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Dordt College
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Table of Contents

List of Tables

Table Page

Abstract

This research study examines the correlation between the effects of physical fitness scores on academic assessment tests. The study examines students' PACER scores and what impact that causes with the MAP (Measures of Academic Progress) test. The study included a sample of 147 students from a large Midwestern elementary school of fifth graders. The study found that PACER scores seems to have a positive relationship with students' MAP scores; that improving on the PACER does not show significant gains to show a connection between the two variables; that high BMI scores can indicate lower MAP scores and that lower BMI scores indicate higher MAP scores; finally that attendance days show a relationship with PACER and MAP scores. This study concluded that BMI, PACER scores, and attendance can show a positive impact on students' academic performance.

CHILDHOOD FITNESS AND ACADEMIC ACHIEVEMENT

In today's national, state, and local education systems there has been a shift in the focus towards academic scores and cognitive development. This change of direction has drawn cutbacks in physical education classes. Over the past several academic years, school districts have also seen major budget concerns causing some to reduce their time spent in or even cut their physical education (PE) programs altogether. According to Stork and Sanders (2008) only 39% of elementary schools in the United States require PE. This is concerning as opportunities to be active are diminishing while childhood obesity rates are on the rise. In order to combat these statistics, there needs to be an emphasis on the importance of physical activity at the elementary level. Physical fitness habits established in the early childhood years can develop and be retained into adulthood (Kall, Nilsson, Linden, 2014). A PE teacher's job includes teaching students the importance of strong life habits, valued food choices, and basic health knowledge. PE class is an opportunity for teachers to develop the enjoyment of life-long skills and activities in their students. PE class is also a place where students with all levels of physical abilities can work to develop a sense of teamwork and collaboration.

In addition to the lost benefits of PE, students are also missing out on other valuable physical activity because some schools have also put a limit on the time students receive recess throughout the week. In the Sioux Falls School District, if a classroom section has PE class in the morning, they will not have a morning recess. The same is true of the afternoon. According to Rhea (2015), the average first-grader spends seven hours a day at school, sometimes without any recess, much less one that is outdoors and unstructured. Administrators are feeling the pressure to get the most from their teachers and the time spent in the classroom. This pressure comes as the result of the always changing standardized tests that occur yearly in each school district. Schools are judged, fairly or not, by how well students do academically each year, and

the urgency to press for more classroom time is constantly increasing. Castelli, Hillman, Buck, and Erwin (2007) explain that because of the mandates of No Child Left Behind (NCLB), schools are feeling the pressure to produce students who are competent in reading, mathematics, and science in all socioeconomically diverse school environments.

However, a study done by Ahamed, MacDonald, Reed, Naylor, Liu-Ambrose, and McKay (2007) showed that simply committing to an additional 10 minutes of physical activity during the day did not compromise academic performance. The researchers also looked back at other studies which confirmed that extra physical activity each day had a positive impact on academic performances; these are mentioned later in this introduction. Furthermore, a study done by Castelli et al. (2007) showed that students who were more physically fit were more likely to perform better on their school's standardized tests. These researchers continue to discuss that school children who showed elevated levels of physical fitness were more likely to have higher standardized test scores in the areas of reading and mathematics. Knowing that aerobic fitness can be associated with academic achievement scores, one can only look at the structure of our PE curriculum and teach to the benefits of this finding.

Statement of the Problem

Because of the focus on increased academic instruction, PE time and recess time has been cut. Physical education teachers, therefore, must question how they can still deliver the obvious benefits of physical activity to their students despite this environmental shift. Van Dusen, Kelder, Kohl, and Perry (2011) reviewed that there is a link between physical fitness and academic performance in school children. Their main finding was that the importance of cardiovascular capacity was connected with academic achievement. These researchers went on to discuss that

students with higher cardiovascular scores had better attention spans, working memory, reaction time, and overall processing speed. As they saw it there were enough data to show a positive biological link between aerobic fitness and academic performance. Time cannot be added to classes so one has to question how PE classes can be re-structured to better assist students so they can benefit from such a link. This could then lead to more efficient time during class to reap the benefits of that physical activity. The hypothesis is that if one were to explore the fifth grade Fitnessgram Progressive Aerobic Cardiovascular Endurance Run (PACER) test scores, they would positively correlate with their quarterly Measures of Academic Progress (MAP) tests.

In the articles reviewed there continues to be a need for additional research instead of application of learning theories (Tremarche, Robinsion, Graham, 2007). Tremarche et al. goes on to share that an increase in physical activity enhances brain function and produces many cognitive and physiological benefits. Since our current society is heading in the opposite direction of this idea, there is a need for some research to help solidify this claim. Currently 65% of South Dakotans are overweight or obese; of those, 30% have a BMI (Body Mass Index) of 30 or higher, and of that percentage 12% have a BMI of 35 or greater (SD Dept. of Health, 2011-2014). There are minimal pieces of literature that show the depth of this topic, and so there needs to be more credible research exploring the link between physical fitness and academic achievement. Despite that need, there is a research basis for the idea that physical activity affects academic achievement. Coe, Reeves, and Womack (2006) found that when students participated in high intensity or vigorous activity, they performed better academically compared to those students who did not participate. They went on to explain in their discussion section that research is pointing in the direction that vigorous activity levels associated with physical activity

and PE may positively influence academic performance. These findings help give the validation needed to pursue the hypothesis mentioned above.

Several other studies also support a positive correlation. A study was done between 1970 and 1977 in the Trios-Rivieres region in Quebec. According to Shephard and Trudeau (2008), 546 primary students were involved. In their article, Shephard and Trudeau explained how one group of students received their regular 40 minutes of PE a week while another group was given five additional hours of PE a week. Those hours were taken from the academic time of the week. The results showed that those students who received the additional PE time scored high in mathematics despite the fact that mathematics instruction was removed for PE time. Another study that Shephard and Trudeau (2008) discussed included 266 first grade children in Israel who received a school-based movement education program. The results showed an increase in reading skills and arithmetic scores compared to when they did not have this program.

Despite these encouraging results, however, not all studies show a positive academic trend with an increase in physical activity. Shephard and Trudeau (2008) explained a study of 11 year-old students who received fifty-five minutes per day of PE compared to another group who received art or computer sciences. The results came back that both performed the same in math, science and English. There was no positive impact with the additional PE that they had received in the day. Their explanation regarding the study showed the need for additional research to clarify how physical fitness or the intensity of it can impact academic scores.

If one can find a correlation between physical fitness scores and academic scores, it is evident that a trend could develop towards a positive outcome with academic scores. Along that line, since elementary PE is addressed in this study, schools need to remember the early stages in

school children. There is a connection between motor and intellectual performance which is strongest during this early time. The research is not lengthy into how physical fitness can affect academic achievement, but there are a few studies that support such a link. Kall, Nilsson, and Linden (2014) explained that there is increasing evidence that aerobic fitness and academic achievement are linked. However, research of PE and physical activity and how much it impacts school children is relatively scarce. More data could motivate the physical education community to push on and find evidence to validate the impact the profession is having on the students in the classroom.

Research Questions

This research project sought evidence of a correlation between physical activity and classroom test scores. The hypothesis was that time spent being active would not only provide health benefits but also show academic benefits. The research questions are:

1. Does BMI play a role in the association between the two factors: Fitnessgram PACER and MAP Testing?
2. What is the magnitude and direction of the association between the Fitnessgram PACER scores and MAP scores?
3. Is there a relationship between physical fitness scores, attendance records and MAP scores?
4. Is there a difference between the participants who met the HFZ (Healthy Fit Zone) for aerobic capacity and those participants who did not meet the HFZ?

Summary

The research continues to show that the benefits of being physically active can positively impact classroom behaviors as well as academic scores. Stork and Sanders (2008) share the need for physical education due to an increased concern about public health. They also explain how current research is showing a link in regards to activity-related precursors and the health risks in school children. The risks they point to are sedentary lifestyles, limited nutrition at home, as well as limited physical activity. Van Dusen et al. (2011) explained that if the PE curriculum is attempting to assist in the development of academic achievement, it should stress cardiovascular fitness and strength over body composition. Due to policies in the Sioux Falls School District and the time limitations at the elementary level, keeping an impactful PE program should be a priority for the future. When it is all finished, this study will hopefully answer the important question: does the physical fitness testing that is utilized provide any benefits in the classroom?

Definitions:

Overweight or Obese – Overweight or obese is defined as having a Body Mass Index (BMI) of 25.0 or above. Body Mass Index (BMI) is calculated by taking a person's body weight in pounds, divided by their height in inches, divided by height in inches (again) times 703. The mathematical equation for BMI is: weight (lbs.)/height $(in)^2$ x 703.

No leisure Time Physical Activity: No leisure time physical activity or exercise during the past 30 days other than regular jobs.

BMI: Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters. A high BMI can be an indicator of high body fatness. BMI can be used to screen for

weight categories that may lead to health problems but it is not diagnostic of the body fatness or health of an individual.

Literature Review

In today's society the percentage of overweight adolescents has risen by nearly 300 percent (Singh, McMahan, 2006). This is especially alarming considering this statistic was from over ten years ago. According to the Centers for Disease Control, in today's society 17% of U.S. youth are obese (Ogden, Carroll, Fryar, Flegal, 2015) which suggests there is a public health crisis happening. Children are less active compared to previous generations and technological access has allowed a more sedentary lifestyle in households. Children play outside less and are on devices more regularly. This was researched by Wen, Kite, Merom, and Rissel (2009), who found that 43% of children spent more than two hours a day playing computer or video games, and watching TV, while only 37% spent less than a half an hour a day playing outside. As this impacts their health it can also impact their academic achievement scores in the classroom. It has been hypothesized that there is a correlation between fitness scores and academic performances on standardized tests. The following five articles look more deeply into supporting this hypothesis.

A study done by Singh and McMahan (2006) looked into the relationship between academic performance and physical fitness measures in California schools. Their purpose was to find the strength of the relationship between physical fitness scores and academic scores within Orange County. The study drew its sample from 253 elementary schools in the Orange County School District in 2004-2005. The researchers used the Fitnessgram (PFT) assessment to measure each student's fitness level in five areas: 1) aerobic capacity, 2) body composition, 3) trunk strength, 4) upper body strength, and 5) flexibility. Along with these, the researchers used

the California Standards test (CST) for reading, mathematics, and science to measure each student's academic ability. Once Singh and McHahan (2006) completed the correlational study, they found that the fitness scores significantly correlated with English scores r=.598, p<.001; with math scores, r=.559, p<.001; and with science scores r=.583, p<.001 (Singh, McMahan, p. 210). The researchers also went on to run a simple correlational test between the CST and PFT of the male students and their scores were: English, r=.581, p< .001; math, r=.540, p<.001; and science scores, r=.578, p<.001. The same correlational test was used with the female students scores and their CST and PFT scores; English scores, r=.566, p<.001; math, r=.537, p<.001; and science scores, r=.548, p<.001. The last factor the researchers looked at was the economically disadvantaged students. Their CST and PFT scores were put through the same correlation test and they found their math scores were r=.423, p<.001; math, r=.398, p<.001; and science scores were r=.361, p<.001. Overall, the researchers found that in each group; total, male, female, and economically disadvantaged, their PFT scores significantly correlated with their CST scores. As their PFT scores increased, so did their CST scores. This supported Singh, and McMahan's hypothesis, which is that physical fitness testing would have a positive impact on academic achievement. Overall, the researchers came to a pivotal recommendation which is that with today's trend of physical activity being less of an emphasis in a student's life, there needs to be a focus put back on PE in the schools. They also concluded that physical education may be the only time some children receive health & fitness training, so the schools should attempt to keep such programs.

