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Increasing Physical Activity in Young Adults with Autism Spectrum Disorder

Katherine B. LaLonde
Western Michigan University, katelalonde@gmail.com

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INCREASING PHYSICAL ACTIVITY IN YOUNG ADULTS WITH AUTISM SPECTRUM DISORDER

by

Katherine B. LaLonde

A dissertation submitted to the Graduate College in partial fulfillment of the requirements for the degree of Doctor of Philosophy Psychology
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Doctoral Committee:

Alan Poling, Ph.D., Chair
Ronald VanHouten, Ph.D.
Cynthia Pietras, Ph.D
Steven Ragotzy, Ph.D
Experts recommend that individuals walk 10,000 steps or more per day and doing so has been shown to have several health benefits. Unfortunately, many people fall short of 10,000 steps per day. Exercise levels are characteristically lower in people with Autism Spectrum Disorders (ASD) than in people without ASD. The present study comprised two experiments that used goal setting and reinforcement to increase physical activity in young adults with ASD. The first study employed a multiple-baseline-across-participants design in combination with a reversal design to determine the effects of a treatment package on the number of daily steps taken by young adults with ASD while at school. Participants were given pedometers to wear. Once participant’s number of steps stabilized in baseline, they set individual goals and received reinforcers for successfully meeting those goals. By the end of each treatment condition all participants were successfully meeting their goals and walking at least 10,000 steps per day. The classroom teacher reported the treatment package was easy to implement and effective. These findings suggest that goal setting and reinforcement can substantially increase the number of steps by people with ASD.
Experiment 2 used a multiple-baseline-across-participants design to determine the effects of goal setting and reinforcement on the number of daily steps taken by young adults with ASD at home and during the weekends over a six-month period. The number of steps taken by each participant increased during the goal setting and reinforcement phase and participants consistently met their daily goal outside of school. Participants’ weight and body mass indices decreased during the study. A modified concurrent chains procedure was used to assess whether participants liked wearing the Fitbit. When participants were given a choice between immediate access to a preferred item and the opportunity to wear the pedometer, participants consistently chose to wear the pedometer. The finding of the two studies suggest that goal setting and reinforcement are useful in increasing exercise in people with ASD.
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Katherine B. LaLonde
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CHAPTER I

INTRODUCTION

It is widely recognized that most people do not engage in sufficient physical exercise to confer health and other benefits (US Department of Health and Human Services, 2008), and it is also known that exercise levels are characteristically lower in people with Autism Spectrum Disorder (ASD) than in people without ASD (Drahelm, Williams, & McCubbin, 2002).

Activity level may be lower in individuals with ASD as a result of impairments in motor, social communication, behavioral problems, and lack of time and resources. More than 50% of children with ASD have movement difficulties based on standard motor skill assessments (Green, Charman, Pickels et al., 2009) and poor motor coordination and balance may limit their ability to be successful in certain activities (Potvin, Snider, Prelock et al, 2013). A defining characteristic of ASD is deficits in social skills and this may significantly impact their interest in participating in group sports (Srinivasan, Pescatello, & Bhat, 2014). Moreover, behavioral problems (e.g., physical aggression) and academic deficits may take priority when developing treatment planning with little or no priority given to physical activity goals. Finally, additional factors such as family life, access to equipment or resources, lack of structure, or an unsupportive social community may effect physical activity...
levels of individuals with ASD (Rimmer & Rowland, 2008; Obrusnikova & Miccinello, 2012).

Up to 50% of adults with intellectual disabilities (including ASD) live sedentary lifestyles and it is likely these individuals with have health problems as a result. These sedentary individuals are more likely to have cardiovascular disease, insulin resistance syndrome, and be obese (Chanias, Reid, & Hoover, 1998). Physical activity has been shown to improve various aspects of individual’s lives including physical and cognitive functioning (Hillman, Erickson, & Kramer, 2008; Brown, 1977), symptoms of anxiety and depression (Orwin, 1974; Brown, Ramirez, & Taub, 1987), and academic performance (Best & Jones, 1974).

As indicated in a recent review (Lang et al., 2010) and a recent meta-analysis (Sowa & Meulonbroek, 2012), inducing physical exercise in people with ASD has been shown to produce a substantial range of behavioral improvements, as well as increased physical fitness. Lang et al. provide a clear and concise summary of the 18 studies they reviewed:

A variety of exercise activities were employed (e.g., jogging, weight training, bike riding). Following the exercise interventions decreases in stereotypy, aggression, off-task and elopement were reported. Fatigue was not likely the cause of decreases in maladaptive behavior because on-task behavior, academic
responding, and appropriate motor behavior (e.g., playing catch) increased following physical exercise (p. 565).

It is interesting that each of the 18 studies focused on the beneficial effects of exercise on subsequent behavior, rather than on engendering a consistent pattern of regular physical activity *per se*. A majority of these studies (n=13) evaluated the effects of various exercise activities (e.g., jogging, swimming, snow-shoeing, roller skating) on undesired behaviors such as self-stimulatory behaviors (e.g., Powers et al., 1992), maladaptive behavior such as aggression, self-injury and property destruction (e.g., Elliot et al., 1994). Six studies evaluated various exercise activities on desired behavior such as time on-task and completion of academic tasks (Powers, Thibadeau, Rose, 1992; Reid et al., 1988; Rosenthal-Malek & Mitchell 1997; Watters and Watters, 1980). Five studies evaluated various exercise activities (which all required training) on measures on physical activity and related health outcomes. For example, Lochbaum and Crews (2003) taught three participants to ride a stationary bike and to lift weights on an exercise machine. The dependent various were measures on the Power Work Capacity Fitness Test (PWC; Astrand & Rohahl, 1986) and improvements on bench and leg press. Similarly, Pietetti et al., (2007) evaluated five participants walking on a treadmill and measured improvements in exercise capacity (i.e., speed and evaluation on treadmill), caloric expenditure, and body mass index.
None of the 18 studies substantially increased physical activity in people with ASD, however previous research has used behavioral interventions to increase the number of steps taken by sedentary adults (Kurti & Dallery, 2013), overweight adults (VanWormer, 2004), healthy, nonobese adults (Normand, 2008), and typically developing obese preschool children (Hustyi, Normand, & Larson, 2011).

The main components of these interventions were goal setting with feedback and reinforcement. For example, Hustyi, Normand, and Larson (2011) demonstrated modest increases in steps taken by obese preschool children during 20-min sessions using goal setting and reinforcement. Half-way through each session, the experimenter provided feedback to the participant and, if the daily goal was met, at the end of the session the participant selected an item from a prize box. Kurti and Dallery (2013) used an online goal setting and feedback program for sedentary adults with no diagnostic label. If participants met their daily goal, which increased every 5 days, they received monetary rewards. For 5 of 6 participants, the number of steps increased substantially during treatment, eventually meeting national recommendations. These studies suggest that goal setting and reinforcement may be a viable treatment option for increasing the number of steps taken by individuals with ASD to a specified level, such as 10,000 steps per day, a level likely to have health benefits (Iwane et al., 2000).

The purpose of the present study was to examine a simple procedure for inducing young adults with ASD to walk long and often enough to meet or exceed
minimum guidelines for aerobic activity. Although walking was not used as a form of exercise in any of the studies examined by Lang et al. (2008) or by Sowa and Meulenbroek (2012), walking is a simple, convenient, and inexpensive way to exercise (Trosts, Owen, Bauman, Sallis, & Brown, 2002). Nearly everyone knows how to walk, so no special training is needed for this form of exercise, and walking requires only minimal equipment, in the form of comfortable shoes and clothing, so it is inexpensive. Moreover, walking can be easily and accurately quantified (in terms of steps taken) through the use of automated pedometers (Iwane et al., 2000; Crowley-Koch & Van Houten, 2013), which is an advantage in both research and everyday settings.
CHAPTER II
EXPERIMENT 1

Methods

Participants, Setting, and Materials

Four men (herein called Billy, Casey, Charlie, Peter, not their real names) and one woman (herein, Rose) volunteered for the study. Informed consent (see Appendix A) and Assent (see Appendix B) for participation in the study was obtained from each participant and experimental arrangements were approved by the Western Michigan University Human Subjects Institutional Review Board (see Appendix C) and in accordance with the Helsinki Declaration of 1975.

