorporating peer mentorships that have proven to be effective supports for college age students with I/DD in their social and academic realms (Griffin, 2016; Rillotta, et al. 2018). There is a gap in the literature discussing the ability for individuals with I/DD to provide this same level of peer support to each other in their daily environment, especially in the realm of physical activity. This current study looked at college age students with I/DD in a PSE program providing peer support for physical activity through social media.

Purpose of Study 2

The purpose of this study was to evaluate the use of peer support using the social media platform of Facebook to increase physical activity for college-age students with I/DD in a PSE program. An ABAB single subject research design was used to analyze a functional relation between peer support and the increase in physical activity.

Research Questions

(1) What are the effects of peer support through social media (Facebook) on increasing physical activity for college students with I/DD? (2) What is the social validity of using a peer support through social media (Facebook) to increase physical activity for college age students with I/DD?

Informed Consent

Prior to the study, support letters were obtained by the director of the PSE program. Full approval then was received by the University's Institutional Review Board. Finally, signed informed consent was obtained from each participant.

Method

Participants included four college-age students diagnosed with I/DD who were enrolled in a PSE program at a large university in the Southeastern United States. Participant ages ranged from 19 to 20 years old, and pseudo-names were used to maintain confidentiality. Students enrolled in this program audited college courses not included in the PSE program and completed course work in Life Skills, Digital Literacy, and Career Planning that were required for the PSE program. This study took place in the Life Skills class where students were learning about independently exploring their communities, local clubs, recreational activities, available transportation options, financial literacy, and working on setting short-term and long-term goals. This project was introduced during the first week of the semester as an opportunity to work as a group supporting each other in building and maintaining their physical fitness as college age students. Study data were collected by the main researcher, who was a doctoral student in the field of special education at the time of this study with 12 years of experience working in this field.

Participants

Kelsey. At the time of this study, she was a 20-year old female student with a diagnosis of intellectual disability. She was described as an active student by members on her high school IEP team and enjoyed playing soccer. Kelsey stressed over happiness

and making friends. She was currently enrolled in a college level soccer class and stated that she enjoyed having classes across campus so she could walk to them.

Breanna. At the time of this study, she was a 19-year old female student with a diagnosis of intellectual disability and speech language disabilities. She described herself as an active individual with her favorite sports being basketball and bowling. She also shared concerns of her body weight and wanted to increase her physical activity. Many weekend throughout this study, she attended different sporting events with her family.

Kimberly. At the time of this study, she was a 20-year old female college student with a diagnosis of multiple disabilities including autism spectrum disorder, traumatic brain injury, and visual impairment. During her elementary and high school years, she received services in the areas of physical therapy, occupational therapy, and speech-language. She currently used a power wheel chair for long distance.

Kylen. At the time of this study, she was a 19-year old female college student with a diagnosis of intellectual disability. During her elementary and high school years, Kylen received related services in the areas of occupational therapy and speech-language. Kylen was moderately active at the time of this study.

Settings

This study began in a Life Skills college level classroom for students diagnosed with I/DD on a large public college campus in the Southeastern United States. The classroom was set-up with tables formed the shape of a horse shoe. The instructor delivered the lessons at the front of the room using a projector and PowerPoint presentations with whole classroom and small group discussions. Initial instruction

focused on students independently accessing their community and college campus through public transportation with discussion of using walking as an alternative mode. The classroom staff included the main instructor, who was a doctoral student in Counselor Education, the researcher, who was a doctoral student in Special Education, and one peer mentor, who was studying Speech and Language Pathology. There were 15 students in this class with diagnosis of intellectual or developmental disabilities. Of the 15 students, initially seven students were chosen for this current study based on their interest in increasing their physical activity, access to social media (Facebook), willingness to wear a device that tracks their exercise, and current enrollment in the PSE program in which this study was being conducted. Only four participants' data have been included in this dissertation from the original seven participants who volunteered due to insufficient amount of data in two of the participants' baseline and limited contact by the primary researcher with the other participant during intervention due to schedule conflicts.

The engagement in physical activity occurred on campus and in the participants' community. All the participants were enrolled in a physical education course at the university including soccer, dance, basketball, and adaptive physical education.

Materials

The materials used in this study included (a) four Fitbits (wearable technology), (b) four mobile phones, and (c) the Fitbit app. Data were collected and analyzed on campus, but students engaged in physical activity on and off campus measured seven days a week and 24 hours a day through using Fitbit and Apple Technology.

The Fitbit Blaze is a wrist watch used as wearable electronic device to tell time and can measure an individual's physical activity in multi-sport modes. The Fitbit is paired with a mobile device (e.g., cell phone, tablet) by setting up an account through the Fitbit app and an email address (see Figure 12). This device measures physical activity in duration, steps, miles, floors, and heart rate. Statistics are displayed on a dashboard in the app on the paired mobile device (see Figure 13) and are accessible through weekly progress emails for the Fitbit technology (see Figure 14). The goals and individual physical activity can be shared through social networks and connected to multiple apps such as *Map My Fitness*, *Strava*, *Map My Walk*, and *Cyclemeter* (see Figure 15) that provides a visual map of location and other statistics of the chose activity. This device can be paired with social media groups (e.g., Fitbit Community, Facebook, Instagram, etc.) to share daily physical activity (see Figure 16).

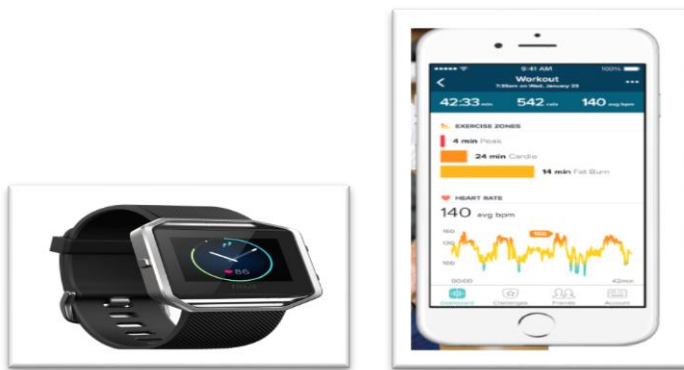
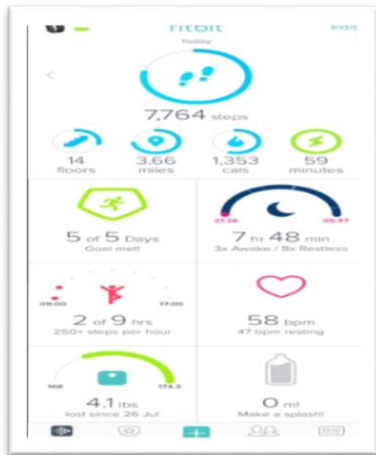


Figure 12. Fitbit wearable technology paired with mobile phone



Fitbit

Figure 13. Fitbit dashboard displaying visual representation of percentage of goal step count, duration, and other information that monitors daily and weekly activity

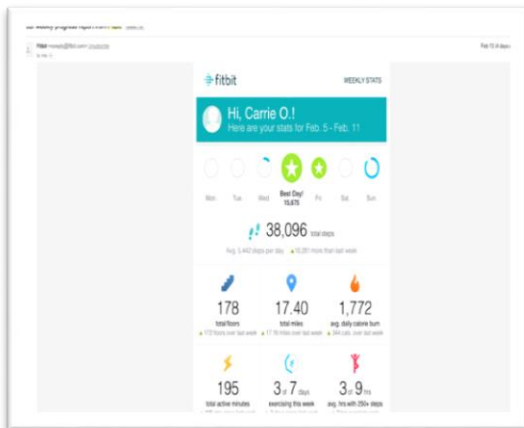


Figure 14. Fitbit email with dashboard displaying weekly progress measured in steps, miles, calories burned, duration, days of the week, average, heart beat, and weight change option

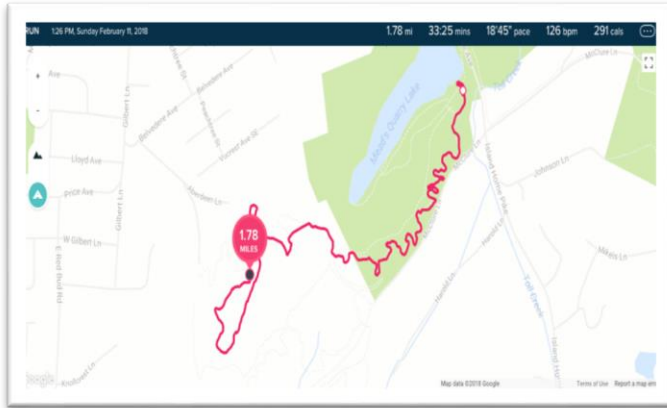


Figure 15. Pairing of Map My Run app with Fitbit technology to provide a visual display of activity route



Fitbit

Figure 16. Fitbit technology paired with social media

Independent and Dependent Variables

The independent variable was peer support, defined as recognizing and making positive statements such as “great job” towards peers on their daily physical activity using social media (Facebook). The dependent variable was the daily amount of physical activity measured in steps for each participant. Physical activity was measured using participants’ Fitbit Blaze wearable technology synchronized to a mobile device recording daily activity through a compatible Fitbit app. Initially, minutes, miles, and steps were recorded and analyzed during baseline, but steps were chosen to measure daily physical activity due to most consistency in data patterns across participants. An example of inconsistency was based on one student not moving at an intense enough rate for duration for her physical activity to be detected by the Fitbit technology and in the beginning of the study, this participant’s step count was not high enough to equate to measurements in mileage. Also, the students were observed referring to number of steps taken per day when reporting their total to the main researcher and sharing with others in their program area (e.g. peer mentors, staff, each other). The participant’s physical activity was measured daily during the 24-hour time-period throughout a seven-day weekly period.