Van Dunsen, Kelder, Kohl, Ranjit, & Perry (2011) found that students attending PE dropped significantly between 1991 and 2003, from 42% to 28%. Their study asked the question "what is the magnitude and direction of the association between each individual Fitnessgram

fitness test score and reading and math Texas Assessment of Knowledge and Skills (TAKS) scale scores?"(Van Dunsen et al., p.735). The purpose of their students was to examine the relationship between the physical fitness levels and academic test performances with kindergarten through grade twelve students in Texas. The sample size for this study was 254,743 students.

When they gathered all of their information, they found that cardiovascular fitness was found to have the strongest correlation with academic achievement. With a standardized mean difference effect size of .17 for boys-reading, .34 for boys-math, .27 for girls-reading, and .33 for girls-math. The second largest association were the curl-ups, next was the pushups, sit and reach, and truck lift which had an effect size of .07. Looking at all these areas and investigating their correlation there were no nonsignificant association between any of the fitness tests and the areas of academic achievement. The one academic area that had the strongest correlation with the five fitness tests was the math TAKS scores. Another area the researchers looked at was the associations between the BMI numbers and academic achievement. The top and bottom quintiles, along with the middle three quintiles were used; they adjusted for grade-level, ethnicity, economic disadvantage, cardiovascular fitness, and curl ups. Results showed that boys with a low BMI did show lower TAKS scores when compared to moderate BMI boys. There was no association in girls and their BMI scores. When all five areas of Fitnessgram (PACER, curl ups, pushups, trunk life, and sit and reach) were looked they all showed a positive linear association with academic performance. A few recommendations were made by the researchers, first to investigate the impact physical fitness has on academic scores over the course of a few years instead of one; second, research the physiological mechanisms that are connecting physical fitness and strength and mental acuity; finally, if academic scores are showing to be impacted by

physical fitness scores, and PE is offered in school districts then the PE curriculum should be under strong consideration for schools and administrators. This positive impact that has been found should give administrators the incentive they search for to boost their school and district standardized test scores.

Additional studies have examined the strength of the relationship between physical fitness and academic testing success. Rauner, Walters, Aver, and Wanser (2013) looked at the Progressive Aerobic Cardiovascular Endurance Run (PACER) and compared it to the Nebraska State Accountability (NeSA) tests for math and reading. Their purpose was two- fold; first, to find an association between the aerobic fitness scores as well as the math and reading tests; second, to determine the impact BMI has on passing standardized tests in third-eighth graders. The study drew its samples from 11,743 students in 47 public schools in Nebraska. The results showed that aerobically fit students had better odds of passing the NeSA math and reading tests compared with aerobically unfit students. Of the 8,116 students who were categorized as Fit students, 80.5 % pass the NeSA math, 84.3% passed the NeSA reading. Of the 3627 that were categorized as Unfit only 65.8% passed the NeSA math, and 71.3% passed the NeSA reading. The Rauner et al. also found that fit students who were not receiving free/reduced lunch had 2.41 times greater odds of passing the NeSA math and 2.23 better odds of passing the NeSA reading test. This was compared to unfit students who also did not receive free/reduced lunch. For those students who were receiving free/reduced lunch, the fit students had a 1.68 times better odds of passing the NeSA math and 1.56 times better odds passing the NeSA reading. This was compared to the unfit students who had received free/reduced lunch. Another aspect calculated was the students Body Mass Index (BMI) scores; that showed that those numbers were not a predictor of passing the NeSA math or reading tests. Overall Rauner et al. came to their

conclusion that "because entering the PACER's HFZ was associated with academic outcomes; we suggest that school systems use the PACER as a stand-alone measure of aerobic fitness (Rauner et al., p. 347)." The study felt that the PACER was easier to conduct compared to timed runs and was useable in all climates in the event schools cannot get outside due to weather. The researchers overall recommended that any further research be longitudinal evaluating how aerobic physical fitness as well as BMI impact academic achievement. The data used in this study was done by tracking a district where in the future they suggest both a intervention and control group to determine efforts in improving physical fitness and closing the achievement gap which was found in this study.

Most studies have looked at the association between fitness scores and math or reading scores, but there is also a study that looked at language skills along with math and sciences. Sardinha, Marques, Minderico, Palmeria, Martins, Santos, Ekelund (2016)looked at Oeiras municipality in Portugal and how their native tongue, Portuguese, and foreign tongue, English were impacted or associated with physical fitness scores. Their main purpose was to examine any associations between cardiorespiratory fitness (CRF) and academic achievement. The researchers drew a sample size of 1,286 fifth, sixth, and seventh grade students aged 11-14 and followed them for three years. They began with pre-testing the students as well as monitored progress through those years and finished with a post-test. They used four classifications with students from baseline to follow up: fit-fit, unfit-fit, fit-unfit, and unfit-unfit. Along with those classifications they only used the Progressive Aerobic Cardiovascular Endurance Run (PACER) test as their gauge for cardiovascular fitness. What Sardinha et al. found was those who were marked as being consistently fit added to the chances of having a high academic score in Portuguese (Odd Ratio (OR)=3.49, 95% CI, 1.97-6.20; $p<0.001$) and in foreign

language(English) (OR=2.41; 95% CI, 1.39-4.14; p<0.001) compared to those who were marked as unfit. Those students who were unfit but became fit at the follow –up had high odds of achieving better scores in Portuguese (OR=2.52; 95% CI, 1.42-4.45; p<0.001) and with foreign language (English) (OR=2.13; 95% CI, 1.23-3.67; p<0.01).

Over all, the researchers found that there is an association between academic achievement especially in someone's native tongue and a foreign language. With their categories they found that fit students or unfit but became fit students during the 3-year follow-up showed an association between their CRF scores and their academic scores. Due to these findings they discussed that there should be an investment into the aerobic and physical fitness programs as they have an impact on the academic achievement of students. If that is the case they also felt that there needed to be a priority put on the physical education programs to ensure CRF is developed and achieved (Sardinha et al., 2016)

In order to make PE a priority in our schools, administrators need to understand that taking academic time away from the classroom will not negatively impact their student's tests scores. Also, not all research studies have found that physical activity has a significant, positive impact on academic achievement. However, in a study completed in 2007, Ahamed, Macdonald, Ree Naylor, Liu-Ambrose, and McKay found that using physical activity can benefit student's academic performance without compromising classroom time. Their main purpose was to evaluate the effectiveness of a school-based physical activity intervention for maintaining academic performance in elementary children. The study drew students from 4th and 5th grade in 10 elementary schools in the Vancouver and Richmond School Districts in British Columbia. Once they found consenting schools they created two groups: a control group, intervention (INT) and an experimental group, usual practice (UP). The INT schools had their classroom teachers

implement additional classroom-based activities for fifteen minutes each day, five days a week. Teachers were given training as to how to do these additional activities. UP schools were given no training or direction. UP and INT schools continued to participate in their regular two 40 minute PE classes during the week. Over the course of 16 months Ahamed et al. (2016) found that there was no difference in academic performance between children at the INT and UP schools (-15.3; 95% CI: -41.8, 11.2). They also found that there was no difference between boys and girls regarding the follow-up test (P=0.27). The final result was there difference in academic performance between Asian and Caucasian students (P=0.15). Overall the researchers recommended using the Action Schools! BC model to incorporate 10-15 minutes of physical activity to classroom as their study showed it will not compromise the academic time used with students.

When looking at the mentioned studies there is a collection of evidence that physical activity has a correlation to academic achievement scores. The constant battle between administrators of classroom time can be a constant dilemma though to work through. As discussed taking time away from the classroom to focus on physical fitness does not hurt the academic scores needed to boost a school's academic profile (Ahamed et al., 2007). If additional physical activity time can be allocated towards elementary students their cardiovascular scores could be impacted which in turn has a direct effect on the yearly academic scores (Rauner et al. 2013; Singh, McMahan, 2006; Van Dusen et al., 2011; Sardinha et al., 2016). To add to this growing issue, overweight students are missing more school compared to fit students. Singh and McMahan (2006) found that overweight students miss about 4.2 days of school while fit students missed 0.7 days. They also found that their academic scores were lower due to those missed days of school as well as contributing factors such as low self-esteem and psychological stress.

If PE and additional physical activity time can be provided Sardinha et al. (2016) shared that aerobic fitness can bolster numerous physical benefits for students: cognitive control, brain plasticity, better cognitive abilities and memory improvement. With the growing problematic issue of child obesity one can only conclude that an emphasis on physical activity in the classroom and PE curriculum should be an emphasis for all administrators and school districts.

Methodology

Participants

The participants in this study consisted of 147 fifth grade students (N = 69 boys, N= 78 girls) from Discovery Elementary School which is in the Sioux Falls School District in South Dakota. There were six sections of fifth grade and these classrooms are determined each school year by the school administrator. The participants were made up largely of homogeneous in regards to their age, socioeconomic status and ethnicity. The group of participants were mainly Caucasian at 87% (N= 128), 9% (N=14) African American, 2% (N=4) Hispanic, and .02% (N=1) are Asian. Participants in this school are located in a middle class urban section of Sioux Falls, South Dakota.

Measures and Procedures

For the cardiovascular testing the Progressive Aerobic Cardiovascular Endurance Run (PACER) from the Fitnessgram was used to assess the fifth grade students. This test is designed to measure a student's aerobic capacity which factors in physical endurance and fitness levels. The PACER is a multi-stage running test that progressively gets faster as students run. The test was completed using an iPod provided by the school district. Students run 20m between two markers and attempt to touch the baseline of the basketball court with their foot before the iPod

beeps. As the test continues students are required to run faster and faster until they can no longer perform the test at a proficient level; students should try to run as long as physically possible. Students receive a PACER score which then can determine aerobic fitness along with their height, and weight. When all this information is calculated students will fall into one of three categories: “healthy fit zone” (HZ) or “needs improvement” (NI) or “needs improvement-heart rate” (NI-HR). The test was completed and performed by the PE teacher at Discovery Elementary school multiple times throughout the school year. This was to ensure students had multiple opportunities to practice the test, but the final PACER test used in this research took place in January 2017. The tests were completed in September and January and were the scores used to compare with their academic test scores.

As for the academic test, the fifth graders used the Measures of Academic Progress (MAP) test. The MAP test is a computer adaptive test which consists of questions that are adjusted based on the previous responses to questions. As the tests progresses either the test gets harder or easier based on students selected responses. The results of the MAP test create a numerical Rasch Unit (RIT) score. This score will show the students’ academic knowledge, skills, and abilities. Throughout the school year the scores will be compared to show how much students have progressed—comparable to measuring height with a ruler. The MAP test consists of reading, language usage, and mathematics. The structure of the test is made up of multiple choices, drag and drop, and other types of questions. The first found of MAP testing was completed during the dates of September 12-30 of 2016; the second round of testing was completed January 9-27, 2017. With these two tests there will be enough information regarding the fifth grade participants to calculate the correlation between the MAP scores and their PACER scores.

Design

This project looked at the independent variable which is the PACER test the participants will complete. The dependent variable is the MAP testing which the participants completed twice throughout the school year. Other variables that could possibly be analyzed would be the boys, girls, BMI scores as well as attendance at school. The research question is to investigate if there is a correlation between the PACER test and the MAP test. Did the results of the PACER test show any indication there could be a relationship with the participants MAP scores? That was a main question asked when looking at both variables. These variables were be looked at as a whole group first, followed by the sub groups mentioned; that ensured all information is looked at its entirety.

