Examining the Relationship between Fitness Scores and Academic Achievement in Middle School Students

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Table of Contents

List of Tables

Abstract

The purpose of this study was to determine whether students who achieved high levels of fitness would achieve higher quarterly grades in English and math. The measurement tool used was the Fitnessgram fitness assessment and quarterly grades. This study investigated whether students who achieved a healthy fitness zone on the curl-up, push-up, or P.A.C.E.R. (Progressive Aerobic Capacity Endurance Run) fitness tests would have higher quarterly grades than their peers who did not achieve healthy fitness zone. The results were not statistically significant in favor of the students who achieved healthy fitness zone having higher quarterly grades. However, descriptively students who achieved healthy fitness zone had a higher grade-point average in fourteen of the nineteen comparisons. As educators look to address all factors that influence a student's academic achievement there is a need for further research to investigate the relationship between being physically fit and academic achievement as measured by quarterly grades.

CHAPTER 1

INTRODUCTION

Overview

Nearly one in five school age children (6 to 19) are obese. In the state of Maryland 33.6% of 10 to 17-year-old children are overweight or obese. This exceeds the national average. Half of American children (12-19) are not vigorously active on a regular basis. As children get older there is a drastic decline in participation in any type of physical activity (Healthy schools, 2017).

In 2017, on average only 31.8% of Maryland middle school (grades 6-8) students met grade level expectations for English on the PARCC assessment. In Baltimore County only 27.8% of students achieved the met level. For math the numbers are even lower. On average 21.8% of Maryland middle school students are meeting expectations while in Baltimore County that number is only 17.3% (Maryland Report Card, 2018).

According to SHAPE's (Society of Health and Physical Educators) SHAPE of the Nation Report for 2016, "active kids learn better" (Status of Physical Education, 2016). From the previous data it is evident that students are not as active as recommended and they are not learning at expected grade levels. In addition, the Center for Disease Control (CDC), contends that students who have high levels of physical activity and physical fitness have improved cognitive performance (Healthy schools, 2017).

Due to budget cuts and increased pressure to improve English and math test scores, physical education often lands on the chopping block. By removing Physical Education or significantly decreasing class time many students have lost their only opportunity to be physical

active. If SHAPE's statement that "active kids learn better" is true, then cutting physical education time may in fact have the inverse of the intended outcome.

As a veteran physical educator in Baltimore County, this researcher has observed the number of students demonstrating healthy fitness levels decline each year. In addition, each year students seem to struggle more to achieve grade level outcomes. The key to improve student achievement may lie in increasing time spent in physical education and investing more in the results of Fitnessgram assessments.

Statement of Problem

The data indicates reasons for concern for student physical fitness levels in the numbers of obese/overweight children as well as the lack of achievement on standardized grade level assessments. One suggestion is to increase the amount of time in physical education to increase physical fitness levels which has a link to increased academic performance. This study examines the impact of achieving healthy fitness zone on the Fitnessgram assessment on middle school students' academic performance in English and math.

Hypothesis

This study hypothesizes that students who achieve healthy fitness zone in aerobic capacity, and/or the curl-up test, and/or the push-up test will not have statistically significant higher achievement in English and math, as measured by quarterly report card grades.

Operational Definitions

Academic achievement in this study is defined as earning an A or B in the students' grade level English and math class. *Fitnessgram* is a health-related assessment designed by the Cooper Institute. The purpose of the test is to assess youth fitness levels using evidence based standards. In each test students try to achieve the *Healthy Fitness Zone (HFZ).* A score in the HFZ

indicates the student has the fitness level needed for good overall health. If students engage in regular physical activity they should be able to obtain HFZ for their age and gender. *Aerobic capacity* is measured using the students' gender, age, weight, and score on the Progressive Aerobic Capacity Endurance Run (PACER) to determine VO2max. The higher VO2max score the more the student can efficiently use oxygen and complete endurance activities ("Health-related", n.d.).

CHAPTER II

REVIEW OF THE LITERATURE

Overview

This review of literature seeks to examine the correlation between Fitnessgram physical fitness assessment scores and academic achievement. For the purpose of the literature review, all measures of academic achievement are standardized state tests. The review will describe findings about the different Fitnessgram tests and how they affect academic achievement in English/Language Arts (ELA) and math. Finally, the review will seek to determine whether the literature indicates any correlation between physical fitness assessment scores and achievement on standardized academic assessments.

