THE IMPACT ON ACADEMIC ENGAGEMENT AFTER SOCIAL ATTENTION DURING PHYSICAL ACTIVITY

by

EMILY G. POLLACK

(Under the Direction of Kevin Ayres)

ABSTRACT

Recess is vital to maintaining academic engagement to regenerate productivity in school. Previous research suggests an increased level of moderate-to-vigorous physical activity (MVPA) increases academic engagement in the classroom. In a systematic replication of Mercado Baez et al., (in review), the current study extends research on MVPA by evaluating the effects of social interaction between teachers and students during recess, as well as the effects of MVPA on academic engagement. Researchers measured academic engagement before and after recess sessions using group momentary time-sampling to determine a percentage of on-task behavior during instruction time. Results showed functional relations between MVPA and the group game in that students engaged in higher levels of MVPA when the group game was in place than in the baseline condition. However, MVPA had little effect on academic engagement levels. These findings extend other work by further identifying the impact on antecedent activity to instruction.

INDEX WORDS: physical activity, on-task behavior, engagement, group game

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Chapter 1: Introduction

Many adolescents fail to maintain a healthy body weight (Gonzales et al., 2019). With limited physical activity, children face an increased risk for obesity and associated health complications (Larson et al., 2014). In addition to the academic component of school, recess can play an important role especially when they are given the opportunity to engage in moderate-to-vigorous physical activity (MVPA). MVPA has many benefits, including the proper development of musculoskeletal movement, improved coordination (Janz et al., 2010), and increased executive functioning (Visier-Alfonso et al., 2021). However, notwithstanding widely reported health and well-being advantages, schools scarcely achieve the recommended physical activity guidelines established by the Center for Disease Control (CDC; 2022) of 60 min per day (Mayorga-Vega et al., 2019; Zerger et al., 2016). The term, recess, refers to a temporary suspension of an activity. In school, recess is vital to maintaining academic engagement to regenerate productivity (Jarrett et al., 1998). Research suggests a positive correlation between MVPA and academic performance (Jarrett et al., 1998; Thalken et al., 2021), signifying recess is a complementary priority to academic time and holds equal importance. Previous research shows embedding recess into the school schedule increases on-task behavior and limits excessive movement in the classroom (Jarrett et al., 1998).

As adolescence is a high-risk period for weight gain that is often maintained and magnified through adulthood, many studies have examined the effects of Body-Mass-Index (BMI; Graff et al., 2016; Schwarzfischer et al., 2017) on physical activity. Researchers have found physical activity is associated with BMI, as an increased level of physical activity can lead

to a lower BMI, and MVPA may show a meaningful reduction of excess weight gain across individuals. Pedometers have become a popular assessment tool as the device is the best method to directly measure physical activity. Steps, as a unit, are universally understood as an indicator of activity, and previous investigations have linked wearing a pedometer to increased activity (Eisenmann et al., 2007; Normand & Burji, 2020; Tudor-Locke, 2002). Pedometers provide practical, affordable, and objective methods of assessing physical activity in a summative fashion (Tudor-Locke et al., 2008).

Location of MVPA is also important, although some of the research has yielded conflicting results. In particular, some research has shown that fixed structures in play areas diminish MVPA (Brown et al., 2009), while other research contradicts these results (Hustyi, et al., 2012). Brown et al. (2009) found play objects, like balls or hula-hoops, with an open space, produced higher levels of MVPA than contexts with structured and dramatic playscapes. The researchers recommended paying close attention to the availability of outdoor materials and spaces, as location may interrupt the opportunity for physical activity. Conversely, Hustyi et al. (2012) found that a playground with fixed equipment, like a jungle gym, produced the highest levels of MVPA among open space, and outdoor toys conditions. Based on available items in the context where recess occurs, MVPA levels may differ. Bower et al. (2008) determined a supportive environment including fixed structures would achieve a higher level of MVPA exhibited by students.

Along with contextual stimuli (or, lack thereof), researchers have also evaluated the effects of social interaction between children and adults during recess on MVPA (Gonzales et al., 2019; Hustyi et al., 2011; Larson et al., 2014; Ledford et al., 2016; McKenzie et al., 1997; Zerger et al., 2016). McKenzie et al. (1997) reported that both preschool and elementary school-aged

children accumulate much of their physical activity during the first 10 min of play in a 30-min recess. Researchers also found that students have a considerable decline in physical activity 3 min into the 30-min recess session.

