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A Behavioral Intervention For Child Obesity: Increasing Physical Activity On The Playground Via Reinforcement In A Preschool Classroom

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A BEHAVIORAL INTERVENTION FOR CHILD OBESITY: INCREASING PHYSICAL ACTIVITY ON THE PLAYGROUND VIA REINFORCEMENT IN A PRESCHOOL CLASSROOM

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ABSTRACT

Child obesity rates have reached an all-time high in the United States with rates quadrupling since 1963 for children ages 2-5 (Fryar, Caroll, & Ogden, 2012). This has led to increased research directed toward understanding the causes of this proliferation. The literature shows that several key variables, including physical activity level, diet, and health education are related to childhood obesity (Epstein, 2005; Trost, et al., 2003). In the realm of physical activity level, many interventions have been proposed and conducted with varying degrees of success. Of these few have attempted to impact the physical activity level of children in free play, probably due to the complex nature of free play periods. In addition, activity preference is an important but often neglected aspect of free play since choice complicates the ability to influence physical activity level. The current study describes an intervention that attempted to increase physical activity level as well as determine if activity preference changes as a result of providing reinforcement for physical activity. Using behavior modification techniques associated with a classroom token economy, preschoolers' moderate-to-vigorous physical activity on the playground was reinforced in attempt to influence both level of physical activity and activity preference. Also, in order to better understand the importance of peer influences on activity, sociometric interviews were conducted with the children before, during, and after the intervention. Accelerometers were used on the playground throughout the study to determine both which children were physically more or less active, and to measure any increase or decrease in level of physical activity. Several statistical tests were used to determine significant differences between mean activity level at pre-, during, and post-intervention, and sociometric

interview data were analyzed for relationships among sociometric variables and activity levels. Results regarding the effectiveness of the intervention were inconclusive, as 50% of participants did not respond and the other 50% significantly increased their activity levels on the playground. Conclusions based on findings suggest a need for closer control of the magnitude and quality of reinforcement in order to increase response rate and that reinforcement-based intervention could be useful on playgrounds in equipment poor environments.

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I. INTRODUCTION

According to the Center for Disease Control and Prevention in the United States, the past 25 years have shown a dramatic increase in obesity rates across all 50 states. Where most states in 1985 showed obesity rates below 10% of their populations, no state in the United States was below 20% in 2010. Mississippi in particular has the highest current rate of obesity at 34%, an increase from less than 10% in 1990 (CDC, 2010). This national increase in adult obesity is of obvious concern, as obesity can have profound health effects, such as increased risk of developing Type 2 diabetes, hypertension, coronary heart disease, and some types of cancer (CDC, 2010). Childhood obesity has also increased dramatically, quadrupling for children ages 2-5 since 1963 (Fryar, Caroll, & Ogden, 2012). We have long known that there are several distinct developmental periods where individuals are at highest risk for developing obesity, including early infancy, adiposity (~5-7 years of age), and adolescence (Dietz, 1994). Obesity among children has been shown to be related to a myriad of environmental and genetic variables, including parent weight, socioeconomic status, and high birth weight (Danielzik, et al., 2004). Health education, dietary habits, and physical activity level have also been identified as factors important to the development of obesity in children (Cole, Waldrop, D'Auria, & Garner 2006; Salvy 2008). Because obesity is such a pressing problem, it is not surprising that interventions targeting the variables known to be important in its development have been described in the literature yielding varying degrees of success.

Variables Affecting Child Obesity

Studies investigating the effectiveness of school-based interventions for obesity have yielded several interesting findings. Health education programs have led to marked reductions in Body-Mass Index (BMI) longitudinally for school-based programs which promote and educate the practice of healthy dieting and exercise (Gortmaker, et al., 1999). Several studies have also found that increasing physical activity has similar effects on BMI (e.g. Brownell & Kaye, 1982; Davis, 2002; Marshall, & Bouffard, 1997). Though the above studies examined the effects of health education and physical activity separately, these variables have been shown to effect more change when put together than when implemented individually (Gortmaker, et al., 1999). Unfortunately, the programs described in these studies are not practically applicable, as they require large amounts of time and major changes in curricula to accommodate the proposed interventions. An initial step in an effort to streamline the approach which has been shown to be maximally effective, is an analysis of the components of change.

For the three variables proposed to influence child obesity (i.e. health education, changing dietary habits, and increasing physical activity level) the components of change are intuitively evident. For health education, observational learning and reinforcement are key as parents and teachers both model and directly teach lessons in hygiene and exercise, and reinforce children's successes and behavior change. The same is true for dietary habits, where only those foods presented by parents, teachers, or related individuals are consumed. Studies that find high correlations between parent and child weight help to emphasize the point that the dietary habits of parents play a role in determining child dietary habits (e.g. Danielzik, et al., 2004; Hesketh, et al., 2005; Magarey, Daniels, Boulton, & Cockington, 2003). Physical activity level, however, is modeled somewhat differently than health education or dietary habits. There are many influences

on children's activity levels that are at work simultaneously, including the availability of time and space for play; parent and teacher permission; the presence of peers; activity preference; and benefits of one type of play over other choices (Bagby & Adams, 2007; Tomes, 1995). This has made framing interventions for physical activity difficult as the important variables must account for parent, teacher, and child motivations and preferences. Many interventions have been proposed, particularly in the last decade, which attempt to bridge gaps in our understanding of children's physical activity.

Physical Activity Interventions for Child Obesity

Researchers formulating interventions to impact child obesity by way of manipulating physical activity levels have generally focused on two primary areas: home and school. These two areas provide a wide range of opportunities to help address the problem of limited moderate-to-vigorous physical activity (MVPA).

One home based intervention compared family-physician clinic based care typified by a 6 month check-up and a family-based counseling program. The program consisted of weekly sessions with parents to teach them how to change their children's habits concerning food choice and physical activity level through controlling food type and intake as well as praise and rewards for making healthy choices. After one year, significant decreases in BMI were reported for both children and parents (Stark, et. al, 2011). Family-based interventions have been shown as effective in many other studies which focus on behavioral intervention strategies as well (Faith & Wrotniak, 2009). Despite these findings, this type of home intervention is incredibly difficult to implement. This has led many researchers to investigate interventions in schools which provide for a theoretically more stable and accessible environment.

Interventions for physical activity level at school have taken many forms in the last 10 years. Each of these studies can fall under one or more of the following three methods: increase time spent in MVPA in physical education classes; decrease overall sedentary activity time; or increase the amount of time spent in MVPA during free play. (Bagby & Adams, 2007). Well-designed interventions within these categories were reviewed in the American Journal of Preventative Medicine (Khan, et. Al, 2002). Of these, only interventions in physical education classes proved effective in increasing physical activity level. Of note however is that the classroom-based interventions described by these authors did not attempt to directly increase physical activity level, but instead focused on health education with little to no other active elements. Interventions directed toward free play were also largely non-existent or poorly designed (Kahn, et. al, 2002). This point further punctuates the difficulties in formulating interventions targeting the classroom and free play.

The difficulties inherent in studying physical activity during free play are diverse (Ridgers, Stratton, Fairclough, 2006). First, activity choice during free play is not necessarily stable and may vary between children in a given classroom as well as across time. During free play each child is allowed to participate in activities of their own choice, which could be primarily sedentary, such as playing in the sandbox, or primarily physically active, such as playing tag. This makes it difficult to impact this variable with the traditional methods outlined in the previous two types of school interventions, which focus on structured play. The second difficulty with this type of intervention has traditionally been measurement. Traditional paper and pencil methods for coding activity levels on a school playground make reliable and valid measurement of the important variables much more difficult than ratings of a single, structured task. The third and final difficulty is the variability of time, location, and play opportunity that

playground play represents. Whereas special education classes (such as PE) meet at a specific time of the day in most schools multiple days of the week, and opportunities in class allow the teacher to work in physical activity to reduce sedentary behaviors, free play is usually seen as "extra" time. The amount of time spent outside varies from day to day and school to school. Location also presents a difficulty as weather plays a much larger role in the canceling of recess compared to physical education or class-based interventions. These problems have made interventions designed to increase MVPA on school playgrounds difficult to implement, and may explain why so little research has been done on this period of time. Importantly, if interventions can easily and cheaply influence child activity preference and amount, a more lasting and generalizable effect may be realized than has been shown from knowledge-based interventions.

Studies to date have primarily utilized two methods to increase MVPA on playgrounds: marking and fitness breaks (Ridgers, Stratton, Fairclough, 2006), as increasing time spent on the playground by itself has been shown to provide no additional benefit (Alhassan, Sirard, & Robinson, 2007). Marking, which is the use of paints or chalks to mark off areas to be used for structured play, have been shown to increase levels of MVPA for both sexes as well as increase the duration of play time (Straton, 2000; Stratton & Leonard, 2002; Stratton & Mullan, 2003). Fitness breaks are also based on providing additional choices for students during free play, where obstacle courses are constructed that require MVPA to complete and students are urged to complete them at regular intervals. Fitness breaks have also shown favorable results benefiting both sexes and increasing overall levels of MVPA (Scruggs, Beveridge, Watson, 2003). Of these choices the common element is the addition of equipment for students, increasing the variety and likelihood of choosing an activity that requires MVPA. What these studies do not explain, however, is the mechanisms of influence.

Playground Activity Preference

Research investigating playground activity preference has centered on two variables: degree of choice and motivation to play. The degree of choice a child has concerning where and with what he/she wishes to play has been shown to greatly influence their amount of MVPA. In one study, children were 3.3 to 12.6 times more likely to play in areas with playground equipment than in open, grassy areas. In addition children were more active physically in areas with preinstalled equipment, such as basketball goals and jungle gyms. The researchers concluded that the presence of playground equipment has a strong influence on choice but only a moderate influence on physical activity level due to motivation to play (Farley, Meriwether, Baker, Rice, & Weber, 2008). Another study noted gains in physical activity level as a result of additional play facilities, with gains of 4-9 minutes of additional MVPA attributable to the number of permanent play facilities (Nielsen, Taylor, Williams, Mann, 2010). Motivation to play also has a large role in these studies though. As discussed earlier, peer influences, teacher presence, and other variables can all influence a child's motivation to play (Tomes, 1995). As such, influencing play behaviors have proven difficult for researchers in a free play environment. Behavioral science however may posit a solution to this problem through the principles of reinforcement.

Principles of Reinforcement

B.F. Skinner, in *The Behavior of Organisms* (1938), discussed ways in which the concept of reinforcement applies to learning. In summary, the book outlined what we know of today as behaviorism as a science. Since its publication, behaviorism has found many applications for reinforcement, including interventions for child obesity. Perhaps one of Skinner's most useful

theoretical contributions was that of how reinforcement works, its underlying principles, and its ability to be applied simply to everyday circumstances. Additionally the book outlined guidelines for clearly defining variables based on observable components (operational definitions). Based on these definitions Skinner and numerous scientists to follow have found the principle of operant conditioning, which is basically that an individual will be more or less likely to engage in a behavior based on the consequences of that behavior, to hold true in applications across multiple contexts. These results have been classified into two groups of related consequences: those that increase the likelihood of a behavior (reinforcement) and those that decrease the likelihood of a behavior (punishment). Research investigating the use of these principles on obesity have focused on increasing the likelihood of an individual being physically active or reducing the likelihood of an individual being sedentary. Although many types of interventions have been formulated in the past attempting to increase or decrease levels of physical activity or sedentary activity, few have been formulated that tap into the fundamental attributes of behaviorism and operant conditioning in attempt to increase children's physical activity during free play.

One of the few well-designed interventions that demonstrated the effects of reinforcement on children's MVPA during free play was conducted by Epstein, Woodall, Goreczny, Wing, and Robertson (1984). In this experiment female children between 5 and 8 years of age in a summer camp were reinforced for physical activity during free play time. The students were reinforced when "caught" engaging in MVPA when researchers would blow a whistle at predetermined times of which the participants were not aware. The study found that significant increases were present concerning physical activity level as well as caloric expenditure following reinforcement for choosing physically active activities over sedentary play

during free play time in a gym environment. The authors concluded that reinforcement for physical activity is a relatively easy way to impact activity choice as well as physical activity level in children.

The problems inherent with the study of increasing free play activity level lie within this principle of motivation for play and choice. Whereas many studies have simply provided additional materials to be used, the underlying, fundamental component of change has not been considered. By providing more materials, increases in MVPA were seen, but the true variable of change, motivation for choosing one activity over another (as each child can choose whether or not to use the new equipment), was not assessed. When applying the findings of B.F. Skinner and other behaviorists, the motivations for behavior and predicting future behaviors can be made clearer. As shown in Epstein's experiment, reinforcement and behavior principles do work in a relatively simple way to increase MVPA in school-aged children independent of additional materials provided. Additionally gains with other behaviors, such as physical aggression, have also been influenced by reinforcement programs (Roderick, Crawley, Pitchford, & Miller, 1997; Lewis, Powers, Kelk, Newcomer, 2002). If teachers and researchers use these principles of reinforcement in the schools, child activity choice on the playground can be influenced with minimal financial buy-in of new equipment or additional staff. By providing reinforcers to children for engaging in MVPA, perhaps an increase in MVPA independent of equipment choice can be seen. This deduction leads into the current study, which focused on using reinforcement principles in the classroom for being physically active on the playground toward the goal of increasing MVPA of students overall. This method allows for the opportunity to provide a low/no cost solution toward increasing physical activity level in children during some of their most vulnerable stages of development.

Statement of Purpose

The current study investigated the use of a reinforcement program in the classroom to determine if classroom reinforcers can impact physical activity level. In addition, sociometric interviews were conducted to assess for changes in peer relations as well as activity preference before and after the intervention. Six specific hypotheses were tested:

1) Children will show an increase in average MVPA during the intervention stages as compared to their baseline stage average MVPA.
2) Children will show a decrease in average MVPA during the extinction stage as compared to the intervention stage's average MVPA.
3) Children will prefer more physically active behaviors following the intervention stage.
4) Children will prefer less physically active behaviors following the extinction stage
5) Children's best friend nominations will demonstrate similar levels of physical activity to each other.
6) Child nominations for most physically active will change following each intervention stage as a function of physical activity change.

II. METHODS

Participants

Participants were 14, 4:1-4:11 year old preschool children (baseline) with an average age of 4:6. Subjects were 85% Caucasian, 7% African-American, and 7% Asian-American, and all were from families of middle-high socioeconomic status. Consent forms were sent home with each child that described the research and requested that the parents sign and return them to the school if they wanted their child to participate. Seventeen children comprised the classroom and of these, 14 returned parental consent forms and were included in the study. Researchers also obtained assent from the children prior to data collection. Participants were then assigned an ID number in order to maintain confidentiality.

Research Design

An A-B-A design was utilized to determine the effectiveness of the intervention, with physical activity level being the independent variable. Since all children received the same intervention and each child served as her or his own control, random assignment was not necessary.

All fourteen students underwent baseline, intervention, and extinction stages at the same time. During the first stage (baseline) each student was equipped with an accelerometer to record his/her physical activity level while on the school playground during their ~30 minutes of free play per school day. This stage lasted for 10 days (two/three school weeks), and each child's

physical activity level was recorded. A pre-test sociometric interview then was conducted, a percentile BMI calculated, and skin fold measurements taken for each child. After this, on the third school week of the study, the intervention was introduced and continued until the end of the fifth week (a total of 12 observations). The students were again given the accelerometers to record physical activity level on the playground, but before play they were informed that they will receive a reinforcer if they are physically active while on the playground. At the end of play, each child's accelerometer data was retrieved and quickly analyzed (<5 minutes) in order to determine the students who would be reinforced for physical activity level (determined as a 5% increase over mean baseline MVPA). The children who qualified were then immediately reinforced via an established classroom token economy. At this point a mid-point sociometric interview was conducted. The sixth and seventh school weeks repeated the procedures from the initial baseline stage as an extinction, or return to baseline, stage. At the end of the 7th week, post-extinction sociometric interviews were completed, completing data collection.