To participate in the study, an individual had to be a student at the Young Adult Program (YAP) located in Kalamazoo, MI, which is where the study took place. This post-secondary educational program is part of the public school system and provides a range of transition services to young adults (i.e., those 17 to 26 years of age) with disabilities. The participants in the study were from the same 12-student ASD classroom. Students attended the program from 8 a.m. to 2 p.m., Monday through Friday. Activities at the program are typically flexible and tailored to meet the needs of students, who are transitioning to less structured environments. Informal observation and discussion with school staff indicated that considerable free time was available to students and that it would be feasible for them to walk around the school grounds during those periods.
One of the students, Peter, left campus two days a week to work in the community and therefore participated in the study three days a week. All of the students in the classroom took trips out in the community to practice independent living skills such as shopping and eating at restaurants a few times each week. All of the participants lived at home except for Peter, who lived in a group residence.

The dependent variable in the present study was the number of steps taken daily, which was tracked through the use of Zip™ Wireless Activity Trackers by Fitbit (San Francisco, CA). Each participant was given one of these devices to wear in their pocket or attach to their waistline. The Zip™ device is a pedometer that uses a 3-axis accelerometer that automatically measures motion patterns to determine the number of steps taken (other outcomes, such as calories burned, can also be measured but this was not done in the present study). Fitbit measures of physical activity (i.e., number of steps taken) have been shown to be accurate and reliable, and preferred by participants who have worn various tracking devices (Visovsky, Kip, Rice, Hardwick, & Hall, 2013). The cumulative number of steps taken is displayed on the front screen and can be viewed by tapping the screen. The Zip™ is a small device (0.55 x 0.43 x 0.15 cm) that weighs about 8 grams. It can store data for up to seven days and be synchronized with a computer to transfer information to it. In the present study all of the Zip™ devices were synchronized with a laptop computer and programmed to transport data at the end of each school. This allowed for easy and accurate data
recording. Additional materials included self-monitoring forms, sticker charts, stickers, and rewards.

**Experimental Design**

A multiple-baseline-across-participants design in combination with a reversal design for four of the participants (Poling, Methot, & LeSage, 1995) was used to determine if goal setting and reinforcement would increased the number of steps taken by participants. The baseline condition baseline was in place until visual inspection revealed no trend in the number of steps taken by an individual participant across three consecutive sessions. At that time, treatment was arranged until participants were consistently walking 10,000 or more steps per day. As required by a multiple-baseline design, the time at which treatment was introduced was staggered across participants. Once a participant consistently met the walking criterion, treatment was terminated for several days (i.e., a reversal, or return to baseline, was instituted). Treatment was then implemented again and kept in effect until the students were dismissed for summer break. The study lasted, on average, 42 days (range: 25 to 42), however, the number of days each participant participated varied due to work schedules, absences and because one student (Casey) only attended school four days per week. Peter’s work schedule was such that he was available for 25 days, too few to allow a return-to-baseline condition to be arranged for him.

**Baseline.** During baseline a piece of black electrical tape was used to cover the screen on the Zip™ so that participants could not see the number of steps taken.
They were told the device would record the number of steps they took but were not shown how the device worked.

Each participant had a small, clear Ziplock® plastic container taped to their desk and was instructed to put their Zip™ in the container at the end of the school day. A 5-day sticker chart with two cells for each day was also taped to each participant’s desk (see Appendix D). Participants were prompted to put a sticker on their chart in the morning for putting on their Zip™ device and another sticker in the afternoon when they removed the device and placed it in the container. If a participant had two stickers (which happened every day) they could choose a small prize from a container. Prizes included pieces of gum, pencils, stickers, washable tattoos, and pens. After participants left school for the day, a member of the research team synchronized each device with the computer, logged into the Fitbit website to see the number of steps taken and recorded this number into an Excel document. Baseline continued until the number of steps taken by all participants was stable as determined by visual inspection of graphed data.

**Goal Setting and Reinforcement.** Treatment was implemented following baseline. Goal setting and reinforcement were the primary components of treatment. On the first day of treatment, a member of the research team met individually with each participant. At this time the tape was removed from the face of the Zip™ device and participants were shown how the device worked. A member of the research team first demonstrated how to view the step counter by tapping on the screen and then had
the participant practice that. Next, the researcher asked the participant to hold the Zip™ device in her or his hand, walk around, and watch the step tracker increase. The researcher explained that the Zip™ device was counting steps and counted aloud the number of steps indicated on the screen. The researcher then told the participant that each day he or she would set a step goal and, if the number on the screen matched or exceeded that goal at the end of the day, she or he could chose an item from a different prize box. This prize box contained preferred items that were chosen by participants one week prior to the start of intervention, when staff took participants to local stores (e.g., Dollar General). Finally, the researcher provided suggestions on ways they could get extra steps. For example, the class had a scheduled 15-min break every morning in a common area shared by three classrooms. It was observed that many of the students spent this time sitting and talking, looking at comics, or listening to music on headphones. The researcher suggested walking during this time in the common areas or in the hallways (which was acceptable to the teacher and staff).

A goal was set each morning. Goals were proposed by a member of the research team and agreed to by individual participants. The initial goal proposed for each participant was determined by taking the average number of steps walked by each person during baseline and increasing that number by 10%. For example, if the average number of steps taken per day during baseline was 2,000, the initial goal during treatment would be 2,200 (2,000 + [2,000 x 0.10]) steps. The goal increased by 10% each time the previous goal was met on two consecutive days until each
participant was walking 10,000 or more steps per day. Two participants (Charlie and Casey) were almost meeting this terminal goal during baseline so their goal started at or above 10,000 steps per day.

Participants were given their own self-monitoring form (see Appendix E) with 4 columns (date, goal, steps taken, and prize earned). Participants kept the sheets on their desks or in school binders that stayed in the classroom. Each morning, a member of the research team proposed a daily goal and asked if that goal was acceptable, which it always was. Participants were then asked to write the date and their goal. For the first week, each goal-setting meeting took approximately 3 minutes, but thereafter this meeting was usually completed in less than one minute. At the end of the each goal-setting meeting, the participant was given two small pieces of paper with their daily goal on it, one to tape to their desk and one to put in their pocket or purse. This was done so participants had consistent access to their goal if they were out in the community, where they did not have their data sheet.

At approximately 1:30 p.m. each day a member of the research team asked the participant if he or she wanted to record the number of steps taken that day. Participants always indicated that they wanted to do so and subsequently found the step counter on their Zip™ device and recorded the number of steps taken on their data sheets. Then they recorded, “Yes” if they had met their goal or, “No” if they had not. If they met their goal they chose an item from the prize bin. If participants had not met their goal they were told they had until 2 p.m. (time of classroom dismissal)
to do so. From 1:30 p.m. to about 1:55 p.m. the classroom had free time. Students usually spent this time cleaning up their desk, sitting, or on individual computers watching videos. If participants had cleaned up their items they had the option of walking around the common area or hallways to meet their goal. On all but two occasions participants chose to walk during this time if they had not met their goal. This phase continued until participants were walking over 10,000 steps for several days at which time the goal setting and reinforcement was removed.