Design and Procedures

A withdrawal design was used to determine the effectiveness of peer support on the duration of physical activity in college age students with I/DD. This design permits for a clear demonstration of experimental control by implementing a system of repeated introduction and withdrawal of baseline and intervention phases (Gast & Ledford, 2014). This type of design illustrates causality of behavior change using sequential replication of

effects comparing the intervention phases with adjacent baseline phases (Horner et al., 2005). During baseline and withdrawal phases, participants did not receive peer support delivered through Facebook. The Facebook page was developed and made accessible the first day of Intervention (B₁). During intervention, participants were encouraged to post their daily activity and requested to comment on their peer's daily activity.

Baseline Phase (A1). Baseline data were collected daily by recording data from the dashboard of the Fitbit app onto individual data sheets for each participant. The duration of physical activity, miles accumulated, and number of steps taken was tracked over a five-day period by the participants' wearable technology establishing a mean of present level of performance in fitness. According to What Works Clearing House (Kratochwill, et al., 2010), baseline is established after stability in data is determined with a downward trend of data points across five consecutive sessions in a non-therapeutic direction observed through visual analysis, but the baseline data in this study revealed that the all participants' current physical activity was far below the daily recommended amount of physical activity established by the CDC (2016) and intervention maybe effective before stability in data could be determined across all participants. A data sheet (see Appendix G) was used to record daily physical activity and then transferred into an excel sheet to create a visual analysis using line graphs (Appendix H). The participants received a Fitbit on the first day of baseline and no instructions were provided during this period regarding the multiple functions or modes accessible in a Fitbit device. The recording of physical activity across participants began on the same day. The participants were encouraged and reminded to wear their Fitbit technology.

Group Pre-training. After baseline, the main researcher shared with each participant their average duration of physical activity measured in minutes and step count during the baseline period. The researcher discussed the recommended amount of physical activity by the CDC (2016) of 2 hours and 30 minutes a week of aerobic exercise with a combination of strength training, which can be broken down to around 30 minutes five days a week. Also, the main researcher emailed each participant a chart (Appendix I) outlining recommended number of steps per day (Tudor-Locke & Bassett Jr., 2004; Tudor-Locke et al., 2008). Next, the participants were guided in checking their data and shown on their mobile device how to track weekly progress in steps. The participants were informed about the weekly progress emails they would receive from Fitbit.

Next, the Facebook page, which would be used to provide peer support, was introduced to the participants as a group in the Life Skills Class. The main researcher discussed with the group that some days maybe more active and other days less active, but as a group, they will motivate each other to increase their physical activity through posting supportive messages to each other on the Facebook page and in person. All participants who had a Facebook account received an invitation to participate on this private Facebook page that was created by the main researcher. One participant did not have a Facebook account, but was currently active on Instagram and was interested in expanding their social media activity to Facebook. The primary researcher assisted this participant after class in setting up their account and showed the participant how to post and comment on other peer's posts. Each participant was familiar with loading pictures

and posting comments onto social media. After the Facebook page was introduced, the participants were asked as a group if they liked to post and receive comments on social media sites or use the thumbs up icon. Each participant said yes. Also, the participants were asked if they would like a text sent from the researcher during weekdays as a reminder to exercise and share their activity on Facebook. Each participant said yes. The main researcher chose not to text the students during the weekend to give them a break from school related activities and to be respectful of family time. Then the participants and researcher discussed activities available to access on campus and close to the participants' homes. The participants were reminded to wear their Fitbits daily so that their physical activity could be tracked. The participants were asked if they had any questions.

After class, the main researcher sat with each participant individually in a public computer lab commonly used by the participants and asked them to post a comment when they were ready. A couple of participants stated they were not interested in posting at that time and one participant wanted her mother's permission before posting.

Peer Support Intervention (B1). After baseline and group training, intervention began. Data were recorded on a consistent daily schedule by the main researcher accessing the data tracking dashboard on the Fitbit app. The main researcher discussed and reviewed with each participant their total steps accumulated per day. The data were usually recorded as a group with positive feedback provided to each participant regardless of accumulated steps the day before with intention of modeling positive-reinforcement. The participants were also encouraged to check the graphs created on the

apps that displayed the accumulation of physical activity across days and partitioned into weekly-periods. During week days, a group text message was sent out daily by the main researcher that included a statement of praise based on the day before physical activity, a reminder encouraging participants to post any activity they engaged in during that day, and to comment on each other's post. Also, a Facebook post was added to the private fitness page daily by the main researcher with either a positive comment or a statement encouraging participants to engage in physical activity. Intervention phase continued until stability in data were established and an increased trend in a therapeutic direction of physical activity, measured in steps, over five consecutive days was observed through visual analysis with a mean level change between baseline and intervention as recommended by Gast and Ledford (2014).

No Peer Support (A2). After intervention phase, baseline conditions were reintroduced. During this phase, data were still recorded daily by the wearable technology and the first review of data with the participants was collected five days after the last day of baseline by accessing the data tracking dashboard on the Fitbit apps. This time-period removed any attention or support modeled by main researcher to the participants during withdrawal. The Facebook page was turned off to prevent peer support through social media. The participants were not told ahead of time that the page would be shut down. No group text messages were sent out during this phase either. This phase continued until the mean level performance of the participants returned to similar conditions during baseline and the trend turned towards a non-therapeutic

direction, demonstrating a decrease in behavior when the intervention was withdrawn (Cihak et al., 2010; Horner et al., 2005).

Peer Support Reinstated (B2). Peer support was reinstated by reactivating the Facebook page and sending group text messages from the main researcher to the participants with positive statements of the group's performance (e.g. great job yesterday, we had some high steppers yesterday), reminders to post daily activity on Facebook, and comment on each other's post. Data continued to be recorded daily with the main researcher interacting with the participants in small groups.

Maintenance Procedures

Maintenance of the independent variable on the dependent variable was measured two weeks after the last intervention phase by recording each participant's physical activity in steps per day. During the time-period between the last intervention phase and maintenance, the primary researcher did not send daily text messages or interact with the participants. The group Facebook page was active during this time-period, but the primary researcher did not add any posts. Social validity was also collected during maintenance (see Appendix J) to gather data from the student survey examining the importance of the goals, procedures, and effects of change (Wolf, 1978).

Inter-observer Agreement (IOA)

Inter-observer agreement (IOA) was collected by the primary researcher, the classroom instructor who was a doctoral student in the field of Counseling Education, and an undergraduate student studying in the field of speech pathology. The participants' step data were collected from their mobile dashboards and recorded onto a data sheet by

the main researcher. At the end of baseline (A₁), the undergraduate student and main researcher accessed each participant's dashboard together comparing this data to the information recorded on the data sheet by the main researcher. After the final intervention phase (B₂), the main researcher and classroom instructor accessed each participant's data dashboard and chose random days checking if the recorded data on the sheets were the same viewed on the participant's dashboards for the chosen days. The IOA data were collected over 40% baseline and 40% intervention conditions across participants. A continuous record and permanent product was available in the app and could be accessed using the calendar icon by choosing the backward or forward arrows to select different days of the week. This process assisted with checking any recording mistakes made by the main researcher during the daily recording process. When a mistake was found on the original recording of data, the researcher crossed out the number and recorded the correct step count. The mean IOA across participants was 100% during baseline, 95% during the first intervention, 96% during withdrawal, and 100% during the last intervention phase.

Treatment Integrity

Treatment integrity data were collected with checklists (see Appendix K) containing information for the researcher during intervention of charging, wearing, and collecting participants' data. These data were recorded on a bi-weekly basis during baseline and intervention with assistance from staff in the PSE program. Treatment integrity was defined as 90% or better and was calculated by staff-members' agreement of observed procedures adhered to by the researcher on the treatment integrity worksheet

during this eight-week study. The main researcher did adhere to treatment integrity with accuracy 100% during baseline, intervention phases, and withdrawal.

Data Analysis

Visual analysis was used to demonstrate evidence of a functional relation between the independent variable (peer support) and dependent variable (physical activity) by assessing the (1) level, (2) trend, (3) variability, (4) immediacy of effect, (5) overlap, and (6) consistency of data patterns with-in and between conditions as recommended by What Works Clearinghouse (Kratochwill, et al., 2010). Within-phase comparison was evaluated to assess replicated patterns of data and adjacent phases were evaluated to assess if a change in the dependent variable was due to the independent variable. Next, the effect size was calculated to estimate the magnitude of the intervention on the desired outcome. There are many different methods for calculating effect size in single subject research design with each having advantages and disadvantages based on the variability of the data set and other factors such as outliers that can compromise a more precise calculation of intervention effect. The use of PEM is recommended when there are outliers in the baseline and variability of data overtime (Lenz, 2013), which was representative of this data set. The scale used to determine effect size for PEM is 0-1 with $\geq .9$ being considered highly effective, .7-.9 as moderately effective, and $< .7$ questionable or not effective (Ma, 2006).

Results

The group and individual participants' step count data have been summarized averaging data seven-days per week (see Table 6) during the phases and then averaging

data five-days per week with excluding weekend data (see Table 7). Immediacy of effect was also calculated to determine the mean level of change between adjacent phases. Next, range in step count per phase for the group and individual participant's physical activity was summarized in Table 8 including weekend data and Table 9, excluding weekend data. Effect size using the percentage exceeding the mean (PEM) was calculated for the group and individual participants' activity with weekend data included (see Table 10) and without weekend data (see Table 11). Finally, the participants' individual Facebook activity was recorded in Table 12 for the first intervention phase (B₁) and Table 13 for the second intervention phase (B₂). Tables were created to compare information calculated during phases including and excluding weekend data, but visual graphical analysis was only provided for data including weekend data to capture the original essence of this dissertation focusing on barriers, issues, inclusive programs, and motivational practices that contribute daily to the physical activity of individuals with disabilities.