Baseline stage – No reinforcement for MVPA available →

Pre-test sociometric interview and percentile BMI →

1st Intervention Stage – Reinforcement for MVPA available →

Post-Intervention sociometric interview →

Extinction stage - No reinforcement for MVPA available →

Post-withdrawal sociometric interview →

Measures

Two forms of measurement were used to address study hypotheses: sociometric interviews and playground accelerometer measures. Peer-nomination sociometric interviews were conducted individually with each child to assess sociometric status (liked, disliked, or controversial), current friendships, and other social characteristics of each child both at baseline and following the intervention. Accelerometer measurement of children's activity levels was used to determine the degree of change in physical activity on the playground over time.

Sociometric Interview. The sociometric interview is a peer nomination measure in which participants nominate classmates for a number of social categories. Sociometric interviews were orally administered to each participant individually via Qualtrics survey software. Examples of questions include: "Who are your best friends?", "Who in your class do you like the most?", and "Who in your class do you like the least?" These types of questions have been successfully used to assess friendship preference and liking in other studies (e.g. Dodge & Coie, 1987; Denham & McKinley, 1993; Shin, 1997; Werner & Crick, 2004; de Guzman, et al., 2004). The questionnaire used also included additional items that are indirectly related to current friendships, which provided insight into friendship preferences and liking. These items included questions such as: "Who in your class is healthiest?" and "Who in your class gets picked on the most?" The questionnaire also included several 'distracter' questions such as 'What is your favorite TV show?' and "What is your favorite color?" which were included to make the task more interesting for the children. In addition several questions for activity preference and availability were included with both physically active and sedentary activities to assess change over time. See Appendix A for full screen capture of questionnaire.

Accelerometer Measurement on the Playground. In order to measure physical activity level, accelerometers were used. Although playground observations can also be used, accelerometers provide a degree of sensitivity that paper and pencil observations cannot. In a preschool population, accelerometers have been used successfully in a number of studies where physical activity level was measured (Kahan, Nicaise, & Sallis, 2011; McMahon, Brychta, & Chen 2010; Puyau, Adolph, & Butte, 2002; Sherar et al. 2011). In accordance with these studies, the accelerometers were placed on a waist belt on participants right sides as this position has been shown as the most reliable for data collection in preschool samples. The accelerometer of choice by researchers is the ActiGraph wGT3X+Activity Monitor, which collects data along three axes (vertical, horizontal, and lateral) to provide the most accurate data possible, and this model of accelerometer was used throughout this study.

Procedure

Several graduate students assisted in data collection and in implementing the intervention. Prior to interacting with the children, all researchers completed the CITI program training in the ethical conduct of research with children and were trained in how to conduct the sociometric interview and playground observations, including how to properly activate each device, the correct positioning of the accelerometer, and how to quickly obtain results to determine which students will be reinforced for physical activity level.

Participants were recruited from a local nursery school; limited to children ages 4-6. A cover letter describing the study was sent to parents along with a consent form. Children only participated in the study once informed consent was obtained from their parents and assent was obtained from the children. Fourteen of seventeen students in the class meet both of these

criteria. Also to insure confidentiality, children were assigned an identification number at this time.

The first stage of the project was baseline. During this time the accelerometers were programmed to begin data collection simultaneously at a specific time just prior to the beginning of recess. Each student was then equipped with an accelerometer via an elastic belt around their waist with the accelerometer resting on their right hip. The researcher recorded the exact time that the availability of physical play time began in order to disregard the data between the start times of data collection and play availability. Also the researcher recorded the temperature and humidity at the start of play time. At the end of recess the researcher then recorded the exact end time as well to ensure that the only time to be analyzed for the purposes of the study will be those in which physically active play time was available. The accelerometers were then collected from the students. After 10 observation periods (two/three school weeks) this stage concluded and the first sociometric interviews were conducted in addition to percentile BMI and skinfold measurement taken.

Graduate research assistants orally administered the sociometric questionnaire to the children individually via the Qualtrics survey software. During a class period, students were called out of class individually to a separate room to be interviewed. The interviewer then conducted the sociometric interview, which began with some rapport building activities (e.g. coloring a picture, small talk, block play) and continued on with the online sociometric questionnaire of which several screen captures are presented in Appendix A. Each child's responses were recorded via the software. ID codes were used for both the interviewed children and the children that they are nominating for the various categories in order to protect the confidentiality of all children in the study. After the pre-test sociometric interviews were

completed, each child's weight and height were recorded and converted into a percentile BMI score. Also skin fold measurements were taken along the tricep and suprailiac skin fold sites to determine fat percentage. After these activities were completed, the intervention stage began.

During the intervention stage, reinforcement for physical activity was introduced. Accelerometers were still programmed to begin data collection just prior to recess beginning. During the intervention stage, students were informed that they could earn tokens for being more physically active on the playground. These tokens were redeemable for a variety of small toys within the existing token economy system in their classroom. The token economy had been implemented by the teacher for classroom behavior management and the students were familiar with the tokens as well as the array of back up reinforcers available to them. The researcher again recorded the exact beginning and end time of recess. After collecting the accelerometers the researcher downloaded the data into the ActiLife 6 software, an analysis package for accelerometer data which provides almost instantaneous analysis of results. Utilizing this software along with empirically developed cut-points for preschool physical activity levels (Pate, 2006) the researcher formulated a list of students who increased their MVPA during the immediately preceding recess period by 5% over their recorded baseline. This list was then given to the teacher to distribute tokens accordingly. The time between the end of recess and giving the list to the teacher took no more than 5 minutes, allowing for almost immediate reinforcement of physical activity level. This stage concluded after 12 school days (Three to four school weeks). A mid-point sociometric interview was conducted at the end of this period of time as well following the same procedures as the pre-test interview.

Upon completion of the intervention stage, the extinction or return to baseline stage began. This stage followed the same procedures as the initial baseline stage. After 10 observation

periods (Two to three school weeks) a post-test sociometric interview was completed following the same procedures as the pre-test sociometric interview, including weight, height, and skin fold measurements, finishing data collection.

III. RESULTS

Demographics

Participants were 14 preschool students ages 4-5 in a private preschool program. Subjects were 85% Caucasian, 7% African-American, and 7% Asian-American and all were from families of middle-high socioeconomic status. There were 8 male and 6 female participants. According to BMI measurements, at baseline 85% were in the Healthy range, and 15% were in the Overweight and Obese range; after the extinction stage 86% were in the Healthy range and 14% were in the Overweight and Obese range (one participant went from Overweight to Healthy). Sum of skin fold measurements were also obtained at baseline and following the intervention stage. These measurements, however, were considered invalid due to inconsistent measurement technique (at baseline the researcher did not "pinch" fatty tissue correctly and therefore did not get accurate readings) between the two administrations and were therefore excluded from analyses.

Environmental Conditions

Temperature and humidity readings were taken on all days in which physical activity play was possible and observations were taken. School policy states that teachers cannot bring their students outside in inclement weather (i.e. snow, rain, sleet) and/or if the temperature is below 40 degrees Fahrenheit. Children were always comfortably and appropriately dressed for the temperature and weather conditions on days they went outdoors for recess.

All MVPA measurements were taken in sunny or cloudy conditions with temperatures ranging from 51 degrees Fahrenheit to 77 degrees Fahrenheit with an average temperature of 65.51 degrees Fahrenheit across days in all phases of the experiment. The average temperature for the baseline stage was 71.51; for the intervention stage was 64.53; and for the extinction stage was 60.51 degrees Fahrenheit.

Humidity readings ranged from 34.5% to 73.9% humidity with an overall average of 55.3% humidity. The average humidity for the baseline stage was 52.8%; for the intervention stage was 62.1%; and for the extinction stage was 51.8% humidity. A linear regression was also conducted to determine the relation of temperature and humidity to MVPA in the study. With an R Square of .024 little to no relation in the current sample was seen between temperature, humidity, and MVPA.

Among observation periods, free play availability ranged from 15 to 69 minutes. The average time for free play across all days in the study was 30.17 minutes. The average time for free play at baseline was 26.20 minutes; at intervention was 32.67 minutes; and at extinction was 31.33 minutes. The free play area was split into two regions: an upper playground and a lower playground. The upper playground consisted of an area approximately 7000 square feet with a gravel play area and a large tree house. No other play equipment was present. The lower playground consisted of an area approximately 58,000 square feet with 14 total swing set seats, 5 play equipment areas, a basketball goal, tetherball court, and a large grassy area for play. Participants in the study played on both playgrounds, and separate analyses will be conducted for each playground in order to accommodate equipment effects on physical activity level.

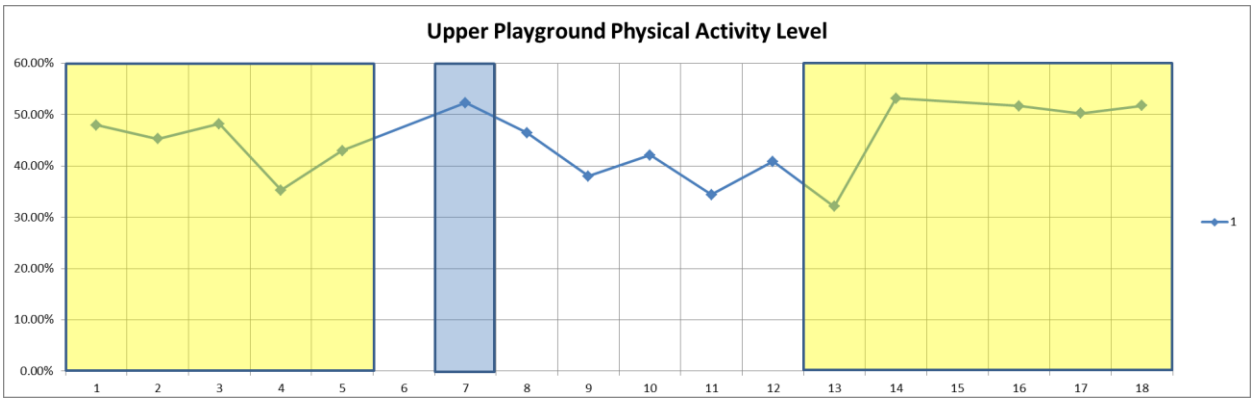
Points Exceeding the Median Analyses

Two sets of analyses were conducted on playground accelerometer data: Moderate-to-vigorous physical activity (MVPA) percentages and Vector Magnitude Counts per Minutes (VMCPM). MVPA percentages were analyzed as they are the variable of interest that is most often found in related literature. MVPA percentages and cut points were calculated using the Pate preschool cut-off equation and Pate cut points (Pate, 2006). VMCPM were also analyzed in order to determine the effectiveness of the intervention across all participants on a continuous plane, as light physical activity level would also be included in VMCPM, but would not be in MVPA counts. VMCPM counts are found by utilizing all three axes of the accelerometer (horizontal, vertical, and lateral) and combining them into one value. The numbers of counts are then calculated per minute to give an overall value for physical activity level. For both analyses Points Exceeding the Median (PEM) analyses were conducted on each participant's data individually to determine the effects of the intervention. To accomplish this, only the participants who displayed a stable baseline were considered in the analyses. In order for the intervention to be considered effective, PEM analyses compare baseline median values to the values present over that median during the intervention stage. This provides a percentage of points exceeding the median which is then compared to established levels to determine effectiveness. For PEM analyses, Very Effective results are considered to be greater than 90%; Moderately Effective results fall between 70% and 90%; and Not Effective or Questionable results fall below 70% (Scruggs, Mastropieri, Cook, & Escobar, 1986).

Upper Playground. The upper playground, which is the smaller of the two playgrounds and also contains limited equipment choices, was considered first for PEM analyses of MVPA and VMCPM.

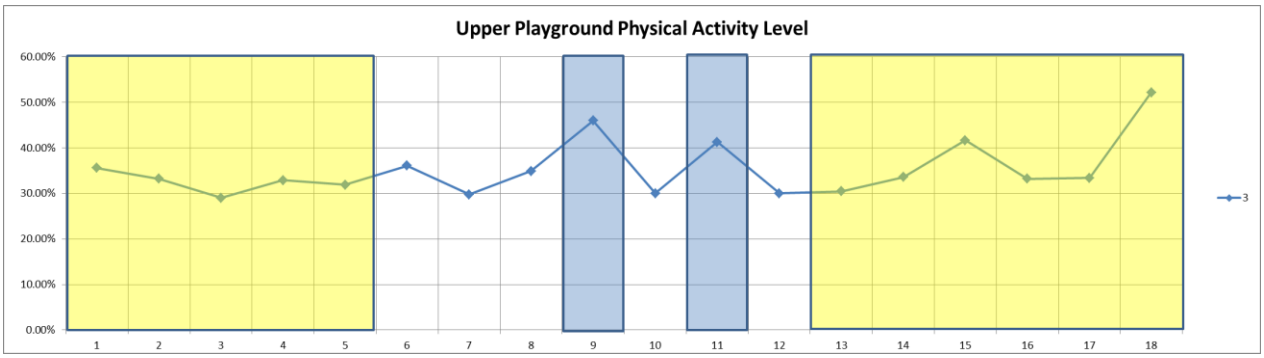
Moderate-to-vigorous physical activity. MVPA among all 14 participants for the upper playground averaged 36.22% during baseline; 39.26% during intervention; and 39.23% during extinction. Of the fourteen participants, seven displayed a stable baseline (defined as all baseline data points for MVPA falling within 10% of the mean MVPA for the baseline period for each participant, and also having at least three baseline data points) which allowed for PEM analysis to be conducted. Among the seven children with a stable baseline, the PEM average is 57.81%, which suggests a questionable overall effectiveness for the intervention on the upper playground. The following figures indicate the individual results of these seven individuals whose PEM values range from 100% (very effective) to 14% (not effective). On each graph the first beige area indicates baseline period, white indicates the intervention period, and the second beige indicates the extinction period. The bar(s) indicate times the participant was reinforced.

Figure 1: Participant 1



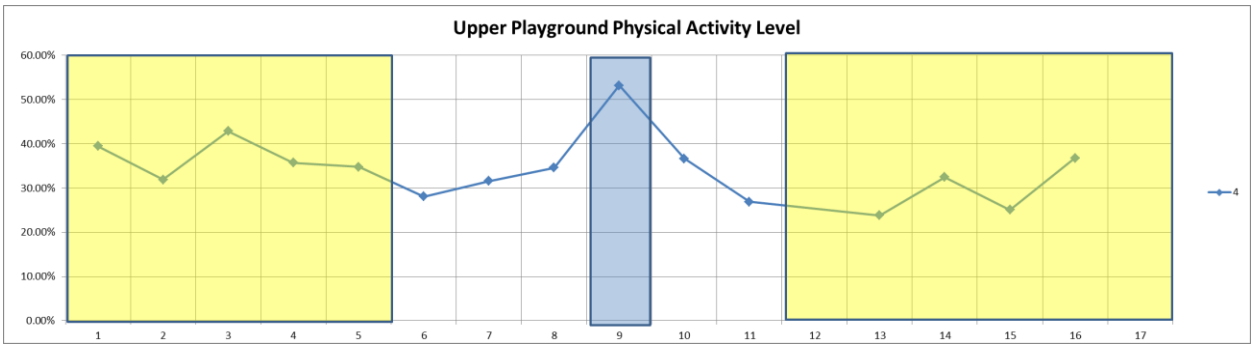
PEM = 33%; Median = 45%; Male.

