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Take 10 Program Effects on Fifth Grade Academic Achievement

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Abstract

Problem Less than one-fourth of children reach their recommended 60-minutes of daily physical activity. Inactivity can result in poor academic performance; whereas physical activity stimulates brain functions responsible for regulating comprehension and attention, release of brain chemicals to improve learning, and enhances neurogenesis resulting in better cognition. The purpose of this quality improvement project was to evaluate the Take 10 exercise program in a rural, Midwestern elementary school fifth grade classroom.

Methods An observational, descriptive design with a purposeful sample of fifth-grade students in a rural elementary school. Grades in math, science, and reading were examined the semester before (quarter 1 [Q1]) and during (quarter 2 [Q2]) the Take 10 program implementation.

Results Of 22 students (N=22), males (n=11) and females (n=11) were equal, and an increase in scores of four tests occurred. The mean math test one score increased from 67.32 (SD=11.53) in Q1 to 74 (SD=13.49) in Q2 (t (21)=-3.46, p=.002); for Q1 math test three the mean was 80.36 (SD=12.30) and Q2 was 90.45 (SD=9.57) (t (21)=-3.44, p=.002); the mean score for Q1 science test two was 72.57 (SD=16.80) and Q2 was 81.71 (SD=11.67) (t (20)=-2.66, p=.015); mean reading test one score increased from 91.36 (SD=11.67) in Q1 to 96.59 (SD=7.14) in Q2 (t (21)=-4.39, p<.001).

Implications for practice Promoting physical activity during the school day may improve some test scores, contributing to a healthier cognitive development in children.

Take 10 Program Effects on Fifth Grade Academic Achievement

A sedentary lifestyle has become prevalent among children in American households and schools in the age of computers and the internet. Consequences of inadequate physical activity related to increased screen time not only affects kids during their school and adolescent years, but also into adulthood. According to the Centers for Disease Control and Prevention (CDC, 2019), one in five children aged six- to 19-years are obese. Sedentary and obese children are at increased risk for becoming adults with chronic health conditions and have an increased probability of poorer academic achievement when compared to their physically active peers (CDC, 2018).

Lack of physical activity is a major contributing factor affecting weight among the pediatric population since less than 25% of children meet the recommended amount of daily activity (CDC, 2018). Recommendations for physical activity in children and adolescents suggest a minimum of 60 minutes of moderate to vigorous exercise each day. Those who do not achieve this are at risk for developing conditions such as type-2 diabetes, osteoporosis, obstructive sleep apnea, and heart disease (CDC, 2018). Additionally, inactivity can result in poor academic performance, less time spent working on projects, and impaired memory and concentration (CDC, 2018).

Physical activity stimulates brain functions responsible for regulating comprehension and attention, causes the release of brain chemicals to improve learning, and enhances neurogenesis resulting in better cognition (Snyder, Dinkel, Schaffer, Hiveley, & Colpitts, 2017). When a child engages in physical activity, endorphins are released and capillary growth is stimulated, which strengthens both the structure and functionality of the brain (Rodriguez-Ayllon et al., 2019). The brain's structural integrity is improved following regular exercise as neuron growth is stimulated, cell survival is improved, and hippocampus vasculature is increased, contributing to better memory and cognition (Chaddock-Heyman, Hillman, Cohen, & Kramer, 2014).

In 1999, the International Life Sciences Institute (ILSI) created a program called Take 10 in collaboration with experts in health and education. Since its development, Take 10 has been implemented in The United States, Brazil, Argentina, The United Kingdom, China, and parts of Indonesia (Take 10, 2015). The Take 10 program utilizes a classroom-based approach to address the lack of movement children may experience during the school day without sacrificing academic learning time (Take 10, 2015). Activities are designed to get children moving for 10-minute intervals and emphasize education about health and nutrition. These structured physical breaks can be incorporated during math, science, reading, social studies, and language arts lessons (Take 10, 2015). The program curriculum is designed for students in kindergarten through 5th grade and provides teachers with grade-specific materials for activities that are easily adaptable to their routine.

The ILSI noted several positive effects on children both physically and academically when the Take 10 curriculum was utilized in the classroom. The findings included greater nutritional knowledge, more time spent on task, higher academic achievement, decreased body mass index (BMI), and increased daily physical activity (Take 10, 2015). Kibbe et al. (2011) reported improved grades in math, reading, and spelling when evaluating outcomes of classrooms using the Take 10 program. Take 10 provides lesson plans designed to fit into a teacher's schedule without interrupting classroom flow while providing students with physical activity breaks to improve overall cognition and school performance.

The purpose of this quality improvement project was to evaluate the Take 10 exercise program in a rural, Midwestern elementary school fifth grade classroom. The aim was to see increased math, science and reading scores by 10% after one quarter of the Take 10 program implementation. Outcome measures of interest were test scores in math, science, and reading before and after the initiation of the Take 10 program in a fifth-grade classroom. The question for this study was: In a fifth-grade classroom, how does the Take 10 program compared to a traditional classroom program affect academic achievement in math, science, and reading over a 10-week period?

Literature Review

The literature search was conducted utilizing the search engine CINAHL, the Cochrane Library, ERIC, and the Take 10 resource page. Key search terms included: *physical activity, learning, school, academic achievement*, and *children* with the Boolean operators AND and OR. Initially, 120 publications were obtained between the selected databases. Inclusion criteria were only studies completed in years 2015 to 2019, published in English, and school-aged children. Excluded studies were those with children kindergarten age and younger, and those in high school or older. After further refining the criteria, the search yielded 33 studies of which 12 were selected for this review.