Procedure

The participants took the PACER test in September and January. They practiced the test numerous times before the final tests used for this research. Students that were not in attendance performed the test when they returned to class. Once the test had been completed their scores were entered into the Fitnessgram data base. From that program all the students' data and BMI information were collected for the 147 fifth grade students. The participants also performed the MAP test during their classroom time in September and January. Once the tests had been completed the data was taken from the MAP test and then be used to look at its correlational relationship with the participants PACER scores.

Data Analysis

The PACER scores for the fall and winter were entered into a spreadsheet along with all the students BMI and attendance records. Along with this all the students MAP scores in the

areas of math, reading, and language usage were entered into the spreadsheet. The final pieces entered were the attendance and the students ID numbers.

Once those were entered the variety of groups being looked at were sorted and their data was looked at. The Mean will be searched for all areas and compared to each other to see what correlations appear. The fall and winter scores were compared to see how they compared to one another and what their mean scores look like. The scores from fall and winter were compared to see what the improvements look like and what areas show the most improvement.

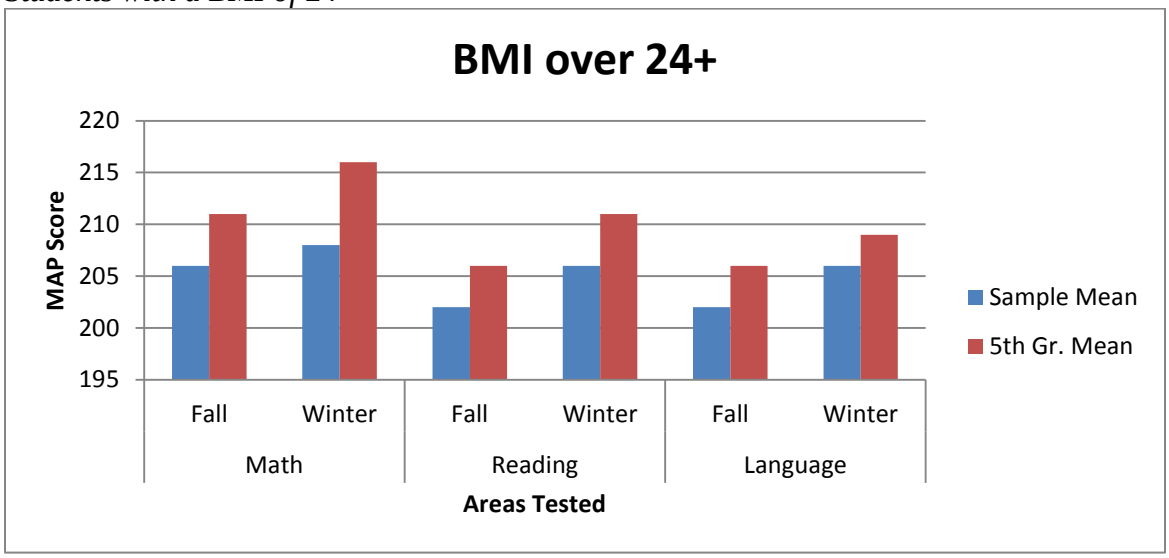
Results

Research Question One

The first research question asked by the researcher is whether a student's BMI plays a role in the association between the two factors: the Fitnessgram PACER and MAP Testing. To answer that question, the researcher broke down the sample group into three groups: students who had a BMI over 24+ (these would be students who would be possibly categorized as obese or over weight); students who had a BMI between 16-23.9 (these would be students who would be categorized as healthy); and students who had a BMI from 0-15.9 (these would be students who would be categorized as underweight or borderline healthy).

The first group sampled consisted of 12 students who had a BMI of over 24. Table 1 below shows that these students had scores in all the areas tested that were well below where the fifth grade mean scores were.

Table 1 -
Students with a BMI of 24+

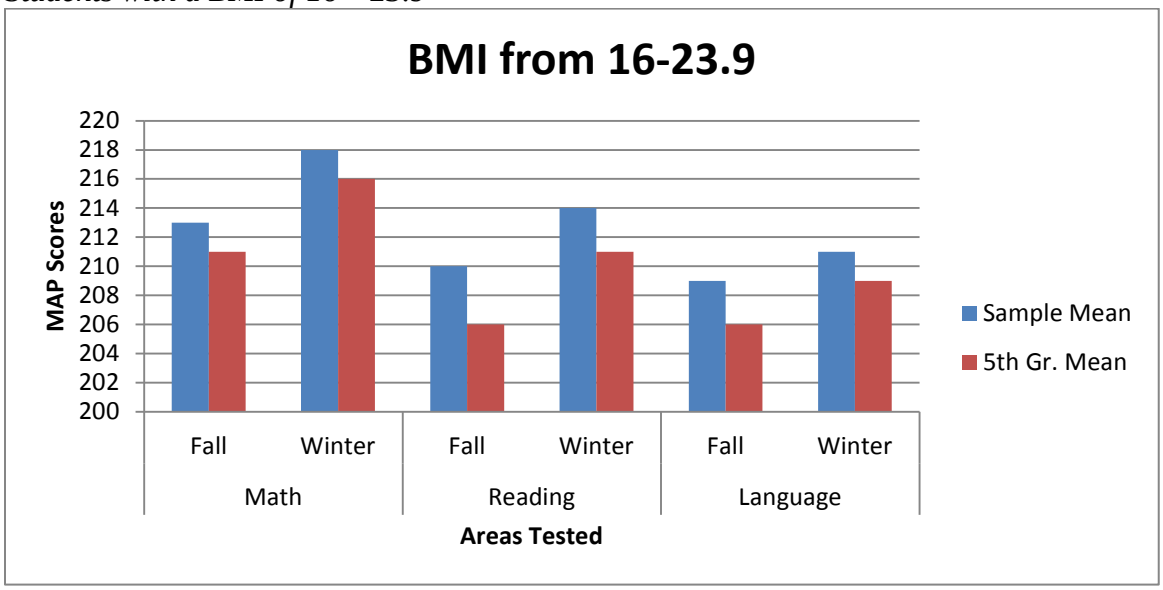


The information showed that this group had math MAP scores that were lower in the fall with a 206 compared to the whole 5th grade mean of 211; in the winter the 12 students scored a 208, while the mean of the whole group was 216. Their reading scores were also below the mean of the whole group with a mean of 202 in the fall and 206 in the winter. The final area tested was language usage, and they were below the sample mean too, scoring an average of 202 in the fall and a 206 in the winter. The researcher also found that this group missed 6.5 days of school compared to the group who missed 3.5 days. This sample group also had a mean of 16 on the PACER in the fall and a 20 in the winter compared to the whole group whose mean PACER in the fall was 34 and in the winter was 38.

The second group the researcher looked at were the 70 students whose BMI was between 16 and 23.9.

Table 2

Students with a BMI of 16 – 23.9

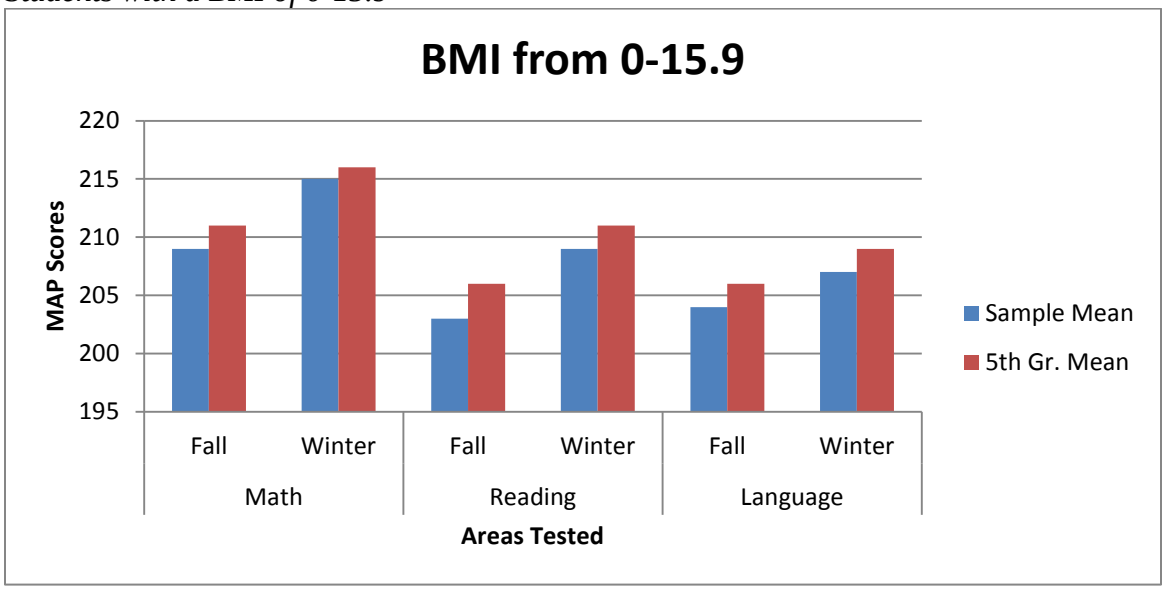


What the researcher found was these students had MAP scores that were above the whole group's mean. Table 2 shows that during the fall this group scored a mean on the MAP test of 213 in the math area while the whole 5th grade's mean was 211; in the winter they scored a 218 while the group's mean was a 216. As for reading, this sample group scored a mean of 210 in the fall and a 214 in the winter, while the 5th grade mean was 206 in the fall and a 211 in the winter. As for their language usage, this group scored a 209 in the fall and a 211 in the winter, which was above the 5th grade mean of 206 in the fall and 209 in the winter. This group did show significant improvements in their math scores by increasing their mean by 5 points between the fall and winter. The researcher also found that this group missed a mean of 3.6 days of school. They also had a mean of 33 for the PACER in the fall and a 36 in the winter.

The final group was students who have a BMI from 0 to 15.9. This group that consisted of 65 students.

Table 3

Students with a BMI of 0-15.9



The researcher found that this group had slightly lower mean scores compared to the whole 5th grade group. What Table 3 shows is that this group scored a mean of 209 in math during the fall and a 215 in the winter. The 5th grade mean was a 211 for the fall and a 216 for the winter. As for their reading scores, this group fell below the overall 5th grade mean; in the fall they scored a 203 and in the winter a 209. The whole 5th grade group had a mean of 206 for the fall and 211 for the winter. The final area was language usage, where they scored a mean of 204 in the fall and a 207 for the winter. One interesting point was that this group showed a higher increase in their reading scores by improving their mean by 6 points between the fall and winter tests.

In summary, those students who had a higher BMI scored lower in the areas tested and their PACER scores were lower compared to the rest of the group. The middle BMI group showed gains in all areas and were slightly above the fifth grade mean for all the scores, and their PACER scores were developmentally appropriate too. The final group showed that they

had slightly lower scores in all areas but nothing that is alarming, and their PACER scores were higher when compared to the other two groups. Overall the researcher found that having a higher BMI score has more of an impact on MAP tests compared to the other two groups and their BMI scores.