Benefits of Physical Education and Physical Activity

Despite the knowledge that physical activity levels decline during the adolescent years many school systems have continuously cut Physical Education (PE) time in middle and high schools. For many middle and high school students PE is the outlet for physical activity and their opportunity to improve fitness levels. Schools are cutting PE to increase time for academic content. However, these moves may prove counterproductive. While there is no definitive data that PE class specifically helps academic achievement, there is research to support that students who are physically active and healthier do perform better academically (Kall, Malmgren, Olsson, Linden & Nilsson, 2015).

Physical activity affects the brain's structure and function by increasing brain tissue and the development of new neuron connections. These changes have a positive effect on an individual's ability to concentrate, process data, develop memory strategies, and employ coping strategies. All of which puts students in a position to be more academically successful. In

addition, students with higher levels of physical activity demonstrate higher levels of attention. This has been shown to have a positive effect on the learning environment and cognitive development (Iri, Ibis & Aktung, 2016).

Chomtiz, Slining, McGowan, Mitchell, Dawson, and Hacker (2009), support that physical activity has been shown to positively affect cognition and concentration. Moreover, students with high levels of physical activity have demonstrated higher levels of self-esteem and lower levels of anxiety. These two factors in this combination have been linked to higher academic achievement. At this time there is more data supporting the overall benefits of physical activity to the educational experience than a direct link to high fitness levels and academic achievement. However, it still supports the need for physical education as an integral part of a child's educational experience. As school systems struggle to meet the high demands associated with standardized testing by cutting PE, they are stripping student's ability to be physically active daily. This may not be the answer to improving scores. The research shows that increasing PE time has not had a negative effect on academic performance. In fact, learning may be increased by having physically active students.

Bass, Brown, Laurson, and Coleman (2013) also supports not cutting PE programs in favor of additional academic classes due to the cognitive benefits of being physically active and improving cardiovascular health. Even though there is no definitive conclusion that physically fit students perform better academically than their sedentary peers there are significant findings that indicate the overall positive affect of being physical active. PE provides a place for students to be physically active and improve their fitness. Therefore, Physical Education class and its content should be valued as another method to help students achieve academically.

Fitnessgram-Fitness Testing

In a public education system that is increasingly results driven and demands proof of student growth Fitnessgram has emerged as the favored fitness assessment in the United States. The common practice of using Fitnessgram in PE has increased the validity of the assessments and it is required by most state and local systems (Martin & Chalmers, 2007). Fitnessgram is being used by systems in all fifty states and fourteen countries. The need to monitor student fitness levels stems from the decline in physical activity and fitness levels as a student moves from childhood to adolescence. There is a sharp decline in moderate to vigorous activity from 180 minutes at age nine to 42 minutes at age fifteen. This shows that students as they move in to adolescences are insufficiently physically active. Moreover, they are lacking strong cardiorespiratory endurance which has been shown to have the strongest correlation to academic achievement (Suchert, Hanewinkel & Isensee, 2016).

In Baltimore County Public Schools (BCPS) all students in grades 3 through 9, who are physically able, are required to participate in Fitnessgram at least once during the school year. The initial testing must be completed by January and submitted to the central office. The purpose of Fitnessgram is to provide students with a comprehensive assessment of their health-related fitness (Masterson & Walkuski, 2004). The Fitnessgram testing that is required in BCPS include the back-saver sit and reach, shoulder stretch, trunk extension, curl-ups, push-ups, and progressive aerobic capacity endurance run (P.A.C.E.R.). These tests address the health-related components of fitness of flexibility, muscular strength, muscular endurance, and cardio respiratory endurance. For each test students are trying to achieve a score that falls in their healthy fitness zone (HFZ) based on their age and gender. If a student does not fall in their HFZ

suggestions are provided for activities the student can do to improve that area of fitness. This is an advantage of using Fitnessgram as it provides an individualized report for each student.

One criticism of Fitnessgram is that a child's age may act as a negative factor. For example, and eleven-year-old boy only needs to complete 23 laps on the P.A.C.E.R. to achieve HFZ. However, a twelve-year-old boy must complete 32 laps. If a child took the test the week after he turned twelve it may be difficult for him to increase his score by nine laps where as a child who was well into their twelfth year may not notice the increase of laps. The age factor is more of a negative factor for males than females as female scores do not jump as drastically. Despite this the Fitnessgram has been determined to be a valid and reliable test (Wittenberg, Northrup & Cottrell, 2012).

Fitness Levels and Academic Achievement

According to Martin and Chalmers (2007), the investigations into the relationship between academic achievement and physical fitness have produced mixed results. This is seen in the review of the literature on the topic. While all the literature pointed to at least some positive association between higher levels of physical fitness and academic achievement on a whole it is minimal. There is a variation in the effects based on the fitness test, the academic subject, and between males and females. In general, cardiorespiratory endurance (reaching HFZ on the P.A.C.E.R. test) shows the strongest tie to higher levels of academic achievement while the flexibility tests show no correlation to academic achievement.