According to a meta-analysis in a systematic review conducted by Rodriguez-Ayllon et al. (2019), increased physical activity and decreased sedentary behaviors may have a positive effect on the status of mental health among the pediatric population. Because childhood is a period of rapid growth not only for the body but for the brain as well, physical activity positively affects the entire child. Exercising may enhance mental health through the release of endorphins and stimulation of capillary growth, and can improve the brain's overall health (Rodriguez-Ayllon et al., 2019). In addition, more movement and less sitting may help to satisfy basic psychological needs such as feeling socially connected and increased levels of self-acceptance (Rodriguez-Ayllon et al., 2019). In their meta-analysis, researchers compared results from 114 publications and noted a positive relationship between sedentary lifestyles and depression (Rodriguez-Ayllon et al., 2019). In fact, an inverse relationship was found between life satisfaction and overall happiness with sedentary behaviors, and depression in school aged children (Rodriguez-Ayllon et al., 2019). Thus, a significantly positive relationship existed between physical activity and mental health. This review also noted an excess of sedentary behaviors due to increased screen time during a child's day and discussed the negative association between screen time and mental health (Rodriguez-Ayllon et al., 2019). Very few studies examined preschoolers and school-aged children, resulting in a gap in the literature for these age groups.

Likewise, a child's academic success may be reliant on behavioral engagement when learning (Harvey et al., 2018). Behavioral engagement can occur in many forms: a student's classroom effort, attention, concentration, compliance, and involvement in tasks are all indicators of engagement in the school setting (Harvey et al., 2018). Furthermore, physically active classroom breaks may improve certain behavioral engagement factors such as concentration and time spent on task (Harvey et al., 2018). Harvey et al. (2018) was part of a large cluster, randomized control trial (RCT) examining 17 schools over a three-year period to determine physical activity's effect on academic achievement. Results displayed a significant improvement in the classroom behaviors of the physically active intervention groups compared to the sedentary control group who demonstrated either no change or poorer classroom performance (Harvey et al., 2018). While this study had a strong design and large sample size, the instrument used to evaluate behaviors was not validated and behavioral observations were subjective (Harvey et al., 2018). Regardless of these limitations, physical activity seemed to have a positive impact on behavioral engagement levels for students.

Multiple studies have successfully linked classroom-based physical activity programs to higher academic gains in children (Amin et al., 2017; Egger, Benzing, Conzelmann, & Schmidt,, 2019; Fedewa, Fettrow, Erwin, Ahn, & Farook., 2018; Have et al., 2018; Mullender-Wijnsma et al., 2015; Snyder, Dinkel, Schaffer, Hiveley, & Colpitts, 2017); therefore, academic achievement may be improved when physical activity-based learning is incorporated into the elementary classroom. Have et al. (2018) performed an RCT involving 505 school-aged children in Denmark and found improved math grades when classrooms incorporated physical activity-based lessons when compared to traditional classroom instruction. Data collected over a nine-month period displayed a 24.7% improvement in math scores (Have et al., 2018). In the United States, Fedewa et al. (2018) found higher achievement scores in reading among classrooms utilizing aerobically structured breaks compared to those with traditional breaks. Furthermore, Mullender-Wijnsma et al. (2015) found significant achievement increases in math and science, but no changes in reading over a two-year period with nearly 500 children when teachers were trained to incorporate physical activity into lesson periods. In their RCT, they determined physically active learning led to better math and science scores with an estimated four-month academic gain (Mullender-Wijnsma et al., 2015). These studies had strong designs and large sample sizes which contributed to the generalizability of their results.

Similarly, Amin et al. (2017) linked a school environment supportive of physical activity with improved scores in math for school-aged children from 17 public schools in Massachusetts. Researchers from this study noted a positive relationship between a strong physical activity environment and higher achievement in math when compared to schools putting little emphasis on the importance of physical activity (Amin et al., 2017). These results were especially significant in lower income children as their test grades were the most improved; hence, there may be implications for further research on physical activity's effects on academic gains in this subcategory of students. However, because this study involved mainly low to middle income students, the results may not be entirely generalizable to other populations (Amin et al., 2017).

In addition to evidence of improved test scores as a benefit when physical activity is incorporated into the classroom, one study investigated the relationship between the intensity of classroom exercises and the type of cognitive engagement on academic gains. Egger, Benzing, Conzelmann, and Schmidt (2019) found when students participated in high-intensity exercises paired with activities requiring significant cognitive involvement (the combination group), their mathematic achievement levels improved when compared to those without high-intensity exercises. For example, classes in the combination group played games requiring both physical skill and critical thinking, and students were encouraged to adapt to game changes while committing certain movements to memory (Egger et al., 2019). High-intensity exercise was demonstrated to have the most success in contrast to groups requiring less cognition or less physical activity (Egger et al., 2019).

While this well-designed study exemplified a strong connection between physical activity and cognitive function, limitations included a lack of knowledge regarding each participant's language preference or potential disabilities, and a decrease in program adherence for the latter half of the implementation process (Egger et al., 2019).

Other studies analyzed the effects of the physical activity-based programs on a general physical level relative to cognitive abilities. Goh, Leong, Brusseau, and Hannon (2019) and Drummy et al. (2016) demonstrated activity levels in children were increased following the integration of physical movement programs into a school's daily routine. For both projects, activity before and after program implementation was measured using objective measurements. Goh et al. (2019) found not only did physical activity-based programs positively influence children's activity and physical health levels, but long-term implications to improve behavior, cognitive function, and academic performance existed. Drummy et al. (2016) found no difference in body measurements with skin calipers; however, a long-term study would benefit the research of physical activity on physical health. Objective measurements of physical activity through accelerometer analysis and the real-life school setting were significant strengths in program evaluation for these studies. Limitations included the lack of a control group for comparison, which would have been useful in further analyzing program effectiveness on physical health and cognition. Other limitations included limited health profiles of students and short intervention time frames. Regardless, evidence of improved physical activity levels was related to improved cognitive performance in school.

