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Brain Breaks and Student Engagement

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Abstract

The purpose of this action research project was to determine the relationship between brain breaks and student engagement, specifically on-task and off-task behaviors. The participants included 23 twelve and thirteen-year-old students who attended a middle school in Nebraska. Students participated in a 3-4 minute brain break movement activity during the 10 day intervention period. Brain breaks consisted of GoNoodle mirrored dances or "Would You Rather" guided movement activities. Data was collected by the researcher using a tally-mark system to indicate the occurrence of off-task behaviors. The study found that the implementation of brain breaks did have a positive effect on students' engagement by decreasing off-task behaviors.

Brain Breaks and Student Engagement

Physical activity has been shown to have positive effects on children's motor development, physical fitness, cognition, attention, learning, academic achievement, and mental health (Mok et al., 2020). Furthermore, physical activity helps children to develop healthy habits that can follow them into adulthood (Cline et al., 2021). Despite these important benefits, recent studies have found that only about 42% of children meet the World Health Organization's physical activity guidelines of 60 minutes a day of moderate-to-vigorous physical activity (Abi Nader et al., 2019). Physical inactivity is one of the leading causes of childhood obesity and other health-related issues associated with sedentary behaviors (Parera et al., 2015). Based on these alarming trends and the vast benefits of regular physical activity, parents, educators and other stakeholders must work together to encourage and guide children to develop a healthy lifestyle as they enter into early adulthood.

Schools have been identified as an important place to incorporate and promote physical activity, due to the significant amount of time per year children spend in an educational setting. Roughly 95% of children across the United States are enrolled in school and, on average, spend about 30 hours per week in an educational setting, making it a prime place to encourage physical activity (Cline et al., 2021; Whitt-Glover et al., 2011). Furthermore, school-based physical activity comes at no cost to parents and provides students with access to important health and fitness related programs and interventions, regardless of their socioeconomic status (Wilson et al., 2015). School-based physical activity can be helpful in not only preventing obesity, but also assisting schools in meeting their academic goals.

The No Child Left Behind Act of 2001 has made it challenging for teachers to implement opportunities for students to be physically active throughout the day, due to an increased focus

on academic achievement and standardized test scores (Mok et al., 2020). Many schools have felt pressured to decrease opportunities for students to be physically active in order to increase time for academic instruction (Bailey & DiPerna, 2015). As a result, children spend the majority of their school day sedentary (Watson et al., 2019). When children are sedentary for long periods of time, they can easily become disengaged, which can affect their academic performance and overall classroom behavior (Wilson et al., 2015). This can negatively impact the classroom environment for both teachers and students (Owen et al., 2016). Because of this, it is important for educators to find new ways to encourage and integrate opportunities for physical activity into the classroom to support student engagement, academic achievement and the overall health of students (Podnar et al., 2018).

Short movement breaks, commonly referred to as brain breaks, are one strategy that can be used by classroom teachers to encourage physical activity while providing students with an opportunity to take a structured break from academic demands. Examples of simple brain breaks can include quick activities such as running in place, walking, jumping jacks, dancing, yoga, mindfulness, guided breathing, stretching and other activities that provide students with an opportunity to relax their brain. Brain breaks have been shown to improve student concentration, engagement, classroom behavior and overall academic achievement, all while providing beneficial amounts of physical activity (Perera et al., 2015).

The older students get, the fewer opportunities they have for movement breaks such as recess and play time throughout the day (Owen et al., 2016). According to a study conducted by researchers at UC San Diego School of Medicine, “children’s moderate-to-vigorous physical activity decreases by greater than one-third as they age from 9 to 15” (Edwards, 2008). Studies have also found that participation in organized sports and other recreational activities outside of

school declines as children enter into early adulthood. This can be due to lack of interest or an increasingly busy schedule (Lounassalo et al., 2019). Over the past decade, an increase in technology has also contributed to an increase of sedentary behaviors. Outside of school, young adults spend around 5-7 hours per day on a digital screen (Rosenkranz et al., 2020). According to Bailey and DiPerna, "without opportunities for school-based physical activity, approximately 50% of children will not achieve the minimum recommended amount of daily physical activity" (2015, p. 481). All of these factors, among others, have made it increasingly difficult for young adults to achieve the daily recommended amount of physical activity.

Based on these factors, there is a growing need for educators to find ways to incorporate more opportunities for physical activity within the classroom. Many of the cognitive, nutritional and physical activity habits that children acquire during this time period follow them into adulthood (Cline et al., 2021). Because of this, it is crucial to help young adults develop a healthy and physically active lifestyle. Overall, physical activity is associated with numerous physical and cognitive benefits among school aged children. By incorporating a structured 3-minute daily brain break midway through a lesson, the researcher plans to examine the effects of the brain break intervention on 7th grade students' engagement and overall behavior within the classroom. The findings from this study can be used to improve teaching practices in a way that positively affects the learning environment for both teachers and students, while also promoting the importance of physical activity.

Literature Review

Introduction

There is a growing body of research surrounding the importance of physical activity for children and young adults. Participation in physical activity is associated with multiple cognitive, academic, behavioral, and health benefits, all of which are important aspects of growth and development throughout adolescence (Stylianou et al., 2016). There are many pieces of available literature that discuss the academic, behavioral, physical, mental and social benefits of providing students with short physical activity-based breaks throughout the day. According to Mok et al. (2020), "existing literature emphasizes the positive effects of physical activity on children's motor development, physical fitness, cognition, attention, learning, academic achievement, and mental health" (p. 2).

Decrease of Physical Activity

The Center for Disease Control, American Heart Association and the World Health Organization all recommend that children ages 6-17 participate in at least 60 minutes of moderate-to-vigorous physical activity per day (Cline et al., 2021; Mok et al., 2020; Stylianou et al., 2016). Currently, only 42.5% of 6–11-year-olds, 7.5% of 12–15-year-olds and 5.1% of 16–19-year-olds meet these recommendations (National Physical Activity Plan Alliance, 2018). Overall, many researchers agree that this alarming trend of inadequate physical activity must be addressed (Abi Nader et al., 2019; Mok et al., 2020; Perera et al., 2015; Phillips et al., 2016; Podnar et al., 2018; Rosenkranz et al., 2020; Tumynaitė et al., 2014).