**Return to Baseline.** This phase was identical to the initial baseline except tape was not put over the screen of the Zip™. Participants frequently asked the researcher to set a goal during this phase and were reminded that it was not a goal-setting day but that they would set goals in the future.

**Return to Goal Setting and Reinforcement.** This phase was identical to the initial treatment condition except now each participant had a daily goal of at least 10,000 steps. This goal was chosen because each participant demonstrated they could meet this goal and it is the recommended number of steps for adults (Centers for Disease Control, 2014).

**Procedural Integrity**

During all conditions a member of the research team was present every morning to ensure that participants: wore their Zip™ devices; put their stickers on their chart; completed their data sheet, which included writing the date and their daily goal, and; received two small pieces of paper with their daily goals listed (one for.
their desks and one for their pockets). At the end of each day, a member of the research team was present to ensure that participants: checked their and recorded the number of steps taken; wrote, “Yes” or “No” if their goal was met; picked a prize from the bin if appropriate, and; returned their Zip™ devices to the container on their desk. On 30% of all days, selected at random, another member of the research team was present at the beginning and the end of the school day and used an eight-item checklist (see Appendix F) to record whether the steps described above were taken appropriately. Overall, 98% of the steps were taken appropriately. The only errors observed occurred when a participant left school early and took the Zip™ device with him. To determine whether participants wore their Zip™ devices throughout the school day, a member of the research team visited the school on 30% of days when data were collected and determined whether or not participants were wearing the devices. The days and times of observation were selected at random and all participants were wearing their Zip™ devices when observations occurred.

Social Validity

At the end of the study the participants were asked to complete two questions with, “Yes” or “No” answers. The questions were: “Did you like wearing the Fitbit each day?” and “Do you want to wear the Fitbit and set goals next fall?” At the same time, the classroom teacher was asked to answer, using a 7-point Likert scale, three questions from the modified Treatment Acceptability Rating Form Revised (see Appendix G) (TARF-F) (Reimers, Wacker, Coopers, & Raad, 1992). The questions
were: “How acceptable was the treatment?” How willing were you to carry out the treatment?” and “How effective was the treatment?”

Results

Daily Steps

Figure 1 displays the number of steps taken every day by all participants, the mean number of steps taken daily by each participant in each condition (horizontal lines through the data points), and the daily goals during treatment (represented by bars). There were substantial differences across participants in the number of steps taken per day during the initial baseline condition and there was considerable within-participant variability in this measure. During treatment, the number of steps taken by all participants increased and each participant eventually met the goal of taking 10,000 or more steps per day. Although there is some overlap of data points when the initial baseline and initial treatment conditions are compared, there are substantial overall differences in performance levels. This is evident in the performance of each participant.

During the initial baseline, Peter, Rose, Billy, Charlie, and Casey took, on average, 6,569, 5,257, 6,611, 7,588, and 10,240, steps per day, respectively. Their respective mean steps increased to 11,844, 9,286, 9,352, 12,008, and 12,929 during the first exposure to treatment. At the end of this condition, each of them regularly reached or exceeded a goal of above 10,000 steps per day. Terminal goals for Peter,
Rose, Billy, Charlie, and Casey were 10,255, 11,268, 10,647, 16,265, and 13,630 steps per day, respectively. Steps taken each day decreased when Rose, Billy, Charlie, and Casey were exposed to a return the baseline condition, then increased when treatment was reinstated, although this condition was in effect for too short a period for performance to fully recover in all participants.

Social Validity

Each of the five participants answered, “Yes” when asked, “Did you like wearing the Fitbit each day?” and when asked, “Do you want to wear the Fitbit and set goals next fall?” Using scales where 1 indicated “very (acceptable, willing, or effective)” and 7 indicated “not at all (acceptable, willing, or effective),” the teacher responded with 7s to the questions “How acceptable was the treatment”, “How willing were you to carry out the treatment?”, and “How effective was the treatment?”
Figure 1. Number of Steps Taken at School. The line graph represents the number of steps each participant took each day. The grey bar represents each participants daily step goal.
Discussion

In the present study a treatment package comprised of goal setting and reinforcement increased the number of steps taken each day by each of five young adult participants with ASD. By the end of the initial intervention condition all of the participants were walking 10,000 or more steps per day, which is generally recognized as sufficient exercise to confer health benefits (e.g., Iwane et al., 2000). Several prior studies, reviewed elsewhere (Lang et al., 2010; Sowa & Meulenbroek, 2012), have generated exercise in people with ASD, so it is unsurprising that we were also able to do so. What is noteworthy is the high level of exercise observed in the present study, which appears to substantially exceed the level observed in prior studies. Steps taken per day was not used to quantify exercise in any of those studies, making direct comparisons impossible, but participants apparently exercised for 30 or fewer minutes per day in each of the 18 studies reviewed by Lang et al (2010). Walking 10,000 steps requires considerably more than 30 minutes.

Participants in the present study were able to routinely walk 10,000 or more steps during a 6-hour school day. They did so without disrupting their everyday school activities, but it is important to emphasize that those activities were designed to facilitate an effective transition from living and working in a tightly controlled environment to doing so in more a more flexible and independent one, hence the participants had a substantial amount of discretionary time, which they devoted to walking. Students with ASD in other school settings (e.g., students attending high
school) would have less discretionary time, although they would undoubtedly have some (e.g., at lunch). For such individuals, modifying the treatment program to include after-school time would be a tenable option. Examining the effects of such a program would be worthwhile goal for future research.

So, too, would be examining the sustainability of the kind of exercise program used in the present study. Good exercise programs sustain activity over years, not just weeks or months, and the duration of the present study was relatively brief. Our social validity data suggest, however, that the program used to engender exercise was acceptable to all concerned parties, which suggests, but certainly does not prove, that it could be sustained. The treatment package used to engender exercise in the present study was relatively inexpensive (each Zip™ device cost about $60), easy to implement, socially valid, and effective. Therefore, further research examining the range of conditions under which such a treatment package is useful and the sustainability of such a package appears to be merited.
CHAPTER III

EXPERIMENT 2

Experiment 1 demonstrated that goal setting and reinforcement increased the number of daily steps participants took while at school. It is possible that physical activity levels were high (i.e., above 10,000 steps) at school because of naturally occurring opportunities to walk. For example, if weather permitted students and staff walked to grocery stores that were located within 1 to 2 miles of the school. There were also several breaks and free time throughout the school day in which participants had time and were encouraged to walk, although were not required to do so. Participants were frequently observed walking during break times (there was at least one scheduled 15-min break each day), which is unsurprising as it led to meeting their daily goal, which in turn led to receiving reinforcers.

Although, the results of Experiment 1 are encouraging, physical activity levels outside of the school setting were not measured. It is possible that participants engaged in little physical activity outside of the school setting. Ideally, high levels of physical activity would maintain when individuals went home and also when they aged out of the program. YAP is a transitional program and after the age of 26 years students no longer receive formal educational instruction and transition to various locations including group homes, work, or college. These settings would undoubtedly be less structured, which may result in lower levels of physical activity (Drahelm, Williams, & McCubbin, 2002; Kilpatrick, Hebert, Bartholomew, 2005). Therefore, it
is important that individuals with ASD develop a consistent routine of engaging in physical activity outside of the school setting. One purpose of Experiment 2 was to evaluate the effects of the goal setting and reinforcement procedure on the number of steps taken each day in each participant’s natural environment outside of school (i.e., in the evening and weekends).