In addition, staying focused on a project (on-task) was an outcome measure for classroom-based physical activity programs in some studies. Bartholomew et al. (2018)

observed students individually at their desks following active learning exercises and tracked their concentration and focus by categorizing them as either on- or off-task. The on-task students were those engaged in the teacher's lesson or quietly following instructions at their desks, whereas off-task students were observed walking around, talking to others, or resting their heads on their desks (Bartholomew et al., 2018). They found students participating in the physically active learning program spent significantly more time on-task than those not in a physically active learning program (Bartholomew et al., 2018). Thus, a positive effect for on-task behaviors occurred when students had integrated physical activity exercises compared to those who experienced a sedentary classroom time (Bartholomew et al., 2018). More specifically, Podnar, Novak, and Radman (2018) reported a 9% increase in on-task behavior of students aged six- to eight-years following the introduction of a five-minute physical activity break into their daily routine during math, science, language, and art classes. On-task behavior did not improve until after the brief activity break was completed. Baseline measurement of on-task behavior was very high (greater than 90%) prior to the physical activity, so the margin for significant improvement was small and was a limitation to this study (Podnar et al., 2018). The incorporation of physical activity during classroom time may result in less time for teachers to assist students in remaining on-task.

In another study, Snyder, Dinkel, Schaffer, Hiveley, and Colpitts (2017) piloted purposeful movement and its effects on physical activity and academic outcomes. Purposeful movement is a kinesthetic approach to learning and could be valuable for elementary educators since most children learn by doing (Snyder et al., 2017). Those who retain information best by seeing, touching, and doing may greatly benefit from a purposeful movement style of learning. In this study, one third-grade teacher and one physical-education (PE) teacher collaborated to design a program where purposeful movement was incorporated into the school day (Snyder et al., 2017). The program was implemented in one classroom and results were compared to a class not utilizing purposeful movement. Results demonstrated an increase in physical activity, an increase in on-task behaviors, decreased off-task behaviors, higher test scores, and overall positive attitudes towards the physical activity experience when compared to the non-purposeful movement group (Snyder et al., 2017). The limitations of this study included a substitute teacher being utilized for two days during data collection, the physical activity measurement only tracked steps taken, not type of activity, and the non-purposeful movement class did engage in some physical activity during lessons (Snyder et al., 2017). Regardless, there was evidence of improved learning behaviors when movement was included in the classroom lesson.

In summary, while there is evidence supporting classroom-based physical activity programs in schools, limited long-term research or follow-up studies exist. Higher academic gains in subjects such as math, science and reading compared to classrooms not utilizing physical activities have been found. Additionally, physical activity-based learning has been shown to improve on-task behavior in students and may have a positive impact on overall movement throughout the day. There are several benefits to classroom-based physical activity highlighted in the literature, however, further study is needed to determine if physical activity in the classroom affects obesity and its resulting co-morbidities. There is a gap in the literature on the effects of physical movement in the classroom and its effect on weight status, but this may be difficult to establish since obesity is affected by multiple factors, including genetics, diet, and the home environment. In addition, there is little research studying the long-term effects of physical activity on academic achievement in school aged children. Nevertheless, teaching students about the health benefits of physical movement while mentoring this behavior in a classroom through the Take 10 program may influence cognition and performance, and may indirectly affect the physical health of an elementary student.

Utilizing a Plan-Do-Study-Act (PDSA) framework, effects of the Take 10 program were measured in the setting of a local fifth grade classroom. The PDSA model is an effective way to lead a change initiative because it is a cyclic model, allowing for repeated use to facilitate changes for quality improvement (Donnelly & Kirk, 2015). The first step, planning, involves identifying the problem and then setting goals and objectives specific to the change. For this project, the problem was prolonged sedentary time during the school day. The desired outcome for this project was improved grades in the three core subjects. In the next phase, do, the plan to combat the problem was implemented. In this case, the Take 10 program was the intervention being implemented. Study is the next step in the cycle and involves analysis of the outcomes. For this project, Take 10's effect on scores in core subjects were studied to determine if there was any improvement from baseline measurements. The final phase of the PDSA cycle is act. This phase continues to alter processes in small increments to improve and sustain the outcomes (i.e., grades). In addition, assessing the organization's state of readiness to make a change is critical during this phase (Donnelly & Kirk, 2015).

Method

Design

This prospective, observational, descriptive design utilized an initial PDSA cycle for one academic quarter in one classroom. Grades in math, science, and reading were recorded from the semester before the Take 10 program was implemented. At the beginning of a new quarter, the Take 10 program was implemented by a fifth-grade classroom teacher three times per school day: before or during the math, science, and reading lessons. The school district utilized a four-day school week, so the program was implemented Tuesday through Friday each week. The Take 10 program was implemented for a total of 10 weeks, which was the length of the school quarter. At the close of the intervention quarter, test scores and final grades were collected in the core subjects (math, science, reading).

Setting

This study took place at an elementary school's fifth-grade classroom in a rural, Midwestern area. Just over 500 students attend the school and it is one of three elementary schools available in the district. As of 2018, the town's population was estimated to be approximately 8,208 (United States Census Bureau, 2018). The race was predominantly Caucasian (95.5%), the median household income was $43,096, the average household size was 2.63 persons, and 15.3% of the population have obtained a bachelor's degree or higher (United States Census Bureau, 2018).

Sample

This project utilized a purposeful sampling of student grades in one teacher's fifth grade classroom. The inclusion criteria were students in the fifth-grade classroom for the teacher willing to implement the Take 10 program into the daily lessons for one quarter.

Exclusion criteria were students not in the fifth grade or who were in a teacher's class not utilizing the Take 10 program in daily lessons.