Ledford et al., (2016) found that when teachers implemented intervention in an alternating treatments design, consistent changes in social interactions, proximal play, and appropriate engagement associated with MVPA occurred. Larson et al. (2014) conducted a functional analysis to investigate the relationship of MVPA to social attention. Gonzales et al. (2019) replicated this study and found similar results, including a link between interactive play, social attention, and increased levels of MVPA thoroughly exists. Gonzales et al., (2019) found that MVPA levels were highest when students were engaged with peers and adults together in play, especially when adult attention was present. This study confirmed prior research suggesting that contingent adult attention and interactive play are effective in increasing MVPA levels. Additionally, Gonzales et al., (2019) extended research by Hustyi et al., (2012) by comparing outdoor contexts in addition to contingent attention. Zerger et al. (2016) further confirmed the effects of social attention on MVPA confirming that the provision of attention or physical engagement contingent on MVPA can increase the physical activity of young children.

There is a large body of literature surrounding the relation between antecedent activity and academic engagement. Much of the research shows consistent results indicating antecedent physical activity increases on-task behaviors such as academic engagement. Nicholson et al., (2011) used a multiple baseline across subjects design to evaluate the effects of antecedent physical activity on the academic engagement of elementary-school children diagnosed with autism spectrum disorder (ASD). Using Behavioral Observation of Students in Schools (BOSS; Shapiro, 2013) to collect data, the researchers found that antecedent physical activity increased

academic engagement. The researchers also noted an increase in academic engagement with students who exhibited higher levels of participation during the antecedent physical activity sessions. Neely et al. (2014) completed a replication of Nicholson et al. with a similar sample of participants. Their study reported the same results while utilizing a multielement design with three different conditions: no antecedent exercise, brief durations of antecedent exercise, antecedent exercise until behaviorally indicated satiation (Neely et al., 2014). Luke et al. (2014) used a withdrawal design to evaluate the effects of physical activity on on-task behavior with students who had developmental disabilities in a self-contained, pre-kindergarten classroom. Using momentary time sampling, researchers found an increased number of on-task behavior intervals when antecedent physical activity conditions were introduced. As a result, the researchers recommended antecedent physical activity as a plausible intervention of increasing on-task behavior during facilitated instruction for children with developmental disabilities.

Mercado Baez et al. (in review) used a withdrawal design to evaluate the step count levels in young children. Specifically, the researchers used an interactive group game contingent on student movement to assess MVPA levels of students. During baseline sessions, researchers used a naturalistic baseline structure, while incorporating increased adult attention during intervention sessions. Overall, researchers found an increase in student step count and MVPA levels when the group game was implemented into sessions and lower step count rates during baseline sessions.

The present study extends previous research (Mercado Baez et al., in review) on MVPA by evaluating the effects of social interaction between teachers and students during recess, as well as the effects of MVPA on academic engagement. Specifically, the present study addresses the association between MVPA and academic engagement in addition to step count. Therefore,

the following research questions have guided this investigation: What are the effects of MVPA on academic engagement? What are the effects of receiving social attention from teachers during MVPA on step count?

Chapter 2: Method

Participants

Twenty-one students participated in this study. All of the students were part of the same collaborative, team-taught pre-kindergarten class, consisting of a combination of general education and special education students with two teachers. Participation eligibility for the study required student enrollment in the particular class at the school and adequate attendance. Teachers a part of this study were employees of the local preschool, assigned to work with the particular group of students, who allowed researchers to enter their classroom to complete this project. Researchers recruited participants by sending a letter home to discuss the general procedures of the study, as well as an approved Institutional Review Board permission form to parents of students in the class at a local preschool. Every student was vocal with basic levels of play skills. BMI measures were collected prior to the study and showed the majority of students were classified as overweight or obese.

Setting and Arrangements

All baseline and intervention sessions were completed in standard playgrounds of a public preschool in the early morning, before snack, and in the late morning (i.e., before lunch), with academic engagement opportunities between each of these activities occurring in the classroom. An Applied Behavior Analysis Master's degree student conducted the sessions. Sessions occurred twice per day at least two times per week, weather permitting, in the same preschool as reported in Mercado Baez et al. (in review). Generalization was evaluated in the final sessions, where teachers implemented the recess conditions. Students had the opportunity to play on two out of four playgrounds each day, based on a schedule set by the school. Some days,

certain entities of the playgrounds were made unavailable at the teachers' discretion. In all of the play areas, students were allowed access to water bottles if they chose to bring their water outside with them.

The classroom was 62 by 17 ft with numerous items including cubbies for student belongings, center areas with various toys, and several child-sized tables with chairs around each table where the majority of independent small group activities occurred. There were also two teacher areas for personal belongings and adult-sized chairs at child-sized tables where facilitated small group instruction occurred, as well as a 12 by 8 ft carpet with a television mounted on the wall and several bookshelves where many whole group lessons occurred, and a child-sized sink area in the room.