Bass et al. (2013) found the strongest correlations in cardiovascular endurance and muscular endurance for both males and females. However, the correlations were still week ranging from .12 to .27. This research also found that for males there is a non-significant

correlation between muscular strength and academic achievement. However, for females there was a low yet significant correlation between muscular strength and academic achievement.

Wittenberg et al. (2012) extended previous research to look longitudinally at the relationship between aerobic/cardiorespiratory fitness and academic achievement specifically. Three cohorts of students were fitness assessed as fifth graders and then re-assessed as seventh graders. The measure of academic achievement used was the WESTEST which is the state standardized test given in West Virginia. The research showed that students who were in the HFZ in both the fifth and seventh grade had significantly higher WESTEST scores than students who did not achieve HFZ in either grade. The results also indicated students who were not in the HFZ in fifth grade but moved into the HFZ as seventh graders achieved higher than the students who were never in HFZ. However, not as high as students who were in HFZ for both grades.

A study that found a significant positive association between all fitness tests and academic achievement was conducted by VanDusen, Kelder, Kohl, Ranjit, and Perry (2011). In this study, high fitness levels in cardiorespiratory endurance again produced the strongest relationship to higher levels of academic achievement. In this study achieving HFZ in the curl-up test produced the seconded strongest association.

While the associations to fitness testing and academic achievement are varied and overall not that strong according to Bass et al. (2013), "obesity in children has risen and fitness scores have declined and academic achievement scores are falling as well" (p. 832). For these reasons it is important to keep using Fitnessgram to assess students and provide them information regarding their physical fitness (Masterson & Walkuski, 2004). As well as continuing to research the correlation of these scores to a variety of measures of academic achievement.

Fitness Levels and English/Language Arts Achievement versus Math Achievement

Overall there are mixed results on if fitness levels have an impact on general academic achievement. Not surprisingly, when investigating specific subjects, the results are also mixed. Math and English/Language Arts (ELA) are the two subjects that are most commonly tested in standardized state assessments. The majority of the data that exists on the effects of physical fitness on specific subjects' center around these two core academic contents.

Wittenberg, Northrup, and Cottrell (2010) found a correlation coefficient of the P.A.C.E.R. test and WESTEST to be .056 for ELA and .035 for math in males. Indicating that cardiorespiratory endurance may have slightly more influence on reading scores than math but for males only. In the same study the correlation coefficient for females was .160 for ELA and .161 for math. The results indicate that cardiorespiratory endurance has similar effect on ELA and Math achievement for females. However, the greater finding may be that there is a stronger correlation between high levels of cardiorespiratory endurance and academic achievement in females than males.

In a different study the researchers used Fitnessgram and the Massachusetts state standardized test (MCAS) as their measures. The results indicated that the odds of passing the math MCAS increased by 38% for each Fitnessgram test a student achieved HFZ. However, there was a weaker correlation between passing the ELA MCAS. The results revealed the odds of passing the ELA portion only increased by 24% with each test in the HFZ (Chomitz et al., 2009). Therefore, from this study it could be concluded that high fitness levels were more associated with math achievement than ELA. However, again, there was a positive correlation for both academic subjects.

Bass et al. (2013) found statistically significant correlations in both genders and subject areas for P.A.C.E.R. and curl-ups. In addition, there were statistically significant correlations for females in both academic subjects for push-ups. The results also indicated that males who achieved HFZ for P.A.C.E.R or muscular endurance were 2.5 to 3 times more likely to pass both the ELA and math assessments than those boys who did not achieve HFZ. In addition, boys who achieved HFZ in muscular endurance were two times more likely to pass the math assessment but had no effect on reading. However, females who made HFZ for the P.A.C.E.R were 2 to 4 times more likely to meet or exceed both math and ELA test standards.

Summary

Recently, there has been much discussion on the state of schools and the academic achievement of students with controversies in grade changing and abysmal standardized testing scores. In answer to this growing issue many school systems are slashing the amount of time students receive Physical Education in order to increase academic time and free up monies to support tested area contents. However, there is data, while varied in the degree of significance, which shows all positive correlations between having physically fit students and greater academic achievement. There is still a need to longitudinally look at how fitness levels impact achievement in the transition from childhood to adolescence. As well as if there is a difference in benefit between males and females to have a better understanding of the relationship between physical fitness and academic achievement. However, there are many other benefits to being physically fit and active that indirectly benefit achievement in the classroom such as higher levels of self-esteem and greater brain development. Instead of increasing student's desk time to improve achievement the data shows that increasing student's fitness and activity levels may help the problem.

