THE EFFECTS OF ACUTE, VIGOROUS EXERCISE ON ATTENTION

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Abstract

This study investigated the affects of acute, high-intensity exercise on student attention. Twenty-five sixth grade students received the treatment, but I focused on one student's behavior for the study. I measured the student's behavior through a time-sampling process, recording ten, thirty-second intervals as showing either problem or adaptive behaviors. The treatment was a 2-minute routine of high-intensity exercises, including running in place, squats and squats with jumping. To measure the effect of the treatment, I observed the student's behavior three days to gather baseline data. Then, I implemented the treatment three days, observing the student's behavior immediately following exercise. Although there was not a large improvement in behavior after exercise, the study showed more adaptive behaviors and fewer problem behaviors at the week than the beginning. These results suggest the importance for this student of incorporating engaging student activities at the beginning of the week.

The Effect of Acute, Vigorous Exercise on Attention

The benefits of exercise for overall health are numerous and well documented. In fact, according to the Center for Disease Control and Prevention (2011), regular physical exercise is "one of the most important things you can do for your health" (para. 1). Exercise's benefits include weight control; decreased risk of heart disease, Type 2 Diabetes, and cancer; and increased longevity. Not only does exercise improve physical wellness, it also positively affects the brain.

Studies show that exercise positively affects cognition, which in turn plays an important role in academics. In *Brain Rules*, John Medina (2008) cited studies showing, "Exercisers outperform couch potatoes in tests that measure long-term memory, reasoning, attention, problem-solving, even so-called fluid-intelligence tasks" (p. 14). As such, Medina (2008) emphasized the importance of physical activity for maintaining brain alertness as humans age. With that said, he also pointed out the implications of exercise for children, specifically in school. Similarly, Jensen (2000) discussed the positive effects of exercise on the brain, noting, "Movement increases heart rate and circulation, which often increase performance" (p. 34). Studies indicate a relationship between physical activity and various facets of academic achievement, including attention, response to stimuli and focus. Additionally, research shows positive correlations between students with high levels of physical fitness and academic achievement.

Despite the well-known benefits of exercise, Americans remain sedentary and the United States has high levels of obesity (Fedewa & Ahn, 2011). Ogden et al. (2006) noted, "Obesity rates have tripled among school-age youth in the last three decades" (p.

1550). Physical education programs and recess provide an opportunity for students to get active during the school day, yet even these opportunities are threatened. For example, only 50% of elementary schools and 25% of middle schools nationwide require physical education (Burgeson, Weschler, Brener, Young, & Spain, 2001). Additionally, only 3.8% of elementary schools, 7.9% of middle schools, and 2.1% of high schools provide daily physical education classes (Burgeson, Weschler, Brener, Young, & Spain, 2001).

While there are many studies demonstrating the relationship between exercise and academic performance, the reality is that instruction time is precious and teachers face numerous pressures for evidence of strong academic performance. As such, the effect of longer periods of exercise is not germane to general courses other than physical education. Realistically, teachers might be able to incorporate five minutes of physical activity into their classroom but probably no more. This study originally sought to examine the implementation of brief physical activity in the classroom, exploring the question, "what is the effect of acute, vigorous exercise on attention in the classroom?"

Literature Review

This chapter provides a review of the literature with regard to types of exercise, including aerobic, acute and anaerobic, and attention and engagement. While significant amounts of research have been conducted regarding the effect of exercise on cognition, little research has examined the effect of vigorous, or high-intensity, exercise on behavior.

Types of Exercise

Exercise interventions vary greatly from one study to another, but three primary categories emerge in current research and are most pertinent to this study: aerobic, acute

and anaerobic exercise. In general, aerobic activities align with moderate to long duration bouts, while anaerobic exercise is short in duration.