Playground A was a 25 by 25 ft flat, grassy area with one tree in the corner, and a small opening for entry and exit. Students were allowed to play with various items like balls, hula hoops, and large puzzle blocks. There were also three sand tables and small, plastic sand toys on one side of the area, and a 5-ft-tall disk golf basket modified to become a basketball net in the middle of the playground. The tree provided minimal shade to the area.

Playground B was a 20 by 15 ft area with a metal jungle gym. This playground had two slides and monkey bars that teachers restricted access to as it was a safety hazard for children their age. Next to the structure was a 20 by 25 ft field with two sand tables and small, plastic sand toys on one side of the area and two adult-sized picnic tables on the other side of the field, closer to the structure. Over half of the play area received shade.

Playground C was a 40 by 10 ft playscape filled with many entities including a metal jungle gym with a tunnel, a small rock-climbing wall, a slide, and a separate wood structure with two levels connected by a metal bar ladder with a large slide attached. Playground C also

included three playground vehicles. However, inside the wooden tower and tunnel were the only places where there was access to shade, as a metal roof covered the wood structure. During intervention sessions, the separate wood structure remained a safe zone as the second level was inaccessible for the group game.

Playground D was a fenced 40 by 30 ft field. Much of the area was mulched with a large two-person swing attached to a 10 by 5 ft wooden gazebo with picnic tables and a small slide built into the complex, and two child-sized picnic tables separate from the structure. There were hula hoops available, but this playground contained a far limited amount of entities in comparison to the other locations. This playground received a large amount of shade, as most of the area was covered by the gazebo roof.

Response Definitions and Measurement

Behaviors

The dependent variables in the current study included academic engagement and MVPA. Academic engagement was defined as when a student was either sitting or standing when instructed to do and facing the direction where instruction or activity was taking place in the designated area for learning, other than leaving the area to use the restroom or throw away trash. Academic engagement examples included correct body positioning in the direction of the teacher when they were speaking during whole group time or facing the table and looking at the materials in their assigned area during small group activities. Nonexamples included laying down or standing up when not instructed to do so or being disengaged with the task at hand. This behavior was recorded as a duration measure and reported as percentage of 30-s intervals using a partial-interval recording procedure, known as planned activity check (PLAcheck; Cooper et al., 2020).

MVPA was defined as the number of steps a student took during the session. This behavior was recorded as a frequency measure and reported as a group average. Student step count was recorded using Yamax Digi-Walker SW-200 pedometers used in Mercado Baez et al. (in review) and others (Eisenmann et al., 2007; Normand & Burji, 2020; Tudor-Locke, 2002) to determine any relation between the average rate step count and the percentage of academic engagement before and after recess sessions.

Measurement System

Before and after recess sessions, a 5-min academic engagement session was conducted to measure engagement. The researcher started a silent timer for a 30-s interval and recorded the total number of students present during an interval and how many students during that interval were academically engaged. Students were only accounted for in the intervals for which they were present. Late-arriving students were included in the intervals for which they were present. To calculate the engagement percentage, the total number of students engaged per session was divided by the total number of students available per session, as a student may have not been present for one interval but in the others.

Each recess session was 20-min, and students wore pedometers for the entire duration. At the end of each recess, researchers collected and recorded the final number of steps set forth by the pedometer for each student. With total step count, the rate was calculated by dividing the total number of steps each student took by the duration of recess in minutes. The researchers accumulated these rates into a group average in order to display the group progression of treatment.

Reliability and Fidelity

To secure the reliability of the specific pedometers used in this study, one participant was randomly selected to wear two pedometers, one on each hip, at each session, similar to the recent study (Mercado Baez et al., in review). To calculate pedometer reliability, the smaller step score was divided by the larger step score with the sum being multiplied by 100. Pedometer reliability was checked in 80% of sessions throughout the study and showed to be 88.79% reliable for sessions.

Pedometer accuracy data was also taken, like the recent study (Mercado Baez et al., in review), to further secure step count agreement. Researchers randomly selected a participant to wear one pedometer and take 50 steps with the implementer, while the implementer counted each step aloud. At the end of the 50 steps, the researcher took the student's final step count determined by the pedometer and the actual number of steps taken (50) and divided the smaller number by the larger number with the sum being multiplied by 100 (Cooper et al., 2020). Pedometer accuracy was checked in 100% of sessions throughout the study and showed agreement between pedometers and the actual value of steps to be 87.33%.