Approval Process

Approval for evaluation of the Take 10 program in a fifth-grade classroom was granted by the school's principal and assistant principal. The Take 10 program materials were obtained through the ILSI Research Foundation after agreement between the local elementary school and ILSI legal counsel. Approval from the fifth-grade teacher was obtained. Approvals from the Doctor of Nursing Practice (DNP) committee and the university's institutional review board (IRB) were also granted. Both parents and students were required to consent or assent for participation in the collection of test scores and grades by the principal investigator (PI). Therefore, consent forms were completed and signed by parents/guardians and student assent forms were completed and signed by each participating child in the fifth-grade class. Students without signed consent and assent forms were excluded from the data collection portion of this project. While this was a comparison of math, science, and reading scores, a potential risk of this study was a breach of privacy if scores were revealed to an outside party or another student during the collection and data entry process. To minimize this risk, all personal identifiers were removed.

Data Collection/Analysis:

Collected data included demographic: age, gender, and race/ethnicity. Student demographics and scores were recorded by the fifth-grade teacher and de-identified using the code Q1-1, Q1-2, Q1-3, and so on for the academic quarter without the Take 10 program, and Q2-1, Q2-2, Q2-3, and so on for the academic quarter implementing the

Take 10 program. To enhance confidentiality, each student was randomly assigned a code number by the fifth-grade teacher for recording demographics and grade scores. Test scores and final grades in math, science, and reading from the academic quarter prior to implementation and during the quarter of the Take 10 implementation were collected in collaboration with the teacher. Data was recorded and saved to a password-protected computer and portable drive owned by the PI. The software program Intellectus Statistics (2020) was used for descriptive statistics and paired sample *t* tests.

Procedures

A team of stakeholders included the school principle, assistant principle, teacher, and PI. The Take 10 program was selected for implementation into the teacher's fifth-grade classroom. A comparison of test scores in math, science, and reading and their final grade assignment were chosen as the outcome measures to be evaluated during the Take 10 program implementation. Because the school district utilized a four-day school week, the selected class has PE class once per week and recess for 25 minutes per day which was consistent between both quarters.

Results

There were 27 students in the fifth-grade class implementing the Take 10 program, however, only 22 consented and assented for study (*N*=22). The student age range was 10 – 11 years with a mean age of 10.5 (*SD*=0.498). Of this sample, 50% were male (*n*=11) and 50% female (*n*=11). The race/ethnicity of the sample was predominately white (*n*=19; 86%) with remaining participants multiracial (*n*=3; 14%).

Test scores and final grades for quarter one (Q1) occurred the quarter before the Take 10 program implementation. Quarter two (Q2) test scores and final grades occurred with the implementation of the Take 10 program. There were three exams in each subject during Q1 but during Q2, only two tests were given in science and reading. The third test scores for Q1 science and reading were compared to second test scores from Q2. Scores and grades were analyzed using two-tailed paired samples *t*-tests. With the exception of four tests, all test scores were essentially equivalent between the two quarters.

The mean score for Q1 math test one was 67.32 (*SD*=11.53) and for Q2 math test one was 74 (*SD*=13.49). The mean math test one score increased from 67.32 (*SD*=11.53) in Q1 to 74 (*SD*=13.49) in Q2. The difference between the two means was statistically significant at the 0.05 level (*t* (21)=-3.46, *p*=.002) (Appendix A). The mean scores for math test two was 85.50 (*SD*=12.45) for Q1 and 85.17 (*SD*=8.29) for Q2. The average math test two scores had essentially no change between the two quarters from 85.50 (*SD*=12.45) in Q1 and 85.17 (*SD*=8.29) in Q2. The difference between the two means was not statistically significant at the 0.05 level (*t* (17)=0.10, *p*=.918). The mean score for Q1 math test three was 80.36 (*SD*=12.30) and the mean score for Q2 math test three was 90.45 (*SD*=9.57). The mean math test three score increased from 80.36 (*SD*=12.30) in Q1 to 90.45 (*SD*=9.57) in Q2. The difference between the two means was statistically significant at the 0.05 level (*t* (21)=-3.44, *p*=.002) (Appendix B). The mean scores for science test one were 86.18 (*SD*=12.74) for Q1 and 82.91 (*SD*=7.55) for Q2. The average science test one scores had essentially no change between the two quarters from 86.18 (*SD*=12.74) in Q1 and 82.91 (*SD*=7.55) in Q2. The difference between the two means was not statistically significant at the 0.05 level (*t* (2)=1.10, *p*=.283). The mean score for Q1 science test two was 72.57 (*SD*=16.80) and the mean score for Q2 science test two was 81.71 (*SD*=11.67). The science test two score increased from 72.57

(*SD*=16.80) in Q1 to 81.71 (*SD*=11.67) in Q2. The difference between the two means was statistically significant at the 0.05 level (t (20)=-2.66, p=.015) (Appendix C). The mean scores for science test three were 82.10 (*SD*=7.71) for Q1 and 83.24 (*SD*=14.54) for Q2. The average science test three scores had essentially no change between the two quarters from 82.10 (*SD*=7.71) in Q1 and 83.24 (*SD*=14.54) in Q2. The difference between the two means was not statistically significant at the 0.05 level (t (20)=-0.29, p=.778). The mean score for Q1 reading test one was 91.36 (*SD*=11.67) and the mean score for Q2 reading test one was 96.59 (*SD*=7.14). The mean reading test one score increased from 91.36 (*SD*=11.67) in Q1 to 96.59 (*SD*=7.14) in Q2. The difference between the two means was statistically significant at the 0.05 level (t (21)=-4.39, $p <$ .001) (Appendix D). The mean scores for reading test two were 83.23 (*SD*=14.50) for Q1 and 84.50 (*SD*=8.53) for Q2. The average reading test 2 scores had essentially no change between the two quarters from 83.23 (*SD*=14.50) for Q1 and 84.50 (*SD*=8.53) for Q2. The difference between the two means was not statistically significant at the 0.05 level (t (21)=-0.36, p=.726). The mean scores of Q1 reading test three were 92.64 (*SD*=6.07) for Q1 and 84.50 (*SD*=8.53) for Q2. The average reading test 3 scores decreased from 92.64 (*SD*=6.07) in Q1 to 84.50 (*SD*=8.53) in Q2. The difference between the two means was not statistically significant at the 0.05 level (t (21)=3.54, p=.002).