Obesity rates and obesity-related secondary conditions are substantially higher in individuals with developmental disabilities than in the population at large (Rimmer, Braddock, & Fujiura, 1993; Rimmer, Braddock, & Fujiura, 1994; Rimmer, Braddock, & Marks, 1995; Yamaki, Rimmer, Lowry, & Vogel, 2011). Conditions associated with obesity in this population have the potential to undermine physical independence and community participation, and it is likely that these adults will incur substantial health care costs to treat and manage these conditions (Guh et al., 2009; Trasande & Chatterjee, 2009; Wang et al., 2008). Although several factors affect obesity and weight loss, engaging in physical activity has been associated with reductions in body fat, increases in health and fitness and decreases in health-related issues stemming from obesity (U.S., Department of Health and Human Services, 2008). Therefore, another purpose of Experiment 2 was determine if consistently walking 10,000 or more steps per day (if that level was achieved) would decrease weight and BMI over a six-month period.

Lastly, Experiment 1 demonstrated that when reinforcers for meeting daily goals were removed, the number of steps taken by each participant decreased. These
results suggest that an important and effective component of the treatment was the reinforcers that were provided for meeting daily goals. It is possible, although not probable, that individuals with developmental disabilities would be encouraged to engage in physical activity by their social community, which would result in their receiving reinforcers in their natural environment. Therefore, it is important to evaluate interventions that closely resemble participant’s naturally occurring environments. It is likely individuals would have Internet access at home and could use websites (e.g., www. Fitbit.com) and smartphone applications to monitor their physical activity. Internet-based interventions have been shown to be as effective as in-person interventions at increasing physical activity and decreasing calorie consumption (LaPlante & Peng, 2011; Vandelanotte et al., 2007) and researchers (e.g., Cushing & Steele, 2011) have suggested evaluating existing programs in natural settings rather than developing new programs. To this end, Experiment 2 evaluated if self-monitoring via the self-monitoring form used in Experiment 1 and the Fitbit website (www.Fitbit.com) could maintain recommended levels of physical activity (i.e., 10,000 steps per day) alone (i.e., without reinforcers for meeting goals).

Therefore the purpose of Experiment 2 was threefold; (1) to evaluate the treatment of goal setting and reinforcement in each participant’s natural environment (i.e., outside of school), (2) to evaluate the treatment on weight and body mass index (BMI) over the course of six months and (3) to evaluate if self-monitoring via the
self-monitoring form and the Fitbit website could maintain walking 10,000 steps or more per day.

Methods

Participants, Setting, Materials

Three male students (Charlie, Casey, and Billy) from Experiment 1 participated in the study. They were all 22 years of age when the experiment started. The experiment took place in the same school and classroom as Experiment 1 and started at the beginning of the 2014-15 school year. The class had a new teacher as the previous teacher had retired at the end of the school year. Informed consent (see Appendix X) and assent (see Appendix X) were obtained before the start of experiment.

The same Fitbit Zip devices were used in the study and participants were asked to wear the device while at school and at home. A self-monitoring form (same as in Experiment 1) and a monthly calendar (see Appendix H) were kept in a binder that participants had access to each morning. Each morning the participants checked in with a member of the research team. During baseline, if they brought their Fitbit to school they put a green sticker on the current day on their calendar and selected a small prize from a prize bin. If participants forgot their Fitbit they put a red sticker on the calendar and were not allowed to select a prize. During treatment, participants put
green stickers on the previous day for meeting their goal and a red sticker if they did not meet their goal. Prior to the start of the study, the research team created a Fitbit account (www.fitbit.com) for each participant. During baseline participants did not have access to their account so they could not monitor the number of steps they were taking each day. Once treatment started, participants were shown how to synchronize the device with a laptop computer and log into their account (see Appendix I for a screen shot of the website). Additionally, each participant’s weight was measured at school using a High Accuracy Digital Bathroom Scale by BalanceFrom LLC.

**Dependent Measures**

The primary dependent variable was the number of steps taken each day as measured by Zip™ and recorded from the Fitbit website (www.Fitbit.com). The secondary dependent measures were weight and body mass index (BMI). BMI is a numerical measure of body fat based on a person’s height and weight, which provides a reliable indicator of body fatness for most people and is used to screen for weight categories that may lead to health problems. BMI does not measure body fat directly, but has been shown to correlate with direct measures of body fat such as underwater weighting (CDC, 2014). It is calculated using the formula: weight (kg)/height (m)².

There are four weight categories based on BMI; underweight (below 18.5), normal (18.5 – 24.9), overweight (25.0 – 29.9) and obese (30.0 and above).

Each morning throughout the study (baseline and treatment) participants stepped on the scale and the researcher recorded their weight. On the first day of the
study and at the beginning of each month each participant’s height was recorded (there was no height change throughout the study for any participant). Their weight and height were then used to calculate BMI for each day that weight was recorded using the formula above.

**Experimental Design**

A multiple-component, multiple-baseline-across-participants design (Poling, Methot, & LeSage, 1995) was used to determine if goal setting and reinforcement increased the number of steps taken by participants both at school and at home (i.e., during nights and weekends). The baseline condition was in place until visual inspection revealed no trend in the number of steps taken by an individual participant. At that time, treatment was arranged and participants set a series of goals that increased by 10% of the average number of steps taken during baseline (same as Experiment 1). After two weeks of meeting their goal, participants were asked if they wanted to increase their goal. If they responded, “Yes” the goal was increased, if they answered, “No” the same goal was kept in place until their answered, “Yes.” The study lasted 167 days on average (range across participant: 152 to 167 days). The number of days each student participated varied due to unforeseen circumstances such as travel, illness and two participants choosing not to not wear the Zip™ during Christmas break.

**Baseline.** During baseline a piece of black electrical tape was used to cover the screen on the Zip™ so participants could not see the number of steps taken. The
participants were reminded of the procedures of the study and told that goal setting and rewards would start at a later date.

Each school day, each participant met individually with a member from the research team. This took place between 7:30 a.m. and 9:30 a.m., depending on the classroom schedule and each participant’s work schedule. Each morning participants were asked to step on the scale and give their Zip™ to the research team member so it could be synchronized with the computer. If the participant brought his Zip™ to school, then he placed a green sticker on the current day of the calendar and immediately selected an item (e.g., pencil, sticker, small toy) from a small prize bin.

If a participant did not bring his Fitbit to school he placed a red sticker on his calendar, did not receive access to the prize bin and was reminded to bring his Zip™ to school the following day. Baseline continued until the number of steps taken was stable as determined by visual inspection of graphed data. Treatment comprised three phases (goal setting and reinforcement, maintenance, and self-monitoring) for Casey and one phase for Charlie and Billy (goal setting and reinforcement). Implementation of the treatment was staggered across participants to determine if the intervention increased the number of steps taken.

**Goal Setting and Reinforcement.** On the first day of treatment a member of the research team met individually with each participant. At this time the tape was removed from the screen of the Zip™ device and the participant was shown how the device worked. The researcher asked the participant to hold the Zip™ device in his
hand, walk around, and watch the step tracker increase. The researcher explained that
the Zip™ was counting steps and counted aloud the number of steps indicated on the
screen. The researcher then told the participant that each day he would set a step goal
and that the following day at school we would check the website to see if he had met
his goal from the previous day, and doing so would result in selecting a prize from a
larger prize bin. The prize bin contained preferred items that were chosen by
participants prior to the start of intervention when staff took participants to local
stores (e.g., Dollar General); each item cost between 10 cents and $1. At the
beginning of treatment Casey asked if he could earn gift cards for meeting his goal, a
request that was honored. To keep the prize amount similar across participants, each
day Casey met his goal he was given the choice between selecting an item from the
prize bin and placing a sticker on a chart (separate from his calendar). Once he earned
5 stickers (i.e., completed a fixed-ratio 5 schedule of reinforcement), he received a $5
gift card from a store of his choice (e.g., Dollar Store, 5-Below). On Mondays, this
same procedure was carried out except the researcher and participant reviewed the
number of steps taken the previous Friday, Saturday and Sunday.