In addition to pedometer reliability and accuracy measurement, a second observer collected interobserver agreement (IOA) data. Total count IOA methods were used to evaluate academic engagement. In order to gain the most accurate IOA available, both the primary and secondary observers scanned the room systematically, agreeing on a starting point and an ending point before data collection began. To calculate IOA for academic engagement, the smaller percentage of engagement was divided by the larger percentage of engagement with the sum being multiplied by 100 (Cooper et al., 2020). Similar to the recent study (Mercado Baez et al., in review), the researchers used a point-by-point method to evaluate the final step count at the

end of each recess session by taking the number of agreed scores and dividing it by the sum of the agreed and disagreed scores (Cooper et al., 2020). IOA was checked in 66.67% of recess sessions, 50% of pre-sessions, and 53.33% of post-sessions throughout the study. Agreement showed 98.96% for step count rate, 95.53% for academic engagement before MVPA occurred, and 93.87% after MVPA occurred.

Procedural fidelity data were recorded for 66.67% of all sessions during each part of the study with a checklist completed by a secondary observer. Fidelity was determined by taking the total number of correct steps completed in the checklist and dividing it by the number of total steps with the sum being multiplied by 100 (Cooper et al., 2020). Sessions had a report of 99.71% fidelity. The session implementer also performed self-checks to ensure they were following procedures correctly. Self-check data was recorded for 53.33% of all sessions. As a whole, self-check data and procedural fidelity data overlapped 50% of sessions.

Procedures

General Procedures

The present study used an alternating treatment design to evaluate experimental control, with a randomized condition order, to protect against testing threats of internal validity and examine the effects of social attention during MVPA on step count. Additionally, academic engagement sessions were completed during both pre-recess and post-recess regardless of the condition presented to measure the differences in engagement before and after recess. During academic engagement sessions, opportunities varied as sometimes teachers would facilitate whole-group instruction, and other times small group activities and instruction would take place. While other studies employed academic engagement data collection during post-recess sessions

only, the present study conducted academic engagement sessions both before and after recess sessions to directly compare the effects of MVPA.

Much of the general procedures are similar to the previous study (Mercado Baez et al., in review) because the present study is a systematic replication. Before the session, researchers would randomize the order of conditions for the upcoming two sessions, to ensure both conditions would be presented within the same school day. To begin, without referring to the condition, researchers conducted a pre-recess academic engagement session inside the classroom. During pre-recess engagement sessions, the researcher noted the total number of participants present and recorded who, if any, was absent for the session. The researcher scanned the room systematically during each interval and recorded the number of academically engaged students.

Prior to the start of data collection, students were pre-exposed to the pedometers with explanations from researchers on how they work, and by wearing the pedometers during a regular recess where no data collection took place. During recess sessions, students were taken outside to the edge of the playground, and researchers placed pedometers on the students' waists, ensuring the pedometer was set to zero. At the end of the recess session, students were called back to the edge of the playground while researchers removed the pedometers from the students and recorded their final step counts, without informing the students of their scores.

After the recess session, a post-recess academic engagement session occurred inside the classroom. Just as pre-recess engagement sessions, the researcher noted the total number of participants present and recorded who, if any, was absent for the session. The researcher scanned the room systematically during each interval and recorded the number of academically engaged students.

Baseline

During baseline, the researchers released students to play after placing pedometers on their hips. To maintain a naturalistic structure for recess at school, teachers and researchers stood beside the playground in a “teacher area” and provided limited attention to students. Teachers and researchers only interacted with the students if they were injured, engaged in dangerous behaviors, or if the student was touching or playing with the pedometer. If students approached the teacher area for attention, teachers were instructed to prompt students to play elsewhere by stating, “This area is for teachers only, go play with your friends." At the end of the session, the total step count for each student was recorded without informing them of their score.

Group Game

The intervention phase incorporated a group game to enhance adult attention and increase MVPA. This game was a modified version of tag, entitled the “T-Rex game”, where the facilitator was the “T-Rex”, and the participants were the “Humans”. The intent of the T-Rex was to chase the humans, tag them, and turn the humans into T-Rexes, while the purpose for the humans was to avoid being caught by the T-Rex. Once the humans were tagged by the T-Rex, they joined the dinosaur team and their intent changed from avoiding the T-Rex to tagging humans. The implementers differentiated the T-Rex team from the human team by asking the T-Rexes to hold out their arms and make T-Rex noises like grunting and groaning while chasing the humans at recess. Once all players became a T-Rex, the facilitator would announce that the game would be starting over, so all students became humans again, while the implementer

remained a T-Rex. Directly before the first intervention session, the rules of the game were explained via a script similar to the recent study (Mercado Baez et al., in review):