Control charts were generated using Microsoft Excel for final grade analysis and comparison, with a score of 75 percent or a C letter grade, as the control line (Appendix E, F, G). Final grades for math, science, and reading were compared between Q1 and Q2 also utilizing two-tailed paired samples *t*-tests. The mean scores for a final grade in math were 86.55 (*SD*=6.81) in Q1 and 86.09 (*SD*=7.70) in Q2. The average final grade had essentially no change from 86.55 (*SD*=6.81) in Q1 to 86.09 (*SD*=7.70) in Q2. The difference between the two means was not statistically significant at the 0.05 level (*t* (21)=0.52, *p*=.610). The mean scores for final grade in science were 85.09 (*SD*=5.93) in Q1 and 83.68 (*SD*=9.46) in Q2. The average final grade had essentially no change from 85.09 (*SD*=5.93) in Q1 to 83.68 (*SD*=9.46) in Q2. The difference between the two means was not statistically significant at the 0.05 level (*t* (21)=0.82, *p*=.421). The mean scores for final grade in reading were 88.27 (*SD*=4.22) in Q1 and 83.68 (*SD*=6.99) in Q2. The average final grade decreased from 88.27 (*SD*=4.22) in Q1 to 83.68 (*SD*=6.99) in Q2. The difference between the two means was not statistically significant at the 0.05 level (*t* (21)=3.17, *p*=.005).

Final grades in all three subjects were also compared to gender for both Q1 and Q2 using two-tailed independent samples *t*-tests. The mean scores for Q1 final grade in math were 87.73 (*SD*=5.50) for females and 85.36 (*SD*=8.00) for males. The average final grades had essentially no difference from 87.73 (*SD*=5.50) for females to 85.36 (*SD*=8.00) for males. The difference between the two means was not statistically significant at the 0.05 level (*t*(20)=0.81, *p*=.429). The mean scores for Q2 final grade in math were 86.27 (*SD*=6.78) for females and 85.91 (*SD*=8.86) for males. The average final grades had essentially no difference from 86.27 (*SD*=6.78) for females to 85.91 (*SD*=8.86) for males. The difference between the two means was not statistically significant at the 0.05 level (*t* (20)=0.11, *p* .915). The mean scores for Q1 final grade in science were 86.36 (*SD*=5.57) for females and 83.82 (*SD*=6.26) for males. The average final grades had essentially no difference from 86.36 (*SD*=5.57) for females to 83.82 (*SD*=6.26) for males. The difference between the two means was not statistically significant at the 0.05 level (*t* (20)=1.01, *p*=.326). The mean scores for Q2 final grade in science were 84.36 (*SD*=11.16) for females and 83.00 (*SD*=7.91) for males. The average final grades had essentially no difference from 84.36 (*SD*=11.16) for females to 83.00 (*SD*=7.91) for males. The difference between the two means was not statistically significant at the 0.05 level (*t* (20)=0.33, *p*=.744). The mean scores for Q1 final grade in reading were 89.09 (*SD*=4.23) for females and 87.45 (*SD*=4.25) for males. The average final grades had essentially no difference from 89.09 (*SD*=4.23) for females to 87.45 (*SD*=4.25) for males. The difference between the two means was not statistically significant at the 0.05 level (*t* (20)=0.90, *p*=.376). The mean scores for Q2 final grade in reading were 85.55 (*SD*=4.87) for females and 81.82 (*SD*=8.44) for males. The average final grades had essentially no difference from 85.55 (*SD*=4.87) for females to 81.82 (*SD*=8.44) for males. The difference between the two means was not statistically significant at the 0.05 level (*t* (20)=1.27, *p*=.219).

Discussion

The purpose of this study was to examine effects of the Take 10 program, compared to a traditional classroom program, on test scores and final grades in math, science, and reading in a fifth-grade classroom. Findings indicated an overall increase in scores of four tests, two in math, one in science, and one in reading between the two quarters. The means of these test scores from Q1 were lower than the means from Q2 demonstrating an increase in scores during Take 10 implementation. Test scores in math test one increased by 10% from Q1 to Q2 while scores in both math test three and science test two increased by 12.5%. Although scores in reading test one were significant, they only increased by 5.5% between Q1 and Q2. The increase in these four test scores may be related to the break in sedentary classroom instruction. During a Take 10 exercise, students engaged in both an educational game and physical activity, deviating from their traditional learning routine. These active breaks may have allowed students to relieve any excessive energy, engage in physical activity with their peers, stretch, and release before coming back to their schoolwork. Increases in these test scores were associated with a positive academic effect of this program on the students.

Test scores were essentially unchanged for four tests, one in math, two in science, and one in reading. There was one reading test with lower mean scores in Q2 during the Take 10 program implementation, when compared to mean scores from Q1. Despite these findings, there was marked improvement in some test scores between Q1 and Q2 indicating modest gains in academic improvement with the Take 10 exercise program.

Final grades in both math and science had essentially no change between Q1 and Q2 but there was a slight decrease noted in the mean of final grades in reading. In addition, no differences were discovered when comparing final grades in math, science, and reading to gender. While these results do not reveal increases in grades, they do demonstrate how the Take 10 program does not impede traditional learning time or elicit a negative effect on overall grades.