Analysis of Group Data

As stated earlier in this dissertation, approximately 9.6% of adults with disabilities meet the standard of recommended physical activity of 2 hrs. and 30 minutes of moderate-intensity aerobic activity per week (e.g. walking, jogging) in comparison to 23.6% of their peers without a diagnosed disability (Office of Disease Prevention and Health Promotion, 2015). A measurement system, designed by Tudor-Locke et al. (2008) converting minutes of physical activity to step count base, categorizes physical activity into the following classifications: <5,000=sedentary, 5,000-7,499=low activity, 7,500-

9,999=somewhat active, 10,000-12,499=active, and >12,500 highly active. The group's average and individual participants' step count throughout the study was variable with oscillating differences in accelerating and decelerating trend. Baseline results confirm that participants' average daily step count, calculated as a group, was below the recommended amount of 10,000 steps per day (Tudor-Locke & Bassett, 2004). The group's average step count calculated per day during baseline (A₁), including weekend data, across all four participants was 3,174 steps (see Table 6) over a five-day phase, which is considered "sedentary behavior" (Tudor-Locke et al., 2008). When calculated, analyzing week day data only, the groups average step count per day across all four participants was 4,342 (see Table 7), which is also considered "sedentary" (Tudor-Locke et al., 2008). Visual analysis provides an observable downward trend in a non-therapeutic direction during this phase (see Figure 17). During the first intervention phase (B₁), each participant increased their daily step count with the group averaging 4,891 per day with weekend data included and 6,859 analyzing weekday data only, keeping the group's activity into a category considered "sedentary" when including all data and "low activity" range with weekday data only (Tudor-Locke et al., 2008). Analysis of data indicates an accelerating trend in a therapeutic direction during this intervention phase, except for the last two data points, which represented data collected over the weekend. During this phase, the main researcher was aware of this possibility, but chose to include the last two data points over the weekend to analyze if the intervention would have an increase effect on the second set of weekend data compared to the first weekend activity during this phase. The average of physical activity was

significantly lower during the second weekend (317 steps) than the first weekend (1,590 steps). A withdrawal phase (A_2) was introduced resulting in an average step count of 6,054, demonstrating a continuous increase in step count for the whole group with weekend data included and placing the group's average physical activity into the "low activity range" based on step count research conducted by Tudor-Locke et al. (2008). This phase also ended with data recorded over the weekend, which caused a slight decrease in trend noticeable through visual analysis. When analyzing group data not including weekends during withdrawal (A_2), the group average daily step count across all four participants was 6,799, which was a slight decrease in activity, remaining in the "low activity" range (Tudor-Locke et al., 2008). After a 14-day withdrawal period (including weekend data), a decision was made to re-implement the intervention package with intent to move the participants' in their physical activity above the "low activity range. Also during withdrawal phase, the average of the group's activity continued to increase, but individual participant's average step count was decreasing, so all elements of the intervention were re-implemented. Once the intervention was re-implemented, the level of the group's activity decreased in a non-therapeutic direction in both data sets including and excluding weekends with high variability in trend. During this phase, the group's average steps across all four participants was 5,132 and 6,542 when weekend data were not included. Data were collected two-weeks after the last intervention over a three-day period phase to check for maintenance of physical activity. The group's average step count during this period was 8,102, which is considered "somewhat active" (Tudor-Locke et al., 2008).

Table 6. Average Group and Participant Step Count Per Phase with Weekend Data

Participants	Baseline (A ₁)	Intervention (B ₁)	Withdrawal (A ₂)	Intervention (B ₂)	Maintenance
Group	3,174(3,339)	4,891(3,170)	6,054(2,143)	5,132(3,030)	8,102(2,457)
Kelsey	6,066(5,901)	10,051(4,676)	9,122(4,055)	9,383(5,153)	11,718(4,243)
Breanna	5,876(2,924)	7,128(2,413)	5,948(2,905)	7,721(3,459)	10,296(2,617)
Kimberly	438(370)	2,159(1,054)	1,666(1,142)	2,563(1,094)	4,481(2,463)
Kylen	6,071(4,862)	5,065(3,537)	7,595(1,262)	5,850(3,162)	8,503(1,192)

Table 7. Average Group and Participant Step Count Per Phase without Weekend Data

Participants	Baseline (A ₁) W/O	Intervention (B ₁) W/O	Withdrawal (A ₂) W/O	Intervention (B ₂) W/O	Maintenance
Group	4,342(3,968)	6,859(1,497)	6,799(1,241)	6,542(2,105)	8,102.00(2,498)
Kelsey	7,923*	11,151((3,771)	10,355(2,838)	10,786(3,146)	11,718(4,243)
Breanna	7,211*	7,652(2,682)	5,948(2,905)	7,572(3,164)	10,296(2,617)
Kimberly	347.00(345)	2,652(832)	1,991(971)	2,836(1,034)	4,481(2,463)
Kylen	6,764(5,708)	6,956(1,938)	7,755(1,282)	6,106(3,193)	8,503(1,192)

Note. Baseline with only two data points

Immediacy of effect was calculated next to further establish if there was a relation between the independent variable and dependent variable (Kratochwill, 2010). To determine immediacy of effect, the level of the last three data points in baseline (A_1) was compared to the level of the first three data points in intervention (B_1). Immediacy of effect was also calculated between withdrawal (A_2) and intervention (B_2) using the same formula. For the group's average change in level between baseline (A_1) compared to intervention (B_1), there was an increase difference of 4,988 when comparing the mean of the last three data points in baseline to the first three data points in intervention. When using this same formula for withdrawal (A_2) to intervention (B_2), the mean level change had a decrease of 832 steps. There was a larger change in level between the first two phases and the group's activity decreased during the last intervention phase. The amount of overlapping data was very high between adjacent phases with low amounts of consistency in similar phases.

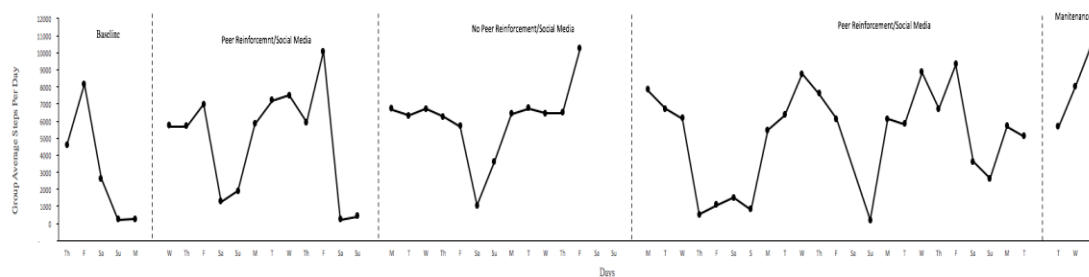


Figure 17. Group's average step count across phases

The group and individual participants' range in steps was also summarized in two separate tables analyzing stability of data in each phase including weekend data (see Table 8) and phases excluding weekend data (see Table 9). According to Gast and Ledford (2014, p. 179), data are considered stable with in a phase when 80% of the data points fall within 25% range of the median referred to as the 25%-80% stability envelope method. Stability in data was not present in any phases when analyzing the group data or individual participant's step counts.

The group's average step count per day during baseline (A_1) ranged from 224 to 8,176. When analyzing week day data only, the groups range in step count measured between from 252-4,599. The group's range during the first intervention phase (B_1) was 218-9,542 including weekend data and 5,678-10,086 without weekend data over this eight-day period. The group range between the withdrawal (A_2) phase including weekend data was 1,037-9,418 steps and 6,267-10,227, not including weekend data. During the last intervention phase (B_2), the group step count range when analyzing data with weekends included was 22-10,227 and 1,634-9,318 without weekend data. The range in step count during maintenance was collected over a three-day period during the week resulting in a span of 6,841-12,846. Noticeably, the range in step count data was shorter during phases not including weekend data.

Table 8. Group and Student Step Range Per Phase with Weekend Data

Participants	Baseline (A ₁)	Intervention (B ₁)	Withdrawal (A ₂)	Intervention (B ₂)	Maintenance
Group	224-8,176	218-10,086	1,037-9,418	22-10,227	6,841-12,846
Kelsey	2,353-12,871	8,623-18,190	22-16,125	6-16,051	9,078-16,631
Breanna	3,206-9,001	4,880-12,059	631-10,343	42-13,652	7,615-12,846
Kimberly	44-927	430-4,011	15-3,047	206-4,316	2,946-7,323
Kylen	231-10,788	7-8,986	6,011-9,939	6-9,448	7,338-9,721

Table 9. Group and Student Step Range Per Phase without Weekend Data

Participants	Baseline (A ₁) W/O	Intervention (B ₁) W/O	Withdrawal (A ₂) W/O	Intervention (B ₂) W/O	Maintenance
Group	252-4,599	5,678-10,086	6,267-10,227	1,634-9,318	6,841-12,846
Kelsey	2,975 & 12,871	6,346-18,190	7,751-16,125	6-16,051	9,078-16,631
Breanna	5,422 & 9,001	4,880-12,059	631-10,343	42-1,365	7,615-12,846
Kimberly	44-724	1,604-4,011	755-3,407	605-4,316	2,946-7,323
Kylen	231-10,788	2,487-8,986	7,786-10,021	6-10,021	7,338-9,721

Effect size was calculated using PEM and analyzed based on a 0-1 scale for phases including weekend data (see Table 10) and not including weekend data (see Table 11). The group's effect size between baseline (A_1) and the first intervention phase (B_1) with weekend data included was .67, which is determined questionable or not effective based on the PEM scale (Ma, 2006) and 1.0 when analyzing phase data not including weekends, which is considered highly effective (Ma, 2006). The effect size calculated between the first withdrawal phase (A_2) and second intervention phase (B_2) was .58 with weekend data included, which is considered questionable or not effective based on the PEM scale (Ma, 2006), and was .73 without including weekend data, which is considered moderately effective (Ma, 2006).