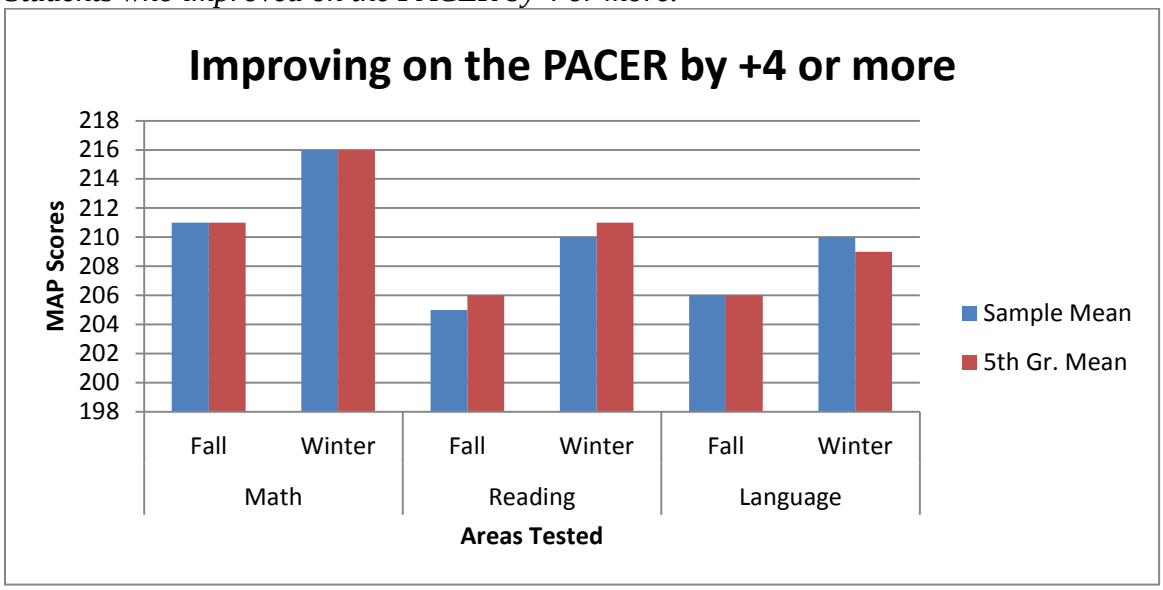
Research Question Two

Another question looked at by the researcher was what is the magnitude and direction of the association between the Fitnessgram PACER scores and MAP scores? To look at this question the researcher looked at two areas: the student's improvement in the PACER and their overall PACER score.

Looking first at student improvement the researcher was able to break the fifth grade sample group into three sub groups: Those who improved by four or more, those who improved by zero to three, and those scores that decreased by one to fifteen.

In the first sub group, those who improved by four or more, the researcher found that there was not a big difference between these 59 students and the whole group. Table 4 below shows that all the mean scores came out almost exactly where the mean scores were for the whole fifth grade sample group.

Table 4
Students who improved on the PACER by 4 or more.

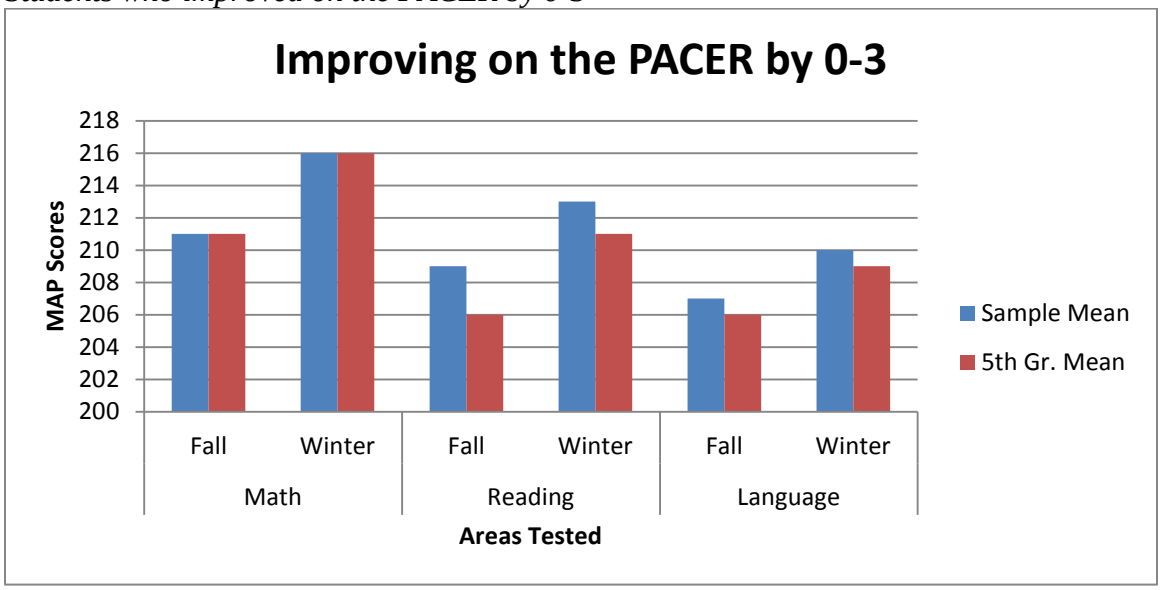


All their math MAP scores came out to be the same for the fall and the winter. The few adjustments in scores came during the fall and winter testing of reading. This group scored one point lower than the whole grade level's mean. Another area that was different was the MAP testing of language usage during the winter. This group's mean was one point higher than the overall group's mean, which overall was close to where the whole groups mean scores are.

The next sub group the researcher looked at were the students who improved by zero to three on their PACER. This group of 63 students were about the same as the first group but they showed some higher scores in reading during both the fall and winter testing compared to that of the whole group. Below in Table 5 you can see visually how they align with the whole group.

Table 5

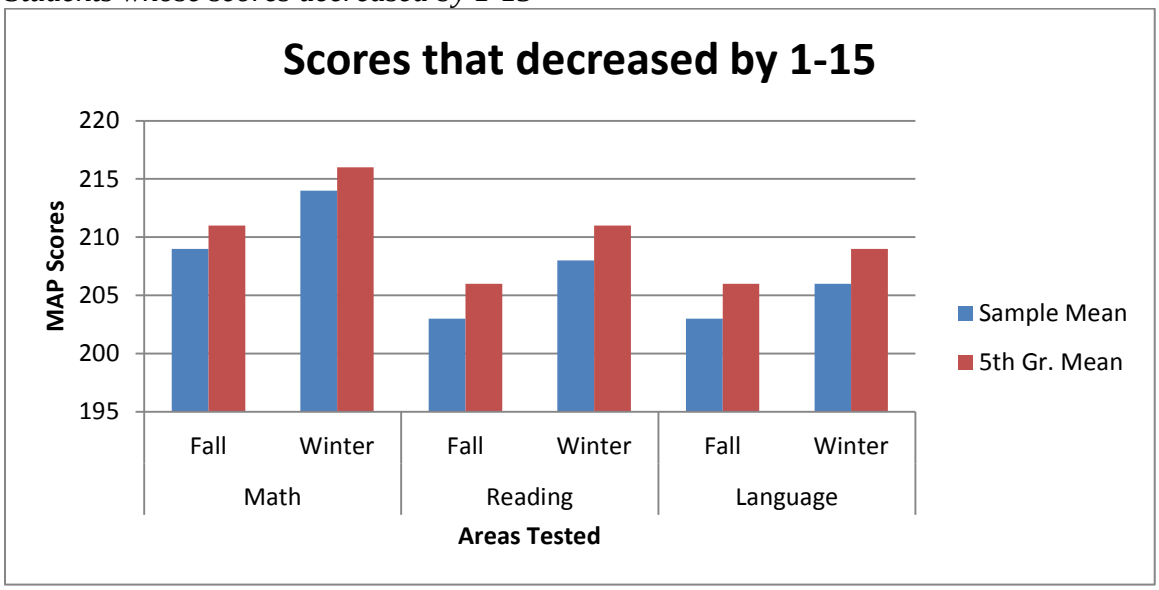
Students who improved on the PACER by 0-3



In the area of math this group was exactly the same as the fifth grade group with their mean scores being 211 in the fall and 216 in the winter. For reading this group scored a mean of 209 in the fall and a 213 in the winter compared to the whole group who scored a mean of 206 in the fall and 211 in the winter. The final area, language usage, they had a mean that was slightly higher compared to the whole group scoring a 207 in the fall and a 210 in the winter which would put them one point above the whole fifth grade group and their mean scores.

The final sub group that the researcher looked at were those students whose scores decreased by one to fifteen. These 25 students showed that their mean scores were below all the fifth grade group in all the areas tested. Table 6 shows this well.

Table 6
Students whose scores decreased by 1-15



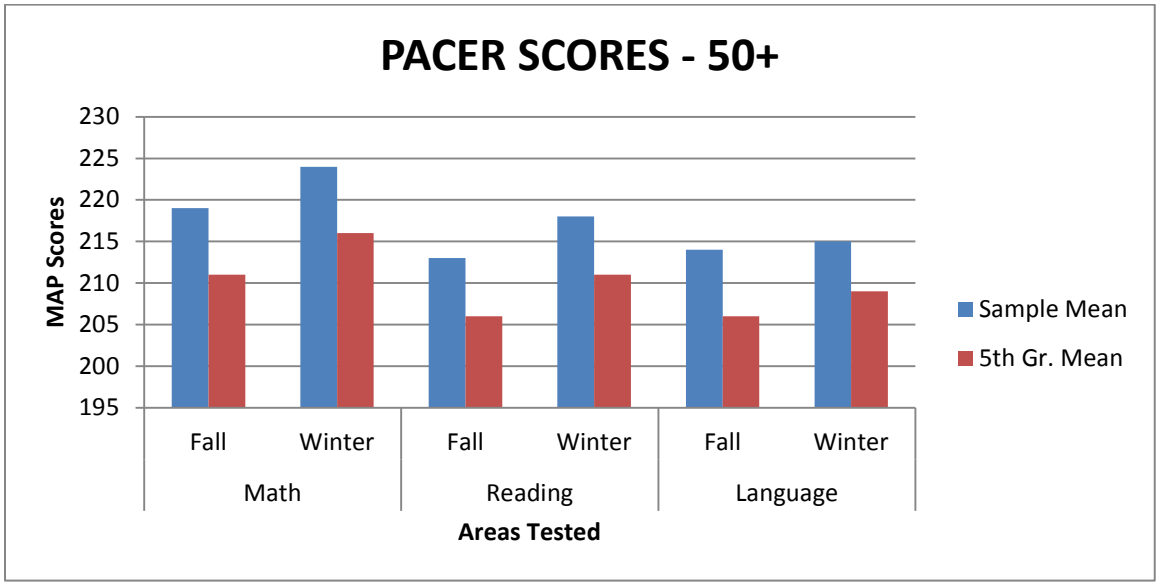
In the area of math, this group had a mean score in the fall of 209 and in the winter they had a mean of 214, which is two points below the mean of the whole fifth-grade group. In reading, they scored a mean of 203 in the fall and a 208 in the winter. This was a full three points below where the whole group's mean was. Finally, in language usage they had a mean of 203 in the fall and a 206 in the winter, which is also three points below where the mean of the whole group is.

The researcher next examined the fifth-graders' overall PACER scores. This was also broken down into three sub groups: Those whose PACER scores were 50+, those who scored between 30-49 on the PACER, and those who scored between 0-29 on the PACER.

In the first sub group, those students who scored above fifty, one can see the scores below in Table 7 and how they compared to the rest of the fifth grade sample group. Overall, 29 students were in this particular group.