Strengths of this study were a purposeful, consistent sample of fifth-grade students between the two quarters and an equal distribution between males and females. A limitation of this study was a disruption in program implementation due to snow days in Q2. There were a total of 35 school days in Q1 and 34 in Q2 but only two snow days in Q1 and six snow days in Q2. Thus, there was a moderate disruption in the program for the fifth-grade students. Due to snow days and the outbreak of the COVID-19 pandemic causing school shutdowns, there was no way to determine the effects of Take 10 over a longer period of time. Future studies may consider implementation of the Take 10 over an entire academic year and student weight monitoring.

Conclusion

While not all exam scores demonstrated increases over time, there was some evidence of higher test scores during the Take 10 program's implementation. Three test scores displayed a 10% or greater increase between the quarter before Take 10 and the quarter during Take 10. In addition, some exam scores and final grades essentially remained the same, indicating both static and positive effects of this program on students' academic performance. Take 10 is a realistic intervention for teachers as it can be easily incorporated into daily lessons without hindering classroom learning. The program is also enjoyable for students as it allows them to learn through exercise-based activities. The results of this study corroborated with existing literature supporting the benefits of physical activity-based learning in the classroom. Adding physical activity into the classroom appeared to be beneficial in one rural elementary school fifth-grade classroom.

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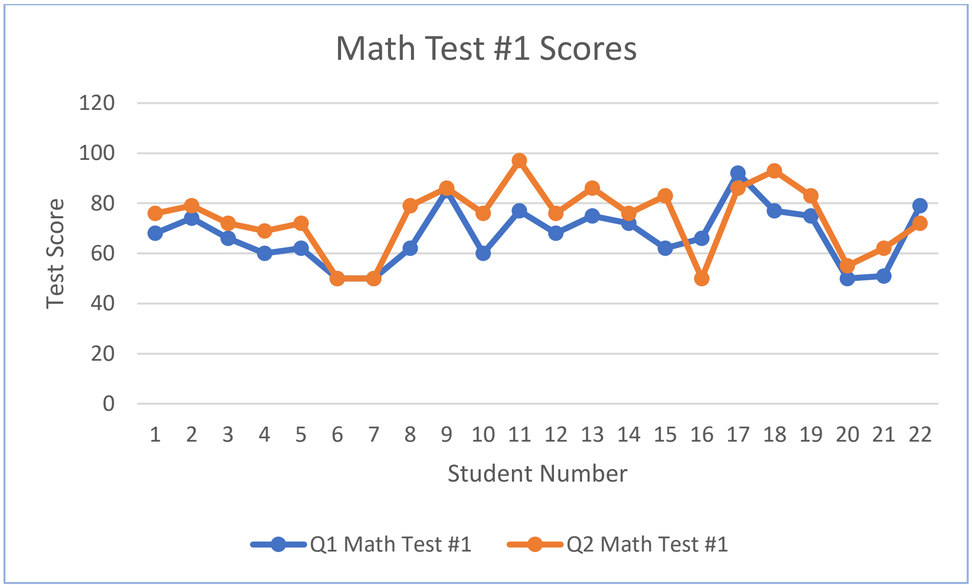
Appendix A

Figure 1.

The means of Math Test #1 Scores for Q1 and Q2



Note:

Two-Tailed Paired Samples t-Test for the Difference Between Q1_Math_Test_1 and Q2_Math_Test_1

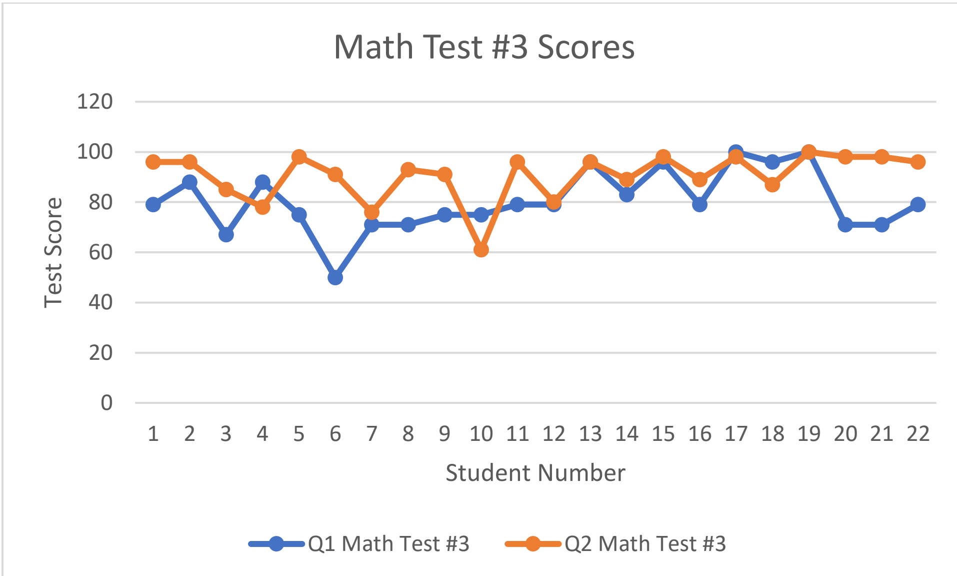
Q1_Math_Test_1		Q2_Math_Test_1				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
67.32	11.53	74.00	13.49	-3.46	.002	0.74

N = 22. Degrees of Freedom for the *t*-statistic = 21. *d* represents Cohen's *d*.

Appendix B

Figure 2.