CHAPTER III

METHODS

Design

The study used a causal comparative design with a convenience sample of sixth, seventh, and eighth grade students at the school where the researcher is a physical education teacher. The independent variables are the scores on the Fitnessgram push-up and curl-up test as well as their VO2max score. The dependent variable is the students' quarterly grade in their English and Math class. Constraints of this research include that students worked with peers to score the fitness tests. During physical education class, students did practice for fitness tests. On the day the students recorded their scores, it was not the first day they had performed the test. Students were provided demonstrations of the correct way to perform the tests with critical cues given verbally and displayed visually on posters in the gym. However, there is no way to guarantee that the tests were assessed and scored with complete accuracy. Another constraint is that students have different math and English teachers. While the same curriculum is taught, the manner of delivery may vary as well as the exact graded assignments that make up the quarterly grade.

Participants

The 123 participants are sixth, seventh, and eighth graders in a public middle school in southwest Baltimore County, Maryland. Of the 800 students, 87% receive free or reduced lunch, making it one of three Title 1 middle schools in Baltimore County. The school is also a priority school under the Maryland State Department of Education due to its continual low performance on state-mandated assessments. In addition, the school is an ELL center for 212 students representing over 25 countries.

The participants in this study are enrolled in the researchers' physical education classes. All students have physical education every other day for 84 minutes for the entire school year. Participants are students who completed all fitness testing by January 2018. Fitness testing was completed during physical education class during December 2017 and January 2018. Of the 123 students 27 are 6th graders (8 males, 19 females), 43 are 7th graders (22 males, 21 females) and 53 are 8th graders (26 males, 27 females). Students range in age from 11 to 15 years old.

Instruments

The Fitnessgram youth fitness assessment is used in all 50 states and over 14 countries making it the most widely used youth fitness assessment. According to the Fitnessgram/Activitygram Reference guide, Fitnessgram was developed by scientists whose expertise was in youth fitness (Plowman & Meredith, 2013). One aspect of Fitnesgram that makes it different than other fitness assessments is that it is a criterion-referenced assessment. Fitnessgram does not compare students to others their age instead their scores are "based on the best evidence available of scores relationship to current and future health" (p. 27).

Morrow, Martin, and Jackson (2010) consider Fitnessgram to be the most psychometrically sound assessment for field based fitness testing. Their research investigated the reliability and validity of Fitnessgram administration between typical school processes compared to highly trained individuals. The results revealed an overall high percentage of agreement between school/teacher results and the experts. However, it was found that aerobic capacity (VO2max) and body composition showed a higher percentage than the musculoskeletal (curl-ups and push-ups) items. Overall, field testing did not have a negative impact on reliability and validity indicating that criterion-referenced health-related fitness tests are trustworthy.

In the middle school where this research was conducted all core contents co-plan. Therefore, students enrolled in the same class receive almost the same instruction no matter the teacher. The co-planning time is built into the teacher's schedule and teachers are required to turn in co-planning grids to show evidence it is being done. In addition, teacher's gradebooks who teach the same content are to mirror one another. This is monitored by the content Department Chair. In English quarterly grades are comprised of approximately 6 to 8 common assessments in addition to a grade level performance based assessment (PBA) that is issued by Baltimore County. Every student unless they are a level 1 or 2 ESOL student is enrolled in their grade level English class.

There is more variability in math classes. In the sixth-grade students are enrolled in Math 6 unless they are in Advanced Academics then they are enrolled in Pre-Algebra. For the students enrolled in Math 6 some students have class every day for 84 minutes while others have it every other day for 84 minutes. While the curriculum is the same, the difference is the pace in which the material is covered. In seventh grade students who are in Advanced Academics are enrolled in Algebra 1 and all other students are enrolled in Pre-Algebra. Algebra 1 meets every other day for 84 minutes while Pre-Algebra meets every day for 84 minutes. For eighth grade students there is even more variability in math classes. Advanced Academic students take Geometry. All other students are either in Math 8 or Algebra 1. The math class an eighth-grade student is enrolled in is determined by recommendation of the seventh-grade math teacher, PARCC scores, and MAP scores. All eighth-grade math classes meet for 84 minutes every other day. ESOL students are enrolled in grade level math classes. There are not separate ESOL math classes. On average students have 3 to 5 graded assignments per unit in addition to a county provided end of

unit assessment. According to the math department chair at this middle school, in general 2 units are covered per quarter.

As a school-wide policy students are permitted to re-do any assignment excluding end of unit assessments and PBA's within two weeks of receiving the graded assignment. The re-do must be initiated by the student and must be completed outside of regular class time. If the re-do earns a higher grade it replaces the previous grade in the gradebook.