Today we are going to play a game that some of you might have heard of, called the T-Rex game! You don't have to play the game, but you can always join if you change your mind. If someone playing the game is near you and you don't want to play the game, you can just tell them 'I am not playing' or 'No thank you'. To start off the game, I am going to be the T-Rex and you are all going to be humans, and if I catch you, you become a T-Rex and you have to try to get all the humans too. You will know who a T-Rex is because they will walk like this [model arms out T-Rex walk] and sound like this [model grunts and groans]. Let's all practice our T-Rex walk and noises [practice and feedback]. Once everyone has been turned into a T-Rex, we can start the game over and everyone will become humans again. One thing you should know about T-Rexes is that they have very bad eyesight and will only chase people if they see them moving. So, jumping jacks, jogging, or any other movement. Let's all practice our movement [practice and feedback]. If you hide or stand still too long, the T-Rex won't know you are playing and won't chase you, and that will become really boring. Does anyone have any questions?"

Throughout the recess session, researchers stayed in the designated play area. They also played along in the game, grunting and groaning with their arms out alongside students. While there were no consequences for students if they did not follow the rules of the game, researchers followed the rules for the entire duration and reminded students of the rules when sedentary activity occurred while waiting to be chased. For all intervention sessions aside from the first day, reminders of the game rules were explained via a different script (Mercado Baez et al., in review):

At recess today, we are going to play the T-Rex game again. Remember, you do not have to play, and you can join or leave anytime you want. Just say "I am not playing" or "no thank you" to someone if they think you are playing. Remember, T-Rex only chases humans who are moving because they have very bad eyesight so if you want to be chased, you need to be running, jumping, or climbing. Once you get tagged by a T-Rex, you become a T-Rex. And then when everyone playing is a T-Rex, the game will start over. Does anyone have any questions?

Caught Being Good Game

As the study progressed, researchers saw an overall decreasing trend in academic engagement during post-recess sessions. To show engagement can be increased, the researchers introduced a modified good behavior game, called the Caught Being Good Game (CBGG; Wahl et al., 2016; Wright & McCurdy, 2011). The CBGG was implemented during later academic engagement sessions before and after recess. This game incorporated a variable-momentary differential reinforcement of other behaviors procedure schedule (Wahl et al., 2016). The researcher assigned students into four teams during whole group instruction and then scanned the room on a variable-interval schedule signaled by a Variable Interval Timer application (Bingham, 2019) during the 5-min academic engagement session and continuing to collect PLAcheck data as usual. During small group instruction, teams were divided by their assigned table during the session. Teams were given points if all members were following classroom rules set by the teachers (Wahl et al., 2016). The team with the most points at the end of the academic engagement session had an opportunity to earn a tangible reinforcement in the form of a sticker, stamp. To implement the CBGG, researchers provided a script to teachers to introduce the contingency to students on the first day of the CBGG:

Today, we will begin a new game during our lessons. We will see how well everyone can follow the rules. The rules are to have a quiet mouth and sit with your hands in your lap. During our activity, we will play this game. [Researchers] will be paying close attention to how well you all follow the rules. I have divided the class into teams [Explain teams during whole group and small group]. [Researchers] have a special timer that is set to go off at random times. You will not know when the timer is going off, but when it does, they will look around the classroom to see which teams have all its members following the rules. The teams that are following the rules will earn a point. Whichever team has the most points at the end of the round can earn a [reinforcement].

For all academic engagement sessions including the CBGG aside from the first session of implementation, reminders of the contingencies were explained via a different script:

We are going to play the rules game again. Remember, during this game, [Researchers] will look for the teams who are following the rules to give points to when the special timer goes off. You want to earn as many points as possible. At the end of the round, whichever team has the most points at the end of the round can earn a [reinforcement].

Generalization and Social Validity

The generalization phase occurred during the final sessions of the study. This phase consisted of training the teachers to run sessions. The teachers were not only familiar with the original study and the basic components, but they observed the researchers conduct the study throughout both baseline and intervention conditions. Researchers were present if teachers had questions about data collection, as well as to ensure teachers were following the procedure correctly, and reminding them of the steps. The teachers followed the study just as described in

the baseline and group game conditions, but researchers continued to collect the pre-recess and post-recess academic engagement data in order to gain unbiased data.

Social validity reigns important in this study as the effects of the recess group game relies on the satisfaction of the consumer (Wolf, 1978). To test social validity with the students in this study, students were allowed to vote on the order of the final two sessions of generalization (Mercado Baez et al., in review). As the conditions were randomized throughout the study, the choice to play the game or not would determine social validity in the students. To certify social validity within teachers, a five-question, open-ended questionnaire was provided to ask how the study affected their classroom regarding behavior and intrusiveness.