Figure 2: Participant 3



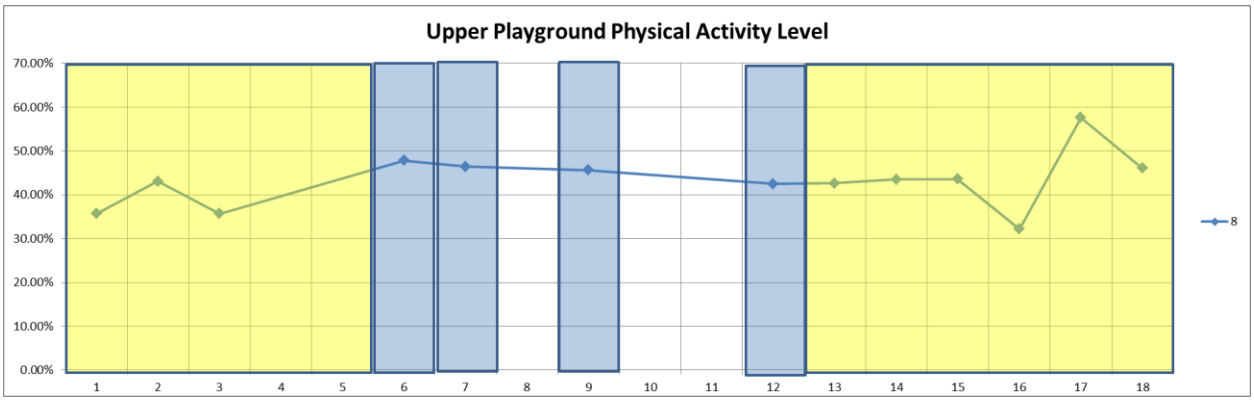
PEM = 57%; Median = 33%; Female.

Figure 3: Participant 4



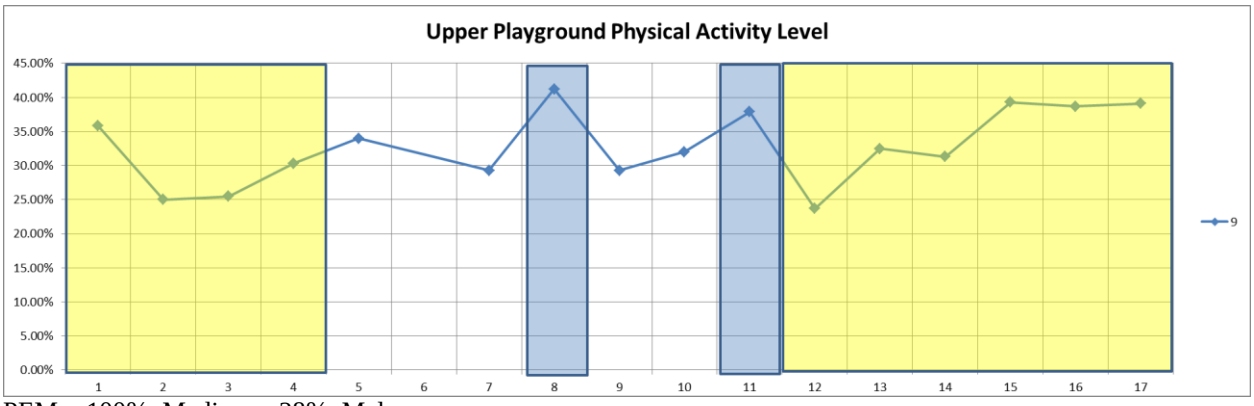
PEM = 14%; Median = 37%; Female.

Figure 4: Participant 8



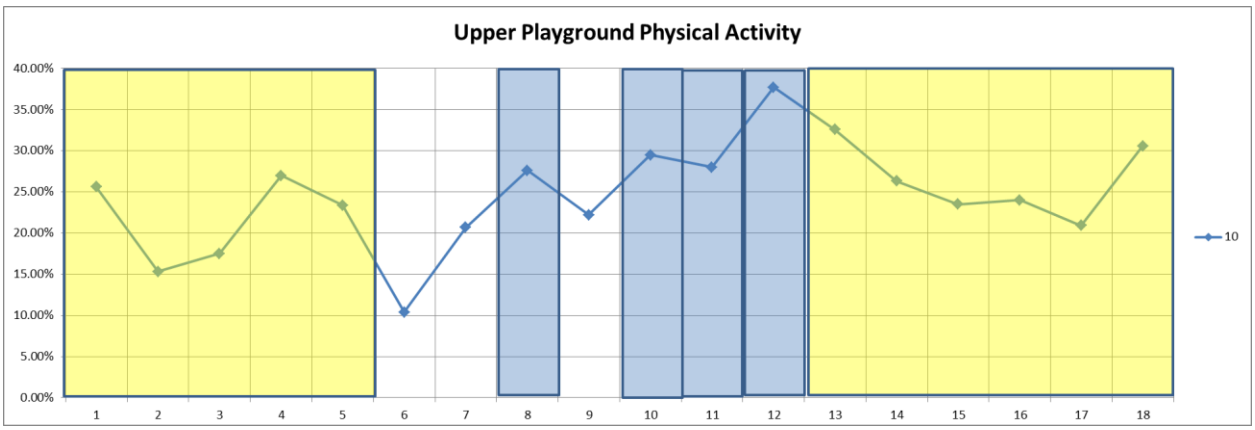
PEM = 100%; Median = 36%; Male.

Figure 5: Participant 9



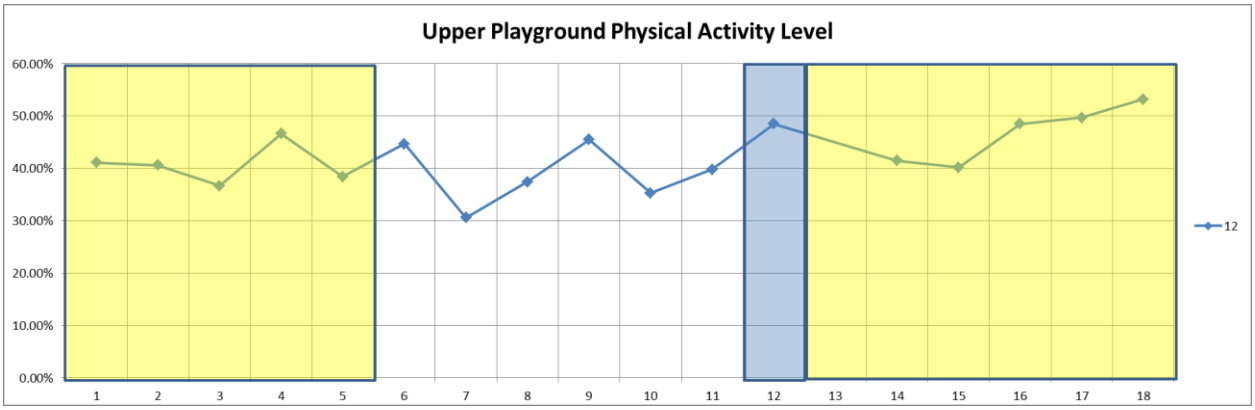
PEM = 100%; Median = 28%; Male.

Figure 6: Participant 10



PEM = 57%; Median = 23%; Female.

Figure 7: Participant 12



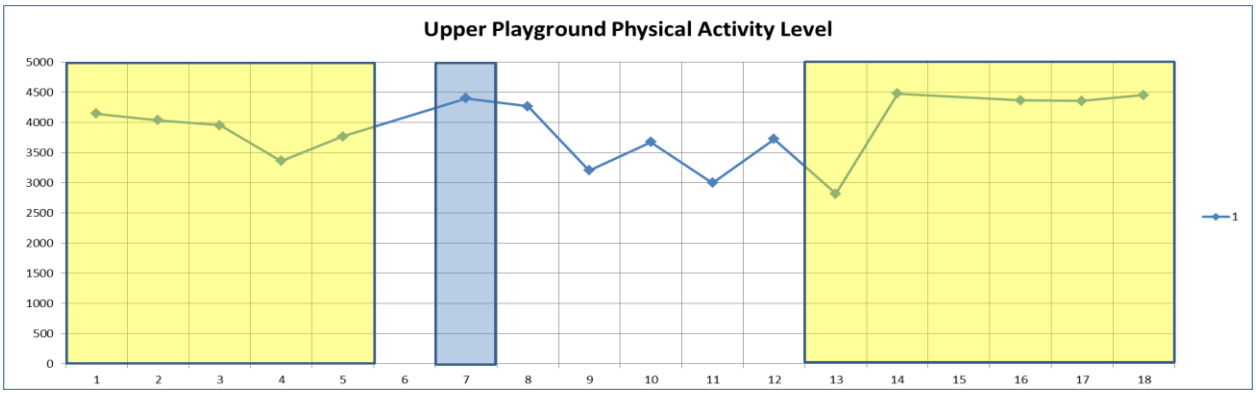
PEM = 42%; Median = 41%; Male.

Among the children with valid baseline activity levels on the upper playground, results were examined for those children who responded to the intervention (i.e., earned tokens for increased MVPA at least 25% of possible attempts). Among the seven participants with a valid baseline four were also deemed to respond to the intervention. The PEM average for those four equals 78.51%, which is defined as moderately effective. This is a 20.7% increase from the total PEM value of all valid upper playground participants together.

A t-test was calculated to determine statistically significant differences between baseline and intervention for all 14 participants on the upper playground. The average MVPA percentage at baseline was 36.21% and at intervention was 39.22% and showed a statistically significant increase in MVPA ($t=-3.105$; $p<.01$).

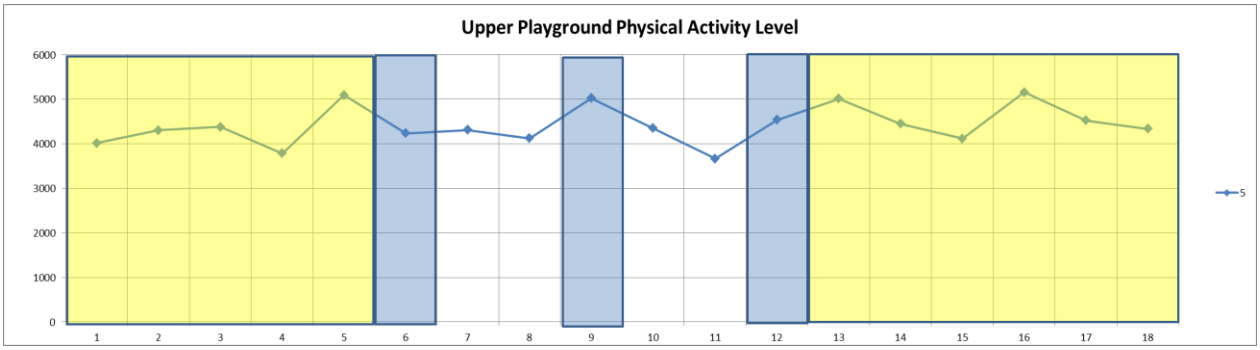
Vector magnitude counts per minute. VMCPM among all 14 participants for the upper playground averaged 3947.6 during baseline; 3502.4 during intervention; and 3582.9 during extinction at 15 second epochs. Overall PEM for the upper playground was 51.26% with a range from 78.4% to 40.83%, a positive but not effective result. Of the fourteen participants, eight displayed a stable baseline (defined as all baseline data points for VMCPM falling within 25% of the mean VMCPM for the baseline period for each participant, and also having at least three baseline data points) which allowed for PEM analysis to be conducted. Among the eight children with a stable baseline, the PEM average is 37.50%, which suggests no overall effectiveness for the intervention on the upper playground. The following figures indicate the individual results of these eight individuals whose PEM values range from 85.71% (moderately effective) to 0% (not effective). On each graph the first beige area indicates baseline period, white indicates the intervention period, and the second beige indicates the extinction period. The bar(s) indicate times the participant was reinforced.

Figure 8: Participant 1



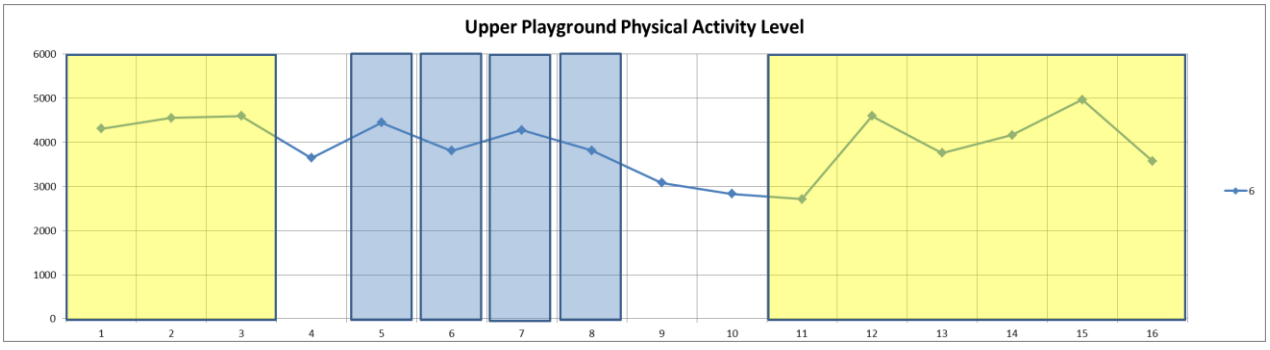
PEM = 33.33%; Median = 3954.4; Male.

Figure 9: Participant 5



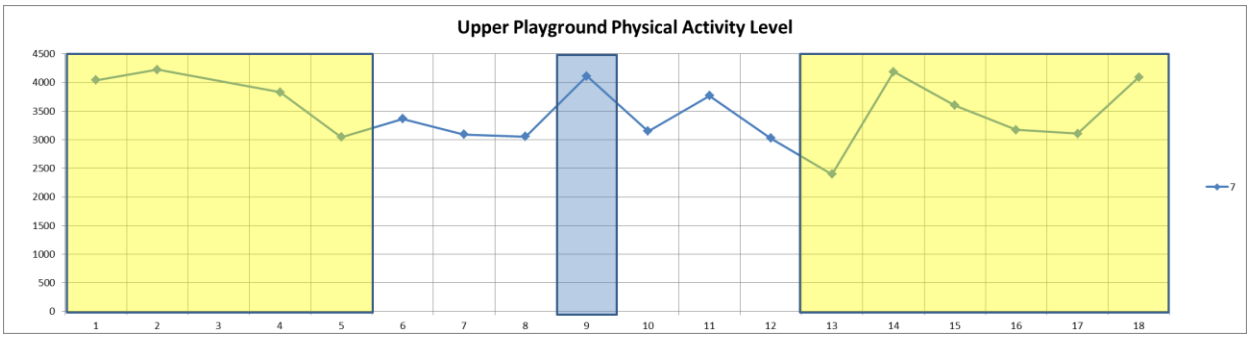
PEM = 57.14%; Median = 4304.8; Male.

Figure 10: Participant 6



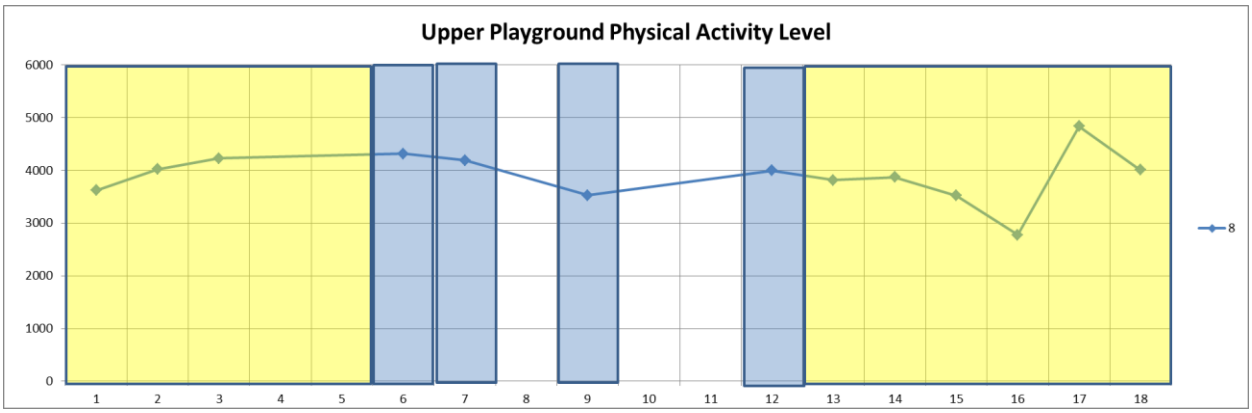
PEM = 0%; Median = 4558.5; Male.