Procedure

During the first quarter of the school year students participated in warm-up games that addressed the areas of cardiovascular endurance, muscular strength, muscular endurance, and flexibility in preparation for Fitnessgram. Every class ran the P.A.C.E.R. (progressive aerobic capacity endurance run) test once to be familiar with the assessment. In addition, as part of the daily warm-up students would complete push-ups and curl-ups. Students would frequently review the critical cues of performing a correct Fitnessgram curl-up and push-up.

On the first day of fitness testing students were given a Fitnessgram scorecard to record their scores. Students completed the P.A.C.E.R, curl-ups, and push-ups during three separate class periods. For students who missed a test they could make it up on an individual basis when there was time during a class period. These students may have completed multiple fitness tests in one day.

For the P.A.C.E.R test students worked with a partner. One person ran at a time. The lines were on the gym floor and marked on the ends with large orange cones. The teacher reviewed with the students about the guidelines of the P.A.C.E.R. test. Students were instructed that they must run in a straight line, both feet must cross the line prior to the beep, they were allowed one miss, and they were not allowed to make large looping U-turns when crossing the

line and changing directions. The teacher then reminded students how to keep score. In the Fitnessgram scorecard there was a chart to mark laps as their partner completed it as well as the score was kept using the basketball scoreboard in the gym and the cadence said the number of each lap completed after the beep. The teacher asked if there were any questions. No student indicated that they had any questions.

The researcher called the first runner up to the line, asked them to check their shoe strings, and then began the P.A.C.E.R. Fitnessgram track from the CD provided in the Reference Guide. Once the first group had completed their test the second group of students completed the P.A.C.E.R test. Students recorded their scores on the scorecards and the scorecards were collected.

A students VO2max score is determined by their score on P.A.C.E.R. in addition to their age, gender, height, and weight. Age and gender is automatically generated using the Fitnessgram data entry site. Height and weight were taken by the researcher. Students were individually called up while participating in physical education. They removed their shoes and were weighted using a digital scale. A tape measure was attached to the wall. Students stood back flat against the wall and a ruler was placed on their head reaching back to the wall to determine a measurement. The student's height and weight was recorded on their scorecards.

To complete the push-up test, students worked in a group of three-the person completing the push-ups, the counter, and the form observer. Even though the students had practiced Fitnessgram push-ups frequently prior to test day, the critical cues and demonstration were still provided. Students were reminded that hands should be shoulder width apart and fingers pointing forward. In addition, student's backs must be straight and feet should be no more than six-inches apart. Students must stay with the up/down cadence. On the down direction elbows

must be bent to ninety degrees and on the up cadence students must return to fully straightened arms. A failure to meet any of the critical cues counted as a miss. Students were permitted one miss and on the second miss must stop. The student observing form was responsible for telling the person doing the push-ups when they had a form break and if they needed to stop. The student responsible for counting correct push-ups recorded the score in the scorecard. The test was run three times using the cadence provided by Fitnessgram.

The curl-up test was run similarly to the push-up test. Students worked in groups of three with students fulfilling the same roles used in the push-up test.

In the curl-up test students must slide their fingers for a distance of four inches. In the school where this research was completed this distance is measured using tumbling mats and floor tape. Floor tape is placed four inches from the edge of the mat. When students lay down in curl-up position (knees bent, feet flat on the floor, hands down by their sides with palms on the mat) they place their fingers on the edge of the tape. The researcher individually checked each student's fingers to ensure they were at the proper distance for the start of the test.

Again, even though students were familiar with Fitnessgram curl-ups the cues were reviewed directly before the administration of the test. The critical cues for the curl-up test include students must keep their feet flat on the floor without any assistance, hands must stay flat on the mat and slide to the edge of the mat on the up command, students must return all the way down on the down command, and students must stay with the cadence. Any use of the elbows or rocking back on the shoulder blades to propel oneself is not permitted. Like the other tests students are allowed one miss during the test. The student responsible for observing form must tell the person performing curl-ups of their miss and when they need to stop the test. The group member responsible for counting recorded the score on their group members score card. The test

was run three times, with the researcher checking the finger placement prior to starting each running of the test. The Fitnessgram cadence for curl-ups was used to complete the test.

Once all Fitnessgram testing was completed the researcher entered the data from student scorecards in to the online Fitnessgram database. This was accessed using Baltimore County School's BCPSOne platform. Due to the connection with the BCPSOne platform students name and information (gender/age) were already in the system. After the data was entered Fitnessgram populates a report card on the student's fitness levels including VO2max scores and if a student achieved HFZ. Using this the researcher obtained students VO2max scores and if they achieved HFZ for the specified test.