Chapter 3: Results

Figure 1 shows the average group responding to the T-Rex game. Generally, there was an increased step count rate during group game sessions, while a consistent lower step count rate occurred without social attention during recess, similar to the previous study. During the first baseline generalization session, students encountered a bubble machine which may have increased step count rate for the session, but overall, the group game increased the step count rates of students. Figure 2 shows the average group responding to the T-Rex game by session location. Altogether, the T-Rex game showed higher step count rates throughout all four locations, while a lower step count rate occurred during all baseline sessions in each location. Figure 3 shows the percentage of on-task behavior among students before and after recess.

As there was a high level of instructional engagement throughout the study, results show while there were differences in step count when social interaction was provided, MVPA appeared to have little to no impact on academic engagement. More than half of the time, engagement appeared to be lower after recess, regardless of if intervention was presented during recess. Additionally, when the CBGG was implemented into academic engagement sessions, there was no effect in academic engagement as the data remained stable. Again, this may be a result of already high levels of engagement. As reported in Vitiello and Williford (2020), on-task behavior in the classroom may substantially change observation-to-observation.

Social Validity

The results of the vote showed that students wanted to play the recess group game as the majority indicated they would like to play during the first session of the final day. One student chose not to play the game during the vote, and one student opted out of voting. Overall, the

teachers were satisfied with the increased interactions between students and would use the intervention throughout the year.

Chapter 4: Discussion

The purpose of the present study was to evaluate a group game on MVPA, if increases in MVPA occur and if MVPA increases academic engagement, as well as the effects of social interaction between teachers and students during recess. Researchers collected data via PLAcheck to measure academic engagement and on-task behaviors before and after recess sessions, regardless of the condition presented during recess. Researchers placed pedometers on each students' hip. During baseline conditions, the researchers stood beside the playground and provided little to no direct attention, unless a student was injured, engaged in a dangerous act, or was playing with their pedometer. During intervention conditions, the researchers played a game with the students, entitled the T-Rex game. Prior to intervention, the researcher read a script regarding the rules of the game to students. The T-Rex game was a modified version of tag where the facilitator was the "T-Rex", and the participants were the "Humans". The T-Rex only chased participants who were moving. In later academic engagement sessions, a modified version of a good behavior game called the Caught Being Good Game was added to investigate a possible ceiling of engagement but showed no effect in academic engagement as the data remained stable. Results indicated an increased step count when the T-Rex game was introduced during recess, but MVPA had little to no effect on academic engagement. Various limitations of this study included possible adaptation threats to internal validity, as changes in participant behavior may have occurred as a result of observer reactivity and Hawthorne effects. It is possible the participants may have been more off-task while researchers observed during academic engagement sessions, or when the participants were informed of being observed during CBGG sessions. There may have also been carryover effects as during baseline sessions,

students began to play the game independently, while not participating during recess sessions where the group game was implemented. Some pedometers fell from students' waists, and researchers were not able to calculate the individual score within the group average rate of MVPA during the session. Other threats to internal validity are also active in this study as students may have simply increased their academic engagement due to various natural contingencies in the classroom, including which of their teachers were teaching the lesson or what activity the student was assigned to complete. Additionally, natural contingencies during recess sessions may have included the different availability at recess. For example, in some settings sand was available, and during the first session of generalization, a bubble machine was available for usage.

Lastly, future directions of this study could include setting event data, as what activity is assigned, and which teacher is instructing may alter engagement. Researchers may collect BMI data before completion of the study, as well as after all data has been collected. Furthermore, setting event data collection regarding which students are actively participating in the game and who the facilitator is may be of interest to future researchers.