Aerobic Training. Aerobic exercise is defined as "an activity that uses the large muscles and involves increased breathing and heart rate over an extended period of time, usually a minimum of 20 minutes" (Sutton, 2007, p. 584). Ratel et al. (2004) defined aerobic performance as the maximal oxygen uptake and aerobic speed (p. 279). In other words, the key characteristic of aerobic training is oxygen intake, and common examples of aerobic, or cardio, exercise include running, walking and swimming. Current research focuses predominantly on aerobic exercise; according to Medina (2008), research suggests that "the gold standard appears to be aerobic exercise, 30 minutes at a clip, two or three times a week" (p. 15). For example, Hill et al. (2010) used aerobic physical exercises as one of the independent variables in their study of exercise on attention. They included activities such as "running on the spot" and "hopping sequences to music" (p. 930). Aligning with the definition as moderate intensity with increased heart rate and shortened breath, "teachers reported that participants were beginning to perspire and were slightly out of breath on its completion" (Hill et al., 2010, p. 930). Like Hill et al. (2010), Kubesch et al. (2009) also tested aerobic exercise. While they labeled their treatment, "a 30-minute PE program," this constituted "predominantly aerobic endurance exercise" (Kubesch et al., 2009, p. 237).

One reason for the predominance of aerobic exercise in this field is that studies show it has a positive effect on various aspects of cognition. Kubesch et al. (2009) provides a physiological explanation, writing that aerobic exercise leads to an "increase in serotonin release in the brain," which "may have an effect on EFs [executive

functions] that rely on 5-HT-dependent structures" (p. 237). Fedewa and Ahn (2011) took a broader view, but like Kubesch et al. (2009), highlighted aerobic exercise in particular: "Aerobic training showed significantly larger mean differences on children's cognitive outcomes than perceptual motor training or physical education" (p. 527). Another study from Harada et al. (2004) examined the effect of aerobic exercise on cognition with a treatment of 30-minutes of jogging two to three times per week for 12 weeks. The researchers found that the experimental group's test scores and reaction time improved significantly. Additionally, these measurements began to decline after the participants stopped their running regimen, thus proving the causal relationship between the aerobic exercise and cognition. Although aerobic exercise is often considered the "gold standard" of exercise, as noted by Medina (2008), acute exercise has gained popularity in educational research.

Acute Exercise. According to Labelle et al. (2012), studies regarding acute bouts of cardiovascular exercise have increased over the past few years, and Labelle et al.'s (2012) study regarding executive control and acute exercise added to that growing literature. However, despite the researchers reference to the topic's rise in prevalence, the term "acute exercise" seems to include several meanings across the board and many researchers do not define the term. For example, Labelle et al. (2012)'s independent variable is exercise intensity, and they record executive functions while participants pedal at 40, 60 and 80 percent of their peak power output. The focus on exercise intensity suggests that this is the researcher's definition of "acute exercise." However, Labelle et al. (2012) hints at a different meaning when they cite Kahneman (1973), who demonstrated that "moderate duration exercise is thought to improve cognition" (p. 10).

This brief contrast hints at Labelle et al.'s (2012) intended meaning of "acute exercise" as a brief bout of exercise. Therefore, while Labelle et al. (2012) assumes "acute exercise" is referring to the duration, Bartholomew et al. (2005) summarizes their study on acute exercise as examining "a single bout of moderate-intensity aerobic exercise." Here, it seems that Bartholomew et al. (2005) is referring not to the duration of the exercise, but the frequency. Due to the contrasting use of the term, it is important to define for this study. As such, I will be defining acute as short duration exercise (five minutes or less).

Anaerobic exercise. Despite increased interest in acute exercise, relatively few studies have focused on acute and high-intensity exercise. Instead, most studies focus on the "golden standard:" aerobic exercise, which is most often the kind of exercise incorporated in physical education programs. In contrast to aerobic exercise, anaerobic activity is usually short, lasting up to two minutes, and triggers higher levels of lactic acid formation. Anaerobic performance includes short-term muscle power, strength and speed (Ratel et al., 2004). This formation breaks down muscles; the rebuilding of muscles increase one's strength and fitness. As with aerobic exercise, studies of anaerobic exercise have showed that anaerobic, or high-intensity, exercise also have a positive impact on cognition.