Student report card grades were obtained using BCPS's school information system. Grades (A, B, C, D, or E) will be cross-tabulated with whether HFZ was achieved. Grades of A or B will be categorized as "achieved," while lower grades will be labeled as "not achieved." The Chi-square statistics will be used to test for statistically significant relationships between grades and HFZ level at the customary 5% level of significance. VO2max scores will be compared by whether grades were achieved or not achieved using the two-sample t-test to determine if customary levels of statistical significance ($p < .05$) were reached

CHAPTER IV

RESULTS

The purpose of this study was to examine the relationship between attaining healthy fitness zone on the Fitnessgram assessments (VO2max, curl-ups, push-ups) and middle school students' quarterly report card grades in English and math. The null hypothesis that there will be no significant difference in English and math achievement in student's who achieve healthy fitness zone in aerobic capacity (VO2max), and/or curl-up test, and/or push-up test failed to be rejected. Overall, English and math grade-point averages for students who attained healthy fitness status on Fitnessgram assessments were not significantly different from students who did not reach the healthy fitness zone.

Tables 1-2 and 5-18 all show no significant difference between the mean grade point averages of those who attained healthy fitness zone and those who did not. Tables 3 and 4 were two exceptions to the general pattern. However, the data in table 3, quarter 3 English compared by VO2max, while statistically significant (p-value=.02) did not support the healthy fitness zone group. In table 4, quarter 1 math compared by VO2max, was statistically significant (p-value=.05) and did support the high grades, healthy fitness zone group.

Data Analysis Summary

Table 1

Quarter 1 English Grades Compared by VO2Max Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	36	1.28	.74	47	3.51	.51
Yes	22	1.36	.79	19	3.37	.50
t-test		.418			1.04	
p-value		.68			.30	
Statistically significant?		No			No	

Table 2

Quarter2 English Grades Compared by VO2Max Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	39	1.38	.12	44	3.43	.50
Yes	18	1.44	.18	23	3.52	.51
t-test		.28			.69	
p-value		.78			.49	
Statistically significant?		No			No	

Table 3

Quarter 3 English Grades Compared by VO2Max Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	43	1.33	.81	40	3.35	.48
Yes	18	.78	.73	23	3.57	.51
t-test		2.48			1.67	
p-value		.02			.10	
Statistically significant?		Yes			No	

Table 4

Quarter 1 Math Grades Compared by VO2Max Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	49	1.33	.75	34	3.21	.41
Yes	25	1.36	.57	16	3.00	.00*
t-test		.20			2.00	
p-value		.84			.05	
Statistically significant?		No			Yes	

*All 16 students had "B" grades

Table 5

Quarter 2 Math Grades Compared by VO2Max Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	59	1.20	.78	24	3.33	.48
Yes	29	1.38	.73	12	3.17	.39
t-test		1.01			1.03	
p-value		.31			.31	
Statistically significant?		No			No	

Table 6

Quarter 3 Math Grades Compared by VO2Max Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	59	1.07	.78	24	3.13	.34
Yes	31	1.32	.65	10	3.20	.42
t-test		1.55			.55	
p-value		.12			.59	
Statistically significant?		No			No	

Table 7

Quarter 1 English Grades Compared by Pushup Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	31	1.29	.74	34	3.50	.51
Yes	27	1.33	.78	32	3.44	.50
t-test		.558			.502	
p-value		.59			.62	
Statistically significant?		No			No	

Table 8

Quarter 2 English Grades Compared by Pushup Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	34	1.32	.73	31	3.42	.50
Yes	23	1.52	.79	36	3.50	.51
t-test		.975			.652	
p-value		.33			.52	
Statistically significant?		No			No	

Table 9

Quarter 3 English Grades Compared by Pushup Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	36	1.22	.80	29	3.38	.49
Yes	25	1.08	.86	34	3.47	.51
t-test		.663			.721	
p-value		.51			.47	
Statistically significant?		No			No	

Table 10

Quarter 1 Math Grades Compared by Pushup Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	33	1.39	.70	32	3.16	.37
Yes	41	1.29	.68	18	3.11	.32
t-test		.627			.434	
p-value		.53			.67	
Statistically significant?		No			No	

Table 11

Quarter 2 Math Grades Compared by Pushup Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	45	1.22	.82	20	3.25	.44
Yes	43	1.30	.71	16	3.31	.48
t-test		.489			.41	
p-value		.63			.69	
Statistically significant?		No			No	

Table 12

Quarter 3 Math Grades Compared by Pushup Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	50	1.14	.81	15	3.07	.26
Yes	40	1.18	.68	19	3.21	.42
t-test		.219			1.16	
p-value		.83			.25	
Statistically significant?		No			No	