A growing body of literature has identified schools as an ideal setting to promote and incorporate opportunities for students to be physically active due to the amount of time per day spent in the classroom (Abi Nader et al., 2019; Bailey & DiPerna, 2015; Cline et al., 2021; Egger

et al., 2019; Mok et al., 2020; Perera et al., 2015; Podnar et al., 2018; Rosenkranz et al., 2020; Stylianou et al., 2016; Watson et al., 2019 & Wilson et al., 2016). Despite the numerous benefits and feasibility of incorporating physical activity into the school setting, efforts to 'sell' the proposal to school administrators have had little success in the past (Wilson et al., 2016). It is also important to note that, to date, there have been only a limited number of studies that have examined the overall physical activity levels of students throughout the course of the school (Podnar et al., 2018 & Wilson et al., 2015). Because of this, researchers suggest that additional studies should focus on evaluating new ways to promote and encourage schools to integrate physical activity into daily activities (Podnar et al., 2018).

Bailey and DiPerna (2015) conducted an 11-week-long study to determine the effects of classroom-based exercise breaks on first and second grade students' physical activity levels. Throughout the course of the study, students wore New-Lifestyles Accelerometer Activity Monitors to measure students' daily physical activity levels (Bailey & DiPerna, 2015). Three first grade and 3 second grade classes participated in the study. During the, 6-week, baseline data collection period, students wore monitors but did not participate in any energizer brain breaks. During the 5-week intervention period, teachers were responsible for leading two 10-20 minute energizer brain breaks at some point during the day. A researcher observed implementation once a week and was responsible for collecting data from the monitors at the end of every week. The study concluded that energizer brain breaks significantly increased the participants' daily steps (Bailey & DiPerna, 2015). This supports their claim that, without adequate opportunities for physical activity throughout the school day, approximately 50% of children do not achieve the recommended daily amount of physical activity.

As physical activity levels continue to decline across the United States, some researchers are concerned that children in rural areas face additional barriers in meeting the recommended daily amount of moderate-to-vigorous activity. Baker et al. (2017) believe that rural communities lack important environmental resources to promote physical activity and continually fail to implement appropriate policy changes. In 2014, Baker et al. (2017) worked together with the "Healthier Missouri Communities" (Healthier MO) to examine and address the best ways to facilitate the dissemination of school-based environmental and policy interventions to increase physical activity across 4 elementary schools in rural, southeast Missouri. The effects of increased physical activity and students' behaviors was also examined.

Public health training, professional development opportunities, and a school committee consisting of administrators, teachers and school nurses, was established to identify necessary interventions. Walking tracks and new playground equipment was added to 3 elementary schools and the implementation of brain break activities took place in all 4 of the schools. Qualitative interviews with teachers and students and quantitative data collected from activity monitors found that the addition of walking tracks, playground equipment and brain breaks helped to increase physical activity levels and decrease behavioral issues across all 4 schools (Baker et al., 2017, p. 542). Other rural schools across the country can use the results of this study to address barriers related to lack of physical activity.

"According to the most recent U.S. report card on physical activity for children and youth, American schools received a grade of D- on physical activity support, as only 20-26% of schools are currently offering quality physical education programs and taking advantage of physical activity opportunities" (Rosenkranz et al., 2020, p. 346). In a study conducted by Parera et

al. (2015) teachers were surveyed to examine the effectiveness of the physical education programs in 379 elementary schools across the state of Oregon. Survey results found that 92% of Oregon elementary schools did not meet the recommended state PE time of 30 minutes/day or 150 minutes/week. The schools reported that, on average, the length of physical education was 70 to 75 minutes/week. Furthermore, only 70% of schools reported they had a specialized physical education teacher in building. The other 30% of schools relied on untrained classroom teachers or teaching assistants to lead physical education classes. The lack of adequate opportunities for children to participate in quality physical education programs is cause for concern as physical activity levels in the youth continue to decline.

Implications for Practice

Carlson et al. (2015) conducted a study from Fall 2013-Spring 2014 to determine the relationship between implementing classroom physical activity breaks and elementary students' overall levels of daily physical activity. The study, consisting of 1,322 1st through 6th grade students, took place within 6 elementary school districts in California. Participating teachers had students participate in a daily 10-minute moderate-to-vigorous physical activity break (MVPA). Students wore Actigraph accelerometers during the school day to measure their physical activity levels. Results of the study found that the average students' physical activity levels during the school day increased from 25.5 to 27.8 minutes/day when given the opportunity to participate in a MVPA break (Carlson et al., 2015). The results of this study suggest that regular classroom teachers can play a role in helping students to increase their daily physical activity levels throughout the school day.

A 12-week long quasi-experimental study, conducted by Podnar et al. (2018) examined the effectiveness of classroom-based physical activity breaks on elementary students' on-task behaviors and PA levels throughout the school day. 149 total students in grades first through fourth participated in the study. Throughout the course of the study, both the control and experimental groups wore SenseWear Armbands to collect data concerning physical activity levels and energy expenditure throughout the day. Daily lessons were also recorded for researchers to observe students' classroom behaviors. Starting week 5, the experimental groups participated in the intervention of a 5-minute HOPSports classroom-based physical activity break between the 20th-25th minutes of a lesson. Results of the study indicated that in both the control and experimental groups, there was a small, non-significant increase in students' overall physical activity levels when participating in the breaks. However, the experimental groups' on-task behavior increased significantly by 9% after participating in the physical activity break whereas the control groups' on-task behavior decreased by 4% during the same time period (Podnar et al., 2018). "These findings suggest that five minutes of physical activity might not be enough to produce a significant increase in the total daily in-school physical activity levels" (Podnar et al., 2018, p. 258). Because of this, more research must be done to examine these claims.