Table 7

Students PACER Scores who scores above 50+

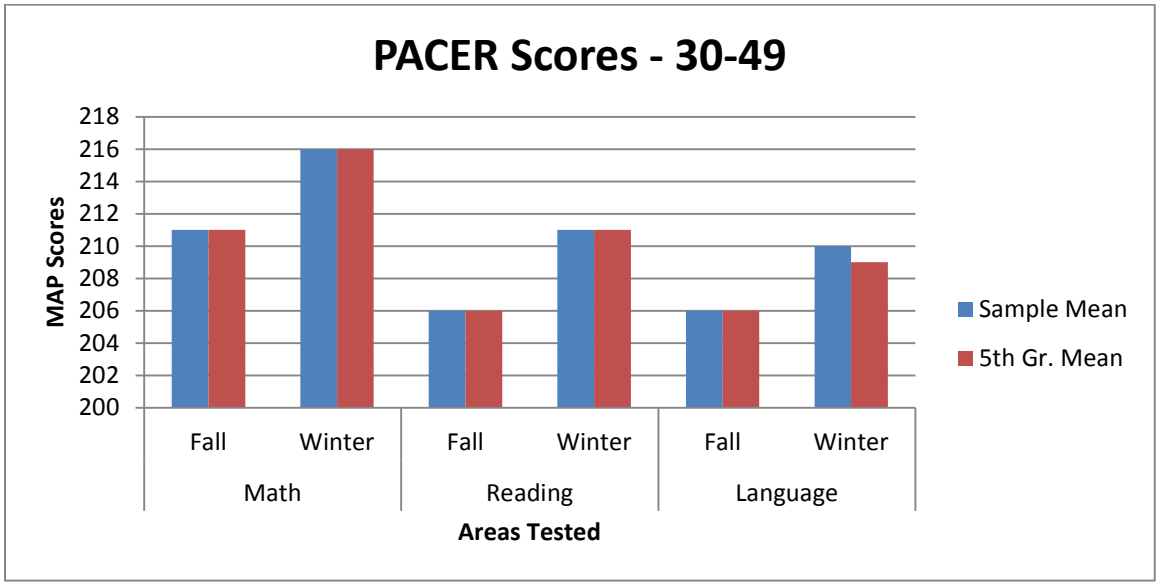


When looking at their MAP scores in the areas tested, it is obvious that this group's scores are significantly above where the rest of their grade level is. In math, their mean score was a 219 in the fall and a 224 in the winter, which is eight points above the rest of their classmates. In reading, their fall scores were a 213 and a 218 in the winter, which is a seven point increase, also a substantial increase. Finally, their language usage MAP scores were a 214 in the fall and a 215 in the winter, which is also above the whole group's mean. Overall, their mean scores in all the areas tested were well above the mean scores of the whole group.

The second sub group the researcher looked at were the 55 students who scored between 30-49 on their PACER test. Once compared to the fifth grade mean scores their scores lined up quite closely. As Table 8 below shows, all the MAP scores line up almost with the whole fifth grade sample group and their mean scores.

Table 8

Students who scored a 30-49 on the PACER

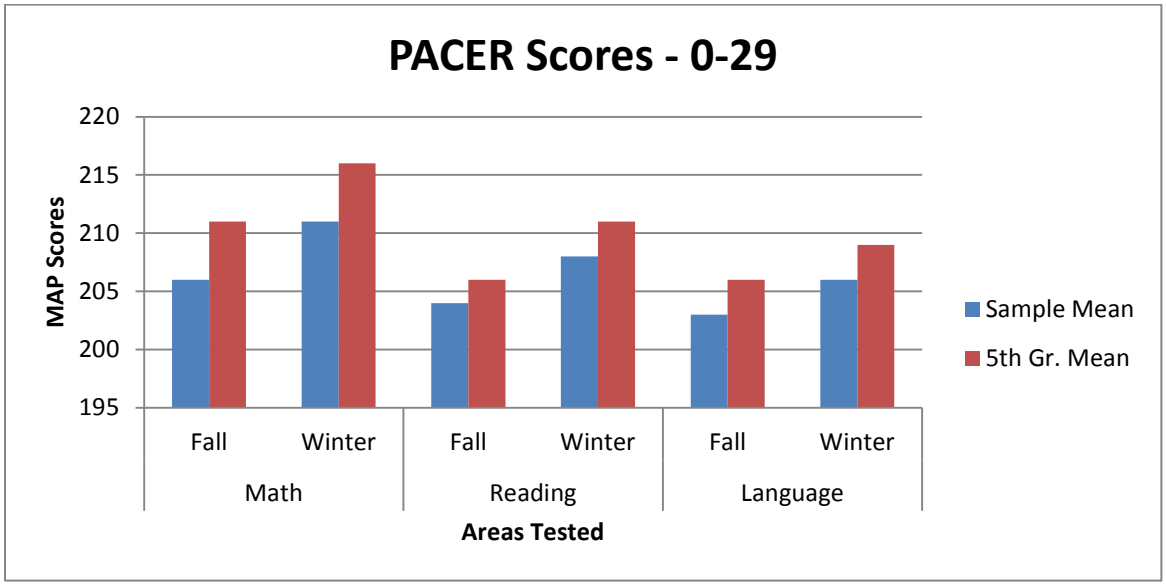


What the researcher found out was that this group's mean scores in the MAP test were aligned with the whole fifth grade group. As for the areas tested, math, reading, and language usage, all these areas showed similar scores. The only area that was different was the winter scores for the sample group which had a mean of 210 compared to the whole group, who had a mean of 209.

The final subgroup the researcher looked at were those 63 students who scored a 0-29 on the PACER.

Table 9

Students who scored a 0-29 on the PACER



What the researcher found was that these MAP scores were below what the mean was for whole group. These 63 students scored a mean of 206 in math in the fall which was 5 points below the average. In the winter they scored a 211 but still below the MAP score of 216 in math. As for reading they scored a 204 in the fall and a 208 in the winter while the whole group had a 206 for the fall and a 211 for the winter scores. Finally in language usage they scored a mean of 203 for the fall, which is short of the 206 the fifth grade group had. For the winter they were able to increase by three points to a 206 which was short of the fifth grade mean of 209. Overall this group scored two to five points lower on their MAP tested areas compared to that of the overall sample group.

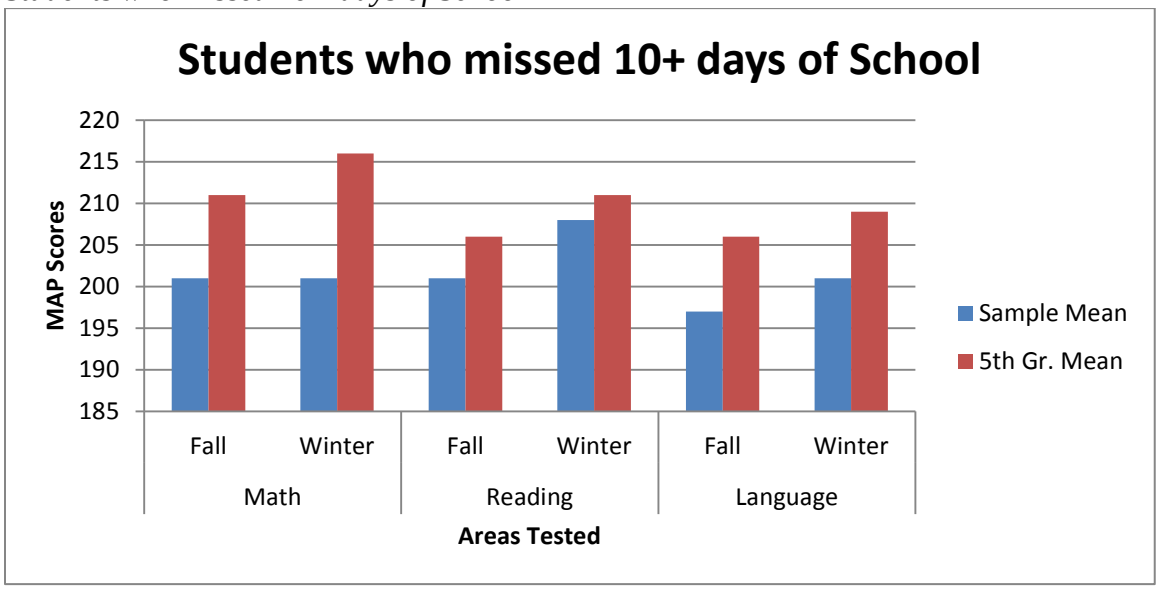
So when looking at the question, what is the magnitude and direction of the association between the Fitnessgram PACER scores and MAP scores? By looking at all these scores it is evident that the PACER can be an used to see how students will achieve on the MAP test by looking at their PACER scores, not by if they improve on it. Though that has some degree of

relevance, looking at how a student scored on the PACER will give a teacher an idea of how they will score on the MAP test in all the areas that were tested. The range of PACER scores allowed enough data to show different ranges and how they aligned with the MAP tests. The only part that showed any significance was if a student decreased on their scores. This was a part that showed some correlation as their math, reading, and language usage scores were below the mean of the MAP scores in the fifth grade group.

Research Question Three

Another question the researcher looked at was how daily attendance impacted the students MAP and PACER scores. This question was broken into three groups like the other areas. The first section looked as was those students who missed ten or more days of school. The data below in Table 10 show what their MAP scores look like compared to the whole group.

Table 10
Students who missed 10+ days of School



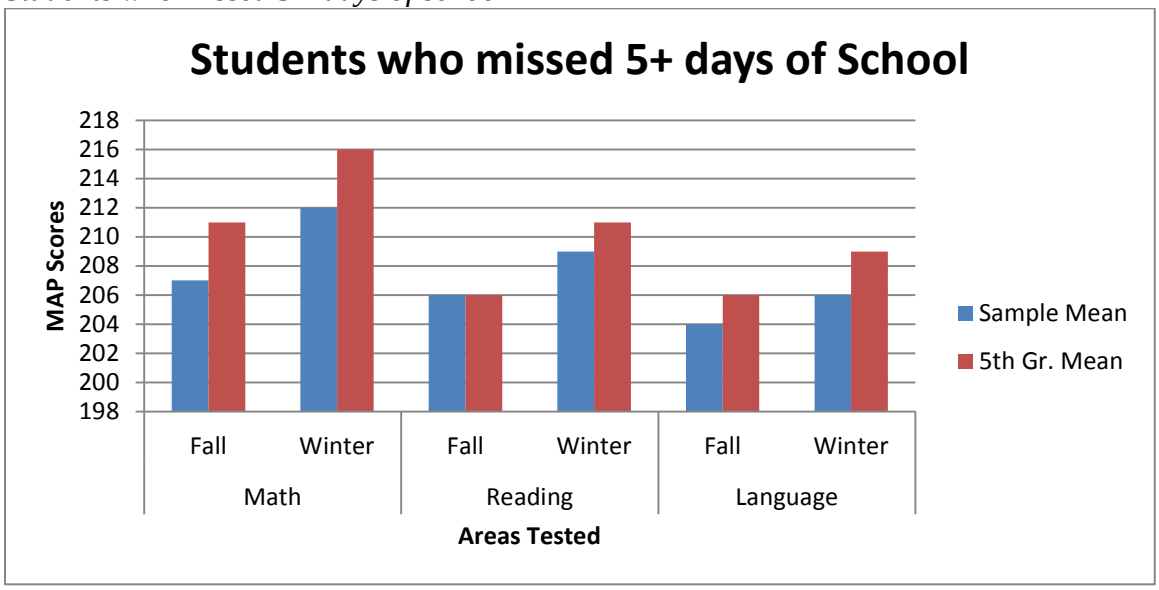
It is evident that these seven students are well below the mean of the whole fifth grade groups in all areas. In the area of math these students had a mean of 201 both in the fall and

winter; out of all these areas this is the one area where the scores were not impacted in a positive or negative way. In reading they had a 201 in the fall and 208 in the winter. Interesting to note, though, is that they saw a 6.2 increase in their scores while other groups saw a 3 and 5.5 increase with reading. Finally, these students scored a mean of 197 in language usage in the fall and 201 in the winter for their mean scores. Besides the reading scores, these students were barely hitting the two hundred mark for MAP scores.