Figure 11: Participant 7



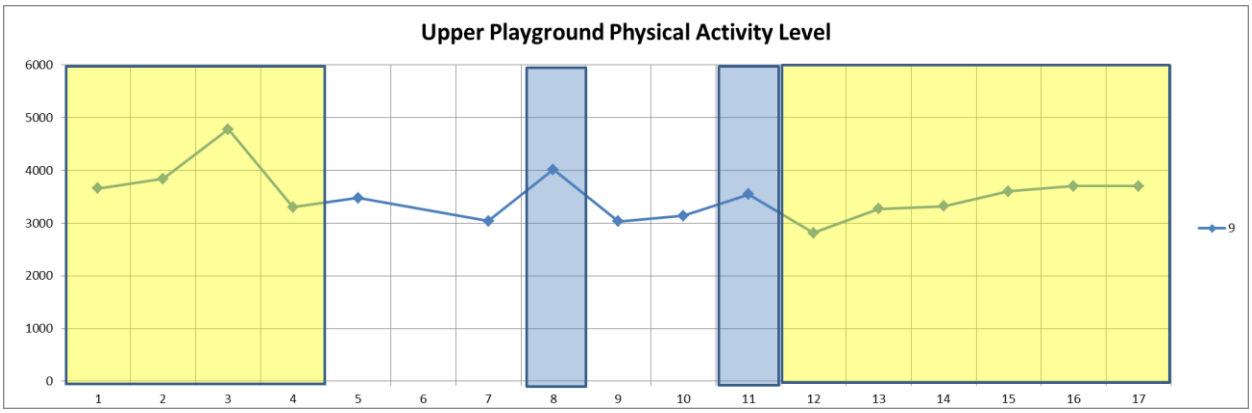
PEM = 14.29%; Median = 3935.05; Male.

Figure 12: Participant 8



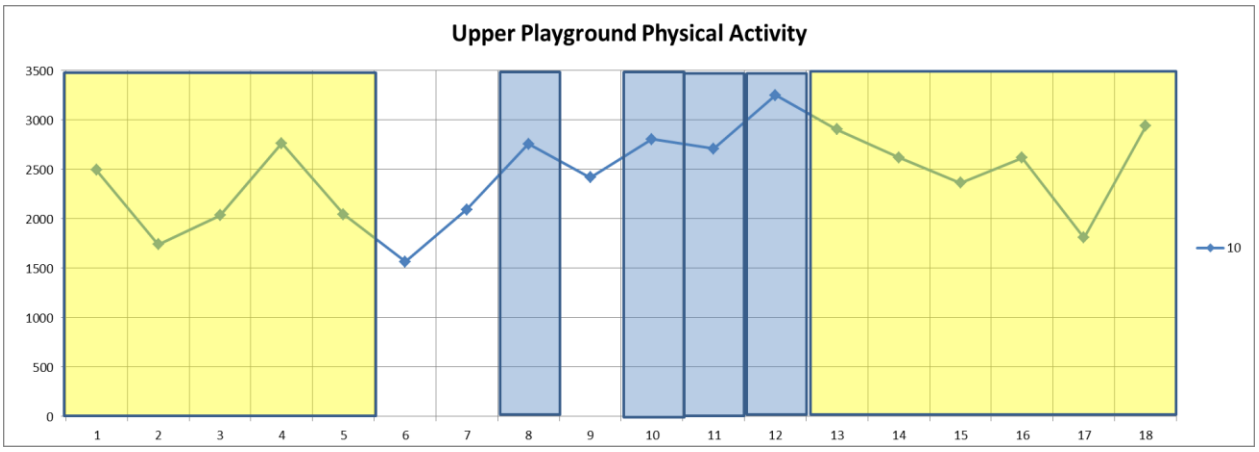
PEM = 50%; Median = 4023.6; Male.

Figure 13: Participant 9



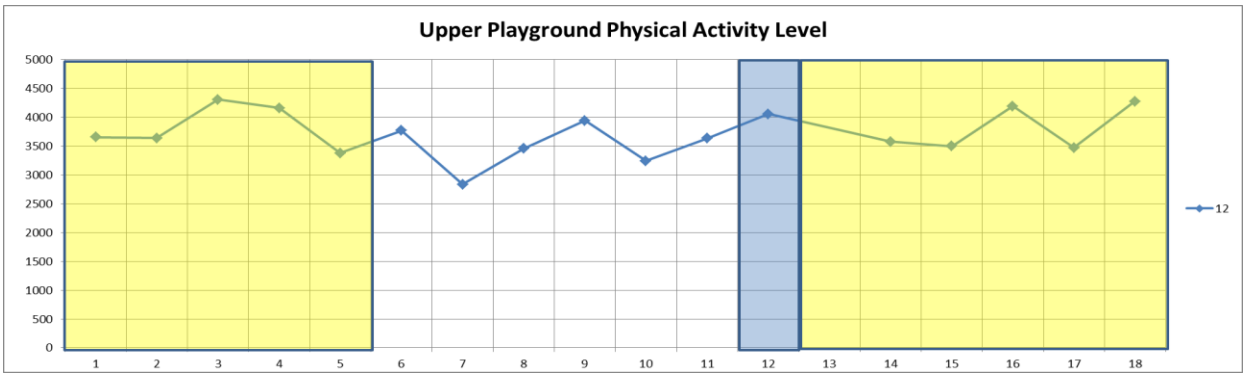
PEM = 16.67%; Median = 3751.5; Male.

Figure 14: Participant 10



PEM = 85.71%; Median = 2046.8; Female

Figure 15: Participant 12



PEM = 42.86%; Median = 3656.2; Male

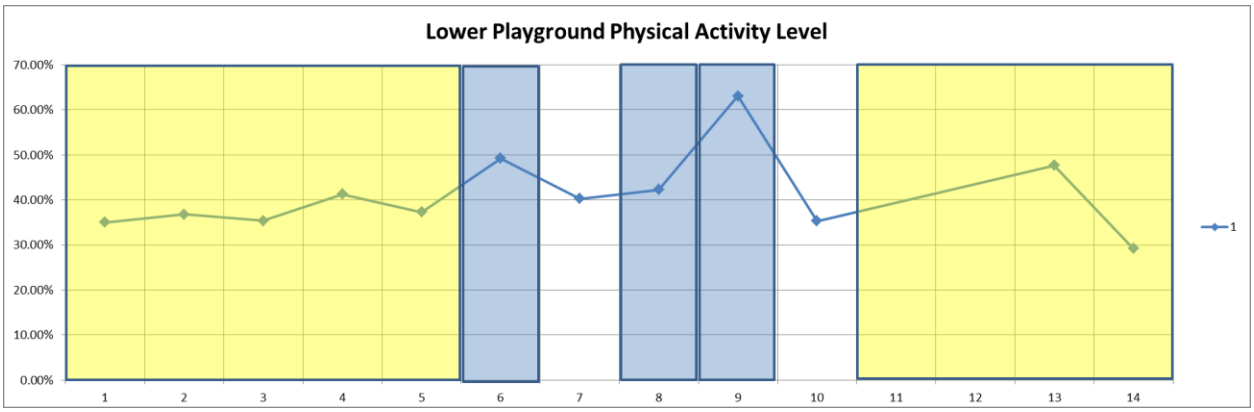
Among the children with valid baseline activity levels on the upper playground, results were examined for those children who responded to the intervention (i.e., earned tokens for increased VMCPM at least 25% of possible attempts). Among the eight participants with a valid baseline five were also deemed to respond to the intervention. The PEM average for those five equals 41.90%, which is defined as not effective. This is a 4.4% increase from the total PEM value of all valid upper playground participants together.

A t-test was calculated to determine statistically significant differences between baseline and intervention for all 14 participants on the upper playground. The average VMCPM at baseline was 4138.6 and at intervention was 3593.7 and were not statistically different ($t=1.375$; $p>.05$).

Lower Playground. The lower playground, which is the larger of the two playgrounds and also contains many equipment choices, also was considered for PEM analyses of MVPA and VMCPM. False positive accelerometer counts were obtained for three participants and were excluded from the analysis. False positive counts were primarily due to large counts not attributable to actual physical activity, which instead were due to swing sets which were only present on the lower playground.

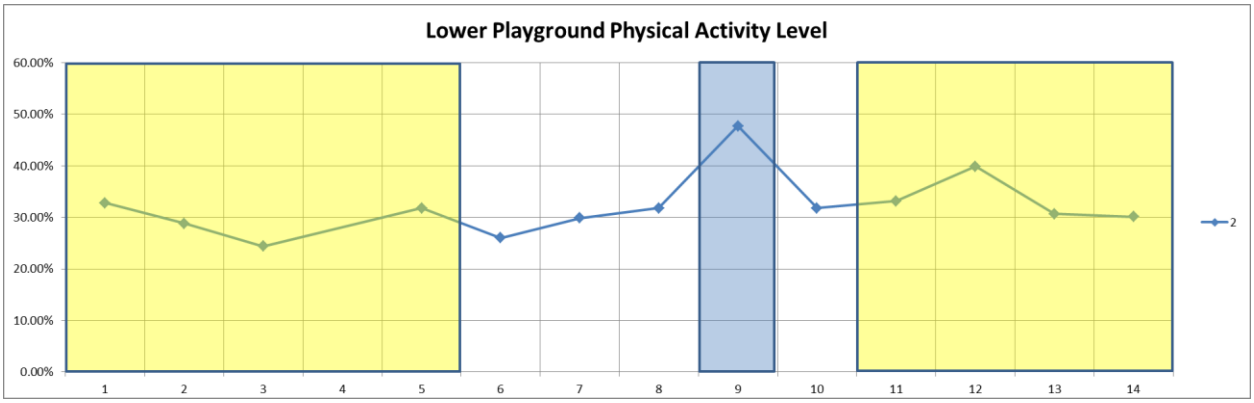
Moderate-to-vigorous physical activity. MVPA among all 11 participants for the lower playground averaged 39.96% during baseline; 41.56% during intervention; and 41.58% during extinction. Of the eleven participants, six displayed a stable baseline (defined as all baseline data points for MVPA falling within 10% of the mean MVPA for the baseline period for each participant, and also having at least three baseline data points) which allowed for PEM analysis to be conducted. Among the six children with a stable baseline, the PEM average is 56.67%, which suggests a questionable overall effectiveness for the intervention on the lower playground. The following figures indicate the individual results of these six individuals whose PEM values range from 100% (very effective) to 14% (not effective). On each graph the first beige area indicates baseline period, white indicates the intervention period, and the second beige indicates the extinction period. The bar(s) indicate times the participant was reinforced.