Active Video Games

Active video games are one intervention that can be used to encourage children to participate in physical activity. Active video games require students to use their hands, feet and other full body movements to depict movements closely related to activities performed in everyday life, such as dancing, cleaning household objects or playing a variety of different sports. Tumynaitė et al. (2014) conducted a 3-month study, consisting of 113 elementary-aged children, with the purpose of examining the relationship between video game-based active breaks and its

effects on sedentary behavior. The experimental group participated in a daily 5-9-minute-long animated video simulation, meant to replicate popular video games. Students ʾoverall physical fitness levels were determined both pre and post-interventions using a series of 9 physical fitness tests and the Health Behavior of School Children (HBSC) questionnaire, filled out by both classroom teachers and researchers. Results of the study found that the active video games helped to decrease sedentary behaviors by 17 minutes in the experimental group. These findings suggest that implementing active video games into the classroom is one possible solution to increase physical activity during the school day.

A systematic literature review, consisting of 38 studies, found that "the integration of video games into physical activities improved the overall health outcome of students by 42% (Primack et al., 2012, p. 633)." Since many children are interested in video games, this highly engaging intervention is one possible solution that can be used to promote opportunities for children to be physically active throughout the school day.

Beemer et al. (2019), conducted a study in Detroit, Michigan that examined the effectiveness of using gamification elements, such as goal-setting, feedback, and external rewards, to promote participation in physical activity. 292 total students in nine different 3rd-9th grade classrooms, participated in the study. During the 7-week baseline data collection, students participated in 4 regular, 5-minute physical activity breaks per day. During the 13-week intervention period, students were given challenging weekly goals to achieve as a class. Completion of the goals would allow students to advance levels. Trained observers used the System for Observing Leisurely Activity in Youth (SOPLAY) instrument to gather and analyze data. The results of the study found that there was a 27% increase in students' overall moderate-to-vigorous physical ac-

tivity levels from baseline to the gamification intervention. Furthermore, 55% of students participated in 20 or more minutes of moderate-to-vigorous physical activity per day, compared to just 25% of students during the baseline. The results of this study suggest that gamification of activities can be an effective way to increase opportunities for students to be physically active throughout the day.

Brain Breaks

Short classroom-based physical activity breaks, commonly referred to as brain breaks or energizers, are another cost-effective, common intervention that can be used to provide students with opportunities to be physically active throughout the day. These breaks can easily be implemented during transitions, integrated with academic lessons or take place in the form of unstructured recess (Abi Nader et al., 2019). Brain break activities can include, but are not limited to, guided stretching, mindfulness, strength and core workouts or aerobic exercises (Perera et al., 2015). Overall, many researchers agree that brain breaks can help to improve student behaviors, academic achievement, time on task and overall physical and mental health (Abi Nader et al., 2019; Cline et al., 2021; Egger et al., 2019; Emeljanovas et al., 2018; Mok et al., 2020; Perera et al., 2015; Phillips et al., 2016; Podnar et al., 2018; Rosenkranz et al., 2020; Tumynaitė et al., 2014 & Wilson et al., 2016).

In 2012, Perera et al. (2015) worked together with the Healthy Youth Program of Oregon State University to develop a DVD consisting of multiple guided exercises that teachers could use as brain break activities within the classroom. The DVDs were given out to 17 elementary schools in 14 school districts across the state of Oregon (Perera et al., 2015). Participating teachers were asked to show students a 5-7 minute video clip at least once per day during class time, for a period of 4 weeks. Upon completion of the 4-week intervention, teachers filled out a 2-page

questionnaire to assess their perceptions of the brain break activities. The results found that 91% of teachers perceived that the Brain Break video segments improved students' focus, and concentration, 95% of teachers believed that their students enjoyed participating in the breaks and 91% of teachers intended to continue using the Brain Breaks, even upon completion of the study (Perera et al., 2015). The results of this study show that brain breaks can be used as a simple and effective intervention to increase students' engagement, and on-task behaviors.

In 2020, Cline et al. (2021) conducted a 10-week, mixed-methods study in Gloucestershire, United Kingdom that examined the effectiveness of using 'Busy Brain Break 'interventions to increase students' overall physical activity levels and engagement in the classroom. Six different schools, consisting of 716 total students in grades 3-6, participated in the study. As part of the study, students participated in three 5-minute-long 'Busy Brain Break" videos per day, at various times throughout the course of the day, at least 3 days per week. The videos consisted of body-weight activities, guided stretching and dancing. Questionnaires, observations by researchers and semi-structured interviews with the 17 participating classroom teachers were used to help collect data. All 17 of the participating teachers noted positive behavioral and educational benefits associated with participating in the brain breaks, especially increased focus, concentration and on-task behaviors (Cline et al., 2021). The results of this study align with a variety of other research surrounding the benefits of brain breaks and on-task behaviors within the classroom.

In 2010, Whitt-Glover et al. (2011) conducted an 8-week study that examined how the Instant Recess Brain Break program could be used in the classroom to increase physical activity while giving students a break from academic content. Students in grades 3-5 in Forsyth County, North Carolina participated in the randomized controlled study. Students participated in 10-minute bouts of physical activity at various points throughout the school day. Qualitative data was

collected through detailed field notes from the observations, and quantitative data consisted of activity logs filled out by classroom teachers. Results of the study found that students' overall moderate-to-vigorous physical activity levels increased by 16% and overall on-task behaviors increased by 11% (Whitt-Glover et al., 2011, p. 294). Instant Recess is another type of brain break that can be used to increase both physical activity and classroom engagement among students.

Physical and Mental Health Benefits

According to Bailey and DiPerna (2015), "children in today's society face unique challenges in maintaining a healthy and well-balanced lifestyle" (p. 481). This is due, in part, to an increase in the use of technology, changes in the food market and decreased opportunities for physical activity (Bailey & DiPerna, 2015). These barriers, among others, have contributed to the growing concern surrounding childhood obesity rates. According to the latest CDC data, about 18.5% of children and adolescents aged 2-19 were reported to be obese. In addition to weight issues, lack of physical activity is also associated with an increased risk of developing chronic health issues, including heart disease, type 2 diabetes and cancer (Center for Disease Control and Prevention, 2021). Healthcare workers, researchers and other stakeholders agree that this alarming trend is something that should not be overlooked.