A member of the research team would synchronize the Zip™, log into the
participant’s Fitbit account, and select the button to view the number of steps taken
the previous day. Participants sat next to the research member and often watched; two
weeks into intervention, participants were asked if they wanted to synchronize the
device and log into their account. Each participant answered, “Yes” and when given
the chance could independently complete this routine. On occasion a participant would ask for help during this process which was usually because there was poor Internet connectivity and the Zip™ would not properly synchronize. A member of the research team was present each morning while the participants checked their account, but did not help the participant unless he asked or unless they did not complete a step (e.g., writing a goal for the current day). The member of the research team recorded the participant’s weight, provided access to items that were not in the prize box (e.g., gift cards) or missing items (e.g., new self-monitoring forms, 3-hole punch, stickers), and provided social praise for meeting goals.

The initial goal proposed for each participant was determined by taking the average number of steps walked by each person during baseline and increasing that number by 10% (same procedure as in Experiment 1). After the participant had met their goal for several days, the researcher would ask if they wanted to increase their goal. If the participant responded, “Yes” a new goal was determined; and if they responded, “No” the same goal was kept in place. This continued until the number of steps was stable as determined through visual analysis. New goals were determined individually and varied throughout the study based on each participant’s average number of steps during baseline and individual preferences. The CDC (2014) recommends that individuals walk 10,000 steps per day. However, previous research has shown 10,000 steps to have a modest effects on weight loss (Tudor-Locke & Bassett, 2004), thus goals in the current study were increased beyond 10,000 steps to
increase the likelihood that participants would lose weight. Casey’s first goal was 15,253 steps, which was increased to 16,778 during the goal setting and reinforcement phase. After meeting his goal on 70% of treatment days, he was asked if he wanted to increase his goal to which he responded, “No.” He asked if his goal could be 10,000 steps (which was the goal during the return to treatment in Experiment 1). After Christmas break (when he chose to not wear the Fitbit) he asked to set his goal at 12,000 steps which was kept in place until the evaluation of the Fitbit website started.

For one participant (Charlie) separate goals for weekdays and weekends were determined. During baseline Charlie was walking an average of 14,853 (range: 9,195 – 21,085) steps per day, Monday through Friday. However, his weekend average was 3,644 steps per day (range: 848 to 11,325) and the average of the last two weekends (four data points) was 3,458 steps per day. This discrepancy between weekday and weekend data suggested that Charlie was obtaining a majority of his weekday steps at school and that walking was not part of his normal weekend routine. His parents reported it was difficult to have him exercise on the weekends and often did not require him to do so because it often resulted in a fight. His first weekend goal was determined by taking the average number of step per day for the last four data (which were lower than previous days in baseline) and increasing by 10%

**Self-Monitoring.** Casey was the only participant that participated in this condition of the experiment. This phase was identical to the previous phase except
Casey did not earn rewards for meeting his goal. Each morning Casey logged into his Fitbit account, synced the device, recorded the number of steps from the previous day, placed the correct color sticker on the calendar, and wrote the current date and goal on his self-monitoring form. Members from the research team provided no praise for meeting goals during this phase and only had limited contact with the Casey. He was prompted (using a visual prompt) to log into the website if he hadn’t done so by 9:30 a.m. The research team member would talk to Charlie about events unrelated to walking (e.g., upcoming birthdays) and help him with missing materials or trouble shooting Internet issues.

Procedural Integrity

During all conditions of the study a member of the research team was present each day and completed a treatment integrity checklist (see Appendix J) to ensure the same series of steps were completed. The steps were stepping on the scale, wearing the Zip™; synchronizing the Zip™ with the laptop, putting the correct color sticker on their individual calendar; selecting a reinforcer if they brought their Fitbit to school (baseline) or for meeting their goal on the previous day (treatment), completing his self-monitoring which including writing the date and the current day’s goal; on Fridays writing their goal for Saturday and Sunday; and putting a copy of their self-monitoring form into their backpack. On 30% of all days, selected at random and unknown to the research member, another member of the research team was present and also completed the itemized checklist to record whether the steps
described above were carried out. Overall, 98% of the steps were carried out appropriately. The only errors observed were when participants did not weigh in, which was easily solved by having the participant come back and weight in; and choosing a reinforcer from the bin before placing a green sticker on their calendar, which was easily solved by prompting the participant to place a sticker on the calendar.

Social Validity

The classroom teacher was asked to answer, using a 7-point Likert scale, three questions from the modified Treatment Acceptability Rating Form Revised (see Appendix G) (TARF-F) (Reimers, Wacker, Coopers, & Raad, 1992). The questions were: “How acceptable was the treatment?” How willing were you to carry out the treatment?” and “How effective was the treatment?”

One parent (Charlie’s mom) also completed a modified survey. Billy lived in a group home and the research team was not able to contact a group home member to complete the survey and Casey was his own legal guardian and therefore the research team was not in contact with his parents. Charlie’s mom was asked to answer, using a 7-point Likert scale, three questions from the modified TARF-F. The questions were: “How disruptive to your night and weekend routine was it to carry out the Fitbit treatment?” and “how effective was the Fitbit treatment for improvement you son’s physical activity?”
A modified concurrent chains procedure (Hanley, Piazza, Fisher, & Maglieri, 2005) was used to assess whether participants enjoyed wearing the Zip™. On the last four days of the experiment participants were presented with three choices; an arbitrary item from the prize bin was placed on a yellow piece of paper, a preferred item (determined by the item that each participant selected the most from the prize bin) was placed on a blue piece of paper, and each participants Zip™ device was placed on an orange piece of paper. Participants were asked to sit down at the table and the researcher said, “If you pick this one (while pointing to arbitrary item) you can have it right away but you cannot wear your Fitbit today. If you pick this one (pointing to preferred item) you can have it right away but you cannot wear your Fitbit today. If you pick this one (pointing to the Fitbit) you can wear your Fitbit today and if you meet your goal you can select a prize tomorrow. Please pick one.” This continued until a preference was determined through visual analysis of graphed choices.

**Results and Discussion**

**Daily Steps**

Figures 2 and 3 show the number of steps taken every day by all participants. Daily step data were divided into weekdays (i.e., days participants attended school) and weekend days (i.e., days participants did not attend school). One purpose of Experiment 2 was to determine if the treatment was effective at increasing (and maintaining) high levels of physical activity during weekends. Casey and Billy set the
same goal for week days and weekends. However, Charlie walked considerably fewer steps on weekends so separate goals were set for weekends.

**Weekday Steps.** Figure 2 displays the number of steps taken every day by all participants during the week (i.e., days participants attended school), mean number of steps taken daily by each participant in each condition (horizontal lines through the data points), and the daily goal during treatment (grey bars). There were substantial differences across participants in the number of steps taken per day during baseline and there was considerable within-participant variability in this measure.

During baseline, Charlie, Casey, and Billy walked, on average, 14,853, 14,899, and 9,533 steps per day, respectively. Their respective means steps increased to 16,132, 19,091 and 14,128 during the goal setting and reinforcement condition. Since Charlie and Casey were walking over 10,000 steps per day during baseline, their initial goal exceeded 10,000 steps and their goals increased until they responded, “No” when asked if they wanted to increase their goal. The terminal goal during this condition was 14,736, 16,778, and 15,054 for Charlie, Casey, and Billy, respectively. Although there is some overlap of data points when the baseline and goal setting and reinforcement are compared, there are substantial overall differences in performance levels; which is evident in the performance of each participant. During the goal setting and reinforcement condition participants met their goal on a consistent basis. Charlie, Casey and Billy met their daily goal 87%, 92% and 97% of days.
**Weekend Days Steps.** Figure 3 displays the number of steps taken every day by all participants on weekends or days that participants did not attend school (e.g., snow days), mean number of steps taken daily by each participant in each condition (horizontal lines through the data points), and the daily goal during treatment (grey bars). During baseline, Charlie, Casey, and Billy walked, on average, 4,738, 11,840, and 0 steps per day, respectively. Their respective means increased to 6,819, 17,838, and 15,006 during the goal setting and reinforcement condition. Terminal goals for Charlie, Casey, and Billy were 5,000, 16,778, and 15,054 steps per day, respectively.