Of those researchers who have studied high-intensity exercise, the majority has described a positive effect on cognition. For example, McGlynn, Laughlin, & Bender (1977) measured the effect of strenuous to exhaustive exercise on a discrimination task and showed momentarily enhancement of cognitive performance. Similarly, Winter et al. (2006) compared the effect of high impact anaerobic sprints, low impact aerobic running, and a rest period on learning performance. This research showed that "vocabulary

learning was 20 percent faster after intense physical exercise as compared to the other two conditions" (p. 597). Despite multiple studies showing the positive effects of anaerobic exercise on cognition, not all researchers are in agreement.

Labelle et al. (2012) demonstrated high-intensity exercise having a negative effect on executive control, specifically switching ability. These researchers pointed to the transient hypofrontality theory, which suggests that high-intensity activity increases the demand for resources in some brain regions. This demand diminishes resources in other areas, such as the prefrontal cortex, which plays an important role in executive functions. Labelle et al. (2012) confirmed this hypothesis, as the results showed a significant increase in errors on a psychometric test from moderate to high-intensity. Notably, Labelle et al. (2012) assessed cognition during the incremental exercise, whereas I will be interested in the effects following high-intensity exercise. Ultimately, Labelle et al. (2012) concluded that research regarding the effect of acute, high intensity exercise on non-executive processes have demonstrated mixed results. Although I will be adding to the body of research on acute, high-intensity exercise, I will be measuring its effect on students' attention, rather than cognitive processes. Furthermore, I will be observing behavior rather than using neuropsychological measures, such as reaction time.

Cognition and Psychometric Tests

Little research has been conducted using direct observation in the classroom. Instead, current research predominantly relies on psychometric evaluations of cognition. Even those studies measuring attention, which this study will observe, use psychometric tests. For example, both Kubesch et al. (2009) and Hill et al. (2010) discussed the effect of exercise on attention. Kubesch et al. (2009) categorized attention, or specifically "the

inhibition of attention and behavior," as one type of executive function, along with working memory and cognitive flexibility (p. 235). To measure these processes, Kubesch et al. (2009) used computerized flanker and dot tasks to measure the ability to ignore external distractions. For the flanker test, participants identified a directional response (left or right) for a target stimulus, which is surrounded by incongruent, congruent or neutral images. Similarly, the dots task also required participants to press a key either on the same or on the opposite side of the stimulus. Like Kubesch et al. (2009), Hill et al. (2010) also examined attention as a cognitive process. They administered psychometric tests that were definable as "mental tracking tasks," which included "paced serial addition, size ordering, listening span, digit-span backwards, and digit-symbol encoding" (p. 930). Since both research groups examined attention as a cognitive process, they used quantitative, neuropsychological tests as measurement tools. While these processes are indelibly tied to academic ability and performance, psychometric tests are inherently disconnected from the realities of a classroom. A student's ability to recall a jumbled sequence of different sized objects in size order (size-ordering test) is much different from a student's ability to refrain from talking to his desk-mate and track the teacher.

Direct Observation

Few studies regarding exercise and learning have used direct observation; however, Mahar et al. (2006) is one study to have done so. Mahar et al. (2006) observed on-task behavior during instruction time before and after classroom Energizers, which are short classroom-based activities. Each day, observers recorded student behavior in one minute intervals, noting whether students exhibited on task, motor off-

task, noise off-task, or passive/other off-task behaviors. Their findings indicated that the Energizers improved on-task behavior.

Although psychometric tests are the dominant measurement tool for studies regarding exercise and academic performance, research focused specifically on student attention frequently utilize direct observation methods. Lauth, Heubeck, and Mackowiak (2006) used the Munich Observation of Attention Inventory (MAI) to contrast the behaviors of students with ADHD problems from their classmates. They observed each student three to eight times for five second intervals, during which, they observed which behaviors the student predominantly displayed including: actively disruptive; passive, inattentive; expected behavior, inconspicuous; self-initiated activity; or other-initiated activity (Lauth, Heubeck, & Mackowiak, 2006). Similarly, Friedman, Cancelli, and Yoshida (1988) and Scope et al. (2007) also used direct observation to compare academic engagement and attention for students with learning disabilities and those without. Notably, Friedman, Cancelli, and Yoshida (1988) showed that attention is more strongly related to the classroom setting rather than an unchanging characteristic of the student. This finding indicates that adjusting the classroom setting through exercise has the potential to influence attention.