According to the Journal of School Health, "physical activity is one of the many factors to influence the growth and development of children, especially in regards to their overall health and well-being" (Rosenkranz et al., 2020, p. 346). According to the CDC, the benefits of regular physical activity include weight management, improved sleep quality, lower blood pressure, stronger bones and muscles, increased heart and brain health, improved balance and coordination and a decreased risk for developing certain types of cancer (Benefits of Physical Activity, 2021).

Because of these important benefits, parents and educators should work together to encourage children to develop a healthy lifestyle that will follow them into adulthood.

Physical activity can also have a positive effect on mental health in youth (Owen et al., 2016). According to the Journal of School Health, "beyond chronic diseases, physical activity may help to ameliorate stress, sleep disorders, anxiety, depression, problem behavior and overall well-being" (Rosenkranz et al., 2020, p. 345). According to the Mental Health Foundation, "physical activity releases chemicals in the brain that help to boost self-esteem, improve concentration, relieve stress and frustration and increase feelings of confidence and self-worth" (Physical Activity and Mental Health, 2018). While there is a plethora of information available surrounding the overall benefits of physical activity and mental health, there is a gap in literature regarding the specific long-term effects physical activity has on young children. Because of this, there is a need for more research to examine how physical activity can be used to support the mental health of children.

Academic and Cognitive Benefits

There is a growing body of research that supports a positive relationship between physical activity, cognitive functions and academic achievement in the youth (Egger et al., 2019; Fedewa et al., 2018; Rosenkranz et al., 2020 & Wilson et al., 2016). According Rosenkranz et al. (2020) "in a meta-analysis of 26 studies of the relationship between physical activity and test scores, results showed significant, positive correlations between activity and academic performance for language, math, reading, and on-task behavior" (2020). Owen et al. (2016) systematically reviewed and conducted a meta-analysis using results from 38 studies to examine the relationship between physical activity and academic engagement. A multilevel model found that, overall, physical activity had a small positive association with academic engagement (Owen et

al., 2016). Owen et al. (2016) concluded that, based on these results, evidence is increasing to suggest that students who are physically active are more engaged with their classroom lessons, which can lead to a positive influence on academic achievement.

A study conducted by Fedewa et al. (2018) examined the differences between an aerobic-only movement break and an academic-based movement break on children's overall academic achievement. 460 students in grades 3-5 participated in the 9-month long study. Students in the academic-based breaks were required to participate in movement breaks that related to academic material, whereas students in the aerobic-only groups could participate in any type of movement break activities. Both groups completed the FastBridge Learning standardized assessment in the areas of math and reading as part of the pre and post test to determine academic performance. The results of the study found that there was a statistically significant gain in the area of reading for students that participated in the aerobic-only movement breaks. The findings from this study can be used to further examine the relationship between different types of movement breaks and its effect on academic achievement.

It is important to note that some pieces of literature state that more research must be conducted in order to clearly determine the benefits between physical activity and academic achievement. According to a previously mentioned study conducted by Podnar et al. (2018) "more research is needed to document the positive relationship between in-school physical activities and academic performance" (p. 24). A previously referenced meta-analysis from Owen et al. (2016) came to the conclusion that "there is a need for more research to determine whether it is a break from academic classroom lessons, the physical activity itself, or both the physical activity and break that can improve engagement in the classroom" (p. 24).

According to Wilson et al. (2016), “there is a growing interest among researchers and educational professionals regarding the impact of physical activity on cognitive development in young people” (p. 181). However, there is some discrepancy among researchers regarding the current literature on the subject matter. Emeljanovas et al. (2018) argue that, “literature continues to support the enhancement of children’s cognitive performance resulting from participation in physical activity.” However, Wilson et al. (2016) argue that researchers have found it difficult to draw any conclusions from available literature. It can be concluded that there is currently a gap in the literature between the benefits of physical activity and cognitive performance.

Student Behavior and Engagement

According to Owen et al. (2016) “school engagement is one of the most critical factors underpinning academic performance and the successful development of youth in society” (p. 4). Their 2016 meta-analysis included studies by Anderman & Maehr (1994); Darr (2012); Janosz et al. (2008); Marks, (2000); & Wylie & Hodgen (2012), which found that students’ overall level of school engagement often declines with age. Lack of engagement can have a negative effect on students’ overall academic performance (Owen et al., 2016). Providing opportunities for students to participate in short physical activity breaks throughout the day is a strategy that is currently being examined among different sources of literature as a possible method of increasing student engagement and time-on-task while helping to decrease off-task or negative behaviors (Abi Nader et al., 2019; Bailey & DiPerna, 2015; Cline et al., 2021; Egger et al., 2019; Mok et al., 2020; Perera et al., 2015; Podnar et al., 2018; Rosenkranz et al., 2020; Stylianou et al., 2016; Watson et al., 2019 & Wilson et al., 2016).

Rosenkranz et al. (2020) present the argument that, “children who struggle academically in school may not necessarily need additional classroom time; it could be physical activity that

they need" (p. 345). Their commentary contains a randomized controlled study conducted by Howie, Beets & Pate (2014) which examined the relationship between classroom-based exercise breaks (ACTI-BREAKS) and the behaviors of 4th and 5th grade students. Results from the study revealed that students' time-on-task and overall behavior was significantly higher after participating in a 10-minute physical activity break compared to those in a sedentary control group (Howie et al., 2014; Rosenkranz et al., 2020). Watson et al. (2019) conducted a similar study with students in grades 3 and 4, however their study also evaluated student perceptions of activity breaks using a 4-point Likert scale. Overall, 96% of students reported that they enjoyed the breaks and 85% of the students reported that they looked forward to them. Furthermore, about two-thirds of the students reported that activity breaks helped them to concentrate better. However, it should be noted that about one quarter of students reported that they found it difficult to calm down after the break (Watson et al., 2019).