Charlie did not wear his Zip™ for two weekends during baseline and those “zeros” were not included in his baseline average. When Charlie did wear the Zip™ on the weekends there was considerable variability (range: 2,197-11,325) in the number of steps he took. On average, he walked 14,853 (range: 9,195-21,058) steps per day on days he attended school, which is a difference, on average, of 10,115 steps per day compared to his weekend day. This suggests that the number of steps Charlie took each day during weekends was a function of his family’s activities and that physical activity was not a planned or routine part of his weekend schedule. When goal setting and reinforcement was implemented Charlie wore his Zip™ every day on the weekends and the variability of steps taken per day decreased over time. Although there is some overlap of data points when the baseline and treatment conditions are compared the stable trend of the last nine days of treatment suggest that the number
of steps he walked were a function of his daily goal. This is further supported by the fact that he met his goal 90% of days.

Billy did not wear his Zip™ on weekends during baseline. It is important to remember that on Monday he earned a reinforcer for bringing the Zip™ to school. Had he worn the device on Saturday and Sunday he would have earned three reinforcers. It is possible that earning one reinforcer was as motivating to him as earning three. A multiple-stimulus (DeLeon & Iwata, 1996) and a free operant (Ortiz & Carr, 2000) preference assessment were conducted to determine possible reinforcers that could have been given for wearing the Zip™ on Saturdays and Sundays. We also asked Billy what he wanted to earn for wearing his Fitbit on the weekend and he would say a specific item from the prize bin. Even with possible reinforcers determined on Friday, he did not wear the Zip™ on weekends and after seven weekends of not wearing the Zip™ goal setting and reinforcement were implemented. The first weekend in treatment he still did not wear the device, but still earned a reinforcer on Monday for meeting his goal on Friday.

The research team spoke with the teacher and staff and they suggested that he earn Video Home Systems (VHS) for meeting his goal. The classroom had a system in place in which students earned community outings for appropriate behavior throughout the week. For Billy, his reward for appropriate behavior was selecting two videos to take home during the weekend. The staff agreed that he could earn two videos for meeting his goal during the weekend. Billy was told that he could select a
movie for each day he earned his goal (only for Saturday and Sunday). The next weekend he wore his Fitbit and continued to do so for the entire experiment, and met his goal on all but two days (on two separate weekends). On the Friday before Christmas break the researcher asked participants for each of their Fitbits (to avoid losing the devices). When Billy was asked for his Fitbit he said, “No” and brought the researcher over to a calendar and pointed to each day of the scheduled break and said, “Fitbit.” We asked if he wanted to wear his Zip™ over break, to which he responded, “Yes.” He wore his Zip™ every day over break and met his goal every day except for Christmas Eve and Christmas Day.

Casey had two additional experimental conditions, a maintenance phase and a self-monitoring phase in which reinforcers for meeting his daily goal were removed. His daily step goal during the maintenance phase was 10,000 and then 12,000 steps. On the twelfth day of the goal setting and reinforcement condition the researcher asked if he wanted to increase his goal (which was 16,778) and he asked if his goal could be 10,000, a request that was honored. Later, he asked to increase it to 12,000 steps per day. He took, on average, 12,878 steps per day during this phase (an increase of 1,038 steps per day from baseline) and met his goal on 79% of days. This phase was kept in place until the evaluation of the self-monitoring condition started. The self-monitoring condition was identical to the previous conditions except reinforces for meeting his daily goal were removed. On the first day of this condition the researcher placed the prize bin out of sight from where he logged into the
computer. He did not mention the prize bin nor did the researcher. He never asked about the bin or receiving a prize throughout this condition. On average he took 13,001 steps per day and he met his goal on 53% of days during this condition. Although he did not meet his goal as often during this condition as in the goal setting and reinforcement condition, he walked 10,000 steps or more on 83% of days. This is a substantial increase from baseline in which he walked 10,000 steps or more steps per day 55% of days.

**Health Measures**

**Weight.** Figure 4 displays each participant’s weight. During baseline, Charlie, Casey, and Billy weighed, on average, 226.2, 229.5, and 222.5 lbs, respectively. Their respective average weights during goal setting and reinforcement were 222.8, 224.2, and, 226.8 lbs. Each participant’s weight shows a downward trend, and from the first to last day of the experiment, Charlie, Casey, and Billy lost 4.6, 12.6, and 0.4 lbs respectively.

**Body Mass Index.** Figure 5 displays each participant’s BMI. On the first day of the study each participant’s weight and height were obtained to determine BMI. BMIs for Charlie, Casey and Billy were 33.5, 33.3, 34.2 respectively, placing them all in the obese category. On the last day of treatment their respective BMIs were 32.8, 31.7, and 34.1 (still all meeting criteria for obesity).
Using scales where 1 indicated “very (acceptable, willing, or effective)” and 7 indicated “not at all (acceptable, willing, or effective),” the teacher responded with 7s to the questions “How acceptable was the treatment”, “How willing were you to carry out the treatment?” and “How effective was the treatment?” Charlie’s mom responded with 7s to “How acceptable was the treatment” How likely did the treatment make permanent improvements in your son’s physical activity” and “How effective was the treatment?”

The modified concurrent chains procedure was carried out for 3 days after the study ended. Charlie and Billy selected the Zip™ device on each of the three days. Casey selected the preferred item on the first two days and the Zip™ on the third day. This demonstrates participants liked wearing the device and, for two participants, would chose to wear it over having immediate access to preferred items that in the past were only available for meeting their daily goal. Casey had not been earning rewards for meeting his daily goal at the end of the study and therefore it is unsurprising that Casey selected the preferred item on the first two days of the procedure. The fact that he selected the Zip™ on the third day suggests he did like to wear the device and that at times he would select to do so even if it did not result in the opportunity to earn rewards. However, it does suggest that the reinforcers for meeting goals were an important component of the study which was also demonstrated in Experiment 1.
In the present experiment goal setting and reinforcement increased the number of steps taken each day by each of three young adult with ASD both on school and non-school days. Experiment 2 replicated the findings of Experiment 1 in that all participants were walking 10,000 steps or more per day during the week (days they attend school) and also extended these findings to show that participants increased the number of steps they walked on weekends (days they did not attend school).

Night and weekends are usually less structured than school days, which can lead to lower levels of physical activity (Drahelm et al., 2002; Kilpatrick et al., 2005). Therefore, it is important that individuals with ASD develop a consistent routine of engaging in physical activity outside of the school setting. During baseline, two participants (Charlie and Casey) walked, on average, fewer steps on non-school days than on school days. This may have been the case for Billy but impossible to confirm because he didn’t wear his Zip™ on weekends during baseline.