Summary of Literature Review

Research suggests that acute, high-intensity exercise improves children's physical fitness, including both aerobic and anaerobic capacities (Ratel et al., 2004). With regards to education, studies have demonstrated a positive correlation between physical fitness and academic achievement (Coe et al., 2006; Van Dusen et al., 2011). Additionally, numerous studies have demonstrated that exercise has a positive effect on brain

processes, with a narrower body of research showing the positive effects of high-intensity exercise on cognition. However, the current emphasis on cognitive performance, usually measured through psychometric testing, is disconnected from the realities of the classroom. How does a student's reaction time to a simulated "beep" translate to their behavior and performance in class? As such, my research question is: how might acute, high-intensity exercise effect attention?

Methodology

Sampling Procedures

One class of sixth grade students (ages 9-12) from a public middle school participated in this study. It was comprised of 25 "highly gifted" students, meaning they have an IQ of 144 and above as identified on tests given the Bellevue School District and are in the top .5 percent of intelligence. This group is a part of Odle Middle School's Prism program and met from 8:40 to 9:30 during the week. Participation in this study was optional and required informed parental consent (see Appendix A).

Although the entire class performed the treatment, one specific student was the focus of the study. Student M, who will be referred to as 'Samuel,' is often distracted in class and displays a high level of energy. He often misses instructions because he is doing another task while the teacher is talking. His off-task behavior is mostly task-oriented, such as doing work from a different class, shredding paper into small pieces, or bending paper clips. Given that his behavior is usually body-kinesthetic rather than interpersonal, this suggests that he has a high level of energy. Based on these characteristics combined with previous research on the effects of exercise on attention,

this seemed to be one type of student who would benefit the greatest from exercise in the classroom.

Research Design

This case study used a single-subject design, because Samuel served as his own control and experimental groups. This design was chosen so that I could focus on one student, rather than comparing groups of subjects. Single-subject designs are often used in social research and this design is effective for measuring behavioral change. I gathered baseline data on Samuel to measure behavior prior to administering the treatment.

Instruments

I used a behavioral observation protocol to measure Samuel's attention and focus, modeled after the assessment used by Sandberg (2009): the Behavior Assessment System for Children, Second Edition (BASC-2) (Reynolds and Kamphaus, 2004). I collected data on Samuel over a four-week period during spring semester 2014. The time sampling occurred six times: three to establish a baseline and three for treatment. Sampling occurred during class periods with direct instruction at the beginning of the period, in order to control the context during which behavior was measured.

Procedures

I observed Samuel for thirty-second intervals and recorded his behavior for each interval as either *adaptive* or *problem.* Actions such as actively listening to the teacher, tracking the speaker, taking notes, and following the teacher's instructions characterized "adaptive behavior." Problem behavior included "inappropriate movement, inattention, [or] inappropriate vocalization" (Sandberg 2009). Samuel's most common forms of off-

task behavior included inappropriate movement and inattention. For each day of observation, I observed Samuel for 10 consecutive 30-second time samplings.

In the first two weeks of the study, I observed Samuel three times: on Wednesday and Thursday the first week, then on Friday the following. I did not conduct observation consecutively because I chose the sampling days based on the flow of the week's lessons. To control the context during which behavior was measured, I observed Samuel on days when there was an extended period (at least ten minutes) of direct instruction. I completed baseline observations when there was no exercise integrated into the class period.

After three baseline observations, I administered the treatment in three class periods over the course of the next two weeks. As with baseline observations, treatment and its corresponding observations occurred periodically over the two-week span according to class structure, so that behavior was measured during direct instruction. At the beginning of the class period, the whole class performed the circuit of exercises developed for this study. I specifically designed the intervention for the classroom to account for limited space and time. The exercises were similar to plyometric training, a specialized method of conditioning that "conditions the body through dynamic movements" (Faigenbaum et al., 2009, p. 37). This routine included a mix of conditioning, such as body weight squats, as well as aerobic exercise, such as running in place, therefore engaging muscular strength as well as quickly increase heart rate. The exercise duration was approximately two minutes and progressed through the following routine:

1. 30 seconds running in place, alternating between a slow and fast pace

2. 15 squats
3. 10 squat jumps

Methodology Rationale

Quantitative research often stems from a positivist philosophy, which asserts that knowledge is observable and quantifiable. Another philosophical assumption underlying this study is that exercise has a great effect on the human body. This assumption is both philosophical in nature and quantitative, given that the effects of exercise have been observed and quantified through measurements such as heart rate, weight and a variety of test scores. Just as these assumptions emphasize observation and quantifiable information, this study sought to examine the effect of exercise on attention through similar measures. Given that an individual can demonstrate aspects of attention through observable behaviors, such as adaptive and problem behaviors, and given this study's interest in the causational relationship between these two variables, a quantitative approach was appropriate for this study.

Data Analysis Methods

I analyzed data by counting the intervals categorized as problem and adaptive behaviors, as well as the number of shifts between these two behaviors for each five-minute observation period. I recorded shifts in attention because they demonstrate another aspect of attention, as they reveal a change in focus. For example, they show whether Samuel frequently shifted between adaptive and problem behavior or whether he stayed in one behavioral pattern for a longer period of time. In addition to the number of problem and adaptive behaviors, I also analyzed the data according to the day of the week.

Results

Figures 1 and 2 illustrate the change in problem behaviors as a result of treatment. During the baseline observation, Samuel had an average of six problem occurrences (see Figure 1) After implementing exercise, the number of problem behaviors increased on the first day of treatment with seven occurrences, but decreased to three and five occurrences on days two and three of treatment, respectively (see Figure 1). As a whole, the total number of problem behaviors decreased from 17 during the baseline observations to 15 after treatment (see Figure 2). As such, problem behavior decreased slightly following treatment.

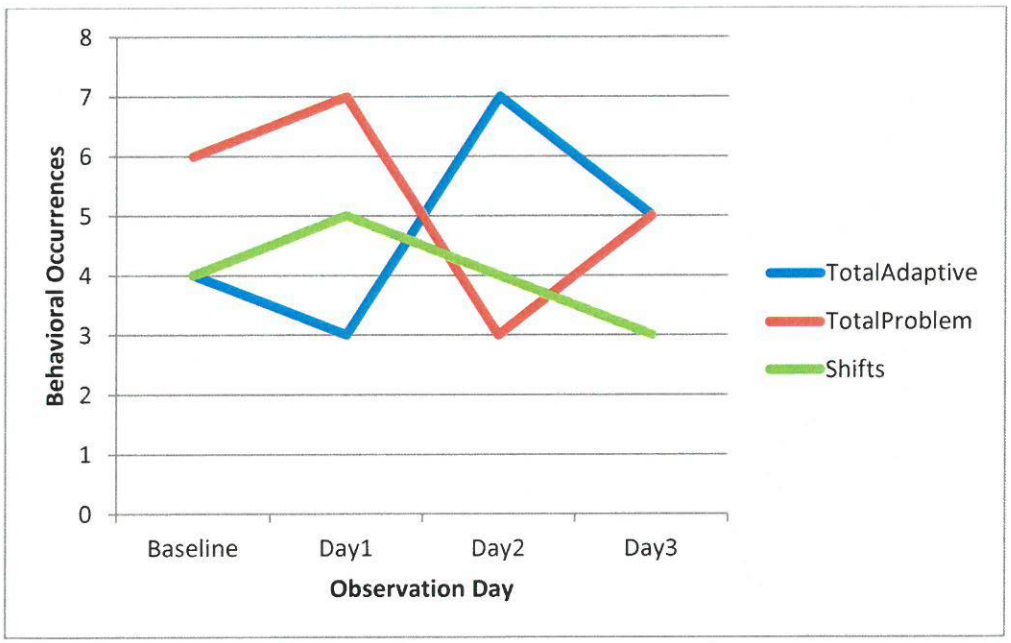

Figure 1. Behavioral Occurrences by Treatment Day. This figure illustrates the number of adaptive and problem behaviors as well as shifts during baseline observation and treatment days.