Figure 1: *The average step count rate during baseline and group game sessions.*

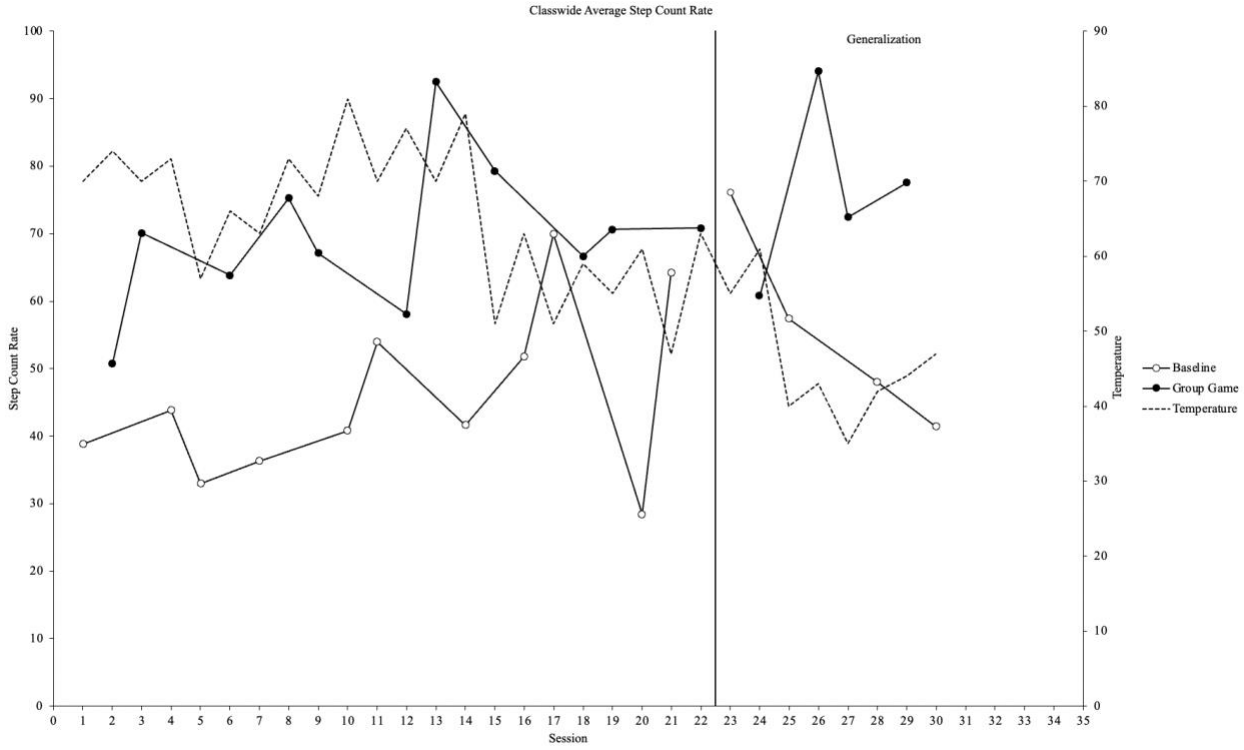


Figure 2: *The average step count rate during baseline and group game sessions by location.*