A summary of participants' Facebook activity has also been included below divided into two separate tables displaying the first intervention phase (B_1) in Table 12 and the second intervention phase (B_2) in Table 13. Numerical values represent the amount of daily activity by each participant in the categories of posting, commenting, "likes", viewed posts, and dates the participants initiated a text to the main researcher.

Table 10. Group and Individual Calculated PEM Effect Sizes Across Phases with Weekend Data

Participants	A ₁ - B ₁	A ₂ -B ₂
Group	.67 (questionable or not effective)	.58 (questionable or not effective)
Kelsey	.58 (questionable or not effective)	.48 (questionable or not effective)
Breanna	.58 (questionable or not effective)	.44 (questionable or not effective)
Kimberly	.92 (Highly effective)	.72 (moderately effective)
Kylen	.50 (questionable or not effective)	.62 (questionable or not effective)

Table 11. Group and Individual Calculated PEM Effect Sizes Across Phases without Weekend Data

Participants	A ₁ - B ₁	A ₂ -B ₂
Group	1.0 (Highly effective)	.73 (moderately effective)
Kelsey	N/A	N/A
Breanna	N/A	N/A
Kimberly	1.0 (highly effective)	.77 (moderately effective)
Kylen	0	.53 (questionable or not effective)

Note. N/A (not applicable) due to insufficient amount of data points in baseline

Table 12. Individual Tallied Facebook Activity Intervention (B₁)

Dates B₁	9/6 Th	9/7 F	9/8 Sa	9/9 Su	9/10 M	9/11 T	9/12 W	9/13 Th	9/14 F	9/15 Sa	9/16 Su	9/30 M
Kelsey												
Post		1					1					
Comment							1					
Like					1		1					
Viewed		1	1		1		1					
Text												
Breanna												
Post	1				1							
Comment				1	1							
Like		1			1							
Viewed	1	1	1	1	1							
Text												
Kimberly												
Post		1	1		1		2					
Comment			1	1			1					
Like	1	3	2		1	1	3		1	1		1
Viewed	1	1	1	1	1	1	1		1	1		1
Text								1				
Kylen												
Post												
Comment											1	
Like												
Viewed	1	1	1	1							1	1
Text												

Table 13. Individual Tallied Facebook Activity Intervention (B₂)

Dates B ₂	10/1 M	10/2 T	10/3 W	10/4 Th	10/5 F	10/6 Sa	10/7 Su	10/8 M	10/9 T	10/10 W	10/11 Th	10/12 F
Kelsey												
Post												
Comment												
Like												
Viewed					1			1	1			
Text			1									
Breanna												
Post												
Comment												
Like												
Viewed												
Kimberly												
Post	1							1				
Comment							1					
Like	1	1		1	1	1	1	1	1	1	1	1
Viewed	1	1	1	1	1	1	1	1	1	1	1	1
Text												
Kylen												
Post												
Comment											1	
Like			1								1	
Viewed			1	1	1						1	
Text												

Dates B ₂	10/13 Sa	10/14 Su	10/15 M	10/16 T	10/17 W	10/18 Th	10/19 F	10/20 Sa	10/21 Su
Kelsey									
Post									
Comment									
Like									
Viewed								1	
Text									
Breanna									
Post									
Comment									
Like									
Viewed									
Text									
Kimberly									
Post					1				
Comment									
Like	1	1	1	1	3	1	1		
Viewed	1	1	1	1	2	1	1		
Text									

Table 13. Individual Tallied Facebook Activity Interventions (B₂) Continued

Dates B ₂	10/13 Sa	10/14 Su	10/15 M	10/16 T	10/17 W	10/18 Th	10/19 F	10/20 Sa	10/21 Su
Kylen									
Post									
Comment			1						
Like									
Viewed			1					1	
Text									

Analysis of Individual Participants' Data

Kelsey. Kelsey demonstrated improvement in physical activity throughout this study (see Figure 18). During baseline (A₁), Kelsey's average step count per day was 6,066, which is considered in the "low activity range" (Tudor-Locke et al., 2008). She did reach a step count of 12,871 during this phase, which puts her activity level for that day in the "highly active range" (Tudor-Locke & Bassette et al., 2008). Kelsey only wore her device three times during this phase, which meets single subject research design industry standards with reservation to demonstrate an effect of the independent variable on the outcome variable (Kratochwill, 2010). There were only data for two days when calculating this participant's step count during baseline without weekends, which is not enough data to constitute a demonstration of effect in baseline (Kratochwill, 2010).

Therefore, the following information was summarized analyzing data including week days and weekends. Kelsey's average step count per day during intervention (B₁), was 10,051, which is considered "active" (Tudor-Bassette et al., 2008). The data were highly variable during this phase with an ascending trend in a therapeutic direction towards the end of this phase. Kelsey's step count was above the daily recommended step count of 10,000 steps per day on four separate days during this 8-day period. When the

intervention was withdrawn, her step count decreased slightly during the withdrawal phase (A₂) with an average of 9,122 steps per day, which is considered in the “somewhat active range” (Tudor-Bassette et al., 2008). Again, the data during this phase was highly variable without any defining trend. During this 14-day phase, her step count exceeded the daily recommended step count of 10,000 on four different days. In the final intervention phase (B₂), Kelsey’s average step count was 9,388 with 6 out of 19-days recording over 12,500 steps, which is considered “highly active” (Tudor-Bassette et al., 2008). There was an ascending trend in data midway of this phase in a therapeutic direction and then high variability with a descending trend in data in a non-therapeutic direction at the end of the phase. Data were collected two-weeks after the last baseline during a three-day period phase to check for maintenance of physical activity. Kelsey’s average step count during this period was 11,718, which is considered “active” (Tudor-Locke et al., 2008).

Immediacy of effect was determined by calculating the level of the last three data points in baseline (A₁) in comparison to the level of the first three data points in intervention (B₁). From baseline (A₁) to Intervention (B₁), the level change between the last three data points to the first three data points had a mean difference of 908. The difference in level change for withdrawal phase (A₂) and the last intervention phase (B₂) was 1,863 demonstrating a slightly larger magnitude of effect. The amount of overlapping data was very high between adjacent phases with low amounts of consistency in similar phases.

During baseline (A_1), Kelsey's step count ranged from 2,353-12,871. Her range in step count during the first intervention (B_1) was 8,623-18,190 over a seven-day period, with an increase in trend towards a therapeutic direction. There was a larger range in data during withdrawal (A_2) with high variability in step count varying from 22-16,125 during this phase. The last intervention phase (B_2) had a large range in data with a step count during this phase ranging from 6-16,051 with high variability in data towards the end of this phase. Data were collected two weeks after the last intervention during a three-day period phase to check for maintenance of physical activity with step count of 9,078-16,631.

The effect size between baseline (A_1) and the first intervention phase (B_1) with weekend data included was .58, which is determined questionable or not effective based on the PEM scale (Ma, 2006). The effect size calculated between the first withdrawal phase (A_2) and second intervention phase (B_2) was .48, which is also considered questionable or not effective on the PEM scale (Ma, 2006). Effect size was not calculated for data excluding weekends due to an insufficient amount of data points in the baseline.

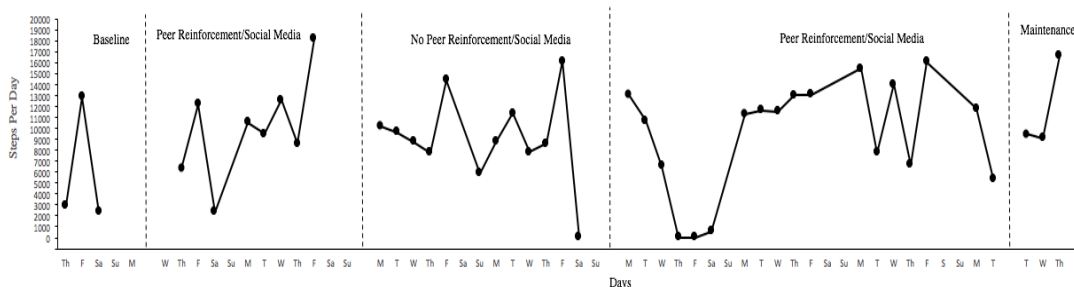


Figure 18. Kelsey's average step count across phases

Kelsey's Facebook activity was very low with in the private page created for this fitness group with activity being recorded on four out of eleven days throughout this phase. During the first intervention phase, Kelsey shared two posts about her status, added a comment to another post about her internship, she "liked" two other posts and viewed the activity on the private fitness page on four different days. During the second intervention, Kelsey viewed on three separated days, but did not add comments, posts, or any form of an emoji.

Breanna. Breanna showed an improvement in physical activity throughout this study (see Figure 19). Data collected during phases including weekdays only were not summarized in this section due to an insufficient amount of data points during baseline. During baseline (A_1), Breanna's average step count per day was 5,876, which is considered in "low activity" (Tudor-Locke et al., 2008). Her average step count per day during intervention (B_1), was 7,128, which is also considered in the "low activity" (Tudor-Locke et al., 2008). During this phase, three-days of data measured between 5,000-7,500 steps (low activity), two-days of step count measured within the 7,500-10,000 range (somewhat active) and one day was above 10,000 steps ranging in the "active" category. In the next phase withdrawal (A_2), her physical activity levels returned close to baseline with a step count averaging in a "low activity" range of 5,948 steps (Tudor-Locke et al., 2008). During the last intervention phase (B_2), Breanna's step count averaged 7,721, which was slightly above her average step count during the first intervention phase, with her activity level remaining in the "low activity" classification category (Tudor-Locke et al., 2008). Data were collected two-weeks after the last

intervention phase during a three-day period phase to check for maintenance of physical activity. Breanna's average step count during this period was 10,296, which is considered "active" (Tudor-Locke et al., 2008).