Figure 16: Participant 1



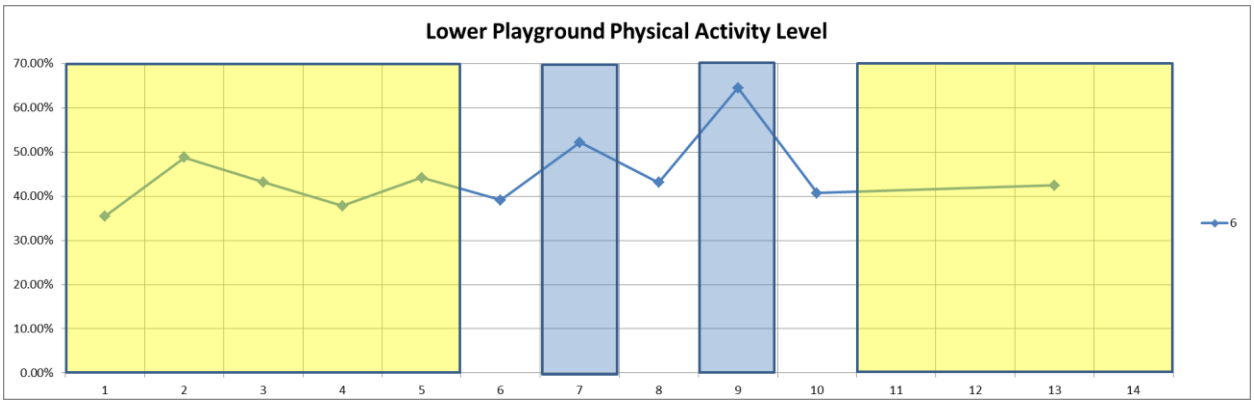
PEM = 80%; Median = 37%; Male

Figure 17: Participant 2



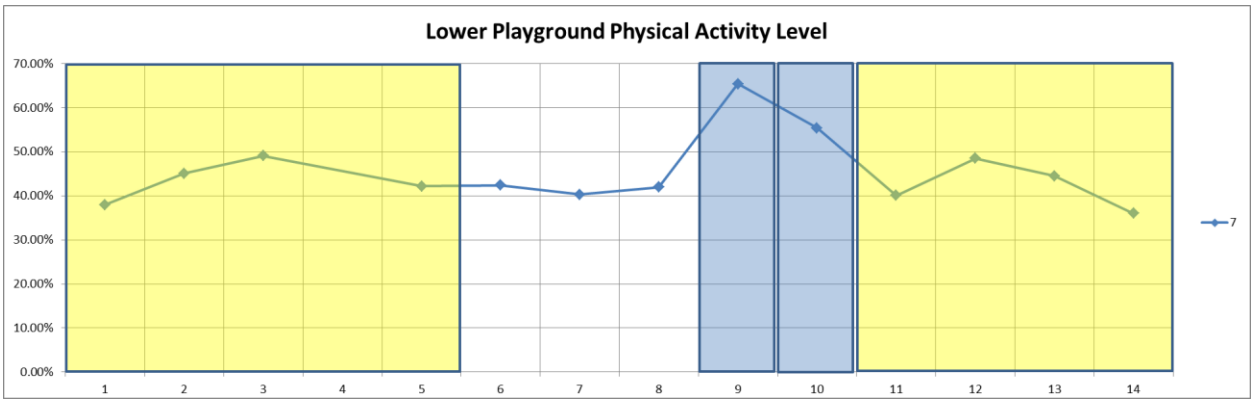
PEM = 60%; Median = 30%; Male

Figure 18: Participant 6



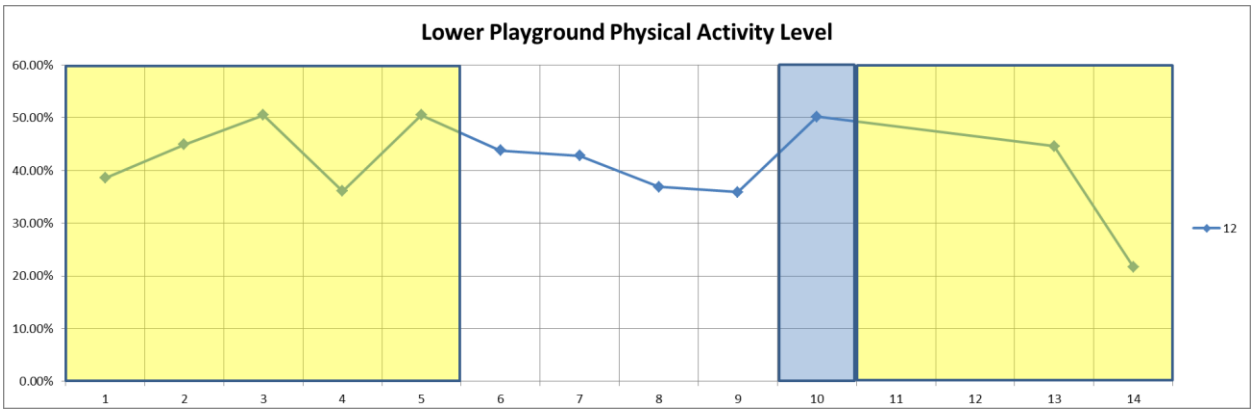
PEM = 60%; Median = 44%; Male

Figure 19: Participant 7



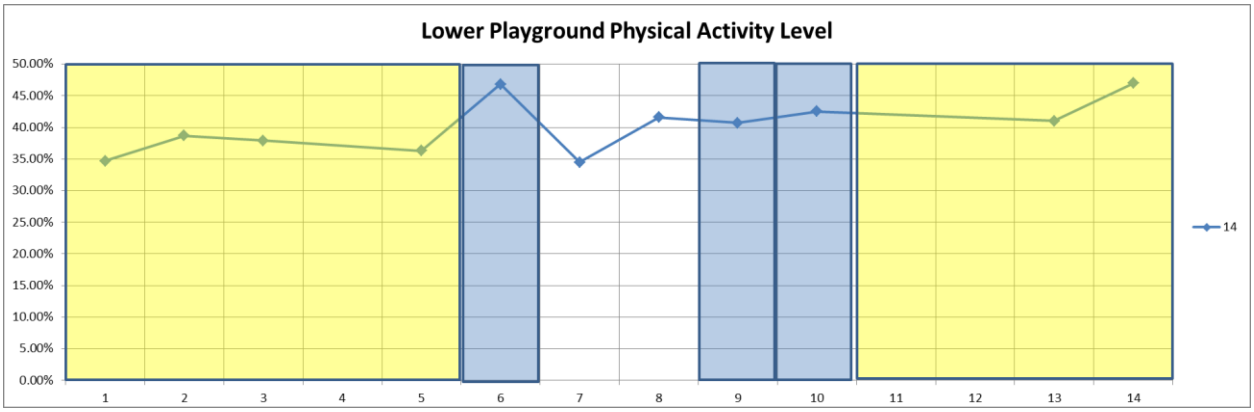
PEM = 40%; Median = 44%; Male

Figure 20: Participant 12



PEM = 20%; Median = 45%; Male

Figure 21: Participant 14



PEM = 80%; Median = 37%; Female

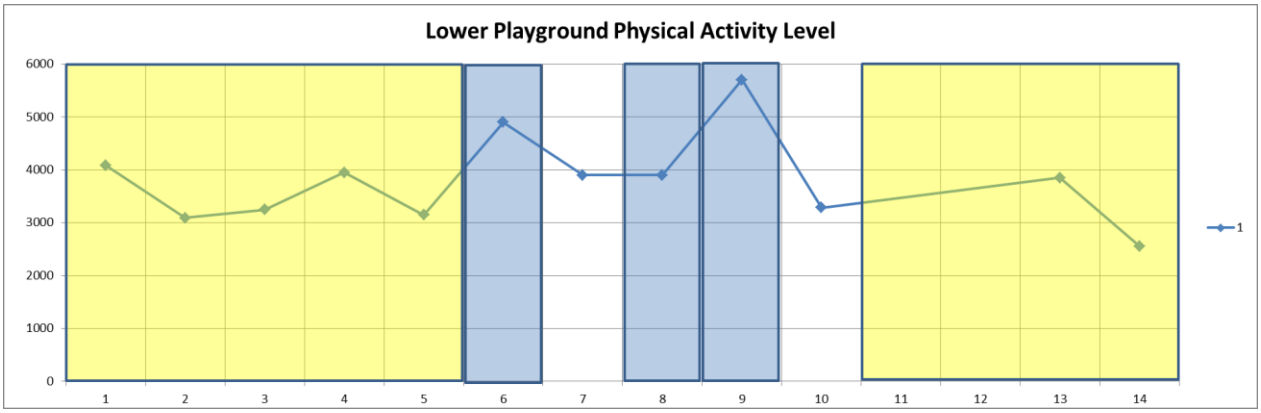
Among the children with valid baseline activity levels on the lower playground, results were examined for those children who responded to the intervention (i.e, earned tokens for increased activity at least twice during the intervention period). Among the six participants with a valid baseline four were also deemed to respond to the intervention. The PEM average for those four equals 65%, which is defined as questionably effective. This is an 8.33% increase from the total PEM value of all valid participants together for the lower playground. Of these six, two were also included in the analysis of upper playground physical activity level due to a stable baseline (Participants 1 and 12).

A t-test was calculated to determine statistically significant differences between baseline and intervention for all 11 participants on the lower playground. The average MVPA % at baseline was 39.96% and at intervention was 41.56% and show a non-statistically significant difference ($t=-0.547$; $p>.05$).

Vector magnitude counts per minute. VMCPM among all 11 participants for the lower playground averaged 3841.2 during baseline; 4262.6 during intervention; and 3700.6 during extinction. The overall PEM for the lower playground was 50.00% with a range from 60.89% to 33.58%, which is a not effective result. Of the eleven participants, seven displayed a stable baseline (defined as all baseline data points for VMCPM falling within 25% of the mean VMCPM for the baseline period for each participant, and also having at least three baseline data points) which allowed for PEM analysis to be conducted. Among the seven children with a stable baseline, the PEM average is 60.71%, which suggests a questionable overall effectiveness for the intervention on the lower playground. The following figures indicate the individual results of these seven individuals whose PEM values range from 100% (very effective) to 25% (not effective). On each graph the first beige area indicates baseline period, white indicates the

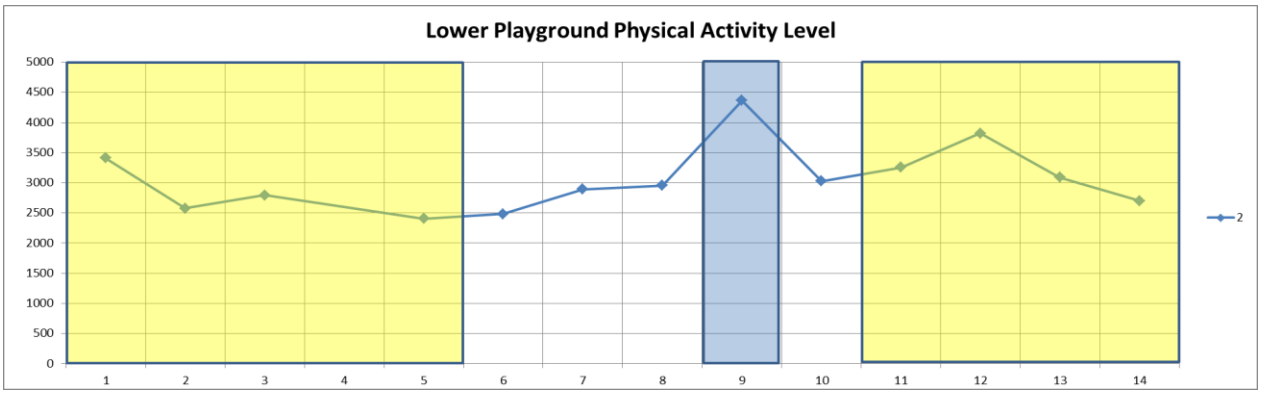
intervention period, and the second beige indicates the extinction period. The bar(s) indicate times the participant was reinforced.

Figure 22: Participant 1



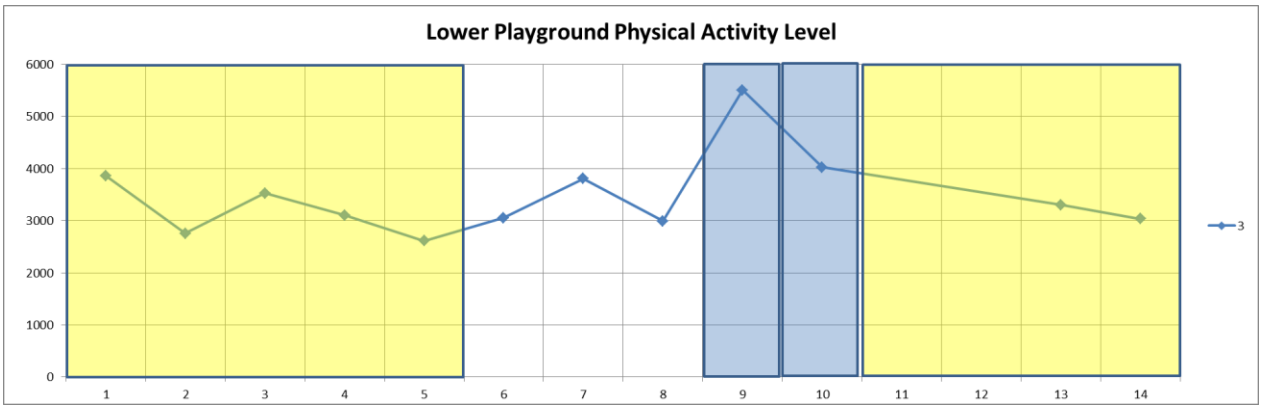
PEM = 100%; Median = 3251.6; Male.

Figure 23: Participant 2



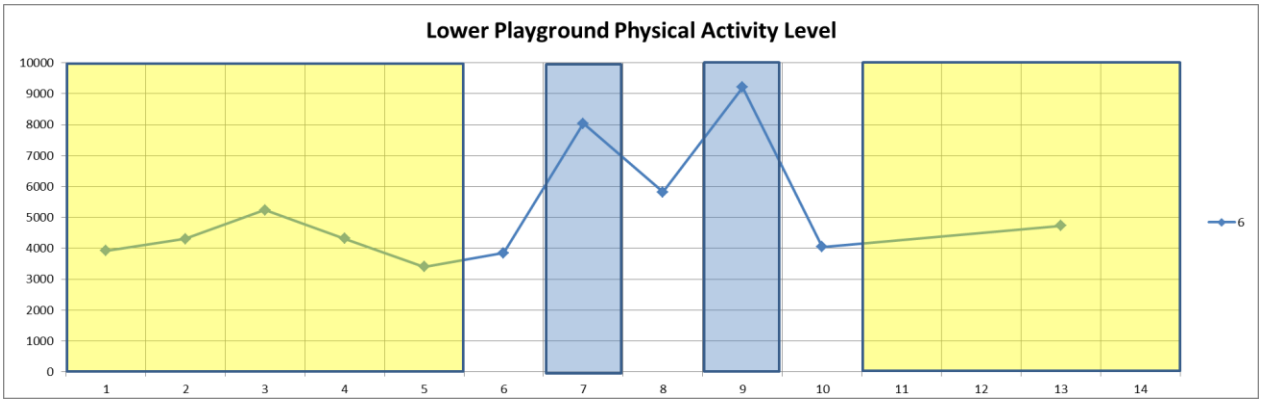
PEM = 80%; Median = 2687.0; Male.

Figure 24: Participant 3



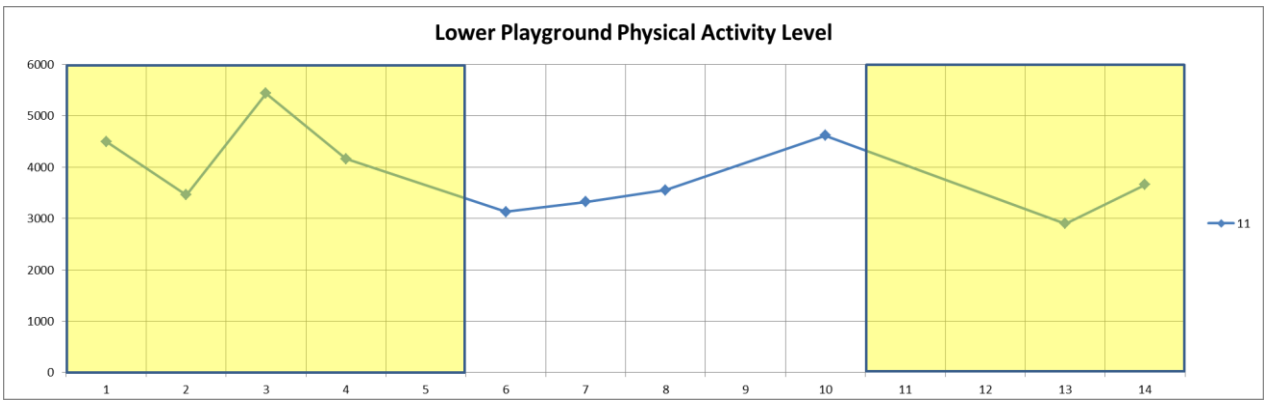
PEM = 60%; Median = 3108.3; Female.

Figure 25: Participant 6



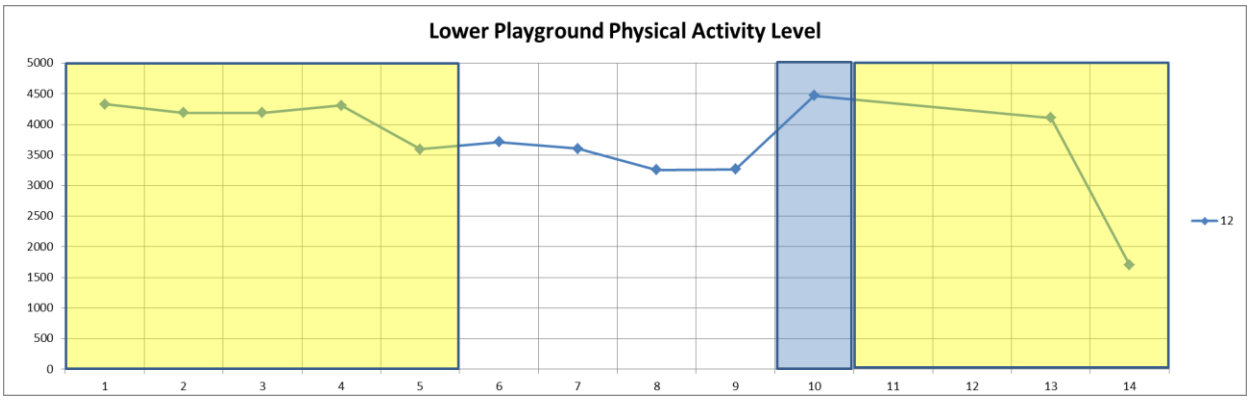
PEM = 60%; Median = 4300.2; Male.

Figure 26: Participant 11



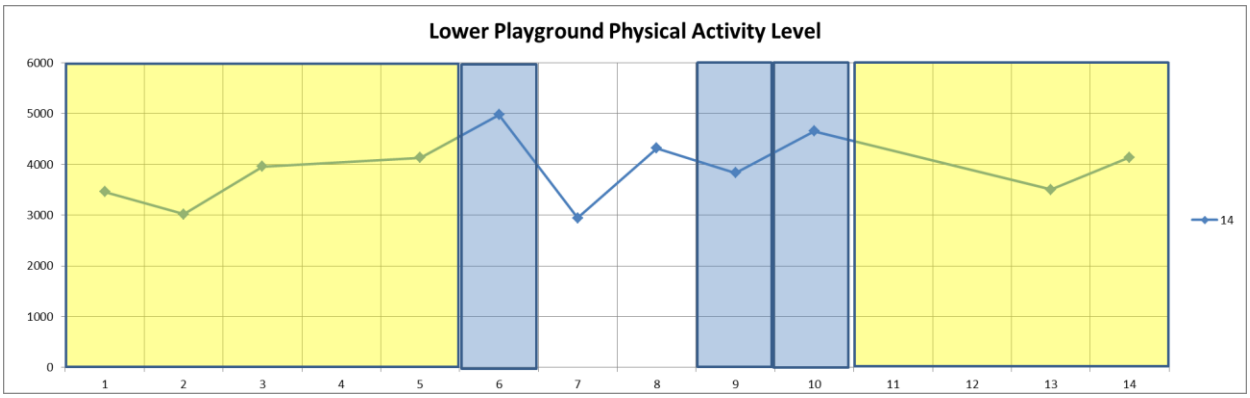
PEM = 25%; Median = 4329.92; Female.

Figure 27: Participant 12



PEM = 25%; Median = 4190; Male.

Figure 28: Participant 14



PEM = 80%; Median = 3710.05; Female.

Among the children with valid baseline activity levels on the lower playground, results were examined for those children who responded to the intervention (i.e., earned tokens for increased VMCPM at least 25% of possible attempts). Among the seven participants with a valid baseline four were also deemed to respond to the intervention. The PEM average for those four equals 75%, which is defined as moderately effective. This is a 14.29% increase from the total PEM value of all valid upper playground participants together.

A t-test was calculated to determine statistically significant differences between baseline and intervention for all 11 participants on the lower playground. The average VMCPM at

baseline was 3841.2 and at intervention was 4262.6 and were not statistically different (t=-1.524; p>.05).

Food and Activity Preference

Food and activity preference questions are presented in Appendix A. Percentages and percentage differences were calculated for preferences reported during the sociometric interviews for healthiest food choice, healthiest activity choice, the most common home activity, the most wanted home activity, the least wanted home activity, the most common playground activity, the most wanted playground activity, and the least wanted playground activity comparing across administrations. These results are presented in Table 1 and Table 2.