A 4-week long study conducted by Wilson et al. (2016), examined the effectiveness of a 10-minute activity break on 5th and 6th grade boys' on-task behaviors. The passive activity break (PAB) students sat outside of the classroom and quietly read while the active activity break (AAB) students participated in a 10-minute teacher-led aerobic activity inside the classroom. Trained observers collected data on the students throughout the research period. The results of the study found that students who participated in the active breaks decreased off-task behaviors by 16% upon completing the break, whereas students who participated in the passive breaks showed no improvement in on-task behaviors (Wilson et al., 2016). The results of this study align with previous research that providing students with physical activity breaks can help to improve on-task behaviors and overall engagement.

Disadvantages of Physical Activity Breaks

While there is evidence that physical activity breaks have positive effects on student engagement and behavior, there are common concerns among educators that frequently appear in existing literature. First, due to time constraints and an already packed curriculum, it can be hard for teachers to find time to implement a break that is not related to class content (Mok et al., 2020; Podnar et al., 2018; Stylianou et al., 2016). Many teachers already feel as if there is not enough time in the year to cover everything. Furthermore, with the added pressure to perform well academically on standardized tests, non-academic related content can get pushed to the back burner (Perera et al., 2015; Podnar et al., 2018; Wilson et al., 2015).

Second, some teachers have reported struggling with transitioning between the activity break and getting the students back on track with the lesson (Perera et al., 2015; Watson et al., 2019). Watson et al. (2019) interviewed teachers upon the completion of the intervention to discuss factors that affected the implementation of ACTI-BREAKS within the classroom. Teachers identified scheduling conflicts and the amount of time it took for students to settle down and return to task as the 2 biggest barriers in implementing the intervention (Watson et al., 2019). This can clearly serve as a disadvantage and take away from the effectiveness of the break. Based on these common factors, further support and guidance must be given to teachers to help the facilitation of such breaks be more successful for everyone involved.

Conclusion

Throughout the last decade, there has been a growing body of research that supports the need to provide children and adolescents with opportunities to participate in physical activity. Research has shown that physical activity is associated with important mental and physical health benefits. More recent literature has shown that physical activity can help to boost students' academic engagement and cognitive functions. Overall, schools that have implemented

brain breaks, or similar interventions, have found success regarding student behavior and engagement. Future studies are still needed to determine the most effective methods of physical activity to best meet needs of students. It is important to further examine the relationship between providing students with opportunities to participate in physical activity and the effect it has on their on-task behavior.

Methodology

To determine the relationship between brain breaks and student engagement, specifically on-task and off-task behaviors, there was one guiding question that this action research study focused on: What are the effects of a short brain break activity on 7th grade students' engagement and behavior? Towards the end of a typical 8-hour school day, students tend to lose focus and become distracted or disengaged. This can result in an increase of off-task behaviors, the need for multiple redirects and a decrease in overall academic performance. These problems, among others, can be a cause for concern for educators.

The independent variable in this study was the implementation of a short brain break activity midway through a 50-minute class period. The dependent variable was the students' behaviors. Off-task behaviors were recorded using a tally mark system.

Setting

This action research took place at a middle school located in Nebraska. The middle school served 770 students, ages 11 to 14 years old, in grades 6, 7 and 8. Due to the ongoing Covid-19 pandemic, 737 students physically attended school within the building and 33 students participated in asynchronous learning. The demographics of the school were 65% Caucasian, 26% Hispanic or Latino, 1% African-American, 2% Asian-American and 3% two or more races. 64% of students were eligible for free or reduced meals (Nebraska Department of Education,

2019). The typical school schedule was from 8:10-3:35, except on Wednesdays, when students were dismissed an hour early for staff PLC meetings. Throughout the day, students attended eight 50-minute class periods. Five periods consisted of core classes and the other three were exploratory classes. The exploratory classes differed based on grade-level. Regardless of the grade-level, all students were required to take the core subjects of math, reading, science, social studies and language arts.

Participants

Towards the end of the day, students can struggle with remaining actively engaged in classroom instruction. Because of this, the researcher's 8th period 7th grade Social Studies class was chosen to take part in the brain break intervention. This class was the last class of the school day for students. The class had 23 total students, 14 females and 9 males, between the ages of 12 to 13 years old. One female student moved into the school district and joined the class at the beginning of the intervention data collection. Six students were on an Individualized Education Plan, 3 students received ELL services and 1 student participated in a district Talented and Gifted program. The class consisted of 17 Caucasian students, 5 Hispanic students and 1 African-American student. A paraprofessional was present in the class every Tuesday, Thursday and alternating Fridays.

Procedures

Prior to beginning the study, the researcher gained approval from the building principal. Twenty-two students participated in both the baseline and intervention data collection process. One student transferred into the school district on the last day of the baseline data collection. Because of this unintended variable, she only participated in the intervention. The baseline data col-

lection took place over a period of 10 days, starting February 17th and ending March 2nd. During the baseline data collection process, students' behaviors were observed without the implementation of any brain breaks. Data collection for the brain break intervention took place over a period of 10 days, starting March 3rd and ending March 19th. During the intervention, students participated in a daily 3-4 minute long brain break activity, midway through the class period. The brain breaks consisted of either GoNoodle mirrored dances or "Would You Rather" guided-movement activities, found on YouTube. Each activity required the students to perform basic locomotor movements such as jumping, turning, arm circles, squatting, balancing and moving forward or backward, and left to right. Upon completion of the daily brain break, regular classroom instruction would resume for the second half of the class period.

Data Collection

The researcher used an iPad to record each lesson and later went back to observe and document the students' behaviors. Quantitative data for both the baseline and intervention was collected using a tally mark system. Anytime the researcher observed a student exhibiting an off-task behavior, a tally mark was recorded in a notebook. At the end of each observation period, the total number of tally marks for that lesson was added together and documented on an Excel spreadsheet. All of the data for both the baseline and intervention was recorded on the same Excel spreadsheet to ensure consistency.

While watching the baseline and intervention lesson recordings, the researcher took anecdotal notes as students' behaviors were observed. These anecdotal notes were used to help the researcher analyze changes in behaviors throughout the baseline and intervention data collection process. Indicators of disengagement included any instance where a student had their head down

on their desk, did not participate in note-taking or other class activities, required a redirect to follow along with an academic task or was prompted to wake up from sleeping. Additional indicators of off-task behaviors included verbal distractions such as blurting or talking with peers during inappropriate times, physical distractions such as wandering around the room, playing with non-academic related objects, touching peers or needing a redirect to follow classroom expectations. A paired-samples t-test was chosen to determine if there was a significant difference in student engagement before and after the intervention. The qualitative anecdotal notes were used to help further analyze and discuss the results of the study.