Immediacy of effect was calculated for the adjacent phases. From baseline (A_1) to Intervention (B_1), the level change between the last three data points to the first three data points (6,055) had a slight mean difference of 179. When calculating the difference in level change from withdrawal phase (A_2) to the last intervention phase (B_2), there was a decrease of 895 in immediacy of effect, but an increase in the overall mean and trend during this phase compared to the withdrawal phase. The amount of overlapping data was very high between adjacent phases with low amounts of consistency in similar phases.

During baseline (A_1), Breanna's step count ranged from 3,206-9,001. Her range in step count during the first intervention (B_1) was 4,880-12,059 over a seven-day period, with an increase in trend towards a therapeutic direction. There was a larger range in data during withdrawal (A_2) with high variability in step count vacillating from 631-10,343 during this phase. The last intervention phase (B_2) had a large range in data, effected by an outlier in the lower range of this data stream. Her step count during this phase ranged from 42-13,652 with a notable increase in data in the direction of a therapeutic trend towards the end of the phases. Data were collected two-weeks after the last intervention during a three-day period phase to check for maintenance of physical activity with step count of 7,615-12,846.

The effect size between baseline (A_1) and the first intervention phase (B_1) with weekend data included was .58, which is determined questionable or not effective based on the PEM scale (Ma, 2006). The effect size calculated between the first withdrawal phase (A_2) and second intervention phase (B_2) was .44, which is also considered questionable or not effective based on the PEM scale (Ma, 2006). Effect size was not calculated for data excluding weekends due to an insufficient amount of data points in the baseline.

Breanna was active on Facebook recording five out of eleven days during this phase. Her activity consisted of two posts, two comments containing positive feedback on another participant's post, and two likes. She had no activity during the second intervention phase on the private fitness page.

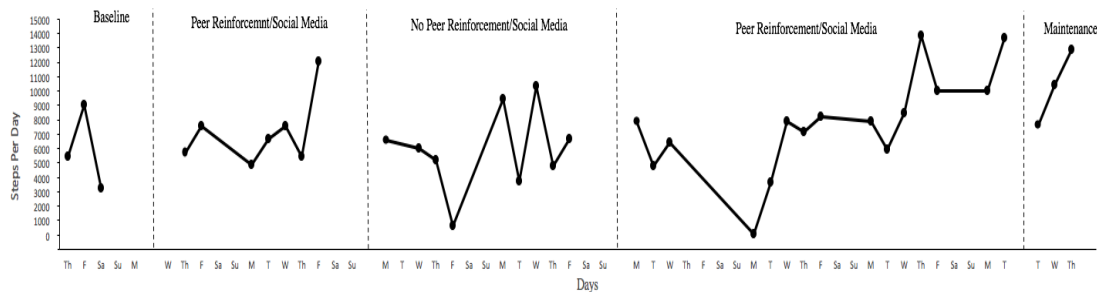


Figure 19. Breanna's average step count across phases

Kimberly. Kimberly's overall physical activity improved over the 8-weeks of this study. During baseline (A_1), Kimberly's average step count per day was 438 when averaging data collected including weekends and averaged 347 steps when analyzing weekday data only, which is considered in the "sedentary range" (Tudor-Locke et al., 2008). Her average step count per day during intervention (B_1), was 2,159 when including weekend data and 2,652 when looking at activity during time-period spanning weekdays only. During withdrawal phase (A_2), her average weekend and weekday step count per day decreased to an average of 1,666 and 1,991 when excluding data collected on weekends. During the final intervention phase (B_2), Kimberly increased her step count to 2,563 including weekend data and her step count measured 2,836 when analyzing weekday data only. Data were collected two-weeks after the last baseline during a three-day period phase to check for maintenance of physical activity. Kimberly's average step count during this period was 4,481, which is still considered in the "sedentary" range (Tudor-Locke et al., 2008).

Immediacy of effect was calculated for the adjacent phases with weekend data included. From baseline (A_1) to Intervention (B_1), the mean level change between phases had an increase difference of 2,238. When calculating the difference in mean level change from withdrawal phase (A_2) to the last intervention phase (B_2), the magnitude was lower than the first two phases with an immediacy of effect 1,680. The percentage of non-overlapping data (PND) between baseline and the first intervention was 83%, which is considered fairly effective (Scruggs & Mastropieri, 1994). The percentage of PND

between withdrawal and the final intervention phase was 17%, which is considered unreliable (Scruggs & Mastropieri, 1994).

Immediacy of effect was also calculated for the adjacent phases with weekday data only included. From baseline (A_1) to Intervention (B_1), the mean level change between the last three data points to the first three data points had an increase mean difference of 2,329. When calculating the difference in mean level change from withdrawal phase (A_2) to the last intervention phase (B_2), the magnitude was lower than the first two phases with an immediacy of effect 1,609. The percentage of non-overlapping data (PND) between baseline and the first intervention was 100%, which is considered highly effective (Scruggs & Mastropieri, 1994). The percentage of PND between withdrawal and the final intervention phase was 31%, which is considered unreliable (Scruggs & Mastropieri, 1994).

During baseline (A_1), Kimberly's step count ranged from 44-927 with data collected over a five-day period including weekends. Her step count ranged from 44-724 steps when analyzing weekday data only. Her range in step count during the first intervention phase (B_1) with weekend data included was 430-4,011, with an increase in trend towards a therapeutic direction in the beginning of the phase and a decrease in trend in a non-therapeutic direction towards the end of the phase. Her range in step count not including weekend data during this intervention phase was 1,604-4,011. There was a larger range in data during the last two phases including weekend data with step count ranging from 15-3,047 during withdrawal (A_2) and 206-4,316 during the last intervention phase (B_2). When analyzing weekend data only, Kimberly's step count ranged from 755-

3,407 during withdrawal (A_2) and 605-4,316 during the final intervention phase (B_2).

There was a downward trend in data during withdrawal, but noting there were three-days of data missing during this part of the phase due to two separate periods of misplacement of the Fitbit. There was high variability in the data during the last intervention phase, which again was due to the presence of extraneous variables present. Data were collected two-weeks after the last intervention during a three-day period phase to check for maintenance of physical activity. Her step count range was 2,946-7,323. There was no consistency in data trends between similar phases.

The effect size between baseline (A_1) and the first intervention phase (B_1) with weekend data included was .92, which is determined highly effective based on the PEM scale (Ma, 2006) and 1.0 when analyzing phase data not including weekends, which is also considered highly effective (Ma, 2006). The effect size calculated between the first withdrawal phase (A_2) and second intervention phase (B_2) was .72 with weekend data included, which is considered moderately effective based on the PEM scale, and was .77 without including weekend data, which is also considered moderately effective.

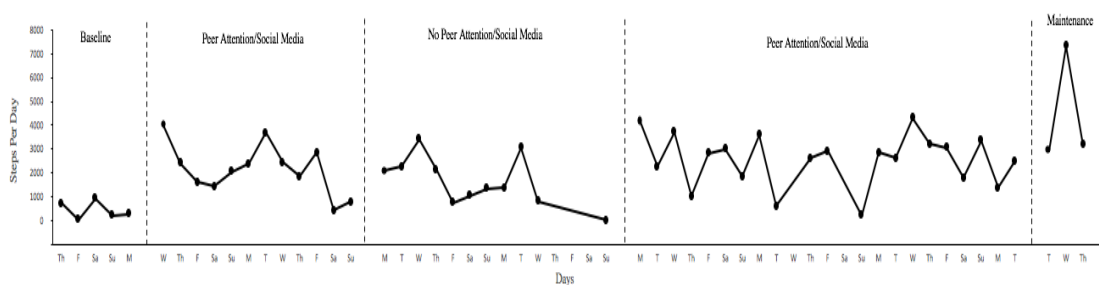


Figure 20. Kimberly's average step count across phases

Kimberly had the most activity on Facebook across participants. During the first intervention phase (B₁), Kimberly had five posts, three comments with positive content, 14 “likes” on other participants’ posts, and was active ten days during this intervention phase. She remained very active during the second intervention phase (B₂) with three posts, one comment, 20 likes, and viewing activity on this private page every day during the intervention phase. Kimberly’s social media activity and change in physical activity emulated similar findings in Maher et al. (2015) finding Facebook activity with a combination of self-monitoring using a pedometer to be a positive influence on health behavior in adults that were previously insufficiently active.

Kylen. Kylen’s step count data varied between the sedentary and somewhat active range during this study with baseline (A₁) data step count averaging 6,071 per day including weekend data and 6,764 analyzing weekday data only. Her average step count per day decreased to 5,065 during the first intervention (B₁) phase with weekend data included and increased to 6,956 analyzing weekday data only. During withdrawal stage (A₂), Kylen’s step count increased to an average of 7,595 including weekend data and an increase with weekday data averaging 7,755 steps per day. Her average step count decreased to 5,851 during the last intervention phase when calculating data with weekends included and to 6,106 steps analyzing weekday data only.

Immediacy of effect was calculated for the adjacent phases including weekend data. From baseline (A₁) to Intervention (B₁), the level change between the last three data points to the first three data points had a decrease mean difference of 1,314. When calculating the difference in mean level change from withdrawal phase (A₂) to the last

intervention phase (B₂), there was a slight increase of 263 in immediacy of effect with no established trend due to high levels of variability in data during this phase. The amount of overlapping data was very high between adjacent phases with low amounts of consistency in similar phases.

Immediacy of effect was also calculated for the adjacent phases including weekday data only. From baseline (A₁) to Intervention (B₁), the mean level change between the last three data points to the first three data points had a decrease mean difference of 1,307. When calculating the difference in level change from withdrawal phase (A₂) to the last intervention phase (B₂), there was a slight increase of 114 in immediacy of effect and no established trend due to high levels of variability in data during this phase. The amount of overlapping data was very high between adjacent phases with low amounts of consistency in similar phases.