Percentage of Participants Nominating Healthier/More Physically Active Choices

Table 1	Baseline	Post-Intervention	Post-Withdrawal
Healthiest Food	29%	43%	43%
Healthist Activity	93%	93%	86%
Usual Home Activity	50%	43%	43%
Most Wanted Home Activity	50%	57%	21%
Least Wanted Home Activity	29%	43%	43%
Usual Playground Activity	43%	29%	29%
Most Wanted Playground Activity	50%	37%	57%
Least Wanted Playground Activity	64%	64%	43%

When nominating the healthiest food among four choices (pizza, assorted vegetables, salad, and a McDonalds Happy Meal) 29% nominated a healthy food choice (either the assorted vegetables or salad) at baseline. At post-intervention 43% nominated a healthy choice. Following return to baseline, 43% nominated a healthy choice.

When nominating for the healthiest activity among four choices (Free play outside, coloring in a coloring book, watching TV, or going to the park) 93% nominated a healthy activity choice (free play outside or going to the park) at baseline. At post-intervention 93% nominated a healthy choice. At post-withdrawal 86% nominated a healthy choice.

When indicating usual home activity among four choices (Free play outside, coloring in a coloring book, watching TV, or going to the park) 50% indicated a more physically active choice

(free play outside or going to the park) at baseline. At post-intervention 43% indicated a more physically active choice. At post-withdrawal 43% indicated a more physically active choice.

When indicating most wanted home activity among four choices (Free play outside, coloring in a coloring book, watching TV, or going to the park) 50% indicated a more physically active choice (free play outside or going to the park) at baseline. At post-intervention 57% indicated a more physically active choice. At post-withdrawal 21% indicated a more physically active choice.

When indicating least wanted home activity among four choices (Free play outside, coloring in a coloring book, watching TV, or going to the park) 29% indicated a more physically active choice (free play outside or going to the park) at baseline. At post-intervention 43% indicated a more physically active choice. At post-withdrawal 43% indicated a more physically active choice.

When indicating usual playground activity among four choices (Free play outside, sandbox, swing set, or playing on the tree house) 43% indicated a more physically active choice (free play outside or playing on the tree house) at baseline. At post-intervention 29% indicated a more physically active choice. At post-withdrawal 29% indicated a more physically active choice.

When indicating most wanted playground activity among four choices (Free play outside, sandbox, swing set, or playing on the tree house) 50% indicated a more physically active choice (free play outside or playing on the tree house) at baseline. At post-intervention 37% indicated a more physically active choice. At post-withdrawal 57% indicated a more physically active choice.

When indicating least wanted playground activity among four choices (Free play outside, sandbox, swing set, or playing on the tree house) 64% indicated a more physically active choice (free play outside or playing on the tree house) at baseline. At post-intervention 64% indicated a more physically active choice. At post-withdrawal 43% indicated a more physically active choice.

	Percentage of Difference Between Administrations for Healthier/More Physically Active Choices		
Table 2	Baseline to Post-Intervention % Change	Post-Intervention to Post-Withdrawal % Change	Baseline to Post-Withdrawal % Change
Healthiest Food	50% increase	0% change	33% increase
Healthist Activity	0% change	8% decrease	8% decrease
Usual Home Activity	14% decrease	0% change	17% decrease*
Most Wanted Home Activity	14% increase	63% decrease	133% decrease
Least Wanted Home Activity	50% increase	0% change	33% increase
Usual Playground Activity	33% decrease	0% change	50% decrease
Most Wanted Playground Activity	29% decrease	60% increase	12.5% increase
Least Wanted Playground Activity	0% change	33% decrease	50 % decrease**

*χ^2 (1) = p< 0.05; **χ^2 (1) =p < 0 .001

Between baseline and post-intervention interviews percent differences were: healthiest food choice (50% increase), healthiest activity choice (0% change), the most common home activity (14% decrease), the most wanted home activity (14% increase), the least wanted home activity (50% increase), the most common playground activity (33% decrease), the most wanted playground activity (29% decrease), and the least wanted playground activity comparing across administrations (0% decrease).

Between post-intervention and post-withdrawal interviews percent differences were: healthiest food choice (0% change), healthiest activity choice (8% decrease) the most common home activity (0% change), the most wanted home activity (63% decrease), the least wanted home activity (0% change), the most common playground activity (0% increase), the most wanted playground activity (60% increase), and the least wanted playground activity comparing across administrations (33% decrease).

Between baseline and post-withdrawal interviews, percent differences were: healthiest food choice (33% increase), healthiest activity choice (8% decrease) the most common home

activity (17% decrease), the most wanted home activity (133% decrease), the least wanted home activity (33% increase), the most common playground activity (50% decrease), the most wanted playground activity (12.5% increase), and the least wanted playground activity comparing across administrations (50% decrease).

Chi-squared analyses were also conducted to explore differences between administrations of preference data gained. When comparing the relation between baseline and post-intervention nominations for Healthiest Food, (χ^2 (3) = 13.883; $p < .05$). This indicates that some effect between baseline and intervention was present to increase nominations for healthy food choices. In addition between baseline and post-withdrawal statistically significant differences were found between Usual Home Activity (χ^2 (1) = 4.667; $p<.05$); as well as Least Wanted Playground Activity (χ^2 (1) = 10.37; $p<0.001$). These suggest some change in both home and playground activity preference. All other chi-squared analyses between baseline and post-intervention; post-intervention to post-withdrawal; and baseline to post-withdrawal were non-significant.

Sociometric Interview

Correlational analyses of sociometric questions were calculated within and between administrations with results presented in Appendix B. Results in which $p<.01$ are highlighted in green with results in which $p<.05$ are highlighted in yellow. The full interview questions for each category are presented in Appendix A. Also of note is that Picked On nominations are considered questionable due to participant uncertainty as to the meaning of the question.

At baseline, nominations for Like Most, Best Friend, and Play With were all highly correlated with one another. In addition, Picked On and Most Healthy nominations were also highly correlated.

Post-intervention nominations for Like Most, Best Friend, and Most Healthy were all highly correlated with one another. In addition Picked On nominations were highly correlated with Like Most and Best Friend nominations. Also Like Most and Play With nominations and Picked On and Run and Jump the Most were correlated highly.

Post-withdrawal nominations for Like Most, Best Friend, Most Healthy, and Play With were all highly correlated with one another. In addition Picked On nominations were highly correlated with Most Healthy and Run and Jump the Most. Lastly Like Least nominations correlated highly with Like Most and Best Friend nominations.

Between stages in the project all stages share Best Friend and Like Most correlations as well as Like Most and Play With nominations. The Baseline and Extinction stages share Picked On and Healthy nomination correlations and Play With and Best Friend correlations. The Intervention stage and Extinction stage share Picked On and Run and Jump the Most; Best Friend and Healthy; and Like Most and Most Healthy correlations.

Several unique correlation sets also exist between administrations. Best Friend and Picked On nominations are only present in the intervention stage along with Like Most and Picked on. Only present in the extinction stage are Play With and Most Healthy nominations as well as Like Least and Best Friend correlations.

Correlational analyses were also conducted in order to determine if students nominated similar physical activity level students for best friend and those they play with most in both the

baseline and intervention stages. To do this, average physical activity levels were calculated for both the nominator and nominees. In each category, baseline play with nominations, baseline best friend nominations, intervention play with nominations, and intervention best friend nominations, comparisons were made to either baseline or intervention average physical activity levels of the nominator. No significant correlations were found between these variables.

IV. DISCUSSION

The current study examined six hypotheses in order to determine the effectiveness of an intervention to increase child physical activity during free play using an established in classroom token economy system. These hypotheses also addressed current conceptualizations about activity preference and choice which may have an effect on how increasing child physical activity level is to be accomplished.

Intervention Effectiveness

Based on the literature, children should show an increase in MVPA during the intervention when compared to baseline MVPA. To demonstrate this, PEM values were calculated comparing baseline and intervention stage MVPA. With overall PEM values among valid results equaling 57.81% for the Upper Playground and 56.67% for the Lower Playground, both of which are considered questionably effective results, the intervention could be considered "not effective" across all study participants. Similar results were found with PEM analyses of VMCPM for both upper and lower playgrounds. In order to better understand these scores though, an understanding of the specific environments and conditions present is needed, especially as they relate to the upper and lower playgrounds

Upper Playground. Four results should be considered when considering the effectiveness of the intervention on the upper playground: T-test results for both MVPA and VMCPM, effect size for MVPA, and effect size for VMCPM.

T-test results indicate a significant increase in MVPA on the upper playground, but a non-significant decrease in VMCPM. As MVPA is the primary metric of interest this bodes well for the future use of the intervention as whole, though the non-significant VMCPM result should be considered as well. The difference between these two counts is one of the inclusion (VMCPM) or exclusion (MVPA) of sedentary and light physical activity. When these data are included, significant results disappear, indicating that the effects of the intervention are significantly increasing MVPA but is not increasing overall physical activity counts in any significant way. This suggests that children who were demonstrating sedentary-light levels of physical activity during baseline were increasing to moderate-vigorous levels during the intervention, but that those at already high levels of MVPA were not increasing their overall physical activity level on the upper playground.

Points exceeding the median (PEM) analyses on upper playground data further help to define the overall effectiveness of the intervention when considering both MVPA and VMCPM. Similar to the t-test results, when considering valid baseline comparisons to those students who were reinforced during the intervention, a moderately effective result (78.51%) is reached for MVPA, but a non-effective result is found for VMCPM (41.90%). This can best be explained by considering the metric that was used as the reinforcing element: MVPA. Only in cases that a student was displaying higher MVPA would he/she be reinforced, so that only those students above a certain threshold, set by their personal baseline, should see an increase in the desired behavior. VMCPM does provide important information about overall increases in physical activity level, and it would be interesting to use this metric as the standard in future studies in determining levels for reinforcing students. This is also an interesting point when considering the effectiveness on the lower playground as well.

Lower Playground. The four same results should be considered when discussing the effectiveness of the intervention for the lower playground: t-tests for both MVPA and VMCPM, and PEM analyses for MVPA and VMCPM.

T-test results for differences between the baseline and intervention stages were both non-significant for MVPA and VMCPM. This suggests some differences from upper playground results that can most readily be attributed to the playground environments themselves. Whereas the upper playground offers very little in comparison in playground equipment, the lower playground has a multitude of options available as well as a much larger play space. When faced with a large number of choices for play type, with many choices being fairly physically active, the same conclusion found for the upper playground can be generalize: those students who demonstrate an already high MVPA percentage are not going to increase their already high MVPA percentage. This point is punctuated by an 8% higher level of MVPA (44.14%-36.22%) at baseline on the equipment rich, lower playground than the equipment poor, upper playground. Beyond this though, the effect sizes for the intervention are of interest.

PEM analyses for the lower playground further back these results. Whereas MVPA PEM values indicate a non-effective result among responsive participants (65%), VMCPM indicates a moderately effective result (75%). An overall increase in physical activity level is being perpetuated by the intervention for those being reinforced, but not quite to the point of increasing MVPA.

Intervention Effectiveness Conclusion. Under these conditions, when considering the results on both the upper and lower playgrounds, and taking into account previous research, the issues of preexisting playground equipment and ceiling effects on MVPA should be considered. The data from the current study suggests that on an equipment rich playground with higher

overall MVPA across participants a smaller increase in MVPA will be seen for this type of intervention, but overall increases in physical activity level, specifically sedentary into light, are probable. Conversely, on an equipment poor playground, with lower initial values of MVPA, significant increases in MVPA are probable.

Also the reinforcement being used could be a prime reason the intervention did not perform as expected. Previous research has shown that in play environments among youths in social environments that the magnitude and quality of reinforcement had a large effect on activity choice (Hoch, McComas, Johnson, Faranda, & Guenther, 2002). In the current study a classroom token economy that was established by the teacher was used as the basis for reinforcement for MVPA. The magnitude and quality of reinforcement within this token economy differs individually for each participant based on preference for certain reinforcers, and could help to explain the inconsistent results seen in the study.

Activity Preference

In the literature increasing the number of free play equipment choices has been the primary avenue for increasing child physical activity level during free play. These studies did not take into account the motivational factors behind this change though and may have misled many to believe that simply adding more equipment is the only way to see gains in physical activity during playground play. The current study challenged this assumption and provides a low cost alternative to this choice. One advantage of the current study was the ability to compare two playgrounds at the same school with the same participants. This provided some interesting cross-comparisons not just between the equipment available, but how the intervention, which introduced reinforcers independent of activity choice, effected physical activity levels in an equipment poor (upper playground) and equipment rich environment (lower playground).

The idea that more playground equipment leads to higher physical activity levels is not necessarily wrong, but perhaps the real question should be *how* more equipment increases physical activity level. The differences seen between the two playgrounds in the current study highlight this problem. Behavioral studies have found that by increasing the number of choices available, you increase the number of possible outcomes, but not necessarily the choices made. With this idea in mind, the lower and upper playgrounds have large contextual differences between them, both in space and equipment available. When a child is faced with the choice of playing on a swing set, basketball court, soccer field, or in a sandbox, as in the lower playground, versus the upper with its limited space and available activities the current study did find less physical activity. But the child must actually *choose* to play on these pieces of equipment or participate in a given activity in order for gains to be seen. The intervention provided a boost in this regard. By providing the students more motivation to act in a certain way (increase MVPA), or participate in a certain activity (more active play), MVPA increases were seen more in the less rich environment. Even with fewer choices to engage in, more physical activity increases were seen on the upper playground than the lower with little to no financial cost on the part of the teacher or school. Further evidence of the change in activity preference was seen in the sociometric interview questions directly related to playground activity preference.

Chi-squared analyses of differences between administrations of sociometric questions related to activity preference found some interesting results. Most notably among these were robust effects across time for statistically different nominations from baseline to post-extinction for both least wanted playground activities and usual home activities. This demonstrates a probable association of the intervention, as overall fairly robust and long lasting effects were seen when inspecting Figures 1-28, to changing the activity preferences of participants. With an

overall decrease in nominations for physically active choices as least wanted on the playground, a shift seems possible in effectively changing the views of students to pick more active choices. Noticeably though, nominations for most wanted playground activity did not change significantly, but an increase of 60% was seen between baseline and the intervention. Although the evidence found is not conclusive, it should be noted that the increases seen in Tables 1 and Table 2 do reflect well on the idea that activity choice can possibly be influenced through similar interventions.

Between the changes in MVPA, VMCPM, and activity preference demonstrated in the current study, the idea that motivation to participate in an activity or play on a piece of school-yard equipment has a large influence on activity choice during free play seems far less far-fetched. As such influencing this choice should be a much larger focus of research than simply reiterating the effect of adding more choices for a child to pick from. By formulating ways in which teachers and school administrators can use their already available resources and training (such as normal class management techniques like using a token economy) schools can influence child level of physical activity at even the youngest levels.

Sociometric Inferences

Although activity preference and choice appears to have been influenced by the intervention, at least as it relates directly to playground activity, social influence should also be taken into account when considering the effect of the current intervention. The current study used several administrations of sociometric questions to better define some of the interpersonal changes that may occur as the intervention was introduced and then taken away. As would be expected nominations for participant best friends and who each child likes most stayed consistent throughout all administrations. Perhaps the most pertinent question to consider, as it relates to

research in the area, were nominations of who each child noted they played with, the most healthy, and those that run and jump the most. Notably correlations across all subjects found that during the baseline and extinction phases, students indicated through nominations that they played with best friends, but not during the post-intervention interview, possibly suggesting a link between the intervention and who children played with. Most Healthy nominations post-intervention and post-extinction to Best Friend and Play With may also help to reinforce the possibility of this link. Only one significant correlation was found between nominations for physically active students (Run and Jump the Most) and Picked On, which may have to be disregarded due to children having difficulty understanding the meaning of "picked on". Many students would ask what it meant, or would go ahead and answer, indicating people that are called on in class, not those who are bullied or get in trouble often.