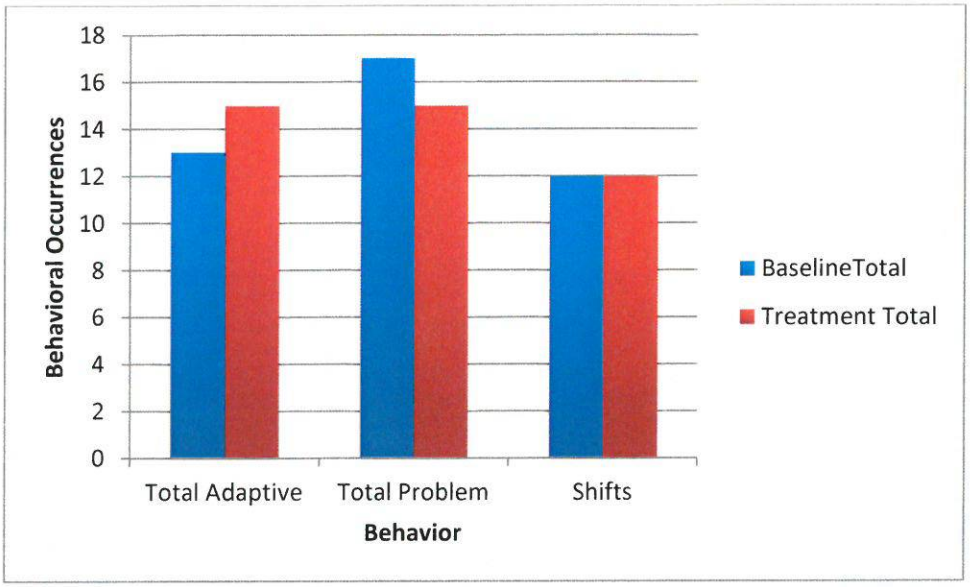

Figure 2. Total Behavioral Occurrences During Baseline and Treatment Observation. This figure illustrates the total adaptive and problem behavior as well as shifts in behavior for the combined baseline and treatement observations.

Just as Figures 1 and 2 illustrate a slight decrease in problem behaviors, these graphs also show a slight increase in adaptive behaviors. There was an average of four adaptive behaviors for the baseline observations (see Figure 1). Once exercise was implemented the total adaptive behaviors decreased from four to three on the first day of treatment. However, adaptive behaviors increased to seven and then five on the second and third days of exercise (see Figure 1). There were 13 total adaptive behaviors during baseline observations, which increased to 15 adaptive behaviors for the three experimental days, combined (see Figure 2). This shows a slight increase in the total adaptive behaviors after treatment.

Although Samuel's attention improved slightly after treatment, the total shifts in behavior remained the same during baseline and treatment days. The total shifts in behavior during baseline observations as well as following treatment were 12 (see Figure

2). Additionally, on a day-to-day basis, shifts in behavior changed minimally. The average shifts in behavior during baseline observations was four, which increased to five on the first day of treatment and then fell to four and three occurrences the last two days of treatment (see Figure 1). The decreasing shifts in attention, albeit small, corresponded with the decrease in problem behaviors. As problem behaviors decreased slightly following treatment, so did shifts in attention.

Although Samuel's change in behavior following treatment was minimal, the data showed a stronger change in behavior based on the days of the week when behavior was observed (see Figure 3). I observed Samuel once on Tuesday and Wednesday and twice on Thursday and Friday. On Tuesday and Wednesday, Samuel had a total of seven and nine problem behaviors, respectively (see Figure 3). However, problem behaviors dropped to five and three on Thursday and Friday, respectively (see Figure 3). Inversely, Tuesday and Wednesday had three and one adaptive behaviors, which decreased to five and seven the last two days of the week. Behavioral shifts remained fairly close to the mean throughout the week, with five, two, four and four occurrences (see Figure 3).