Ethics

Prior to beginning the study, the researcher submitted an exemption request to the Northwestern College Institutional Review Board. Because the research was conducted in a normal educational setting, used normal educational practices and posed little to no risk to students, the IRB did deem the research to be exempt. Upon completion of the project, the researcher deleted all video recordings of students and kept their identities confidential.

Data Analysis

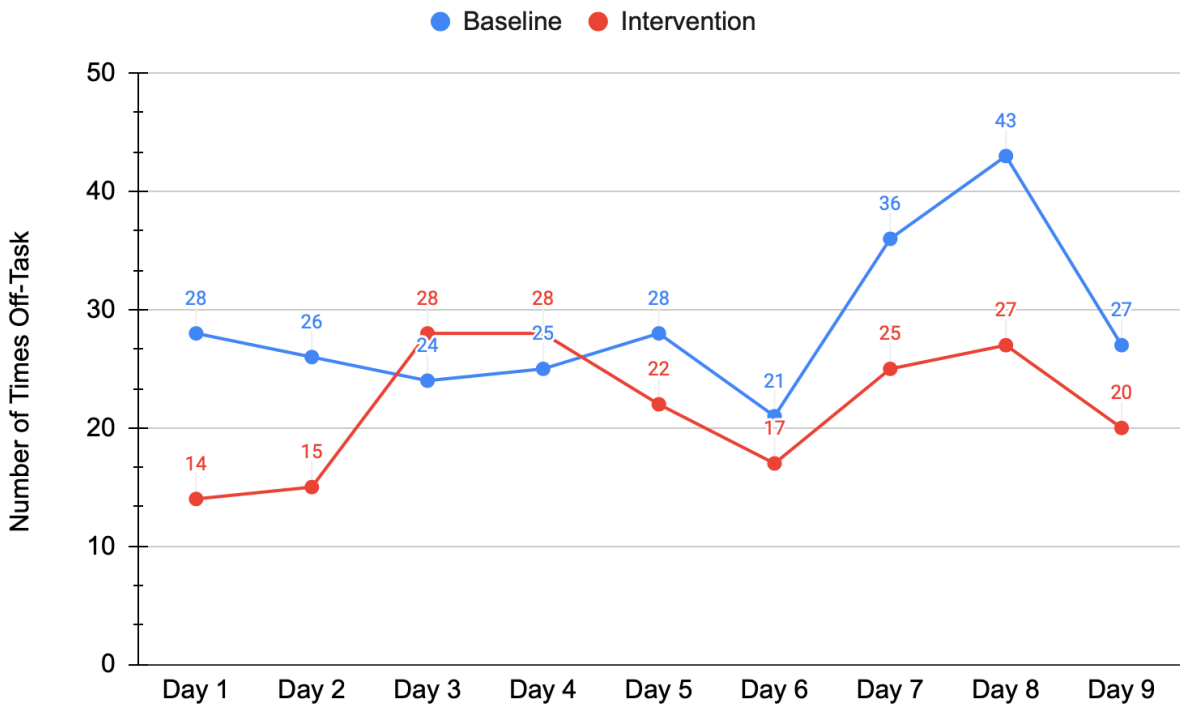
In order to determine the impact a short brain break activity had on 7th grade students' engagement and behavior, quantitative data was collected using a tally mark system. Any time a student was observed to be off-task, the researcher recorded the instance using a tally mark on an excel spreadsheet. At the end of each class period, the total number of off-task behaviors was added up and recorded on the spreadsheet. Both the baseline data and intervention data were collected for 10 days, however, only data for 9 baseline and 9 intervention days was reported due to a significant outlier on day 5 of the baseline collection period.

Due to a noticeable outlier on day 5 of the baseline data collection, the value for that day was excluded from the overall analysis to avoid skewed results. The data from day 8 of the intervention, the lowest frequency of behaviors, was also excluded from the overall results to ensure accurate results from a paired sample t-test.

The baseline data for the daily average of off-task behaviors before the brain break intervention was 29. The greatest number of off-task behaviors observed during the baseline was 43 and the lowest was 21. Once the students started to participate in the brain break movement intervention, the frequency of off task behaviors decreased to an average of 22 per day. The greatest number of off-task behaviors observed during the intervention was 28, on two consecutive days, and the lowest was 14. Figure 1 compares the daily frequency of off-task behaviors from baseline to intervention.

Figure 1

Brain Breaks and Student Engagement



A paired-samples t-test was conducted to compare the total number of off-task behaviors before a brain break intervention was implemented and after intervention. A *p* value of .05 was used to determine if the results of the study were statistically significant. There was a significant decrease between the total number of off-task behaviors while participating in a brain break intervention (M = 21.8, SD = 5.56), compared to the total number of off-task behaviors without a brain break intervention (M = 28.7, SD = 6.75); t(8) = 2.95, p = .018. These results suggest that the implementation of a 3-minute brain break activity, midway through class, can help to decrease 7th grade students' off-task behaviors.

Discussion

Summary of Major Findings

The results of the study indicate that the implementation of a brain break activity helped to reduce 7th grade students' off-task behaviors in the classroom. Baseline data determined that the students' average daily off-task behaviors was 29. During the baseline period, students were not offered a brain break and participated in 50 minutes of classroom instruction as usual. The class period studied was the students' last class of the day, therefore, commonly observed off-task behaviors included talking to peers at inappropriate times, blurting, falling asleep, frequently leaving assigned seats without permission and needing a redirect to follow along and participate. As a whole, the class frequently exhibited these behaviors

During the intervention period, students participated in a daily 3-4 minute brain break activity midway through the 50-minute class period. The breaks consisted of simple guided-movement activities. Intervention data determined that the students' average daily off-task behaviors decreased to 22. Upon completion of the daily brain break, students' overall engagement increased. The researcher observed that far less students fell asleep or laid their head down on their

desk after participating in the brain break. Furthermore, commonly observed off-task behaviors, such as blurting, talking to peers during instruction and students' leaving their assigned seat, decreased with the implementation of brain breaks. Overall, the results of this study suggest that the implementation of a brain break activity can help to increase student engagement and decrease off-task behaviors in the classroom.