The means of Math Test #3 Scores for Q1 and Q2



Note:

Two-Tailed Paired Samples t-Test for the Difference Between Q1_Math_Test_3 and Q2_Math_Test_3

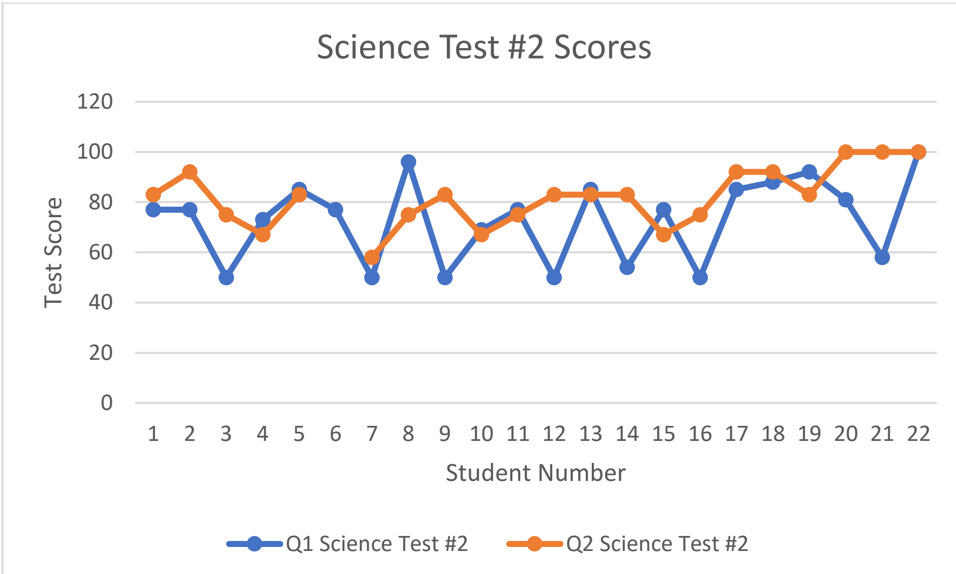
Q1_Math_Test_3		Q2_Math_Test_3				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
80.36	12.30	90.45	9.57	-3.44	.002	0.73

N = 22. Degrees of Freedom for the *t*-statistic = 21. *d* represents Cohen's *d*.

Appendix C

Figure 3.

The means of Science Test #2 Scores for Q1 and Q2



Note:

Two-Tailed Paired Samples t-Test for the Difference Between Q1_Science_Test_2 and Q2_Science_Test_2

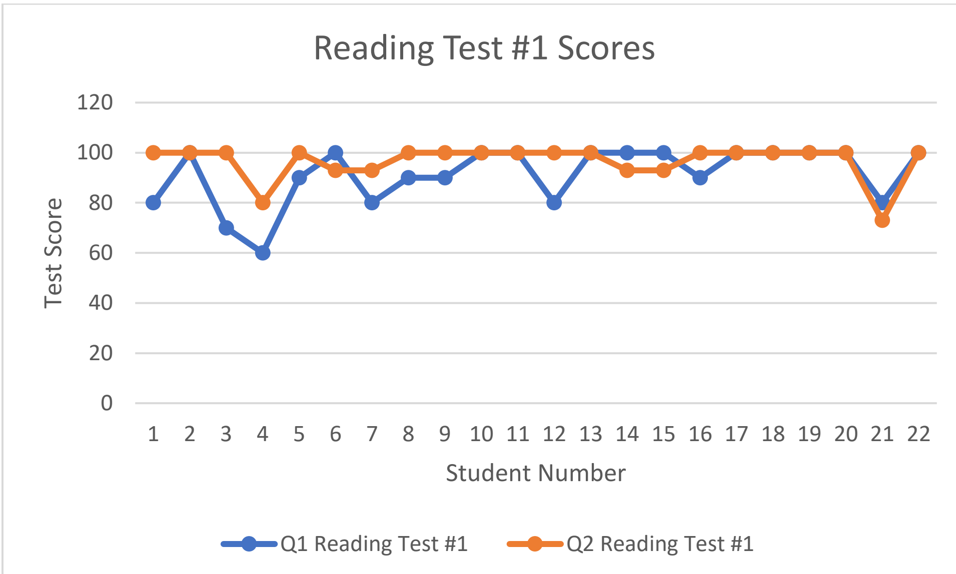
Q1_Science_Test_2		Q2_Science_Test_2				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
72.57	16.80	81.71	11.67	-2.48	.022	0.54

N = 21. Degrees of Freedom for the *t*-statistic = 20. *d* represents Cohen's *d*.

Appendix D

Figure 4.

The means of Reading Test #1 for Q1 and Q2



Note:

Two-Tailed Paired Samples t-Test for the Difference Between Q1_Reading_Test_1 and Q2_Reading_Test_1

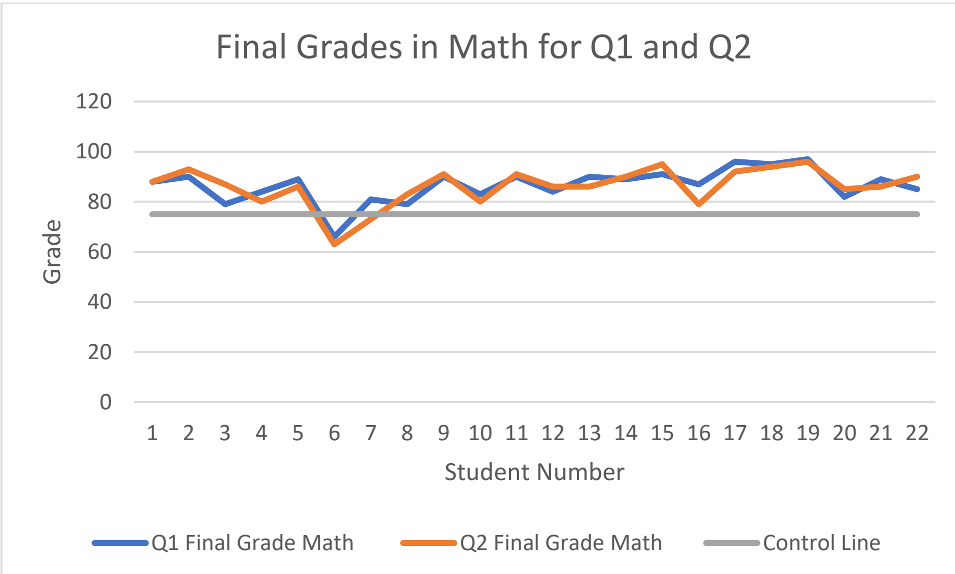
Q1_Reading_Test_1		Q2_Reading_Test_1				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
91.36	11.67	96.59	7.14	-2.36	.028	0.50

N = 22. Degrees of Freedom for the *t*-statistic = 21. *d* represents Cohen's *d*.