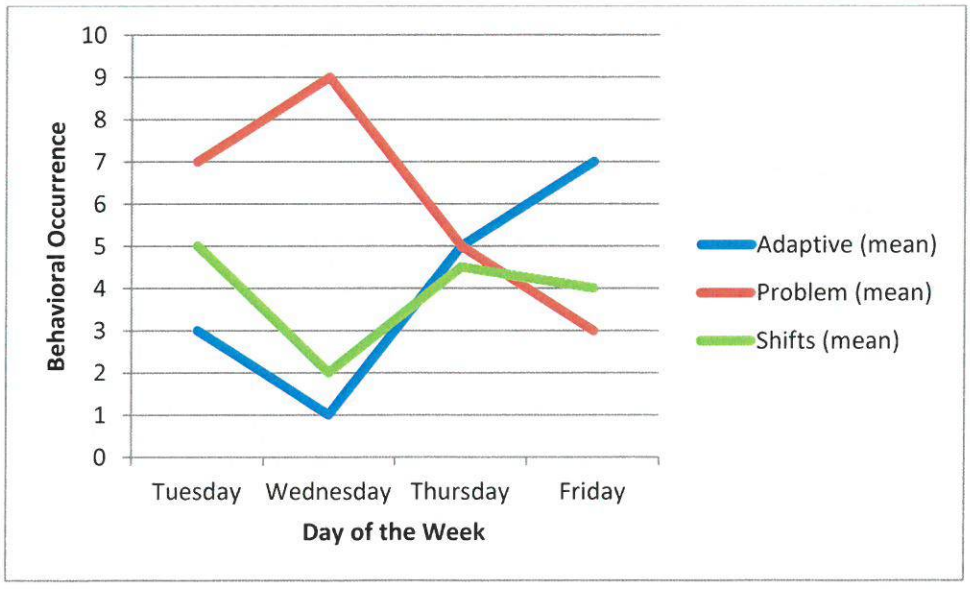

Figure 3. Behavioral Occurrences by Day of the Week. This figure illustrates the total number of adaptive and problem behvaiors as well as shifts in attention for each day of the week on which I observed Samuel.

Discussion

This section reports the discussion of findings, implications of the data, recommendations for future practice, and the limitations of the study.

Discussion of Findings

The original focus of this study was to examine the effects of brief, acute exercise on attention. Focusing on Samuel in particular, the study did not show large improvement in behavior as a result of exercise. Although exercise did not strongly increase Samuel's attention, previous research still supports incorporating physical activity or movement in the classroom. Additionally, other students voiced enjoyment in doing the exercise, with one student asking if we could continue doing the movements. As such, it would be beneficial to continue incorporating movement or physical activity into the classroom.

Although this study did not show a strong effect of exercise for Samuel, the study did show a pattern in his behavior and the day of the week. The results showed that Samuel's attention improved later in the week, as the number of adaptive behaviors increased and problem behaviors decreased throughout the week. This aligns with previous research about the affect of day of the week on student performance. For example, Cornbleth and Korth (1980) found that "language and math showed patterns of decreasing pupil involvement, particularly between Tuesday and Thursday" (p. 322). Furthermore, they found the lowest point for student involvement in language and math

studies was Thursday (Cornbleth and Korth, 1980, p. 322). This is notable, since I assumed that student focus would decrease progressively throughout the week, starting strong on Monday and fading by Friday in anticipation of the weekend. Additionally, a study by Peters (1984) suggested that student test scores were higher when tested on Wednesday than Monday. With the exception of these tests, most literature in this area focused on the effect of day of the week on mood. As such, there is room for further study on the effect of day of the week on student performance and behavior. Additional studies might also look to identify the cause of performance and behavior variance.

Although it is unclear why Samuel demonstrated more on-task behavior later in the week, there are several possible explanations. This finding raises the possibility that direct instruction at the beginning of the week is more focused on reviewing old material or introducing new material. As such, Samuel might be more interested and invested in the content later in the week, therefore better holding his attention. Additionally, this class often incorporated simulations, which were more likely to occur toward the end of the week than the beginning. Even with direct instruction before continuing a simulation, Samuel might have been more engaged due to the explorative and hands on nature of the upcoming simulation.