Table 13

Quarter 1 English Grades Compared by Curl-up Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	24	1.29	.75	22	3.59	.50
Yes	34	1.32	.77	44	3.41	.50
t-test		.157			1.39	
p-value		.88			.17	
Statistically significant?		No			No	

Table 14

Quarter 2 English Grades Compared by Curl-up Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	23	1.48	.73	23	3.35	.49
Yes	34	1.35	.77	44	3.52	.51
t-test		.613			1.36	
p-value		.54			.18	
Statistically significant?		No			No	

Table 15

Quarter 3 English Grades Compared by Curl-up Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	27	1.15	.86	19	3.26	.45
Yes	34	1.18	.80	44	3.50	.51
t-test		.13			1.76	
p-value		.89			.08	
Statistically significant?		No			No	

Table 16

Quarter1 Math Grades Compared by Curl-up Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	31	1.45	.72	15	3.27	.45
Yes	43	1.26	.66	35	3.09	.28
t-test		1.21			1.71	
p-value		.23			.09	
Statistically significant?		No			No	

Table 17

Quarter 2 Math Grades Compared by Curl-up Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	33	1.09	.80	13	3.15	.38
Yes	55	1.36	.73	23	3.34	.49
t-test		1.63			1.24	
p-value		.11			.22	
Statistically significant?		No			No	

Table 18
Quarter 3 Math Grades Compared by Curl-up Fitness Zone

	Low Grades			High Grades		
Fitness Zone Attained	N	Mean	S.D.	N	Mean	S.D.
No	38	1.05	.73	8	3.13	.35
Yes	52	1.23	.76	26	3.15	.37
t-test		1.12			.196	
p-value		.27			.84	
Statistically significant?		No			No	

In table 19, the data was analyzed looking at the quarterly grade points compared to students who achieved healthy fitness zone and those who did not in each Fitnessgram test. In this analysis students were not separated into low (C, D, E) and high (A, B) grades. Of the nine comparisons in English, seven favored the fit group and two of the seven (quarter 2 push-ups and quarter 3 curl-ups) were statistically significant at the .05 level. In math, six comparisons favored the fit group with one (quarter 3 curl ups) being statistically significant at the .05 level.

Table 19
Quarterly Grade Point Means Compared by Fitness Status

		English		Math	
Fitness Test	Quarter	Not Fit	Fit	Not Fit	Fit
VO2Max	1	2.54	2.29	2.10	2.00
	2	2.17	2.61	1.82	1.90
	3	2.30	2.34	1.66	1.78
Pushups	1	2.45	2.17	2.26*	1.85
	2	2.32	2.73*	1.85	1.85
	3	2.18	2.46	1.58	1.83
Curlups	1	2.39	2.50	2.04	2.08
	2	2.41	2.58	1.67	1.95
	3	2.02	2.49*	1.41	1.87*

*Statistically significant difference, $p < .05$

Chapter V

DISCUSSION

The alternative hypothesis (research question) of this action research predicted that students who achieved healthy fitness zone (VO2max, curl-ups, and/or push-up test) on the mandated Fitnessgram assessment would have higher (A or B) quarter grades in English/Language Arts and Math than their peers who did not attain healthy fitness zone. The results of this research do not generally support the alternative hypothesis, using the customary significance level of 5%. However, looking at quarters 1 to 3 grade-point averages for VO2Max, pushups, and curl-ups, seven of the nine comparisons in English and six of the nine comparisons in math favored the fit group, at least descriptively. Three of those comparisons reached statistical significance at the p=.05 level.

Implications of the Results

Physical Education is the only place many children have the opportunity to be physically active. This is especially true in lower income areas where recreational sports are not prevalent or are financially unobtainable. However, Physical Education time continues to be cut in favor of adding extra Math and/or Language Arts classes to a student's schedule. While the results of this study failed to show a statistically significant relationship between high fitness scores and higher academic achievement, except in three cases, this researcher believes valuable information can still be gained from this action research.

Physical fitness needs to be more of a focus in middle school physical education. The low number of students achieving healthy fitness zone is concerning because a student not achieving healthy fitness zone is already putting themselves at risk for heart disease, obesity, diabetes, etc. Secondly, this action research focused on the scores of one Fitnessgram

administration which is all that is required by the school district. This researcher believes that Fitnessgram should be administered more than on time a year and that students should be actively involved in understanding their scores and designing ways to improve or maintain their scores.

This researcher also believes it is important to get students to be physically active outside of physical education class. This includes opportunities such as intramurals, school athletics, brain breaks in content classes and even recess in middle school.