Another important consideration when analyzing sociometric data are who is being nominated and when. Prior research has supported the idea that children play with peers who demonstrate similar levels of physical activity level. As the intervention introduced changes the physical activity level for some participants, nominations for Best Friend and Play With should change between baseline and post-intervention demonstrating this change. Findings did not support this idea, as no correlations were found between Best Friend and Play With nominations and physical activity level values. This may be due to the nominations not reflecting true friendships between members or simply other similarity variables predict friendship nominations better than physical activity level or the relatively small changes in physical activity values seen.

Conclusion

Of the six hypotheses tested, several showed a significant level of support in the current study. The first, which stated that an increase in MVPA would be seen following the intervention

compared to baseline, is supported by an overall increase and clinically significant increases on one of the playgrounds on which data were collected. The second hypothesis, which stated that a decrease in MVPA would be seen during the extinction stage, did not have significant support, but can be explained by a robust treatment effect and the continued presence of the researcher during this time. The third hypothesis, which stated that children would prefer more physical activities following the intervention, was supported by much higher percentages from baseline to post-intervention of physically active choices. The fourth hypothesis though, which stated these values would decrease at the post-withdrawal interview, was not found, and similar to the findings of hypothesis two, support the idea that the intervention had a robust and enduring effect. The fifth and sixth hypotheses further tested the idea that nominations for best friend and play with would change following the intervention and changing values of physical activity level. This was not seen and is best explained by the fact that a multitude of other variables which the current study did not test effect nominations. Overall the intervention in the current study did demonstrate the effects of reinforcement in a preschool classroom utilizing a token economy as a possibly effective intervention for increasing child physical activity level, although significant changes are needed with regard to formulating a more comprehensive token economy system to increase both the magnitude and quality of reinforcement. Especially suggestive and effective evidence was found for environments that are less rich in terms of equipment on the playground to increase MVPA. Lower threshold increases are also probable in environmentally rich playgrounds as well. Further research is needed in this area in order to confirm this result and to provide further evidence of how behavioral reinforcement programs can be used to increase physical activity levels in our at-risk youth.

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LIST OF APPENDICES

APPENDIX A: SCRIPT FOR SOCIOMETRIC INTERVIEW

Interviews will be conducted individually with children in the preschool. You can spend a bit of time "rapport building" with each child: introduce yourself, ask the child's name, and tell the child that you will be asking questions about her/his classmates because we are trying to learn about ways in which children relate to/interact with each other. If you want, you can engage the child in a bit of "small talk" conversation by asking questions, perhaps about activities, school, or anything else that comes to mind.

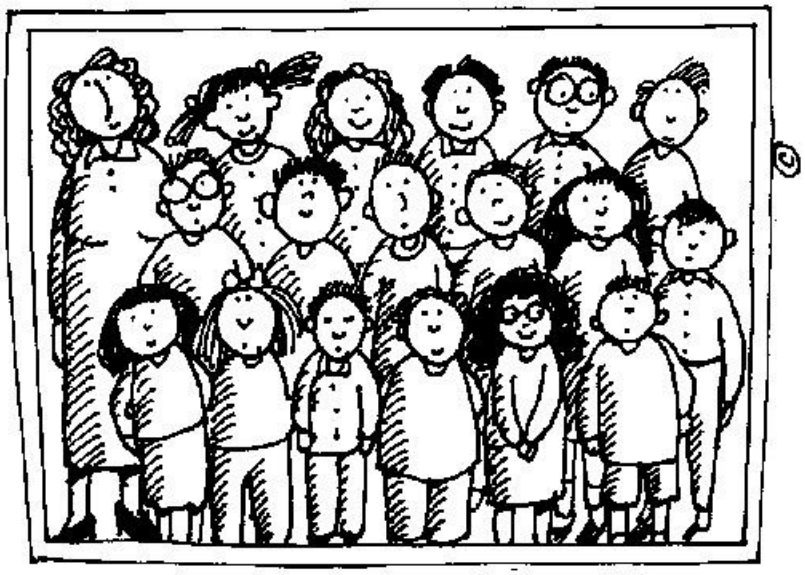
Talk about confidentiality. Tell each child that it is important that they not talk about their interview with the other kids in the class. Tell them that we will be interviewing all kids, and we need to have each one give us her/his own independent answers to the questions. This is one reason why it is important that they not discuss their answers among themselves. Also point out that some kids feelings might get hurt if they know they were or were not named for various questions so it is best that no one talk about what they told you. Ask the child if he or she will help out by reminding classmates not to talk about it if they bring the subject up.

Begin a new administration in Qualtrics and read each question out loud to the student. The student will control the pointer to click on the appropriate picture. If an invalid response is given, read the prompt for the student and redirect them back to the task. If the student does not understand a question, clarify the question by defining unknown words.

After the sociometric questions are completed, record the child's weight and height with a scale and tape on the wall. Skinfold measurements on the right triceps and just above the right hip also need to be taken.

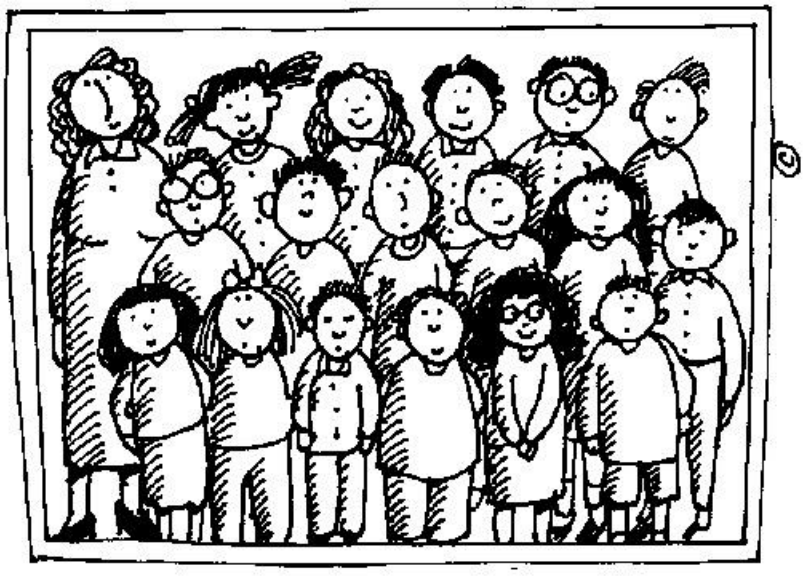
Sociometric Questions List

1. Click on your face in the class picture below.



*

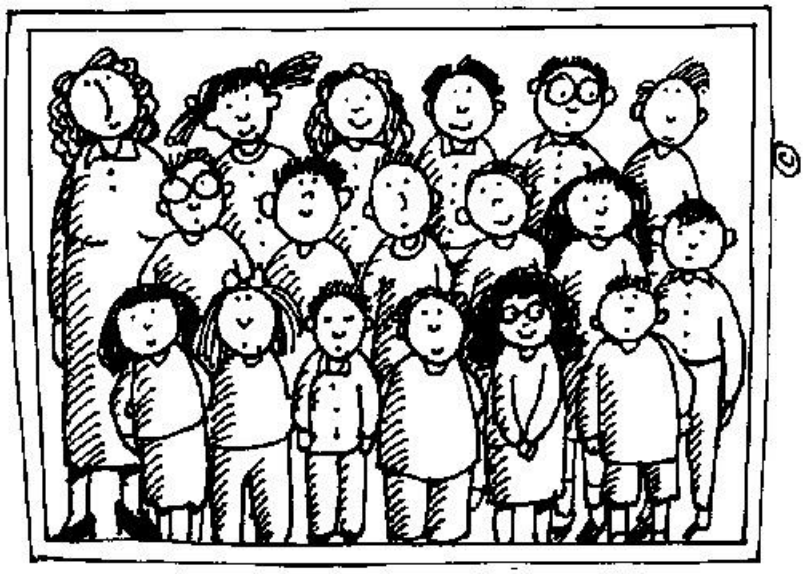
2.
   a. Click the face of the student you like the most in the picture.
   b. Click the face of another student you like the most.
   c. Click the face of one more student you like the most.



*

3.
   a. Click the face of the student who runs and jumps the most.
   b. Click the face of another student who runs and jumps the most.

c. Click the face of one more student who runs and jumps the most.



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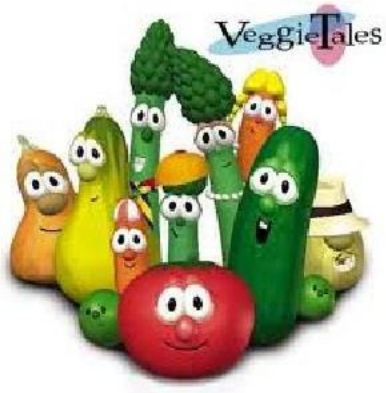
4.

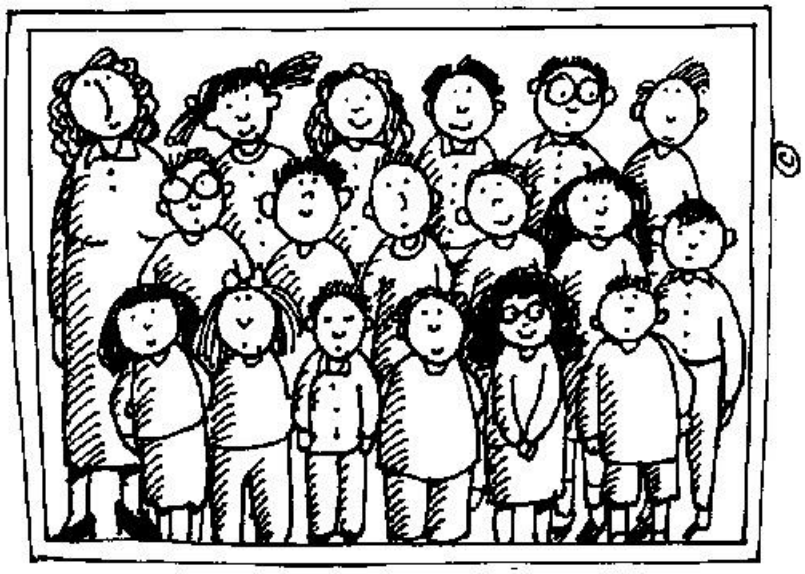
a. Click on the picture that represents the TV show you like the most.



5.

a. Click the face of the student you don't like the most.
b. Click the face of another student you don't like the most.

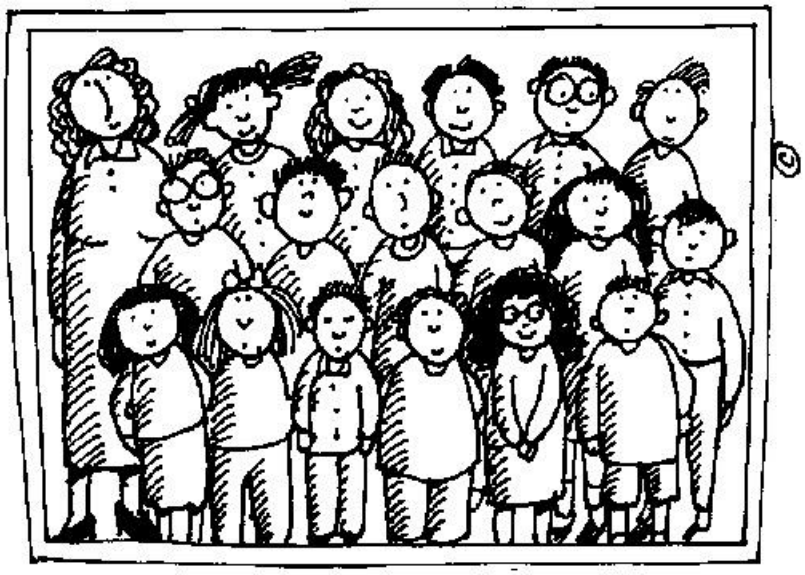
c. Click the face of one more student you don't like the most.



*

6.

a. Click the face of the student you play with the most on the playground.
b. Click the face of another student you play with the most on the playground.
c. Click the face of one more student you play with the most on the playground.



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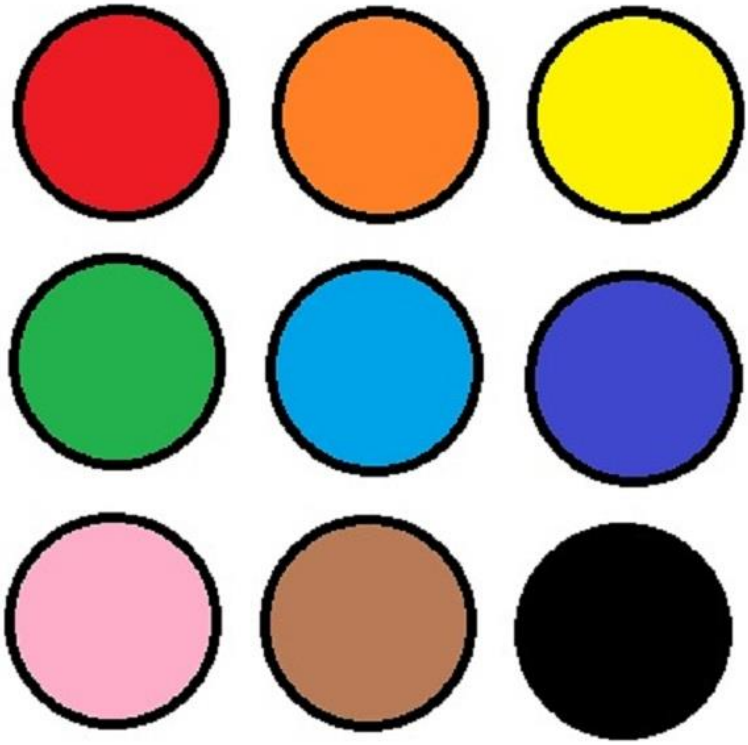
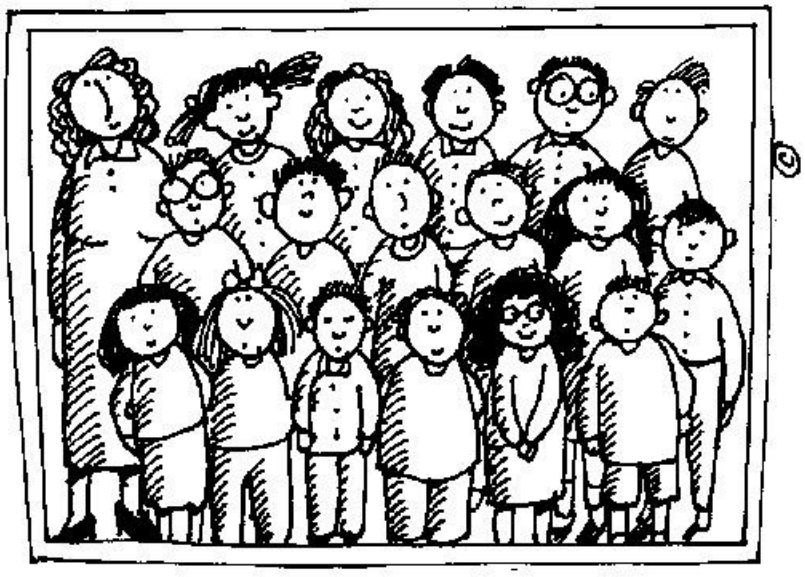
7. Click on the circle that is your favorite color.



8.

a. Click the face of the student who gets picked on the most in the picture.
b. Click the face of another student who gets picked on the most in the picture.
c. Click the face of one more student who gets picked on the most.