The researcher then divided the fifth-graders into two sub groups: Students who missed 5 or more days of school, and those who missed zero to four days of school.

In the first group, there were 70 students who missed five or more days of school. These students had an average on their PACER test of 28-30 with an overall increase of 2.3. As we saw above in our results for PACER scores and those that fall into those numbers, their MAP scores are right at average with the rest of the class. Table 11 shows exactly how they aligned with the whole fifth grade group.

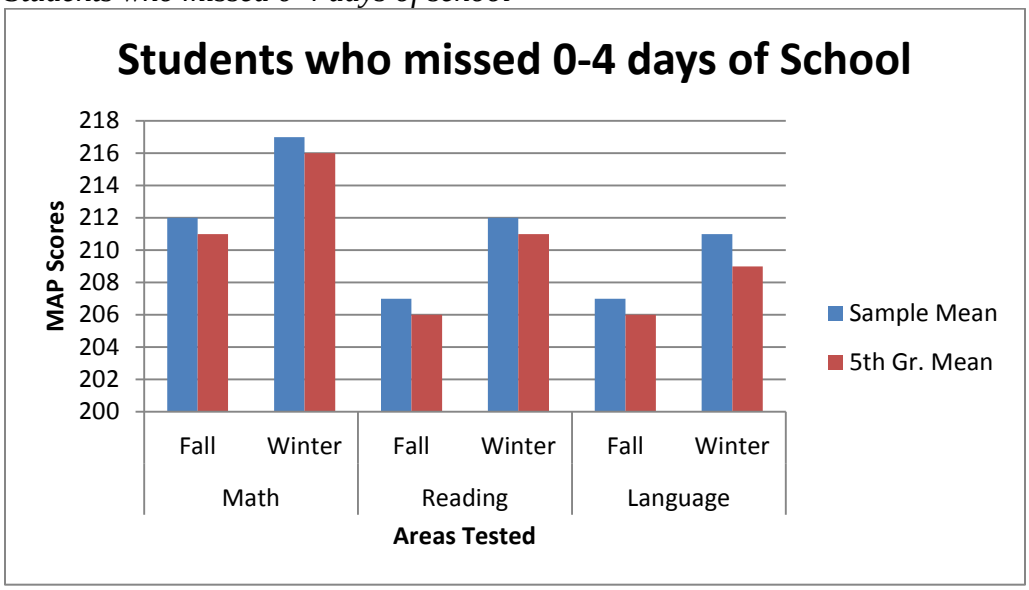
Table 11
Students who missed 5+ days of school



These students were close to where their classmates were but their MAP scores fall just short in all the areas, math being the main one. In the fall they scored a 207 in math for their mean and a 212 in the winter. For reading their mean was a 206 in the fall and a 209 in the winter. The last area, language usage, they were able to get a mean of 204 in the fall and a 206 in the winter.

The final group that the researcher looked at were those students who missed zero to four days of school. Table 12 shows us that this group of 95 students had scores that are above where the whole fifth grade group was.

Table 12
Students who missed 0-4 days of school



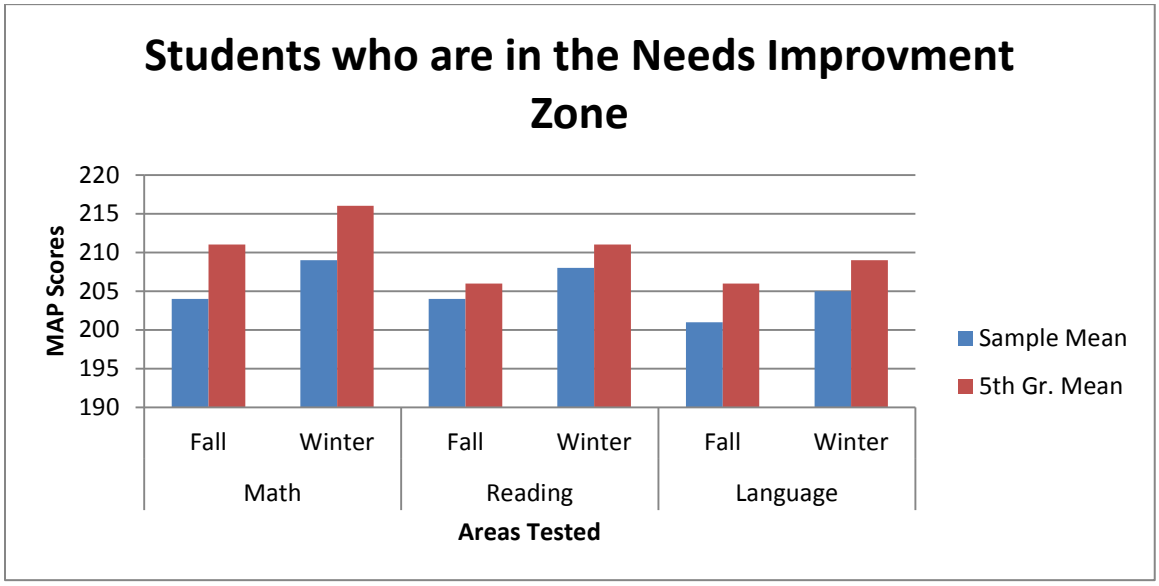
Their mean scores in math for the fall were 212 and in the winter 217, which is one point higher than the mean scores of the whole group. For reading they had a mean of 207 and 212 which again is one point above the mean of the group. Finally, their language usage scores were a 207 for their fall testing and 211, which was higher than the mean of the whole group. Along

with those scores, this group had a high PACER range, which was 38-42, and they increased those scores on average by 3.1 when they ran that test.

Research Question Four

The final question that was looked at by the researcher was: is there a difference between all participants that met the HFZ (Healthy Fit Zone) for aerobic capacity and those participants that did not meet the HFZ and that are in the NI (Needs Improvement) zone?

Table 13
Students who are in the NI Zone

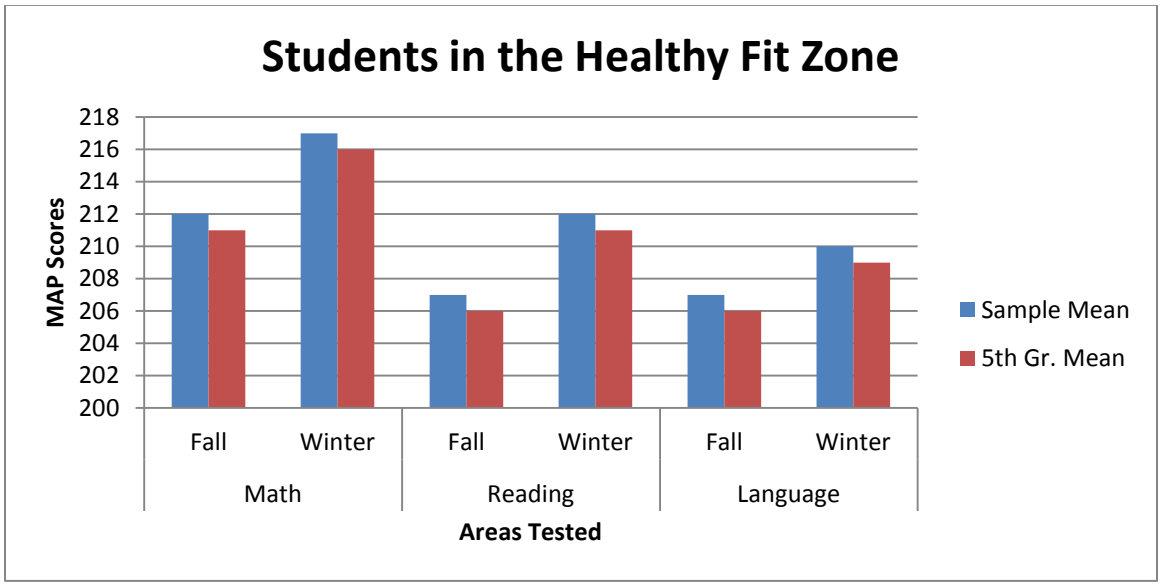


When looking at this data a couple aspects develop for this group of 21 students. The first area is that all their MAP Scores in all three subject areas tested fall below where the rest of the fifth grade sample group scored. In math, their scores were 204 in the fall and a 209 in the winter, which is seven to nine points below the mean of the whole group. In reading they scored a mean of 204 in the fall and 208 in the winter, three points below the whole group. Finally for language usage they scored a 201 in the fall and 205 in the winter, four points below the whole group. The data shows that this group struggled academically with all the areas tested.

Furthermore their PACER scores were also low; their mean for the test was 14.8 in the fall and came up to a 16.2. This group of students also missed 6.4 days of school which is three points higher than the whole group.

The next group are those 126 students who are in the HFZ. These students as Table 14 shows below scored a mean above the whole group.

Table 14
Students who are in the Health Fit Zone



In all the areas they scored one point higher than the fifth grade group mean. In math they scored a 212 in the fall and 217 in the winter. In reading they scored a 207 in the fall and 212 in the winter and in language usage a 207 in the fall and 210 in the winter. All of these are above the group mean scores. As for the PACER, they were significantly higher compared to those students who were in the NI group. This group had a mean of 38 in the fall and a 41 in the winter. As was discussed during our PACER scores section, students who fall between 30-49 in the PACER usually score at or above the class mean. The final piece is that these students missed on average 3.3 days of school, which is a three points below the NI group. Also

mentioned above was how attendance impacts students MAP scores so the correlation there is beneficial.

Overall the data shows that those students who are in school more do better at the PACER test as well as the MAP test in all areas. Those who miss ten or more days of school showed that their scores are significantly lower and their PACER scores are lower. Those who missed five or more days also had lower MAP scores. This data would indicate that attendance does have an impact on the MAP scores as well as PACER scores. This study overall supports this paper's hypothesis in regards to a correlation between Fitnessgram scores and standardized tests scores.

Discussion

Overview of this Study

The purpose of this study was to find the answers to multiple questions regarding physical activity and its relationship to academic tests scores:

1. Whether or not the BMI plays a role in the association between the two factors: the Fitnessgram PACER and MAP Testing?
2. What is the magnitude and direction of the association between the Fitnessgram PACER scores and MAP scores?
3. How does daily attendance impact the students MAP and PACER scores?
4. Is there a difference between all participants that met the HFZ (Healthy Fit Zone) for aerobic capacity and those participants that did not meet the HFZ and that are in the NI (Needs Improvement) zone?

To answer those questions, the researcher collected all the students' data from their fall 2016 MAP test as well as their winter 2017 MAP tests. The fall and winter PACER scores were also collected as well as the students BMI scores and attendance records. Once these pieces of data were collected they were entered into a spreadsheet and were organized according to their topic related to the research. Once all the data was entered the information was then sorted accordingly by topics to begin the search for the relationship between all the variables.