Even though the results of this research did not show an overall statistically significant positive relationship between high fitness scores and academic achievement, there were statistically significant differences in favor of the fit group (pushups Q2, curl-ups Q3 for English; curl-ups Q3 for math). In addition, while not statistically significant the fit group had a higher grade-point average in five other English and math categories. Showing that focusing on a middle school student's physical fitness may help to increase grade-point averages in addition to the other benefits of physical fitness that still make it an important component in an adolescent's life.

Threats to Validity

The data from this study did not identify an overall statistically significant relationship between students with high fitness scores and high quarterly grades in Math and English/Language Arts, except in three specific cases. There are many factors that could have affected the results of the study. There were several factors that proposed a threat to the internal and external validity of the study.

One factor was motivation of middle school students in both the Fitnessgram assessment and their academic classes. As the physical educator of the subjects in this study, the researcher

encouraged students to do their best on each test and provided students with targets to reach for each fitness test based on their age and gender however, ultimately there was no way to control the amount of effort that was put into each Fitnessgram test. The school in which this research was conducted is a historically low-performing school with many students performing at least two grades below level. Similar to effort on the fitness assessments there was no control of how much effort was put in to each quarter's graded assignments.

The fitness testing environment is another threat to this study. Students were scoring their peers as well as monitoring for form. While students had been give explicit and frequent directions on how to score the tests there was no way to monitor all students and how they were monitoring and scoring during testing. In the testing environment students performed the tests in front of their peers. This could cause students to not fully push themselves for fear of embarrassment.

Another threat to internal validity was the variance in students. This research included all students and did not account for students identified as advanced academic, IEP, 504 or English language learners.

The different teachers also presented a potential threat to internal validity. At the middle school level, it is often seen that motivation and desire to do well in a class is related to the students like or dislike for a teacher. Moreover, while the content was the same across the math teachers and across the English teachers the method of delivery varied and could have affected student learning.

A threat to external validity prevents a study from being applicable to other groups. The school in which this study was conducted is a Maryland State Department of Education priority school and a Title 1 school. In addition, 25% of the school's population are English Language

Learners. These factors make it different than most other middle schools. Due to the specificity of the population, very different results may be seen if the same study was conducted in another middle school. These results only can be generalized to similar groups of middle school students in similar schools (with respect to demography, ability, and teacher characteristics).

Connection to Existing Literature

The literature that was reviewed in Chapter II focused on the effects of fitness levels on standardized testing. The results of most studies only showed a slight positive correlation to higher fitness levels and higher achievement on the standardized tests. The current action research used quarterly grades as the measure of academic achievement. The results of this study showed only showed a positive relationship between attaining healthy fitness zone and higher academic achievement in certain quarters and certain fitness measures (e.g., quarter 1 Math /VO2max). In previous studies reviewed in Chapter II, achieving healthy fitness zone on the P.A.C.E.R test (used to determine VO2max) showed the strongest relationship between higher fitness levels and academic achievement. However, since only one test in the current action research supported the existing literature it cannot be concluded that this action research generally supported previous findings on the relationship between academic achievement and high fitness levels.

Implications for Future Research

This research proved the need for further studies in the relationship between levels of fitness and academic achievement. One positive of this action research was that it used quarter grades as a measure of academic achievement instead of a one-time standardized test. More research needs to be conducted using quarter grades or grade-point average as a measure of academic achievement. In addition, this study could be re-created using physical activity instead

of physical fitness. Defining physical activity as at least sixty minutes of moderate to vigorous physical activity a day to see if being active daily has a stronger effect than being able to obtain a fitness level on an assessment given only once or a few times a year.

If this action research was done again, it would be necessary to disaggregate based on demographics such as socioeconomic status, special education status, English language learners, gender, and/or content teacher.

Furthermore, there are numerous benefits of physical activity such as increasing brain tissue, new neuron connections, higher ability to concentrate, and the ability to process data that may not be directly measured by academic achievement. Further research should be done on student's physical activity or physical fitness level and attention span or classroom behavior.

Summary

In this study, the researcher compared if students attained healthy fitness zone on the push-up, curl-up, or VO2max measures on Fitnessgram would they have higher quarterly grades in math and English/language arts. The purpose to see if healthy students performed at higher academic levels as determined by earning a quarterly grade of A or B. The data from this research does not support that physically fit students generally perform at higher academic levels, although for specific quarters, subjects, and fitness tests there were significant results in favor of the fitness group. There are many other factors that affect a student achieving academically. Fitness levels are just one of these factors. This researcher believes that physical fitness scores alone will not determine if a student will achieve academically and therefore cannot be the only reason to justify why physical education is an integral part of a student's educational program.

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