During baseline (A₁), Kylens's step count ranged from 231-10,788 with data collected over a five-day period including weekends and three-day period including weekday data only. Her range in step count during the first intervention phase (B₁) with weekend data included was 7-8,986 with a decrease in trend in the beginning of the phase followed by an increase in trend towards a therapeutic direction with a drastic decrease in trend over the last two data points that were collected over a weekend period. Her range in step count not including weekend data during this intervention phase was 2,487-8,986. There was a smaller range in data during withdrawal (A₂) for phases including weekend data (6,011-9,939 steps) and weekday data (7,786-10,021 steps). The last intervention phase (B₂) for both data sets had a similar range in step count with phases including

weekends spanning from 6-9,448 steps and weekday data only spanning 6-10,021 steps. The last intervention phase had high levels of variability without a defined trend in data. This participant experienced illness and loss of a family member during this phase. Data were collected two-weeks after the last intervention during a three-day period phase to check for maintenance of physical activity. Her step count range was 2,946-7,323. The amount of overlapping data was very high between adjacent phases for this participant with low amounts of consistency in similar phases.

The effect size between baseline (A_1) and the first intervention phase (B_1) with weekend data included was .50, which is determined questionable or not effective based on the PEM scale (Ma, 2006) and 0 when analyzing phase data not including weekends. The effect size calculated between the first withdrawal phase (A_2) and second intervention phase (B_2) was .62 with weekend data included, which is considered questionable or not effective based on the PEM scale, and was only .53 without including weekend data, which is also considered questionable or not effective (Ma, 2006).

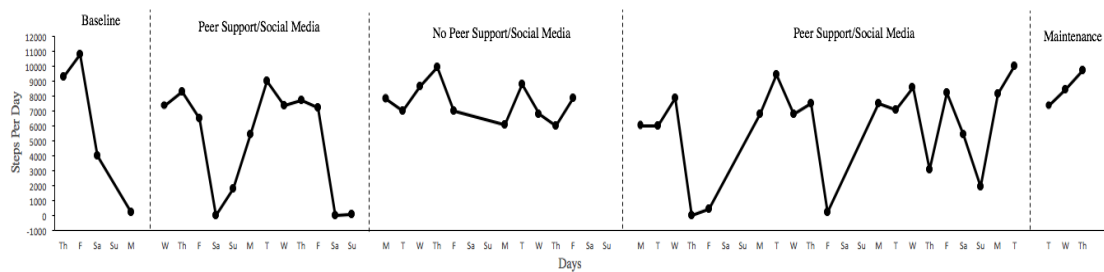


Figure 21. Kylen's average step count across phases

Kylen was active on the private Facebook page on five different days during the first intervention phase. Her activity consisted of five views and one comment. Her activity decreased during the second intervention phase to one comment and viewing the page on two separate occasions. Kylen's answers regarding the use of social media for physical activity on the social validity questionnaire reflected her activity.

Social Validity

During maintenance phase, social validity data were collected using a 5 point Likert-type survey (1-strongly disagree, 2-slightly agree, 3-neutral, 4-agree, and 5-strongly agree) that was created by the main researcher (see Appendix L). The Likert-type survey questions were developed to assess the use of wearable technology to measure physical activity, the participant's opinion of using peer reinforcement, and social media to increase physical activity. There were an additional five open-ended questions addressing factors that effected engagement in physical activity, the use of social media, and behavior change.

Table 14. Student Socail Validity Survey Responses

Student	Using a watch was helpful in keeping track of my activity levels.	I liked sharing my physical activity on Facebook.	I liked receiving comments from my friends on Facebook.	I liked seeing what my friends were doing for physical activity by reading their posts on Facebook.	I liked commenting on my friends' posts on Facebook Fitness page.	I felt supported from my friends through posts on Facebook page to engage in more physical activity.	I liked sharing my steps in person and not on Facebook.	I will continue to keep track of my steps using a watch or app.
Kelsey	4	2	5	4	3	5	5	4
Breanna	5	5	5	5	5	5	5	5
Kimberly	5	5	5	5	5	5	5	5
Kylen	5	1	1	1	1	1	1	5

Table 15. Individual Participant Responses to Social Validity Questionnaire

Student	Questions				
	Open-ended Question 1	Open-ended Question 2	Open-ended Question 3	Open-ended Question 4	Open-ended Question 5
	What motivated you to exercise?	What supports did you need to stay active over the last three months?	Why were your steps lower on the weekends do you want to change this and if so, how?	What did you like or Dislike about using Face book with your peers during this study? Why?	Did your daily or weekly lifestyles change (exercise, new interest, socially, etc.) due to using a Fitbit, Apple Watch, Facebook, or peer interaction? Yes or No. Please explain?
Kelsey	Walking on campus with my friends and walking to class on my own.	Playing games like baseball with my friends, walking around	I relax on the weekends than the weekdays	It's a bit of both	Yes, it did. Because you interact differently when you are on campus than at home
Breanna	Walking help me a lot to be health	4 months	To walk more	I love Facebook I love looking at it	Yes I love it a lot I hope to do it next year
Kimberly	Me	Carrie O'riley	Because I do not walk much during the weekend	I like posting my steps on Facebook.	Yes, because I have had a lot of exercise this semester.
Kylen	My parents want me to exercise, I love to walk	Walking is my passion to keep walking I love to walk	I rest on the weekends not as much on weekends	Use it for social media kind of thing to post about progress	I feel stronger everyday

Discussion

The purpose of this study was to assess the effects of peer reinforcement using social media on physical activity for college age students with I/DD. Overall, the quantitative results from this single subject research design study did not determine peer support using social media was an effective intervention to increase the average step count of physical activity for the group as a single unit during intervention phases. However, three of the four participants did increase in their step count throughout this study, as well as the group's step count was higher during the last intervention phase than baseline. Also, all four participants and the group's step count was much higher during the maintenance phase, which was collected two weeks after the last intervention. The group average physical activity increased from the "sedentary" category of 3,174 steps during baseline to "somewhat active" category with an average of 8,102 steps during maintenance (Tudor-Locke et al., 2008). Also, Kelsey and Breanna's average step count increased from the "low activity" range (5,000-7,000) to "active" range (10,000-12,500) (Tudor-Locke et al., 2008) from baseline to maintenance. Kylen, whose step count was lower during the last intervention phase compared to baseline, had chosen to increase her physical activity, specifically walking, as a way of being more independent on campus and in her community by the end of this study.

The social validity and anecdotal notes add to the discussion of the value of this study of lifestyle change for the college age participants with I/DD that chose to participate in this study. Three of the participants, who increased in step count, would greet the main researcher daily with their data pulled up on their phones to share their

step count from the day before. Kimberly, whose step count remained in the sedentary range throughout this study, was often heard in the hallways sharing her steps with staff, peers, and other acquaintances. Breanna would ask the main researcher to go for walks in the morning to decrease her stress for the day. Group walks became a routine during intervention by request of the participants. Other students and staff would join, including one young college man who used a motorized wheel chair for mobility. The participants would describe these walks as a time to socialize and meet other people. The student, whose step count decreased by the end of the study, text the main researcher on one occasion to share her step count for the day, another occasion looking for a walking partner, and a third time to share her future goal “of getting more exercise around campus” by increasing her step count. All four participants shared they had never walked this much, especially in high school.

Social support and feedback from peers, family, and friends along with self-monitoring of behavior have been identified by individuals with disabilities as motivating factors in their physical activity (Castro, Ng, Novoradovskaya, Bossellut, & Hassandra, 2018; Williams, Ma, & Martin Ginis, 2017). All three of these components were present during this study and referenced in the social validity questionnaire. A group-based approach has also been recognized as an effective strategy to increase physical activity for a variety of populations across different settings with duration and frequency as factors contributing to the efficacy of these programs (Harden et al., 2015). As well, online fitness communities through social networking have been identified as supportive formats for individuals to record, monitor, and share their physical activity (Stragier et

al., 2017). Individuals with disabilities have also reported feeling connected through social media networks with a sense of belonging that contributes to a sense of community and have used these formats for peer support (Shpigelman, 2016).

The results from this study cannot substantiate a causal relation between the independent variable of peer support through social media and dependent variable of change in physical activity due to many factors effecting internal and external validity of this study. The participants' activity was very low and variable on the social media platform without clear defining parameters prior to the intervention outlining statements that would constitute specifically as peer support, the format in which it would be delivered (e.g. comments, thumbs up, emoji), quantity of social activity per participant and receiver with comparison of change in physical activity. These parameters were not more specific due to the natural environment in which this study was being conducted and respect of the age group of the participants with the idea of autonomy and choice of each participant's individual comfort level and willingness to actively participate in social media. There are cautions to consider when using social media as an intervention, especially with a population considered vulnerable (Shpigelman, 2018). Also, due to the natural environment in which this study took place, the main researcher could not control or measure other modes in which the participants were receiving positive reinforcement for their physical activity and the impact these factors might have influenced the change in physical activity. Another questionable factor in this study was the stability of baseline for each participant as well as the group. The intervention was introduced when a descending trend over five data points was noted through visual analysis within the

group's physical activity, but during this period, some of the participants only had data collected over three days with high variability. The study began without a consistent stable baseline across participants as a cautionary prevention to reduce the impact of other environmental factors such as reinforcements stemming from the participant's ability to track their data on their devices (self-regulation) and model others in their environment who share and track daily steps. This concern led to the decision to introduce intervention immediately. The data do not speak to the specific variables that influenced a change in behavior, but since this study, the participants have agreed to train as a group for a 5K in their near future.