In this experiment reinforcers for meeting daily goals were delayed. The delay between participants meeting their goal and selecting a prize from the bin was between 8 hours (during the weekend) and 56 hours (meeting Friday’s goal was reinforced on Monday morning). On the first day of treatment participants were given a description of the procedure; “If you meet your goal by the end of the day, you’ll earn a reward tomorrow.” This description of the procedure may have been a contingency-specifying stimulus (CSS; Schlinger & Blakely, 1987) that altered the reinforcing functions of the number of steps shown on the screen of the Fitbit device.
The current treatment may have to be altered for individuals who do not have the necessarily skills to respond to CSS that describe delayed outcome. For example, rewards could be given at the end of the day, at home, for individuals who do not learn the association between meeting their steps goal and the delivery of the reinforcer on the following day.

The social validity data suggest that the teacher and a parent thought the intervention to be effective and that participants liked to wear the Zip™. At the end of the study the teacher asked the research team to continue the study. As a result, the study will continue throughout the school year; however we will be assessing the efficacy of the treatment in the absence of the research team. That is, the students will continue to set daily goals and earn reinforcers for doing so. The research team will gradually fade out but continue to monitor the number of steps taken each day and how many days participant log into the website by 9:30 a.m. This can be monitored remotely by logging into each participant’s Fitbit account. If the number of steps taken each day decreases overtime or participants no longer log into the website, we will make visits to the school to determine how best to support the program. Additionally, Charlie’s mom has also asked for the procedures to remain in place in the classroom and has offered to buy him a Fitbit and give the school rewards that could be given for meeting his goal. She has also made the goal setting and reinforcement part of Charlie’s Individualized Education Plan (IEP).
Figure 2. Number of Steps Taken on School Days. The line graph represents the number of steps participants took each day they attended school. The grey bar graphs represents each participant’s goal each day.
Figure 3. Number of Steps Taken on Non-School Days. The line graph represents the number of steps participants took each day they attended school. The grey bar graphs represents each participant’s goal each day.
Figure 4. Weight. The line graph represents each participant’s weight through the course of the study. All weights are in pounds.
Figure 5. Body Mass Index. Lines represent BMI for each participant through the course of the study.
CHAPTER IV

GENERAL DISCUSSION

The general purpose of these experiments was to evaluate if behavioral interventions (goal setting and reinforcement) could increase the number of steps that young adults with ASD walked both at school and at home. Experiment 1 demonstrated that the intervention was effective at school. Experiment 2 demonstrated that, for three young adults, the intervention increased and maintained levels of walking outside of the school setting. Experimental 2 also showed that three individuals walking 10,000 steps or more per day decreased weight and BMI, although to varying degrees. These results suggest that young adults with ASD can and will engage in high levels of physical activity both at school and home. It also demonstrates that by providing small rewards for meeting daily goals, these levels of physical activity can be maintained for sustained periods of time (i.e., six months) which has not been demonstrated to date (Lang et al., 2010).

Lang et al. (2010) suggested that “future research involve the evaluation of different procedures used to teach or maintain exercise” (p. 574). Previous research has described how exercise has been taught to individuals with ASD and reported positive outcome on behaviors unrelated to physical activity (e.g., stereotypy and academic responding), however, no study until the current one has evaluated the effects of a treatment package on the number of steps that individuals with ASD walk each day. Showing that a simple package did so is important because the current
intervention did not require training individuals to engage in a new activity (e.g., roller skating, snow shoeing) and did not require any specialized equipment (e.g., treadmill, swimming pool), allowing participants to engage in physical activity in any location. If physical activity is to be incorporated into programming for individuals with ASD, it’s important that treatments are easy to implement and suitable for use in a wide variety of situations. The present data suggest that a procedure that combined goal setting, automated recording of steps taken, and reinforcement meets these requirements.
Appendix A

Informed Consent
Western Michigan University  
Psychology Department

Principal Investigator: Alan Poling, Ph.D.
Student Investigator: Katherine LaLonde, M.A., and Brian MacNeill, B.S.
Title of Study: Increasing Physical Activity within a Special Needs Young Adult Program

Your child has been invited to participate in a research project, entitled “Increasing Physical Activity within a Special Needs Young Adult Program.” This consent document will explain the purpose of this research project and will go over the time commitments, the procedures used in the study, and the risks and benefits of participating in this research project. Please read this consent form carefully and completely and please ask any questions if you need more clarification.

What are we trying to find out in this study?
The purpose of this study is to increase physical activity. We’re trying to determine if self-monitoring (writing down how many steps the participant takes each day) and small rewards (e.g., $5 gift cards) increase how much a person walks throughout the day. It is recommended that adults should walk about 10,000 steps per day, so our goal is to have participants walking that much by the end of the study. To participant in the study individuals must be a student at YAP and be able to walk.

Where will this study take place?
The study will take place at YAP and during community outings.

What is the time commitment for participating in this study?
Participants will record the number of steps they take each day and review this with their teacher or research team from Western Michigan University. This will take approximately 10-15 minutes per day during downtime at the end of the day and will happen each day until the end of the school year.

What will you be asked to do if you choose to participate in this study?
The study will take place at school so nothing is required at home.

What are the risks of participating in this study and how will these risks be minimized?
Potential risks may include over exertion, tiredness and physical injury. Teachers and staff will be monitoring students throughout the day and will have students take breaks if they are showing signs of physical distress (e.g., excessive sweating).

As in all research, there may be unforeseen risks to the participant. If an accidental injury occurs, appropriate emergency measures will be taken; however, no compensation or additional treatment will be made available to you except as otherwise stated in this consent form.

**What are the benefits and costs of participating in this study?**
Increasing exercise can improve physical health and psychological well-being, although these benefits are not certain to occur. Other benefits include earning rewards or the chance to engage in a special activity. Every day a participant meets his or her step goal they will receive a punch on a punch card. At random times these punches will result in the student earning rewards. The rewards will be small toys or gift cards that participants will pick out. Also, a couple times throughout the study if all the participants (there will be 4 or 5 participants) in the study meet their goals the entire class will get a reward or opportunity to engage in a special activity (e.g., bowling, pizza party, movie). It is possible the study will increase social interaction among the students in the classroom. It is our hope that the students will begin to encourage each other to take more steps so that they earn their individual and group rewards. There are no costs required to participate in this study.

**Who will have access to the information collected during this study?**
All personal information will be kept confidential and will only be shared among members of the research team.

**What if you want to stop participating in this study?**
A participant may choose to withdraw from the study at any time for any reason. You will not suffer any prejudice or penalty if you decide to stop your participation. The investigator can also decide to stop your participation in the study without your consent.

Should you have any questions prior to or during the study, you can contact the primary investigator, Alan Poling, Ph.D. at 269-387-4483 or alan.poling@wmich.edu. You may also contact the Chair, Human Subjects Institutional Review Board at 269-387-8293 or the Vice President for Research at 269-387-8298 if questions arise during the course of the study.

This consent document has been approved for use for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and
signature of the board chair in the upper right corner. Do not participate in this study if the stamped date is older than one year.

I have read this informed consent document. The risks and benefits have been explained to me. I agree to take part in this study.

Please Print Your Name

_______________________________________________
Participant’s signature

_______________________________________________
Date
Appendix B

Assent
You’ve been invited to participate in a research project, entitled “Increasing Physical Activity within a Special Needs Young Adult Program.” This consent document will explain the purpose of this research project and will go over all of the time commitments, the procedures used in the study, and the risks and benefits of participating in this research project. Please read this consent form carefully and completely and please ask any questions if you need more clarification.

What are we trying to find out in this study?
The purpose of this study is to increase physical activity. We’re trying to determine if self-monitoring (writing down how many steps you take per day) and small rewards (e.g., $5 gift cards) increases how much you walk each day. It is recommended that adults walk 10,000 steps per day, so our goal is to have you walking that much by the end of the study. You may participate in this study if you’re a student at YAP and able to walk.

Where will this study take place?
The study will take place at school and out in the community during classroom outings.