Based on the data and the possible explanations for Samuel's increasing focus throughout the week, I plan to adjust my instruction to account for lesser attention at the beginning of the week. Prior to this study, I assumed that most students would be less focused at the end of the week, in anticipation of the weekend. However, this study shows that Samuel may display less focus at the beginning of the week instead. In response, I might incorporate anticipatory sets more frequently at the start of the week, in

order to more effectively gain Samuel, and other similar student's, attention. Additionally, I might frontload engaging student activities, such as simulations, at the beginning of the week and shift direction instruction to the end of the week, when possible. This study also suggests that Samuel might respond better to shorter periods of direct instruction at the beginning of the week than at the end of the week.

Combined with the previous research on student engagement, this study also reminded me the importance of using teaching strategies that are meaningful and engaging, especially given the ebb and flow of student attention in class. Samuel's attention fluctuated during the periods of direct instruction from Monday to Thursday, which demonstrates a need to adjust instruction to continue engaging students according to their needs. Not only does the day of the week seem to effect student attention, Cornbleth and Koth's (1980) study suggested that the kind of learning activities also influence student attention. They found that student involvement was higher on Friday when "time creating, conferences with the teachers, and projects and games was greater" (Cornbleth and Koth, 1980, p. 322). As such, I will look to be constantly adjusting my instruction to meet the needs of my students in order to maintain student engagement and thereby increasing attention. One of the ways I can do this is through activities where students are authentically and actively engaged in their learning, such as group work, discovery activities, games, and simulations.

Limitations

The experiment was conducted on days when there was an extended period of direct instruction. Although this was done to control for the context during which I observed Samuel, I did not collect data according to a precise schedule. Additionally,

this scheduling limited the number of treatment days because the class began a simulation activity that greatly decreased the amount of direct instruction. Experimenter bias posed a threat to this experiment's validity because I conducted the observations, rather than an objective third party.

This experiment design also poses logistical challenges that, although not an issue during this study, could impact validity in future studies. For example, certain types of clothing might inhibit students from participating in the treatment. Additionally, students could have medical conditions, such as asthma or diabetes, which might make them unable to participate in the treatment. Constraints such as these have the potential to impact validity because they might impact the random selection process or require a student to sit out of the treatment, leaving the data incomplete for that student.

Future research could address some of these limitations by building in direct teaching time to sequential days in order to observe and administer treatment with a precise schedule. Alternatively, future research could add a level of analysis by categorizing the classroom context surrounding the observation and treatment, and therefore conduct the experiment regardless of the lesson schedule. For example, future researchers could observe students and lead exercise at the same time of day for three weeks, but record whether the students were working in groups, working independently, or following direct instruction. Additionally, a second observer as well as increased subjects and samplings in future studies would help address some of these limitations.

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Appendix A

Participation Consent Form

Dear Parent/Guardian,

Your student is invited to participate in a research study conducted by Dana Kemp, a student in the Masters in Teaching program at Northwest University. The study is being conducted as a class requirement for EDMA 5682, Educational Research Methods and Applications. The purpose of this study is to examine the effects of brief, vigorous exercise on attention.

If you agree to participate in the study your student will periodically exercise for two minutes during class, including jogging in place, squats, and squat jumps. This study will last three weeks.

There are minimal risks associated with participation. There may be risks involved for individuals with health conditions. You may choose for your student to not to participate in this research study. The benefit of taking part in this study is the opportunity to participate in the research process as a research subject.

Participation in this study is voluntary. You may choose for your student to not to participate in this study at any time and for any reason. There will not be any negative consequences for you if your student does not participate. All participants' information will be anonymous. You may keep this consent form for your records. By participating in this study, you are giving permission for your students' data to be used in this research study.

The results from this study will be presented for the School of Education at Northwest University. All data forms will be destroyed July 23.

If you have any questions about this study, please contact me at dana.kemp12@northwestu.edu or 425-456-6624. If you have further questions, please contact my faculty advisor, Jeremy Delamarter at Jeremy.Delamarter@northwestu.edu. You may also contact the Chair of the Northwest University IRB, Dr. Kevin Leach, at kevin.leach@northwestu.edu or 425-889-5248.

Thank you for your consideration of this request.

Dana Kemp
Dr. Jeremy Delamarter

I agree to allow my student to take part in this project. I understand what this project involves and that my student may stop at any time.

_____

Student Name (printed)

_____

Guardian Name (printed)

_____ _____

Guardian Signature Date