Summary

After the researcher entered all the data into their spreadsheet a couple pieces started to show. First in the attendance section, those students who attended school more regularly missing only 0-5 days compared to the other groups scored higher on the MAP tests. These students also achieved higher PACER scores. The students who missed the most school, those who missed ten plus days, had the biggest gains in reading with a 6.2 increase between their fall and winter tests. Those who missed five or more were very average with their MAP scores compared to the whole group.

The second areas that were looked as was how students who improved on their PACER did compared to their MAP tests. One aspect that stood out were those students who made the biggest gains in the PACER made slightly higher gains in math and reading; they increased their scores by 5.2 from the fall to the winter. Those students who improved by zero to three were about at the same level as the rest of the groups MAP scores. The final group whose scores decreased showed MAP scores that were two to three points below the rest of the group and their mean MAP scores.

The next area looked at were those students and their actual PACER scores and how those scores compared to the MAP test. The students who had PACER scores of over 50 were eight points above the whole fifth grade group mean in reading, seven points above in reading and eight points above in the fall and six points above in the winter. They did only though increase by one point from the fall to the winter, the lowest improvement in the three PACER score groups. Those students who scored a 30-49 were at the same level as the rest of the grade level. The final group being those who scored zero to twenty-nine had scores on the MAP tests that were two to five points lower compared to the whole group. They did though improve by five points in their math MAP scores from the fall to the winter; that is comparable to the other two groups.

Another area that was considered were the student's BMI numbers and how those looked when comparing their MAP score numbers. Those students who had lower BMI scores had the biggest reading improvement but their winter average was still below the medium BMI kids' fall starting point in reading. The medium BMI students had the highest scores on math, reading, and language usage but their PACER scores were lower than those of the low BMI students. The students who had high BMI numbers had more absences on average and less math improvement than medium BMI students. These students had the biggest reading improvement but their winter average was still below the medium BMI kids' fall starting point in reading.

Conclusion

Implications

Based on the data that was found, there are a few aspects that show some implications. First is that students should be encouraged to be in school as much as they can as the data shows

that days missed and MAP scores go hand in hand. If they can be in the classroom learning their MAP scores will be at a sufficient level (see Table 10, Table 11, and Table 12).

Another implication that the researcher found was that PACER scores may predict how well a student will do on the MAP test (see Table 7, Table 8, and Table 9). This would mean there needs to be an increase in student's activity time. That could mean increasing their unstructured time of recess or increasing their physical education time. Both would allow students more time to be active, which would hopefully increase their physical fitness level.

Along with the above implications, a health plan for students would be beneficial too. This would be teaching the students what a healthy lifestyle looks like and how eating well is beneficial in all areas of their lives. The researcher was able to find a link between BMI and their MAP scores (see Table 1, Table 2, and Table 3) so if we can help students to be active and engage in a healthy lifestyle the goal would be to have them in the ideal BMI range. As the research above shows, those who have an ideal BMI score better on the MAP test compared to those who have a high BMI.

Limitations

A limitation in this research is that this research has the inability to monitor the heart rate of the 5th grade students. Students should be reaching their target heart rate consistently to ensure they are processing towards physical fitness. The 5th grade participants only attended physical education twice a week for thirty-five minutes. This limited their time to reach their target heart rate.

An additional limitation was that PACER scores and academic tests scores were looked at only for the fifth grade students at Discovery Elementary. In order to broaden the scope of the

results it would be beneficial to either use the whole school district's information for all fifth grade students or look at multiple grade levels including the middle and high school students into this study.

Another limitation was the inability to monitor student physical activity away from school. Students are not monitored as to the amount of activity they participated in away from the physical education class. It is the goal of the teachers to encourage a health and active life away from school but the researcher had no way of tracking such activity.

A further limitation was the small ethnic groups represented in the pool of participants. The participants are from a middle class Midwest elementary school so there are not very many ethnic groups represented in this research. Other groups would have been beneficial to see the full extent of the relationship between different ethnic groups.

A final limitation is the inability to stretch this research over the course of numerous years. This research was done over the time period of August of 2016 to February 2017. To get a complete grasp on the relationship between the PACER tests and MAP scores a collection of scores over the course of years would be beneficial.

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Appendix A

Fifth Grade gender, BMI, attendance numbers, and PACER Scores.

ID#	GENDER	BMI	Days missed	HFZ	FALL	WINTER	Diff.
					PACER		
320797	MALE	16.9	18	HFZ	21	28	**7**
314405	FEMALE	18	1	HFZ	54	56	**2**
319098	FEMALE	16.7	0	HFZ	41	33	-12
314730	FEMALE	16.4	9	HFZ	21	27	6
306979	FEMALE	18.2	3	HFZ	40	42	2
316953	FEMALE	17.6	4	HFZ	42	45	3
314830	MALE	22.7	2	NI	19	18	-1
314846	FEMALE	18.2	1	HFZ	44	31	-13
310078	FEMALE	15.5	0	HFZ	34	40	4
309696	MALE	17.9	7	HFZ	25	28	3
309949	MALE	17.9	2	HFZ	19	20	1
315153	FEMALE	23.4	1	NI	18	19	2
315158	MALE	15.4	11	HFZ	41	41	0
315183	MALE	21.7	6	NI	21	19	2
329057	MALE	16.3	6	HFZ	22	32	10
315225	MALE	16.2	1	HFZ	65	67	2
315305	FEMALE	22.2	2	HFZ	22	26	4
315306	MALE	20.3	7	HFZ	28	33	5
314991	MALE	18.3	2	HFZ	27	33	4
311149	FEMALE	15.1	1	HFZ	28	25	-3
300530	FEMALE	20.1	1	HFZ	20	27	7
315139	FEMALE	25.1	5	NI	16	18	2
240090	MALE	25.3	9	HFZ	14	15	1
315281	FEMALE	17	0	HFZ	54	51	-4
241421	FEMALE	16.1	0	HFZ	46	52	6
311204	FEMALE	27	12	NI	8	10	2
337987	MALE	18	0	HFZ	42	46	4
239059	MALE	14.1	2	HFZ	15	25	10
315050	MALE	20.2	1	HFZ	70	70	0
315164	MALE	14.7	3	HFZ	70	63	-7
331855	MALE	18.8	7	HFZ	45	41	-4
240925	FEMALE	15.1	0	HFZ	22	29	7
315106	FEMALE	16.1	0	HFZ	21	28	7
307834	FEMALE	17.1	1	HFZ	22	23	1

315148	MALE	25.7	4	HFZ	19	21	2
315049	MALE	17.8	0	HFZ	33	42	9
315042	MALE	19.4	7	HFZ	21	21	0
308148	FEMALE	15.3	2	HFZ	29	32	3
329586	MALE	15.1	5	HFZ	75	67	-8
315873	MALE	17.5	4	HFZ	0	53	0
315192	FEMALE	20.3	2	NI	17	21	4
316473	MALE	15.5	8	HFZ	31	35	4
311154	FEMALE	20.2	2	NI	14	14	0
316192	FEMALE	17.4	7	NI	14	14	0
239020	FEMALE	24.4	18	NI	0	18	0
314521	FEMALE	23.9	6	HFZ	34	36	2
315276	FEMALE	22.7	11	NI	15	14	-1
315491	MALE	18.1	7	HFZ	21	25	4
321257	MALE	18	1	HFZ	60	62	2
306582	FEMALE	17.6	4	HFZ	27	30	3
314727	MALE	19.6	3	HFZ	43	46	3
314748	FEMALE	15.5	2	HFZ	26	29	3
314635	MALE	15.6	5	HFZ	31	26	-5
317210	MALE	16.6	7	HFZ	24	27	3
315023	FEMALE	23.8	0	HFZ	32	36	4
308722	MALE	21.5	9	NI-HR	12	13	-1
306985	FEMALE	21.5	9	HFZ	41	43	2
337140	FEMALE	19.2	3	HFZ	41	46	5
330057	FEMALE	20.5	6	HFZ	31	36	5
316061	MALE	18.5	0	HFZ	35	34	-1
310465	FEMALE	16.8	5	HFZ	43	53	10
315224	FEMALE	17.1	6	HFZ	50	51	1
336861	FEMALE	19.5	8	HFZ	28	31	3
315312	MALE	22	0	HFZ	41	60	19
315315	FEMALE	25.5	1	HFZ	24	28	4
306903	MALE	17.8	6	HFZ	35	42	7
315145	FEMALE	19.6	7	HFZ	24	26	2
325877	FEMALE	29.1	0	HFZ	15	28	13
308000	MALE	21.5	0	HFZ	31	32	1
315000	MALE	18.7	9	HFZ	70	75	5
315308	MALE	18.4	1	HFZ	51	66	15
314510	MALE	18	1	HFZ	60	65	5
315385	FEMALE	14.4	5	HFZ	30	32	2
335987	FEMALE	16.1	11	NI	18	17	-1
314377	MALE	17.8	0	HFZ	80	84	4

314429	FEMALE	18.5	5	NI	21	21	0
312485	FEMALE	17.5	6	HFZ	37	41	4
314514	FEMALE	21.3	3	HFZ	26	23	-3
314515	FEMALE	15.8	4	HFZ	30	38	8
315934	FEMALE	23	4	HFZ	30	30	0
313006	FEMALE	19	2	HFZ	28	30	2
310990	MALE	23.4	2	NI	13	21	8
314769	MALE	14.9	4	HFZ	70	62	-8
314851	FEMALE	15.4	2	HFZ	21	28	7
314921	FEMALE	17.4	6	HFZ	45	47	2
312957	FEMALE	16.9	0	HFZ	30	35	5
338498	MALE	18.6	0	HFZ	40	50	10
315008	MALE	23	5	NI	14	18	4
315015	MALE	15.8	3	HFZ	71	85	14
334576	MALE	15.1	0	HFZ	39	47	8
337960	MALE	20.7	0	HFZ	42	48	6
339035	FEMALE	16	2	HFZ	40	64	24
317434	MALE	15.8	8	HFZ	26	29	3
316191	MALE	15.5	1	HFZ	74	75	1
309260	FEMALE	21.4	8	NI	12	14	2
308889	MALE	17.5	4	HFZ	30	32	2
303409	MALE	18.6	0	HFZ	40	51	11
331006	FEMALE	19.7	9	NI	16	12	-4
324110	MALE	15.4	5	HFZ	24	32	8
315102	FEMALE	18.6	7	HFZ	42	47	5
337697	FEMALE	19.7	1	HFZ	42	51	9
314450	MALE	18.2	2	HFZ	35	38	3
314583	FEMALE	18.4	1	HFZ	28	32	4
314497	MALE	18.2	4	HFZ	50	55	5
314825	FEMALE	22.6	3	NI	13	15	2
326453	MALE	22.2	2	NI	25	19	-6
314739	MALE	26.6	7	HFZ	16	17	1
325234	FEMALE	19.1	6	HFZ	42	44	2
337589	FEMALE	18.8	7	HFZ	36	42	6
314915	MALE	18.5	2	HFZ	57	64	7
311258	FEMALE	17.5	1	HFZ	28	33	5
305116	MALE	17.2	4	HFZ	31	21	-10
300274	FEMALE	17.3	0	HFZ	56	53	-3
314988	FEMALE	19.5	2	HFZ	55	48	-7
315112	FEMALE	18	1	HFZ	44	48	4
337811	FEMALE	15.2	1	HFZ	51	52	1

315648	MALE	22.2	5	HFZ	18	21	3
315201	FEMALE	20.2	7	HFZ	58	60	2
313459	MALE	26.6	2	HFZ	31	31	0
315319	FEMALE	16.9	2	HFZ	66	67	1
315322	MALE	22.1	9	HFZ	28	31	3
315348	MALE	18.6	3	HFZ	36	39	3
315269	FEMALE	17	4	HFZ	28	29	1
314453	FEMALE	20.9	5	HFZ	24	25	1
307127	FEMALE	20.6	3	HFZ	33	26	-6
314734	FEMALE	21.9	3	HFZ	34	38	4
304403	FEMALE	32	8	NI		12	0
318132	MALE	25.4	7	NI	10	15	5
314844	MALE	16.9	4	HFZ	76	74	-2
314857	MALE	15.4	1	HFZ	21	36	15
302189	MALE	23.4	4	HFZ	46	51	5
314952	FEMALE	22.1	2	HFZ	26	26	0
300272	FEMALE	17.7	1	HFZ	30	34	4
314423	MALE	18.1	2	HFZ	53	73	20
315018	FEMALE	16.6	4	HFZ	53	55	2
314750	MALE	14.3	0	HFZ	70	55	-15
337384	FEMALE	23.2	1	HFZ	30	46	16
315202	MALE	17	0	HFZ	67	70	3
315205	MALE	20.7	2	HFZ	35	36	1
315214	FEMALE	16.9	10	HFZ		44	0
317075	FEMALE	14.8	1	HFZ	40	52	12
237828	MALE	25.7	5	HFZ	30	31	1
239049	MALE	17.4	1	HFZ	64	57	-7
315288	FEMALE	16.4	1	HFZ	62	69	7
339055	FEMALE	13.7	3	HFZ	46	40	-6
321720	FEMALE	14.1	4	HFZ	34	36	2
317685	MALE	19.9	4	HFZ	30	33	3

Appendix B

Fifth Grade MAP Scores: Math, Reading, and Language Usage.