What is the time commitment for participating in this study?
You’ll record the number of steps taken each day and review your results with the Western Michigan University students or your teacher, Laura, each day. This should take about 10-15 minutes each day before you head home. The study will continue until the end of the school year.

What will you be asked to do if you choose to participate in this study?
Each morning you’ll put on a bracelet to wear while you are at school. The Western Michigan University students or Laura will help you set a goal each day. While at school you’ll try to walk more steps in the hallway or during gym. At the end of the day you’ll write down how many steps you walked. If you meet your goal then you’ll get a punch on a punch card. Sometimes when you get a punch, you’ll get to pick out a prize like a toy or gift card. Sometimes if everyone in the study meets a classroom goal then there will be a special activity or reward for the whole class.
What are the risks of participating in this study and how will these risks be minimized?
Potential risks may include being tired or getting hurt from walking more. Your teachers will be watching to make sure you are safe throughout the day. If you are getting tired teachers will ask you to take a break or drink water.

As in all research, there may be unforeseen risks to the participant. If an accidental injury occurs, appropriate emergency measures will be taken; however, no compensation or additional treatment will be made available to you except as otherwise stated in this consent form.

What are the benefits and costs of participating in this study?
Walking more may improve physical health and may make you feel good. Other benefits include earning punches and the chance to do special activities. Every day you meet your step goal you’ll receive a punch on a punch card. Sometimes the punches mean you get to pick out a special reward. Also, a couple times throughout the study if your friends who are also in the study meet their goals the entire class will get a reward or opportunity to engage in a special activity like going bowling or having a pizza party. It is possible that during the study students in your class will talk to each other more or encourage and praise you when you meet your goals, but that’s not for sure. There are no costs required to participate in this study.

Who will have access to the information collected during this study?
All your personal information will be kept confidential (no one will know) and will only be shared among members of the research team.

What if you want to stop participating in this study?
You may choose to stop the study at any time. Nothing bad will happen to you if you chose to stop the study. The people from the university can also decide to stop your participation in the study without your consent.

If you have any questions before or during the study, you can contact the primary investigator, Alan Poling, Ph.D. at 269-387-4483 or alan.poling@wmich.edu. You may also contact the Chair, Human Subjects Institutional Review Board at 269-387-8293 or the Vice President for Research at 269-387-8298 if questions arise during the course of the study.
This consent document has been approved for use for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and signature of the board chair in the upper right corner. Do not participate in this study if the stamped date is older than one year.

---------------------------------------------------------------------------------

I have read this informed consent document. The risks and benefits have been explained to me. I agree to take part in this study.

Please Print Your Name

__________________________________________________________________________
Participant’s signature Date
Appendix C

Human Subject Intuition Review Board Approval Letter
Date: March 18, 2014

To: Alan Poling, Principal Investigator
    Katherine LaLonde, Student Investigator for dissertation
    Brian MacNeill, Student Investigator

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number 14-03-04

This letter will serve as confirmation that your research project titled “Increasing Physical Activity within a Young Adult Program” has been approved under the expedited category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note: This research may only be conducted exactly in the form it was approved. You must seek specific board approval for any changes in this project (e.g., you must request a post approval change to enroll subjects beyond the number stated in your application under “Number of subjects you want to complete the study”). Failure to obtain approval for changes will result in a protocol deviation. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

Reapproval of the project is required if it extends beyond the termination date stated below.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: March 17, 2015

251 W. Walworth Hall, Kalamazoo, MI 49008-5456
PHONE: (269) 387-8293 FAX: (269) 387-8276
Appendix D

Sticker Chart on Each Participant’s Desk
<table>
<thead>
<tr>
<th></th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>MORNING</td>
<td>Was your FITBIT on by 8 a.m.?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AFTERNOON</td>
<td>Did you take FITBIT off by 1:45 p.m.?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 stickers = Choose from the <strong>prize</strong> box</td>
<td>2 stickers = Choose from the <strong>prize</strong> box</td>
<td>2 stickers = Choose from the <strong>prize</strong> box</td>
<td>2 stickers = Choose from the <strong>prize</strong> box</td>
<td>2 stickers = Choose from the <strong>prize</strong> box</td>
</tr>
</tbody>
</table>
Appendix E

Self-Monitoring Form
<table>
<thead>
<tr>
<th>Date</th>
<th>Goal</th>
<th>Steps Taken Today</th>
<th>Did you earn your reward?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuesday 9</td>
<td></td>
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<tr>
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<td></td>
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</tbody>
</table>
Appendix F

Procedural Integrity Checklist
<table>
<thead>
<tr>
<th>Date:</th>
<th>Data Collector:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Record the highest prompt level, or indp if the step was completed independently</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prompt Level</th>
<th>I indep</th>
<th>V Visual</th>
<th>VB Verbal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Record highest prompt level given

**Participants**

1. 2. 3. 4.

**Intervention (Morning)**

<table>
<thead>
<tr>
<th>Intervention</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>tape</td>
<td>removed</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>Write</td>
<td>date</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>Write</td>
<td>Goal</td>
<td></td>
</tr>
</tbody>
</table>

**Intervention (Afternoon)**

<table>
<thead>
<tr>
<th>Intervention</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>P</td>
<td>writes</td>
<td>date</td>
</tr>
<tr>
<td>b.</td>
<td>P</td>
<td>writes</td>
<td>goal (tell them)</td>
</tr>
<tr>
<td>c.</td>
<td>If goal</td>
<td>met</td>
<td>= prize</td>
</tr>
<tr>
<td>d.</td>
<td>If goal</td>
<td>not met</td>
<td>= no prize</td>
</tr>
</tbody>
</table>

**Treatment Integrity Score**

<table>
<thead>
<tr>
<th>Score</th>
<th>TOTAL STEPS CORRECTLY COMPLETED</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total steps</td>
<td>Treatment Integrity %</td>
</tr>
</tbody>
</table>


Appendix G

Treatment Acceptability Rating Form Revised
**Treatment Acceptability Rating Form**

Please complete the items below by circling the number under the question that best indicates how you feel about the Fitbit Study.

1. How acceptable did you find the Fitbit treatment to be for increasing the student’s physical activity?

<table>
<thead>
<tr>
<th>Not at all acceptable</th>
<th>Neutral</th>
<th>Very acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

2. How willing are you to carry out the Fitbit treatment?

<table>
<thead>
<tr>
<th>Not at all willing</th>
<th>Neutral</th>
<th>Very willing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

3. How effective was the Fitbit treatment for your students?

<table>
<thead>
<tr>
<th>Not at all Effective</th>
<th>Neutral</th>
<th>Very Effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
Appendix H

Participant’s Calendar
Appendix I

Fitbit Website Screenshot
Monday, February 23

- **Steps:** 17,371 steps
  - Champ!
- **Calories:** 3,399 calories
  - Champ!
- **Miles:** 7.53 miles
  - Champ!
- **Very active mins:** 74
  - Champ!
Appendix J

Procedural Integrity Checklist Form
<table>
<thead>
<tr>
<th>Date:</th>
<th>Data Collector:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>indep</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

- a. tape removed
- b. Step on Scale (record)
- c. synced FB
- d. complete self-monitor form (steps and reward)
- d. appropriate sticker for yesterday's goal
  - ☐ red: didn't meet goal
  - ☐ blue: met goal
  - if blue, P selected prize from large bin reward

**Intervention (New Goal)**
- a. P writes date
- b. P writes goal (tell them)

**Treatment Integrity %**

<table>
<thead>
<tr>
<th>TOTAL STEPS CORRECTLY COMPLETED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total steps</td>
</tr>
<tr>
<td>Treatment Integrity %</td>
</tr>
</tbody>
</table>
BIBLIOGRAPHY


doi:10.1038/oby.2009.67