*

9. Click the food choice that you think is the healthiest.



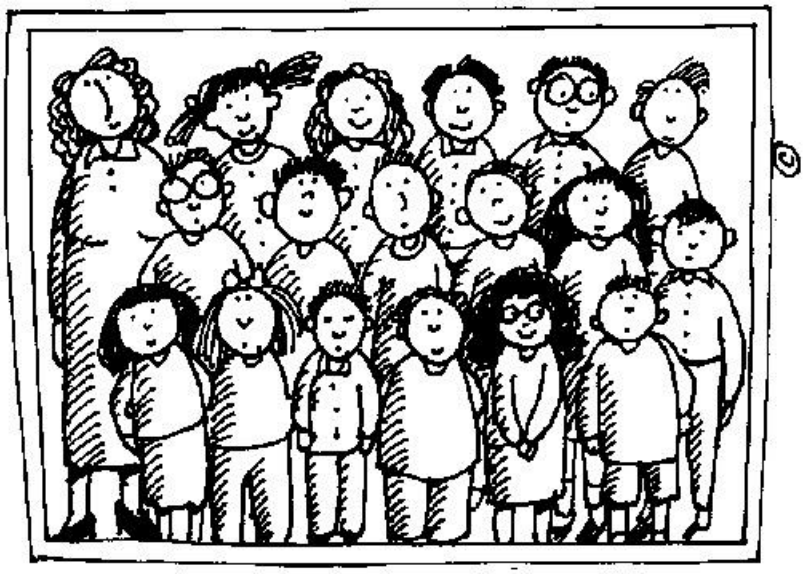

10. Click on the picture of the activity that you think is the healthiest.




11.

a. Click the face of the student who is the healthiest.
b. Click the face of another student who is the healthiest.

c. Click the face of one more student who is the healthiest.



*

12.

a. Click on the picture of the activity you usually do when you get home.
b. Click on the picture of the activity you most want to do when you get home.
c. Click on the picture of the activity you least want to do when you get home.

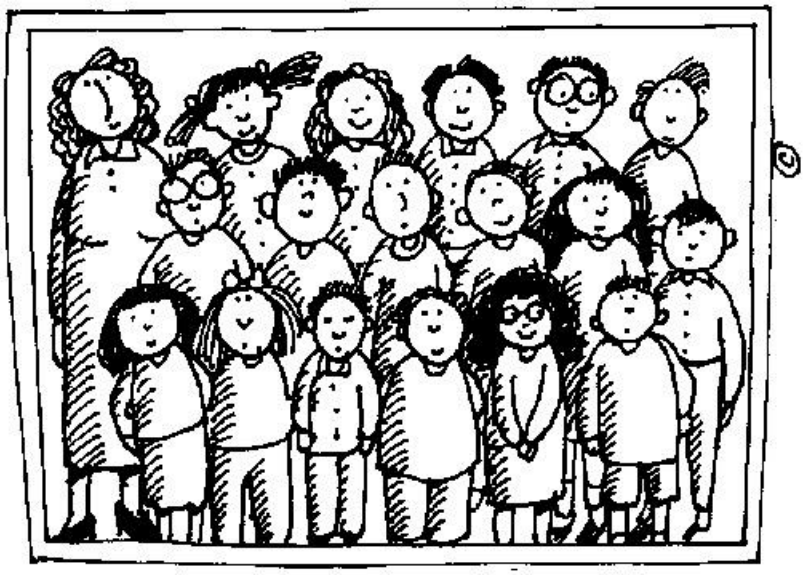
13.

a. Click on the picture of the activity you usually do when you are on the playground.
b. Click on the picture of the activity you most want to do when you are on the playground.

c. Click on the picture of the activity you least want to do when you are on the playground.

14.

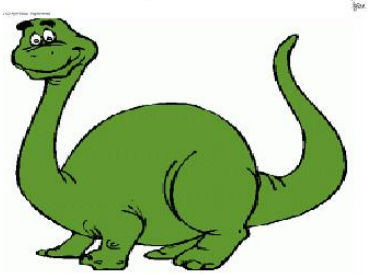
a. Click the face of the student who is your best friend.
b. Click the face of another student who is one of your best friends.
c. Click the face of one more student who is one of your best friends.



*

15.

a. Click on the picture of what you are excited about learning this year.



16. Height (in.)_____

17. Weight (lbs.)_____

18. Tricep skinfold measurement (mm) _____

19. Suprailliac skinfold measurement (mm) _____

*The cartoon class picture were replaced with a class picture of the students in the class.

APPENDIX B: CORRELATIONS BETWEEN STUDY VARIABLES

		LikeMost	RunJump	LikeLeast	PlayWith	PickedOn	Healthy	BestFriend	LikeMost2	RunJump2	LikeLeast2	PlayWith2	PickedOn2	Healthy2	BestFriend2	LikeMost3	RunJump3	LikeLeast3	PlayWith3	PickedOn3	Healthy3	BestFriend3
LikeMost	Pearson Correlation																					
RunJump	Pearson Correlation	.152																				
LikeLeast	Pearson Correlation	.402	.265																			
PlayWith	Pearson Correlation	.583*	.000	.130																		
PickedOn	Pearson Correlation	.000	.207	.084	.155																	
Healthy	Pearson Correlation	.361	-.113	-.120	.207	.644*																
BestFriend	Pearson Correlation	.920**	.125	.462	.593*	-.066	.275															
LikeMost2	Pearson Correlation	.618*	.304	.298	.515	.466	.350	.647*														
RunJump2	Pearson Correlation	.411	.549*	.479	-.118	.298	.285	.410	.417													
LikeLeast2	Pearson Correlation	.278	.000	.133	.054	-.377	-.160	.123	-.317	.291												
PlayWith2	Pearson Correlation	.509	.029	.083	.389	-.126	-.120	.440	.563*	.046	.066											
PickedOn2	Pearson Correlation	.285	.626*	.332	-.191	.434	.239	.249	.594*	.789**	-.076	.221										
Healthy2	Pearson Correlation	.695**	.327	.656*	.639*	.272	.148	.632*	.644*	.296	.062	.463	.359									
BestFriend2	Pearson Correlation	.720**	.438	.560*	.397	.237	.142	.747**	.796**	.516	.000	.471	.666**	.736**								
LikeMost3	Pearson Correlation	.836**	.102	.433	.411	-.036	.173	.820**	.631*	.534*	.403	.650*	.432	.568*	.791**							
RunJump3	Pearson Correlation	.312	.245	.277	.096	.326	.289	.452	.349	.684**	.074	-.092	.399	.214	.376	.360						
LikeLeast3	Pearson Correlation	.587*	.097	.639*	.284	-.184	-.263	.482	.290	.275	.437	.320	.212	.634*	.549*	.553*	.127					
PlayWith3	Pearson Correlation	.851**	.261	.431	.478	.093	.237	.894**	.807**	.489	.049	.523	.511	.598*	.914**	.879**	.376	.506				
PickedOn3	Pearson Correlation	.402	.374	.096	.150	.000	.046	.407	.306	.659*	.384	.241	.512	.267	.374	.458	.667**	.369	.391			
Healthy3	Pearson Correlation	.511	.255	.180	.299	-.073	-.035	.572*	.488	.455	.259	.217	.384	.167	.612*	.625*	.340	.474	.746**	.542*		
BestFriend3	Pearson Correlation	.893**	.114	.420	.669**	.065	.217	.904**	.744**	.442	.257	.549*	.322	.687**	.799**	.894**	.465	.636*	.906**	.522	.699**	

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

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August 2013- August 2014 — **Chicago-area Christian Training Consortium (APA Accredited)**

Primary Rotation: Cornerstone Counseling Center of Chicago

Primary responsibilities include individual, couples, and family therapy among underserved and at risk populations in the Chicago-land area. Also conduct school group/after school counseling for social emotional learning and academic skills. Present workshops/seminars for relationship insight and adjustment.

Secondary Rotation: Lawndale Christian Health Center

Primary responsibilities include Behavioral Health Consultation in a Primary Care pediatric setting. Provide consultations for parents and children ages 9 months - 18 years for a variety of developmental, mental health, and physical health related problems during medical appointments through hand-offs from physicians.

ACADEMIC APPOINTMENTS

August 2010- **Instructor, Department of Psychology**

May 2011 **Clinical Training Program, University of Mississippi**

Teach two semesters of an undergraduate introductory psychology course, including planning and implementing instruction to meet course goals.

September 2007- **Teaching Assistant, Psychology Department**

May 2008 **Clinical Training Program, University of Mississippi**

Facilitate learning of class members through tutoring students in groups and individually; holding regular office hours; proctoring exams; managing day to day operations of the class; fielding questions; and grading exams and quizzes.

May 2008- **Researcher, Psychology Department**

May 2013 **Clinical Training Program, University of Mississippi**

Conduct independent research in a lab environment in health psychology including data collection, analysis, and writing for research into possible interventions for child obesity.

September 2007- **Research Assistant, Psychology Department**

May 2008 **Clinical Training Program, University of Mississippi**

Help in data collection for relevant projects in the lab environment, including research into body image of self and others. Also participate in discussions of other lab related research projects.

CLINICAL APPOINTMENTS

September 2012- **Behavioral Consultant, Baptist Children's Village (Children's Group Home)**

June 2013 **Clinical Training Program, University of Mississippi**

Primary responsibilities include assessment, therapy, and skills training for children in DHS custody or from families who have given physical custody of their children to the group home organization. Responsibilities also include training house parents and interacting with the children's teachers.

July 2011- **Mental Health Therapist, Communicare (Community Mental Health),**

June 2012 **Clinical Training Program, University of Mississippi**

Primary responsibilities include assessment, diagnosis, and treatment of psychological disorders in rural communities of Calhoun County, Mississippi.

August 2008- June 2013 **Mental Health Therapist, Psychological Services Center (University Psychological Services)**

Clinical Training Program, University of Mississippi

Primary responsibilities include assessment, diagnosis, and treatment of psychological disorders in the Oxford, MS community and university.

July 2009- June 2010 **Mental Health Therapist, North Mississippi Regional Center**

Clinical Training Program, University of Mississippi

Conducting group and individual therapy sessions for individuals diagnosed with mental retardation. Also writing, reviewing, and revising behavioral programs; data collection for intensive treatment teams; and assessment of clients' adaptive skill levels, IQ levels, and motor functioning.

August 2009- December 2010 **Clinical Assessment Specialist, Psychological Assessment Center**

Clinical Training Program, University of Mississippi

Specialized assessment and diagnosis of learning disabilities, ADHD, and mental disorders. Involves administration

of comprehensive assessments, detailed analysis and interpretation of test results, report writing, and feedback sessions.

December 2010- June 2011 **Verification Specialist, Office of Student and Disability Services**

Clinical Training Program, University of Mississippi

Review of documentation concerning student applications for disability services, especially those concerning learning disabilities, ADHD diagnoses, and psychiatric diagnoses as well as conduct interviews with those seeking accommodations.

September 2008- May 2009; September 2010- May 2011; **Computer Technician, Psychology Department**

Clinical Training Program, University of Mississippi

Upkeep of Psychology Department Computer Lab and Psychological Services Center computers, including networking, application installation and troubleshooting, and hardware problems. Also on call for computer-related problems of Psychology Department faculty.

NATIONAL/INTERNATIONAL PRESENTATIONS

Karl, K., Flegle, L., Cox, L., & Christoff, K. A. (2010, November). *Social interaction to promote physical activity in preschool children: can working with more active peers help?* Poster presented at the annual conference of the Association for Cognitive and Behavioral Therapies, San Francisco, CA.

Karl, K., Christoff, K., & Flegle, L. (2009, November). *Increasing Activity Levels of Preschool Children: Can Interactions with More Active Peers Help?* Poster presented at the 2009 annual meeting of the Association for Behavioral and Cognitive Therapies, New York, NY.

Flegle, L., Christoff, K., & **Karl, K.** (2009, November). *Can Preschool Aged Children Identify Disabilities in their Peers? A Sociometric Evaluation*. Poster presented at the 2009 annual meeting of the Association for Behavioral and Cognitive Therapies, New York, NY.

Gardner, C., **Karl, K.**, Durkee, A., Nicholas, R. & Christoff, K. (2008, November). *Birds of a Feather V. Opposites Attract: Is Body Size Related to Friendship Choice?* Poster presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Orlando, FL.

Durkee, A., **Karl, K.,** & Christoff, K. (2007, November). *The effect of interracial friendship status on the evaluation of peers*. Poster presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Philadelphia, PA.

Karl, K. & Parra, G. (2007, April). *Family factors as predictors of the discrepancy between youth and parent reports of psychopathology*. Symposium presented at the annual National Undergraduate Research Conference, San Francisco, CA.

Parra, G., Kitzmann, K.M., Luebbe, A., Olsen, J., Davis, G., Jobe, L., Buckholdt, K., & **Karl, K.** (2007, October). *Trajectories of interparental discord during adolescence*. Poster presented at the bi-annual conference of the Society for Research in Child Development, Boston, MA.

STATE/REGIONAL PRESENTATIONS

Karl, K., Flegle, L., Cox. L., & Christoff, K. (2011, February). Friendship Presence on the Playground and its Association to Physical Activity Level: A Preschool Sample. Poster presented at the annual meeting of the Mississippi Academy of the Sciences in Hattiesburg, MS.

This poster won the award for Best Poster by a Graduate Student in the Division of Psychology and Social Sciences of the Mississippi Academy of Sciences.

Flegle, L., **Karl, K.**, & Christoff, K. A. (2011, February). *Social relationships of children with disabilities in inclusive classrooms: comparison to their typical peers*. Poster presented at the 2011 Annual meeting of the Mississippi Academy of the Sciences.

Karl, K. & Christoff, K. A. (2009, September). *Differences of opinion: an analysis of body image perceptions comparing adults with children to adults without*. Poster presented at the annual conference of the Mississippi Psychological Association, Tunica, MS.

Durkee, A.O., **Karl, K.**, & Christoff, K. (2008, April). *The effect of interracial friendship status on the evaluation of peers*. Poster presented at the annual meeting of Sigma Xi at the University of Mississippi.

PUBLICATIONS

Karl, K. & Christoff, K. (In progress). Behavioral Interventions for Child Obesity: Increasing Physical Activity on the Playground via Reinforcement in a Preschool Classroom.

Karl, K., Flegle, L., Cox. L., & Christoff, K. (2011). Friendship Presence on the Playground and its Association to Physical Activity Level: A Preschool Sample. *Journal of the Mississippi Academy of Sciences, 56(1),* 116. (Published Abstract).

Flegle, L., **Karl, K.,** & Christoff. (2011). Social Relationships of Children with Disabilities in Inclusive Classrooms: Comparisons to their Typical Peers. *Journal of the Mississippi Academy of Sciences, 56(1),* 117-118. (Published Abstract).

Karl, K. & Parra, G. (2007, April). Family factors as predictors of the discrepancy between youth and parent reports of psychopathology. Journal of the National Conference of Undergraduate Research, 2007. (Published Abstract).

AWARDS/RECOGNITIONS

March 2011 **Best Poster by a Graduate Student in the Division of Psychology and Social Sciences**

Awarded by the Mississippi Academy for the Sciences for a poster presentation delivered during the 2011 MAS annual meeting in Hattiesburg, MS.

DEPARTMENTAL/UNIVERSITY/ORGANIZATIONAL SERVICE

Fall 2010-present **Association for Behavioral and Cognitive Therapies**

Member

Fall 2006-present **American Psychological Association**

Student Member

Spring 2011- present **Mississippi Academy for the Sciences**

Member

Fall 2009- present **Mississippi Psychological Association**

Member

TECHNICAL SKILLS

Working knowledge of: **SPSS (Statistical Analysis Software)**

Microsoft Office Suite

Windows Operating System

ADDITIONAL TRAINING RECEIVED

Fall 2009 **P.A.S.S. Training**

ICF-MR client management training

North Mississippi Regional Center

Fall 2011 **Cognitive Processing Theory web-based learning course**

Military-focused PTSD therapy training

Medical University of South Carolina

Spring 2012 **Treating the Invisible Wounds of War**

Military-focused PTSD therapy training

Citizen Soldier Support Program

Spring 2012 **Unified Protocol Training**

Unified Protocol research and use

University of Mississippi Medical Center

Fall 2013 **Prepare Enrich Training**

Assessment and psychotherapy training for a specific package for marriage and premarital counseling.

Cornerstone Counseling Center of Chicago

Fall 2013 **Fred Jones' *Tools for Teaching***

Behavioral classroom management training

Cornerstone Counseling Center of Chicago