ID#	GENDER	FALL	WINTER	Diff	FALL	WINTER	Diff	Fall	Winter	Diff
		Mathematics			Reading			Language		
320797	MALE	195	186	-9	192	198	3	198	184	-14
314405	FEMALE	196	207	11	198	210	12	207	204	-3
319098	FEMALE	207	216	9	219	221	2	216	209	-7
314730	FEMALE	200	207	7	201	196	-5	199	208	9
306979	FEMALE	215	228	13	206	211	5	212	222	10
316953	FEMALE	202	209	7	201	205	4	192	195	3
314830	MALE	200	206	3	169	195	26	182	197	15
314846	FEMALE	212	214	2	211	215	4	205	205	0
310078	FEMALE	201	216	15	195	206	11	197	210	13
309696	MALE	195	199	4	187	180	-7	191	188	-3
309949	MALE	219	222	3	221	231	10	213	228	15
315153	FEMALE	210	226	16	223	221	-2	215	217	2
315158	MALE	219	226	7	221	219	-2	213	212	-1
315183	MALE	199	211	12	198	208	10	201	208	7
329057	MALE	175	188	13	160	170	10	161	170	9
315225	MALE	213	219	6	210	214	4	205	209	4
315305	FEMALE	211	217	6	203	227	24	203	215	12
315306	MALE	212	210	-2	209	214	5	204	208	4
314991	MALE	220	227	7	215	222	7	210	211	1
311149	FEMALE	163	183	20	156	170	14	165	170	5
300530	FEMALE	214	225	11	200	213	13	202	199	-3
315139	FEMALE	207	209	2	219	230	11	219	222	3
240090	MALE	211	215	4	206	227	21	216	216	0
315281	FEMALE	232	233	1	219	229	10	219	219	0
241421	FEMALE	213	227	14	200	210	10	207	214	7
311204	FEMALE	205	194	-11	193	208	12	196	208	12
337987	MALE	214	211	-3	215	222	7	208	205	-3
239059	MALE	-	-	-	-	-	-	-	-	-
315050	MALE	222	228	6	221	221	0	215	220	5
315164	MALE	225	225	0	223	217	-6	221	218	-3
331855	MALE	216	218	2	211	218	7	202	216	14
240925	FEMALE	219	228	9	224	225	1	221	223	2
315106	FEMALE	209	204	-5	195	204	9	201	206	5
307834	FEMALE	217	218	1	215	227	12	219	216	-3
315148	MALE	201	200	-1	192	194	2	187	198	11
315049	MALE	221	218	-3	214	211	-3	207	213	6

315042	MALE	198	209	1	206	204	-2	208	196	-12
308148	FEMALE	218	227	9	209	213	4	215	222	7
329586	MALE	214	206	-8	211	200	-11	208	204	-4
315873	MALE	199	205	6	201	202	1	196	206	10
315192	FEMALE	201	207	6	210	213	3	209	207	-2
316473	MALE	207	213	6	208	222	14	208	211	3
311154	FEMALE	225	222	-3	232	225	-7	223	218	-5
316192	FEMALE	217	219	2	212	218	6	205	214	9
239020	FEMALE	204	207	3	214	227	13	211	204	-7
314521	FEMALE	238	251	13	226	222	-4	223	225	2
315276	FEMALE	209	212	3	206	222	16	195	207	12
315491	MALE	242	242	0	226	231	5	227	220	-7
321257	MALE	221	221	0	226	224	-2	217	217	0
306582	FEMALE	158	163	5	150	157	7	160	160	0
314727	MALE	216	214	-2	204	211	7	204	201	-3
314748	FEMALE	209	212	3	209	199	-10	198	207	9
314635	MALE	212	219	7	213	205	-8	199	210	11
317210	MALE	214	213	-1	202	193	-9	200	208	8
315023	FEMALE	220	224	4	209	213	4	210	211	1
308722	MALE	207	219	12	210	208	-2	197	204	7
306985	FEMALE	196	199	3	192	203	11	195	194	-1
337140	FEMALE	219	224	5	223	231	8	226	230	4
330057	FEMALE	190	188	-2	184	174	-10	178	192	14
316061	MALE	207	202	-5	207	208	1	204	209	5
310465	FEMALE	170	183	13	158	176	18	184	183	-1
315224	FEMALE	212	219	7	218	221	3	204	216	12
336861	FEMALE	217	229	12	223	216	-7	217	214	-3
315312	MALE	226	228	2	207	214	7	212	214	2
315315	FEMALE	214	216	2	213	215	2	223	216	-7
306903	MALE	218	223	5	212	209	-3	213	209	-4
315145	FEMALE	204	207	3	205	214	9	207	205	-2
325877	FEMALE	193	201	8	193	186	-7	184	198	14
308000	MALE	205	204	-1	201	200	-1	195	205	10
315000	MALE	223	228	-1	224	223	-1	224	216	-1
315308	MALE	221	222	7	213	212	-1	212	223	4
314510	MALE	232	238	6	227	226	-1	225	224	-1
315385	FEMALE	209	212	3	208	211	3	213	212	-1
335987	FEMALE	171	170	-1	162	167	5	157	169	12
314377	MALE	212	216	4	193	207	14	204	204	0
314429	FEMALE	198	198	0	215	213	-2	215	208	-7
312485	FEMALE	216	224	8	215	214	-1	213	212	-1

314514	FEMALE	223	228	5	216	219	3	221	221	0
314515	FEMALE	214	232	18	216	227	11	215	216	1
315934	FEMALE	198	200	2	203	198	-5	185	199	14
313006	FEMALE	210	207	-3	204	207	3	209	209	0
310990	MALE	215	225	10	216	215	-1	218	213	-5
314769	MALE	224	226	2	209	214	5	216	211	-5
314851	FEMALE	221	233	12	218	217	-1	220	224	4
314921	FEMALE	211	213	2	225	226	1	213	213	0
312957	FEMALE	221	218	-3	201	208	7	202	210	8
338498	MALE	227	235	8	210	214	4	212	205	-7
315008	MALE	231	237	6	233	221	-12	226	231	5
315015	MALE	233	243	10	217	216	-1	218	216	-2
334576	MALE	181	186	5	165	172	7	174	177	3
337960	MALE	227	228	1	213	212	-1	214	221	7
339035	FEMALE	221	236	15	212	220	8	223	225	2
317434	MALE	201	216	15	202	210	8	198	209	11
316191	MALE	212	217	5	193	210	17	202	205	3
309260	FEMALE	206	218	12	202	202	0	204	195	-9
308889	MALE	214	223	9	205	229	24	209	200	-9
303409	MALE	207	208	1	205	203	-2	199	214	15
331006	FEMALE	195	203	8	197	195	-2	184	193	9
324110	MALE	166	174	8	166	177	11	176	174	-2
315102	FEMALE	215	221	6	206	230	24	219	215	-4
337697	FEMALE	203	202	-1	213	210	-3	206	216	8
314450	MALE	212	223	11	204	208	4	211	212	1
314583	FEMALE	228	234	6	229	238	9	225	229	4
314497	MALE	215	220	5	209	209	0	211	216	5
314825	FEMALE	200	202	2	203	201	-2	205	203	-2
326453	MALE	197	193	-4	208	208	0		206	0
314739	MALE	223	225	2	208	211	3	209	209	0
325234	FEMALE	206	217	11	219	219	0	218	213	-5
337589	FEMALE	222	234	12	220	226	6	219	223	4
314915	MALE	231	235	4	227	231	4	218	228	10
311258	FEMALE	202	210	8	202	210	8	205	207	2
305116	MALE	205	210	5	207	219	12	201	208	7
300274	FEMALE	211	231	20	201	205	4	207	200	-7
314988	FEMALE	231	240	9	213	218	5	222	223	1
315112	FEMALE	215	222	7	201	198	-3	206	204	-2
337811	FEMALE	226	227	1	228	242	14	226	227	1
315648	MALE	240	236	-4	232	232	0	223	225	2
315201	FEMALE	217	223	6	221	222	1	221	219	-2

313459	MALE	203	199	-4	204	194	-10	196	197	1
315319	FEMALE	230	233	3	212	231	19	219	219	0
315322	MALE	218	226	8	217	215	-2	214	217	3
315348	MALE	236	242	6	216	234	18	216	225	9
315269	FEMALE	219	233	14	209	213	4	210	212	2
314453	FEMALE	215	216	1	219	231	12	217	215	-2
307127	FEMALE	212	213	1	195	193	-2	200	205	5
314734	FEMALE	225	218	-7	210	215	5	214	222	8
304403	FEMALE	198	208	10	185	194	9	185	184	-1
318132	MALE	202	203	1	189	185	-4	191	197	6
314844	MALE	223	225	2	205	214	9	204	210	6
314857	MALE	208	213	5	191	202	11	193	198	5
302189	MALE	184	194	10	196	204	8	196	207	11
314952	FEMALE	207	213	6	207	208	1	200	213	13
300272	FEMALE	207	215	8	199	207	8	203	206	3
314423	MALE	203	208	5	195	215	20	200	203	3
315018	FEMALE	225	228	3	219	242	23	229	238	9
314750	MALE	209	218	9	207	214	7	216	209	-7
337384	FEMALE	206	212	6	202	223	21	210	215	5
315202	MALE	218	225	7	219	222	3	215	218	3
315205	MALE	216	216	0	214	215	1	219	218	-1
315214	FEMALE	209	213	4	221	218	-3	214	225	11
317075	FEMALE	207	214	7	208	216	8	195	212	17
237828	MALE	218	227	9	212	209	-3	207	213	6
239049	MALE	211	217	6	201	211	10	203	213	10
315288	FEMALE	231	234	0	218	226	8	225	228	3
339055	FEMALE	221	228	7	220	221	1	219	223	4
321720	FEMALE	219	224	5	214	210	-4	215	223	8
317685	MALE	199	218	19	194	207	13	190	209	19