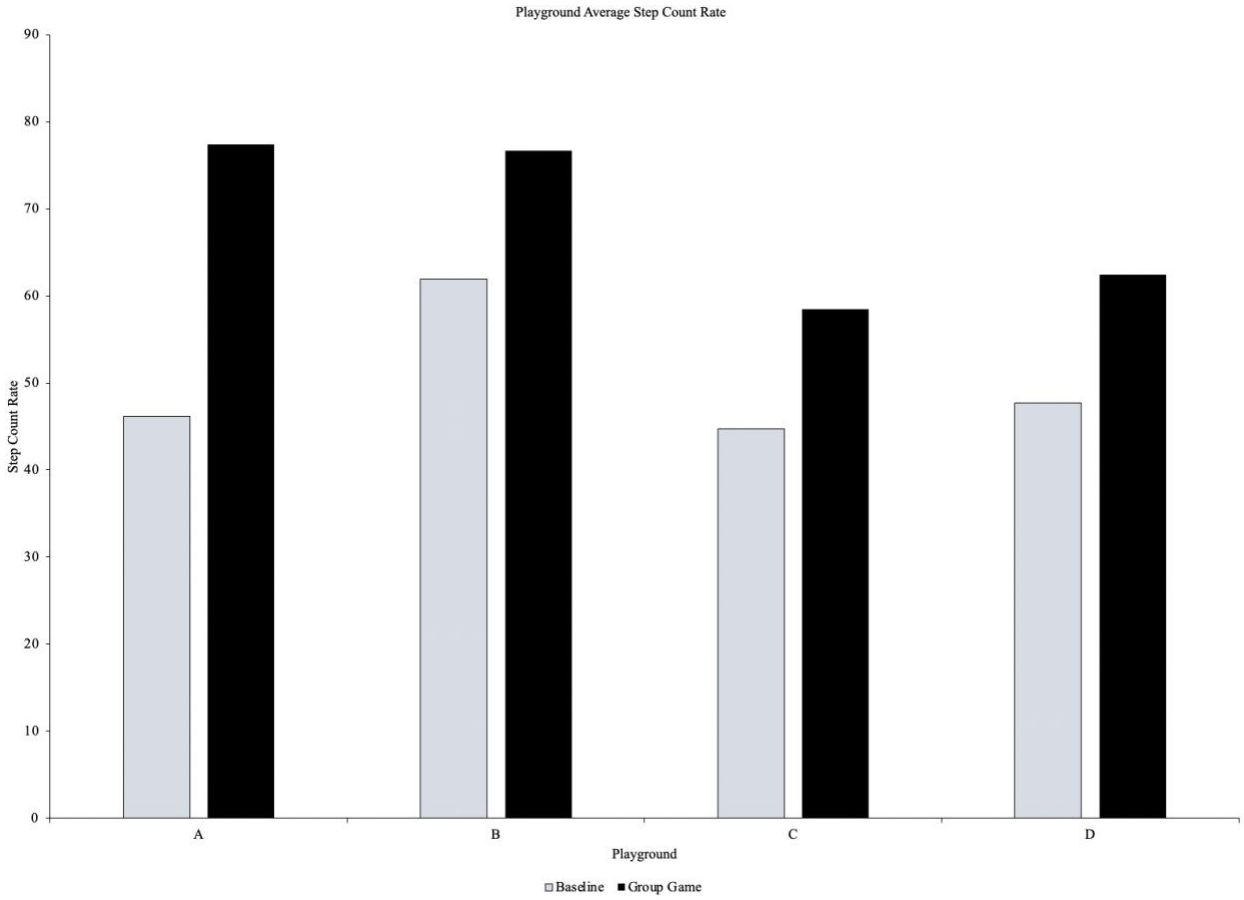
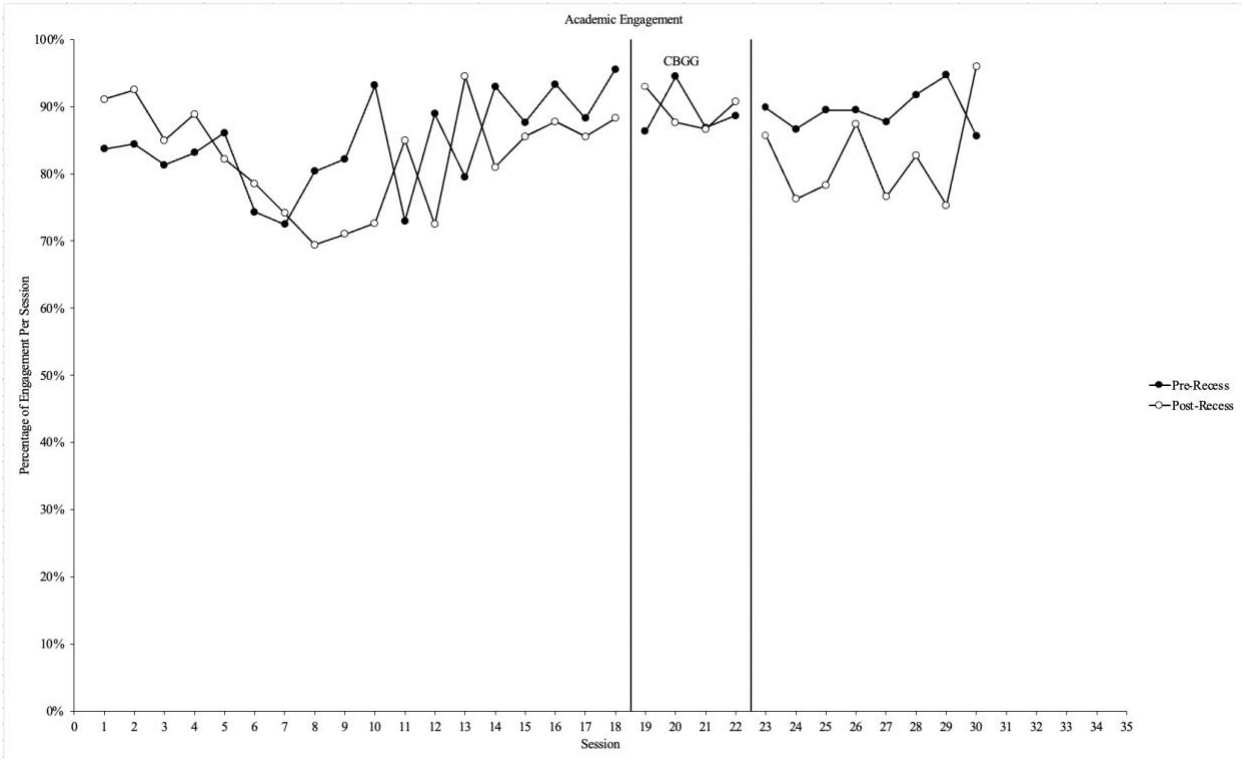


Figure 3: *The percentage of on-task behavior among students before and after recess.*



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