The brain break activities that were implemented during this action research study proved to be an effective way to increase student engagement and decrease off-task behaviors. The activities were short and simple, requiring little to no outside planning. The results of this study align with previous research surrounding the effectiveness of providing students with opportunities to participate in brain breaks throughout the course of academic instruction. Maintaining focus for extended periods of time with minimal breaks can be challenging for students (Rosenkranz et al., 2020). According to Perera et al. (2015), "children's brains require physical activity breaks to process information after intense instruction" (p. 61). Brain breaks, such as those implemented in this action research study, are a quick and simple intervention that can be used to provide students with opportunities to take a break from academic instruction. According to Fedewa et al. (2018), "physical activity has been linked to improved attention, learning, and memory," all of which can greatly benefit students' education both inside and outside of the classroom (p. 1). Providing students with movement breaks allows them the opportunity to relax and reset their brain, making it easier for them to concentrate and re-engage upon completion of the break (Cline et al., 2021 & Egger et al., 2019). Based on the growing body of research surrounding the positive effects of brain break activities, as well as the results of this action research study, parents, teachers and other stakeholders should continue to find ways to incorporate opportunities for students to be physically active throughout the school day.

It should be noted that both baseline and intervention data was collected over a period of 10 days. On day 5 of the baseline data collection, the class was only off-task a total of 5 times throughout the period. On that day, students participated in a BreakOut EDU box, which included frequent movement around the classroom and collaboration with peers. The movement and fast-paced environment resulted in increased student engagement and only 5 off-task behaviors. Although students did not participate in a true structured brain break, the movement associated with the BreakOut box activity helped to significantly decrease off-task behaviors and increase engagement. However, due to this outlier on day 5, the data from that day was removed from the analysis. To ensure there was an equal number of baseline and intervention days, the researcher also removed data from intervention day 9, which had the lowest total of 12 off-task behaviors.

Limitations of the Study

One limitation of the study was the inconsistency of the weekly schedule. Due to inclement weather, school was closed twice, once during the baseline and once during the intervention. Spring break also took place mid-way through the intervention period. Additionally, the teacher researcher was absent one time during the intervention. Because of these factors, students never participated in a full consecutive school week throughout the study. The calendar was choppy, which could have affected the data collection.

Every Wednesday, students are dismissed from school an hour early due to staff PLC meetings. Because of this, class periods are shortened by 10 minutes. Baseline data collection was not affected by this schedule due to school cancelations, however, two different intervention days were. Because of this, students participated in the brain break at a different time than they normally would have. This also could have affected the data collected on these days.

Finally, the ongoing COVID-19 school-wide policies might have affected certain aspects of the study. Students were required to keep their face covering on throughout the course of the day and maintain a safe distance from their peers. Because of the lack of adequate classroom space due to social distancing among students, some of the brain break activities had to be modified. Additionally, a few of the activities significantly raised the heart rates of a few students. As a result of the increased exercise, their face covering became wet due to sweating. This caused a few students to not want to participate in certain brain break activities. This lack of participation could have affected data collection for the day.

Future Research

Due to time constraints of the study, further research should be conducted to examine the long-term effects of brain break activities and student engagement, especially at the middle school level. The brain break intervention period should take place over a period of at least three to four weeks, longer if possible. Future studies could also examine the effects of brain breaks across multiple grade levels and subject areas, not just 7th grade. Finally, it might be valuable for future studies of this type to include opportunities for student feedback via surveys to gather qualitative data to analyze the effectiveness of the intervention and students' overall perception of brain breaks. This additional data could help to better analyze quantitative data collected through observations.

Conclusion

The purpose of this action research project was to determine the relationship between brain breaks and 7th grade students' engagement and behavior. During the intervention, students

participated in a 3-4 minute long brain break activity, midway through class. As shown in Figure 1, the implementation of a brain break helped to decrease students overall off-task behaviors during the intervention period. The findings of this study are consistent with existing literature surrounding the topic of brain breaks and student engagement.

There are a variety of positive outcomes that stem from providing students with opportunities to be physically active throughout the course of a day. However, despite these positive benefits, many children still fail to participate in ample daily physical activity (Abi Nader et al., 2019). The increase in childhood obesity and sedentary behaviors over the past decade should be a cause of concern for parents and educators. Since children spend the majority of their time in an educational setting (Cline et al., 2021 & Whitt-Glover et al., 2011), schools, parents, teachers and other stakeholders must come together to find ways to promote physical activity and a healthy lifestyle. Brain breaks, such as those used throughout the course of this study, can be used to promote physical activity and increase student engagement within the classroom.

References

Abi Nader, P., Hilberg, E., Schuna, J. M., John, D. H., & Gunter, K. B. (2019). Association of teacher-level factors with implementation of classroom-based physical activity breaks. *Journal of School Health, 89*(6), 435–443.

American Heart Association Recommendations for Physical Activity in Kids. (2018). Retrieved from https://www.heart.org/en/healthy-living/fitness/fitness-basics/aha-recs-for-physical-activity-in-kids-infographic

Baker, E. A., Elliott, M., Barnidge, E., Estlund, A., Brownson, R. C., Milne, A., … Hashimoto, D. (2017). Implementing and evaluating environmental and policy interventions for promoting physical activity in rural schools. *The Journal of School Health, 87*(7), 538–545.

Bailey, C. G., & DiPerna, J. C. (2015). Effects of classroom-based energizers on primary grade students' physical activity levels. *Physical Educator, 72*(3), 480-495.

Beemer, L. R., Ajibewa, T. A., DellaVecchia, G., & Hasson, R. E. (2019). A Pilot Intervention Using Gamification to Enhance Student Participation in Classroom Activity Breaks. *International Journal of Environmental Research and Public Health, 16*(21), 4082.