Limitations

Limitations to this study are important to acknowledge. First to note, information of each participant's past-experience using wearable technology and being involved in any type of physical activity interventions was not collected before the study, which excludes information if each participant was equal in their experiences at the beginning of this study. Secondly, wearable technology can provide an estimate of the overall amount of engagement in physical activity for each participant, but accuracy of measurements of physical activity can be affected by multiple variables. For example, the consistency in which participants wore their Fitbits, especially weekends versus weekdays. One participant also mentioned that her Fitbit sometimes tracked movement as she rode in a car. Fitbit can be sensitive to picking up arm movement and this participant engaged in repetitive arm movements. On another note, the main researcher noticed that her Fitbit did not track any steps one day until her afternoon activity. The

main researcher also tested more than one Fitbit Blaze, from the inventory that was used for the group, on a familiar trail system for a period of one-year and found continuous discrepancies in step count and mileage when tested on the same walking/running loop. Finally, a non-random purposeful sampling was used for this study with a small number of homogenous participants, so generalizability of the results of this study is not guaranteed.

Future Studies

Past literature has described the effectiveness of peer support, group interventions, self-regulation, and on-online communities to provide motivation for individuals in their physical activity. Further research on the effectiveness of supportive environments and self-regulation strategies could be powerful tools for grade school and high school age students with disabilities for building early intervention programs to increase engagement in physical activity. These strategies could be generalized into community recreational programs with intent of further community inclusionary practices for individuals with disabilities.

This study continues the line of research from previous studies that implemented peer support, group interventions, self-regulation, and Facebook to increase physical activity levels of individuals, but maybe the first study to use a combination of these interventions with students diagnosed with I/DD, especially at the college level, specifically in a PSE program. Studies including all the components of this study at the higher education level, including PSE programs for individuals with I/DD, were not found during the initial literature search for this study.

Chapter 4: Discussion of Group Interventions and Physical Activity

As discussed throughout this dissertation, individuals with physical, intellectual, and developmental disabilities participate less in physical or recreational activities and are predisposed to be more sedentary in their lifestyle (Frey et al., 2017; Kosma et al., 2002; Sorenson & Zarrett, 2014; Srinivasan et al., 2014). Approximately 9.6% of adults with disabilities meet the recommended physical activity of 150 minutes per week (CDC, 2016) and 38% of children with disabilities are more obese than their peers without disabilities, with adults being three times more likely to have heart disease, a stroke, or diabetes (Office of Disease Prevention and Health Promotion, 2015). The benefits of physical activity are universal for all individuals with and without disabilities, but individuals with disabilities can encounter more restrictive access to environments considered essential to health and development than their peers due to biological, environmental, and institutional constraints (Abbott & McConkey, 2006; Cobigo et al., 2012; Crawford et al., 2008; Murphy & Carbone, 2008; Srinivasan et al., 2014; Stephens et al., 2017). There are positive practices being implemented in the K-12 setting, on college campuses, and across communities to target all individuals in adopting a healthier lifestyle. The purpose behind this dissertation was to explore supportive strategies and interventions that have proven effective for behavior change and implement these strategies with college age students with I/DD who were interested in making changes to their current level of physical activity. Specific interventions used were an interdependent group contingency, peer support, and social media implemented within the supportive environment of a PSE program.

Interdependent Group Contingencies

Study 1 examined the effectiveness of an interdependent group contingency on physical activity for college age students with I/DD. As discussed previously in this paper, group contingencies have shown to be effective to promote behavior change (Foote et al., 2017; Litlow & Pumroy, 1975; Skinner et al. 1996). Results from this study support previous research that used group contingencies to increase desired behavior, especially research that targeted physical activity. Washington et al. (2014) used a contingency management intervention to successfully increase physical activity with college age adults who were considered relatively healthy. Hirsch, Healy, Judge, and Lloyd (2016) found an increase in engagement in physical activity when implementing an interdependent group contingency with elementary age students during physical education sessions. Foote et al. (2017) and Galbraith and Normand (2017) both furthered this line of research to the less structured environment of recess time, still working with in the range of elementary age students. This current study built on these previous outcomes, finding interdependent group contingencies effective on increasing physical activity for college students with I/DD in a less controlled environment of a college campus and within the participants' communities.

The participants in Study 1 unanimously agreed in the social validity questionnaire that they were more interested working as a group in their quest to change their physical activity than alone. Patel et al. (2015) discerned that incentives targeted at a combination of individual and group performance were most effective in increasing physical activity, which is reflective of the participants' experience in Study 1. Although the rewards were

contingent on the group's performance, positive feedback was tailored to the performance of the individual and their contribution to the group's performance.

Social Media

The purpose of Study 2 was to provide peer support through social media, explicitly Facebook, to increase physical activity amongst the participants. In previous research, individuals with disabilities have found Facebook as a platform to build relationships, give and receive social support (Shpigelman & Gill, 2014). Also, social media sites have been used to provide peer and social support in virtual online fitness communities to increase physical activity with adult participants, but results have been inconclusive to the extent that these communities directly affected behavior change (Stragier et al., 2017; Zhang et al., 2015). The results from this current study were analogous of past research involving individuals with disabilities use of Facebook as well as social media platforms effectiveness on physical activity. The participants in this study reported enjoying posting their steps and progress on Facebook, but did not mention Facebook as a motivation or support needed to engage in physical activity. Furthermore, the posting activity from three of the participants was very low with limited comments on each other's activity, except for an occasional "thumbs up" emoji. One participant was very active with sharing step counts, receiving and giving "thumbs up" emojis. This participant had the most significant results during this study, which is comparable to the research findings of Zhang et al. (2015) using social media for participants to record their engagement in physical activity with a peer group.

Peer Support

Peer and family support have been identified as a contributing factor to an increase in physical activity for adolescents (Gill et al., 2018; Knibble et al., 2017; Salvy et al., 2018; Silva et al., 2014). Friendships and belonging to a group have been recognized as motivating influences on physical activity for individuals with and without disabilities (Knibble et al., 2017; Salvy et al., 2018). Individuals have reported feeling empowered to achieve personal physical activity goals through support from their social networks (Knibble et al., 2017). Recreational activities can present openings for social contexts where individuals can find common ground and interests through interacting with peers that leads to supportive friendships.

These findings are reflected in both studies. In Study 1, Dave shared that when they slacked off in their physical activity, they had the group to pick them up. Also, all four-participants reported they preferred working as a group towards their physical activity goals. At the end of this study, the four participants stated they would like to continue working as a group to increase their physical activity.

In Study 2, the participants referred to their family and friends as motivators and supports needed in achieving their physical activity goals. Also, one participant shared going for walks gave her time to visit with friends and possible opportunities to meet new friends or run into old friends. At the end of Study 2, the participants from both studies planned to train for a 5K together.

Supportive Environments

Supportive social environments have been identified as playing a vital role for encouraging physical activity amongst individuals considered at risk for health issues due a sedentary lifestyle (Knibble, 2017; Salvy et al., 2018). PSE programs are developed to cultivate an inclusive environment in higher education for individuals with I/DD. Many programs incorporate peer mentorships, which can naturally lead to a more inclusive environment for students with I/DD on a university campus through expanding social networks (Griffin et al., 2016; Rillotta et al., 2018). The inclusive nature of PSE programs developed with peer mentorships have demonstrated to be effective supports for college age students with I/DD in their social and academic realms (Griffin et al., 2016; Rillotta et al., 2018). PSE programs create a social environment that offers equitable participation and opportunities for interdependence between friends, which has been equated to supportive in promoting health and well-being (Knibble et al., 2017).

Enrollment on a college campus allotted the participants in both two studies to walk further and more frequently than each had experienced in the past, especially high school, as reported by the participants. One student shared feeling better about herself due to the amount of walking they did around campus. Another student chose to visit with friends in a Starbucks located away from campus to break her goal of 10,000 steps. The peer mentors and participants were at times observed by the main researcher sharing steps that each accrued at certain times of the day. PSE programs provide a supportive environment with a range of opportunities for college age students with I/DD to be more socially and physically active in their daily lives.

Limitation

Limitations to these studies are important to acknowledge, as they can affect the interpretation of the results. First to note, information of each participant's past-experience using wearable technology and previously being involved in any type of physical activity interventions was not collected before either study, which excludes information if each participant was equal in their experiences at the beginning of each study. Secondly, wearable technology can provide an estimate of the overall amount of engagement in physical activity for each participant, but accuracy of measurements of physical activity can be effected by multiple variables. For example, the inconsistencies in which participants wore their Fitbits throughout both studies, especially weekends versus weekdays, the intensity of the activity, and type of activity chosen are all factors that can impact the accuracy of the results. Additionally, three participants were measuring their physical activity using Fitbit technology and one participant used Apple technology during study 1. There can be a discrepancy in measurement between two different devices. One participant also mentioned that her Fitbit sometimes tracked movement as she rode in a car. Fitbit technology can be sensitive to picking up arm movement and this participant engaged in repetitive arm movements. On another note, the main researcher noticed that her Fitbit did not track any steps one day until her afternoon activity. The main researcher also tested more than one Fitbit Blaze, from the inventory that she was using for the group, on a familiar trail system for a period of one-year and found continuous discrepancy in step count and mileage when tested on the same walking/running loop. Finally, a non-random purposeful sampling was used for

both studies with small number of participants from similar economic backgrounds and community settings. Due to the homogeneity of the participants, generalizability of the results of these studies are not guaranteed.

Other issues that impacted the variability in data, unstable baselines phases, and missing data points were college calendar schedules, family obligations, travel during holiday breaks, sickness, death in the family for participants, lost devices, along with a desire to relax on the weekends and not track physical activity. The variability in the school schedule reduced the participants' activity of walking around campus as well as working at their internships, which effected their daily step count. Also, the novelty of receiving the Fitbit technology could have impacted the length of the baseline during Study 1.