Appendix E

Figure 5.

Math Final Grade for Q1 and Q2



Note:

Two-Tailed Paired Samples t-Test for the Difference Between Q1_Final_Grade_Math and Q2_Final_Grade_Math

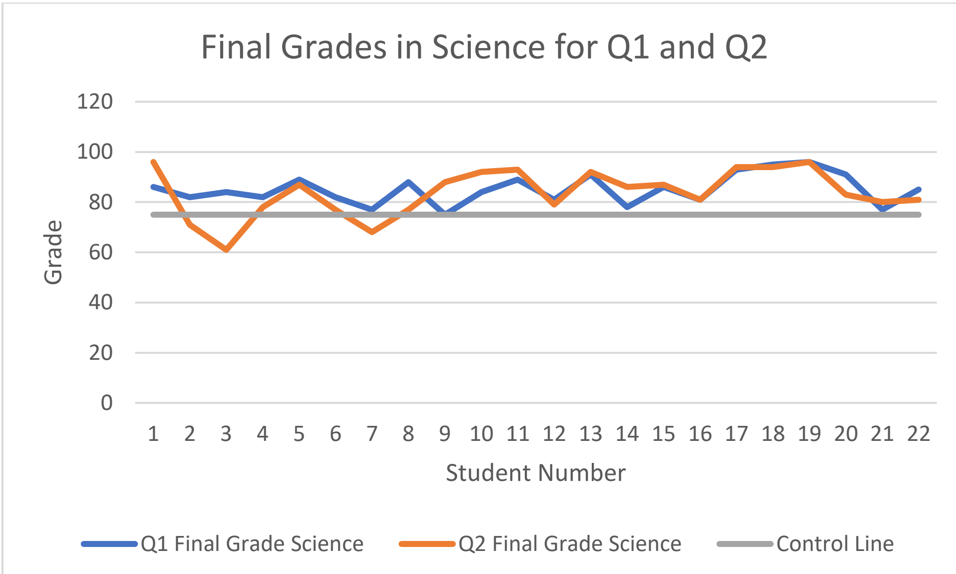
Q1_Final_Grade_Math		Q2_Final_Grade_Math				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
86.55	6.81	86.09	7.70	0.52	.610	0.11

N = 22. Degrees of Freedom for the *t*-statistic = 21. *d* represents Cohen's *d*.

Appendix F

Figure 6.

Science Final Grade for Q1 and Q2



Note:

Two-Tailed Paired Samples t-Test for the Difference Between Q1_Final_Grade_Science and Q2_Final_Grade_Science

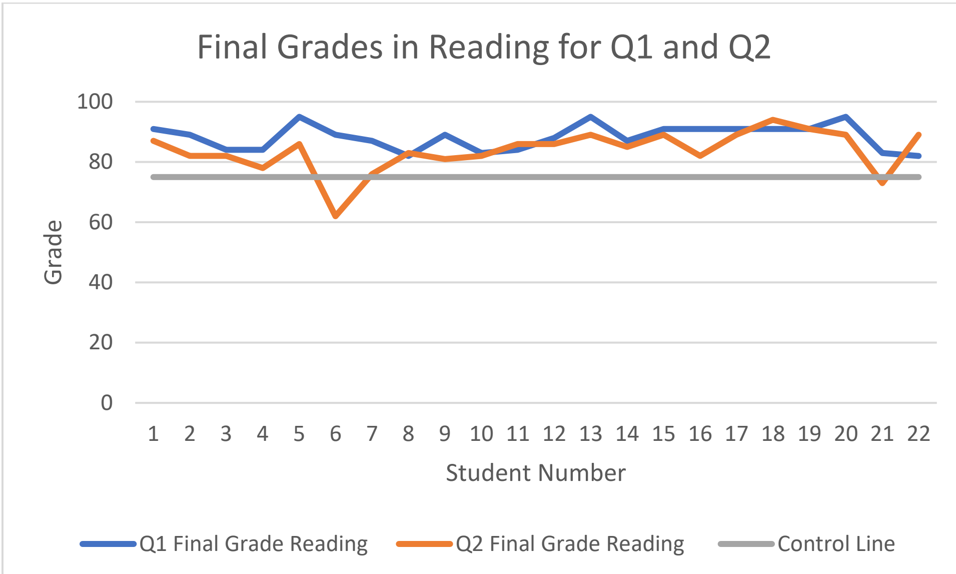
Q1_Final_Grade_Science		Q2_Final_Grade_Science				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
85.09	5.93	83.68	9.46	0.82	.421	0.17

N = 22. Degrees of Freedom for the *t*-statistic = 21. *d* represents Cohen's *d*.

Appendix G

Figure 7.

Reading Final Grade for Q1 and Q2



Note:

Two-Tailed Paired Samples t-Test for the Difference Between Q1_Final_Grade_Reading and Q2_Final_Grade_Reading

Q1_Final_Grade_Reading		Q2_Final_Grade_Reading				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
88.27	4.22	83.68	6.99	3.17	.005	0.68

N = 22. Degrees of Freedom for the *t*-statistic = 21. *d* represents Cohen's *d*.