Centers for Disease Control and Prevention. (2021, January 22). Benefits of physical activity. https://www.cdc.gov/physicalactivity/basics/pa-health/index.htm.

Carlson, J. A., Engelberg, J. K., Cain, K. L., Conway, T. L., Mignano, A. M., Bonilla, E. A., . . . Sallis, J. F. (2015). Implementing classroom physical activity breaks: associations with student physical activity and classroom behavior. *Preventive Medicine: An International Journal Devoted to Practice and Theory, 81*, 67-72.

CDC daily physical activity recommendations & guidelines. (2020, October 14). Retrieved from https://www.cdc.gov/physicalactivity/resources/recommendations.html

Centers for Disease Control and Prevention. (2021, March 1). FastStats- obesity and overweight prevalence. National Center for Health Statistics. https://www.cdc.gov/nchs/fastats/obesity-overweight.htm.

Cline, A., Knox, G., De Martin Silva, L., & Draper, S. (2021). A process evaluation of a UK classroom-based physical activity intervention—"busy brain breaks." *Children*, *8*(2), 63

Edwards, K. (2008, July 15). Physical activity in children declines significantly from age 9 to 15. Retrieved from https://ucsdnews.ucsd.edu/archive/newsrel/health/07-08ChildrenPhysicalActivity.asp

Egger, F., Benzing, V., Conzelmann, A., & Schmidt, M. (2019). Boost your brain, while having a break! The effects of long-term cognitively engaging physical activity breaks on children's executive functions and academic achievement. *PloS one*, *14*(3), e0212482.

Emeljanovas, A., Mieziene, B., MoChingMok, M., Ming-kai, C., Vida, J. C., Fatkulina, N., . . . Arturo Díaz Suárez. (2018). The effect of an interactive program during school breaks on attitudes toward physical activity in primary school children. *Anales De Psicología*, *34*(3), 580-586.

Fedewa, A. L., Fettrow, E., Erwin, H., Ahn, S., & Farook, M. (2018). Academic-based and aerobic-only movement breaks: are there differential effects on physical activity and achievement? *Research Quarterly for Exercise and Sport*, *89*(2), 153-163.

Hayes, W. (2008). No child left behind : past, present, and future. Lahnam: R&L Education.

Kleszczewska, D., Mazur, J., & Siedlecka, J. (2019). Family, school and neighborhood factors moderating the relationship between physical activity and some aspects of mental health

in adolescents. *International Journal of Occupational Medicine & Environmental Health, 32*(4), 423–439.

Lamb, K. (2019). Washington's high-ability programs during the no child left behind era. *Journal for the Education of the Gifted, 42*(4), 283–302.

Lounassalo, I., Salin, K., Kankaanpää, A. (2019) Distinct trajectories of physical activity and related factors during the life course in the general population: a systematic review. *BMC Public Health 19*, 271.

Mok, M. M. C., Chin, M.-K., Korcz, A., Popeska, B., Edginton, C. R., Uzunoz, F. S., … Durstine, J. L. (2020). Brain breaks® physical activity solutions in the classroom and on attitudes toward physical activity: a randomized controlled trial among primary students from eight countries. *International Journal of Environmental Research and Public Health, 17*(5), 1666–1666.

The 2018 United States report card on physical activity for children and youth. National Physical Activity Plan Alliance. Washington, DC: National Physical Activity Plan Alliance, 2018.

Owen, K. B., Parker, P. D., Van Zanden, B., MacMillan, F., Astell-Burt, T., & Lonsdale, C. (2016). Physical activity and school engagement in youth: a systematic review and meta-analysis. *Educational Psychologist, 51*(2), 129–145.

Perera, T., Frei, S., Frei, B., & Bobe, G. (2015). Promoting physical activity in elementary schools: needs assessment and a pilot study of brain breaks. *Journal of Education and Practice, 6*(55), 55-64.

Physical activity and mental health. (2018, December 19). https://www.mentalhealth.org.uk/a-to-z/p/physical-activity-and-mental-health.

Podnar, H., Novak, D., & Radman, I. (2018). Effects of a 5-minute classroom-based physical activity on on-task behaviour and physical activity levels. *Kinesiology, 50*(2), 251–259.

Primack BA, Carroll MV, McNamara M, Klem ML, King B, Rich M, Chan CW, Nayak S. (2012). Role of video games in improving health-related outcomes: a systematic review. *American Journal of Preventative Medicine, 42*(6):630-8.

Rosenkranz, R.R., Neuendorf, C.M., Rosenkranz, S.K. and Sauer, K.L. (2020). Just sit still and pay attention?—a commentary. *J School Health, 90*: 345-348.

Stylianou, M., Kulinna, P. H., & Naiman, T. (2016). '…because there's nobody who can just sit that long'. *European Physical Education Review, 22*(3), 390–408.

Tumynaitė, L., Miežienė, B., Mok, M. M. C., Chin, M. K., Putriūtė, V., Rupainienė, V., ... & Emeljanovas, A. (2014). Effects of Intervention "Hopsport brain breaks" program on physical fitness and sedentary behaviour in primary school. *Baltic Journal of Sport and Health Sciences, 3*(94).

U.S. department of education: every student succeeds act (ESSA). (2015). https://www.ed.gov/essa?src=rn

Watson, A., Timperio, A., Brown, H., & Hesketh, K. D. (2019). Process evaluation of a classroom active break (ACTI-BREAK) program for improving academic-related and physical activity outcomes for students in years 3 and 4. *BMC Public Health, 19*(633), 1-8.

Whitt-Glover, M.C., Ham, S.A., & Yancey, A.K. (2011). Instant Recess®: a practical tool for increasing physical activity during the school day. Progress in Community Health Partnerships: Research, Education, and Action 5(3), 289-297.

Wilson, A.N., Olds, T., Lushington, K., Petkov, J. and Dollman, J. (2016), The impact of 10-minute activity breaks outside the classroom on male students' on-task behaviour and sustained attention: a randomised crossover design. *Acta Paediatr*, *105*: e181-e188.