The results speak to the supports and opportunities provided for students enrolled in PSE programs during the week as well as desire to relax on weekends after a heavy week of school work and activity. The primary researcher and participants discussed during both studies the importance of resting from physical activity at least one day a week, which was on the average weekends for all participants during both studies. Most likely participants did not wear their measuring devices throughout the day if their step count was measured very low such as six-steps in a 24-hour period, but the participants also did not engage in purposeful physical activity, so any data over 0 was recorded during Study 2.

Future Research

Early intervention programs have proven effective for decades for individuals with disabilities in their development and academics (Guralnick, 1997; Muschkin, Ladd, & Dodge, 2015). Future research can begin focusing on effective interventions to provide inclusionary practices for individuals with disabilities in community health and recreational programs beginning in early childhood. This research can focus on parent, school, and community involvement disseminated through local health services and educators. The research can evolve by gathering perceptions of stakeholders to support individuals with disabilities in being more present in community and school recreational activities.

Study 1 demonstrated the effectiveness of using interdependent group contingencies to increase physical activity for individuals with I/DD at the college level. Future research could examine the effectiveness of interdependent group contingencies for elementary, middle, and high school age students with disabilities to increase in their physical activity, especially in an inclusive setting.

Past literature has described the effectiveness of peer support, group interventions, self-regulation, and on-online communities to provide motivation for individuals in their physical activity. Further research on the use of supportive strategies and environments along with self-regulation to increase physical activity could be a powerful tool for grade school and high school age students with disabilities. These tools can be effective interventions to engage individuals with disabilities in more physical activity, especially within inclusive school and community environments.

Study 2 continues the line of research from previous studies that implemented peer support, group interventions, self-regulation, and Facebook to increase physical activity levels of individuals, but maybe the first study to use this intervention with students diagnosed with I/DD especially at the college level, specifically in a PSE program. With an increase in PSE programs across the country, future research can focus on combining efforts and connecting the students from different programs to support each other in building on their physical activity levels and routines through social media groups. Also, this research should give voice to the participants leading the conversation in identifying needed supports and current barriers encountered for college age student with I/DD in pursuing a more active lifestyle.

Summary and Conclusions

Researchers, practitioners, policymakers, health professionals, and other facets of the international community need to embrace the challenge of taking action to align physical activity with health objectives to further build on social, environmental, and sustainable programs for all members of society (Reis et al., 2016). Increasing opportunities for individuals with I/DD such as enrollment on college campuses provides equal opportunities for these young adults to be autonomous in their goal setting and accomplishments in their overall health and wellbeing by experiencing new opportunities in a diverse, supportive, and inclusive community. Working in a field with individuals that have such unique physical, cognitive, and developmental differences, I am continuously reminded of the truth, that when given an opportunity to try anything new in

a supportive environment and given a voice in this experience, all individuals have a level of achievement that is a product of perseverance.

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Appendices

Appendix A

Name	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday
	02/09/18	2/10/18	02/11/18	02/12/18	02/13/18	02/14/18	02/15/18
	02/09/18	02/09/18	02/09/18	02/09/18	02/09/18	02/09/18	02/09/18
	<u>2/23/18</u>	<u>2/24/18</u>	<u>2/25/18</u>	<u>2/26/18</u>	<u>2/27/18</u>	<u>2/28/18</u>	<u>3/1/18</u>

Appendix B

Time								
Name	Friday 2/9/18	Saturday 2/10	Sunday 2/11	Monday 2/12	Tuesday 2/13	Wednesday 2/14	Thursday 2/15	Friday 2/16
Marge	10	0	0	20	24	10	68	
Matt	0	0	0	17	109	43	46	
Kevin	27	12	0	25	67	43	18	
Dave	6	13	11	0	18	24	11	
Total minute	43	25	11	62	218	120	143	
	F	Sa	Su	M	T	W	Th	F
Group Data	14.33	12.5	11	20.67	54.5	30	35.75	

Appendix C

FUTURE Fitness Fitbit Club DATA COLLECTING CHART INTERVENTION					
DATE	GROUP AVG MILES	DAY'S GOAL	GOAL MET	GOAL NOT MET	DAY'S REWARD
2/27	32	30	✓		
3/1	17	20		✓	
3/3	57	40	✓		
3/8	27.5	20	✓		
3/10	27	25	✓		
3/20	35	30	✓		
3/22	15.5	30		✓	
3/23	44	42	✓		

Note: This was the original sheet created by a member of the FUTURE staff and displayed in the FUTURE Program. This sheet should have listed minutes instead of miles.

Appendix D

Instructions: Record the date on the top line and mark an X for agreement and O for disagreement.

Dates	2/09/18	2/10/18	2/11/18	2/12/18	2/12/18				
IOA	X	X	X	X	X				

Dates									
IOA									

Appendix E

Treatment Integrity Worksheet

Data Collector: _____ Date: _____

1. Students are wearing their devices?

Yes or No

2. Fitbits are charged?

Yes or No

3. Physical activity durations are collected from each participant on data sheet provided.

Yes or No

4. The group contingency is randomly chosen three times each week during intervention.

Dates: _____/_____/_____

Yes or No

5. Reward is delivered when students meet criteria.

Yes No

6. The chart is marked goal met or not met

Yes or No

TOTAL: _____/_____ = _____%

Appendix F

Social Validity Worksheet

Name: _____

Date: _____

1
Strongly
Disagree

2
Slightly
Disagree

3
Neutral

4
Agree

5
Strongly
Agree

1. I liked wearing a watch that tracks my activity level.

1 2 3 4 5

2. Using this watch was helpful in keeping track of my activity levels.

1 2 3 4 5

3. I liked wearing the watch every day.

1 2 3 4 5

4. The app was easy to use.

1 2 3 4 5

5. Working as a group was encouraging for me to be physically active because everyone
was rewarded for how well the entire class did.

1 2 3 4 5

6. I liked the rewards.

1 2 3 4 5

7. I am interested in continuing to track my activity through a watch or mobile app.

1 2 3 4 5

8. This study encouraged me to increase my physical activity.

1 2 3 4 5

9. Which physical activity is preferable for you?

10. Are you more interested in increasing your physical activity through group or individual activities? Why?

11. What did you like or not like about the Fitbit and the Fitbit app?

12. Did your daily or weekly lifestyles change (exercise, new interest, etc.) due to using a Fitbit?

Yes or No. Please explain.

Appendix G

Student's Name:

Date							
Baseline A ₁							
Mins							
Mile							
Steps							
Intervention B ₁							
Mins							
Miles							
Steps							
Date							
Mins							
Miles							
Steps							
Date							

Appendix H

Excel Data Recording Sheet

Kelsey	2975	12871	2353
Breanna	5422	9001	3206
Kimberly	724	44	927
Kylen	9274	10788	3992

Appendix I

Steps Per Day
2000-5,000 It is a start, but let's step it up!!!
5,000-7,500 low activity and not bad, but let's step it up!!!
7,500-10,000 Now we are talking!!!
10,000 and more, Wow, we are Rock Stars!!!!4
Don't Forget to Share on Facebook!!!!

Appendix J

Social Validity Worksheet

Name: _____

Date: _____

1	2	3	4	5
Strongly Disagree	Slightly Disagree	Neutral	Agree	Strongly Agree

1. Using a watch was helpful in keeping track of my activity levels.

1 2 3 4 5

2. I liked sharing my physical activity on Facebook with my peers.

1 2 3 4 5

3. I liked receiving comments from my peers when I posted pictures and shared my activity on Facebook.

1 2 3 4 5

4. I liked seeing what my peers were doing for physical activity by reading their post on Facebook.

1 2 3 4 5

5. I liked commenting on my peers posts on Facebook.

1 2 3 4 5

6. I felt support from my peers through posts on Facebook to engage in more physical activity.

1 2 3 4 5

7. I liked sharing my steps in person and not on Facebook.

1 2 3 4 5

8. I will continue to keep track of my steps using a watch or app.

1 2 3 4 5

9. What motivated you to exercise?

10. What supports did you need in place to stay active over the last three months?

11. Why were your steps lower on the weekends do you want to change this and if so, how?

12. What did you like or Dislike about using Facebook during this study?

13. Did your daily or weekly lifestyles change (exercise, new interest, socially, etc.) due to using a Fitbit, Apple Watch, Facebook, or peer interaction? Yes or No. Please explain?

Appendix K

Treatment Integrity Worksheet

Data Collector: _____ Date: _____

1. Students are wearing their devices?

Yes or No

2. Fitbits are charged?

Yes or No

3. Physical activity durations are collected from each participant on data sheet provided.

Yes or No

4. The main researcher sends a text every week day (except for school breaks) during intervention with reminders to get their steps in.

Yes or No

5. The main researcher meets with each participant daily during intervention and provides verbal positive reinforcement. If a participant is absent, the main researcher checks in with the participant when the return to school.

Yes No

6. The main researcher posts comments on a secured page, created for the participants, to motivate the participants to exercise each day during intervention.

Yes or No

TOTAL: _____ / _____ = _____%

Vita

Carrielynn O'Reilly is originally from Chicago, Illinois. She attended Eastern Illinois University where she studied Speech and Language Pathology, Special Education, and earned a Bachelor of Arts with a concentration in History. Carrielynn then moved out west where she finished her studies in Secondary Education at the University of Great Falls with a concentration in Reading. She also completed a teaching endorsement in Special Education alongside a Master Degree in Special Education from Montana State University in Billings, Montana. Later, Carrielynn went on to complete a graduate program in Deaf-blind Education, Autism, and Dual-Sensory Disorders at Texas Tech University. Carrielynn O'Reilly taught Special Education at Columbia Falls High School in Northwest Montana for eight years before returning to school to finish her Ph.D. in Special Education at the University of Tennessee, Knoxville. At the University of Tennessee, Carrielynn worked as a graduate research assistant for the Tennessee Behavior Support Project in conjunction with the University of Memphis and Vanderbilt.