EXAMINING THE IMPACT OF PHYSICAL ACTIVITY TIME ON PHYSICAL FITNESS AND ACADEMIC ACHIEVEMENT AMONG 3RD GRADERS

A Dissertation

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This dissertation meets the standards for scope and quality of
Texas A&M University-Corpus Christi and is hereby approved.

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ABSTRACT

Complex intersections exist between physical activity, academics, and fitness which operate between research, policy, and practice. Perhaps one of the most researched intersections considers whether school-aged children perform better academically when there is time dedicated to physical activity. To date, no research has investigated the impact of the three most commonly observed weekly physical activity periods (135, 225, and 300 minutes) in Texas public schools on academic achievement and physical fitness performance measures. Applying an ecological multilevel perspective, such as that found in socio-ecological modeling (SEM), is crucial to gaining a holistic understanding of policy and practice and how they shape and affect student engagement with physical activity.

The study employed an ex-post facto, causal-comparative research design. The characteristics-present group received 135 minutes of physical activity while the two comparison groups engaged in 225 and 300 weekly minutes respectively. Subjects were recruited from three elementary schools, hereafter referred to as Schools A, B, and C, in an urban school district in South Texas. The non-probability sample consisted of 70, 49, and 63 third graders in these schools, respectively.

School C, which had the highest weekly minutes of physical activity had the lowest academic achievement scores in mathematics and reading. With respect to fitness performance, although some statistically significant differences were found among the schools, no uniform pattern was noted, suggesting the randomness of the findings.

Even though the results of this study are mixed and do not conform to existing literature, it is hard to argue that increased physical activity time does not influence increased academic

achievement and fitness performance. The bigger picture to be taken from this is that physical activity/education programs may not have the oversight necessary to ensure how and when students actually receive physical activity. District and campus administrators might also glean from this study that their actions, attitudes, and decisions about physical activity can have a very direct impact on how their students engage in physical activity, as delineated through SEM.

DEDICATION

I dedicate my dissertation to my daughter, Paloma Faye Woods, and son, Keon Ismael Medrano. I know I lost a lot of time with you both completing my dissertation, but the education we all gained during that process will reward all of us for the rest of our lives. I love you both with all of my heart.

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CHAPTER I: INTRODUCTION

Background and Setting

Across the United States, and around the world, multiple, complex intersections exist between physical activity, academics, and fitness which operate between research, policy, and practice. Perhaps one of the most researched intersections considers whether school-aged children perform better academically when there is time dedicated to physical activity. For instance, Burrows et al. (2014) measured the impact of physical activity time on how well students performed on the System for Assessment of Educational Quality, a national standardized test used in Chile to measure academic performance in the areas of language arts, mathematics and science. Their findings showed students who engaged in four or more hours of physical activity per week significantly increased academic performance in all three content areas (composite *z*-scores above the 50th and 75th percentile). Similarly, Marques et al. (2017) found that increasing the number of physical activity days per week and the intensity of the activity had a significant beneficial effect on academic performance.

However, administrative practice and educational policy often ignore findings that suggest the amount of physical activity time is a known predictor of increased academic performance (Singh, Uijtdewilligen, Twisk, Mechelen, & Chinapaw, 2012). Marques, Gomez, Martins, Catunda, and Sarmento (2017), and Fedewa and Ahn (2011) caution struggling schools and districts against decreasing physical activity time due to increased legislative pressure to improve academic performance (as measured through standardized testing). Through a longitudinal study, Singh et al. (2012) found that physical activity is positively related to academic performance in children when physical activity is consistent throughout the progression of the students' educational path. Fedewa and Ahn (2011) also found when children's physical activity is more intense, or aerobic in nature, it had a positive and significant impact on academic performance. Fedewa and Ahn (2011) and Singh et al. (2012) go on to explain the importance of having these findings discussed by school board trustees and district administrators in order to help change school-based policy that may limit the amount of physical activity afforded to its students.

Physical activity in elementary school is an important factor related not only to student success in school, but longer-range benefits of fitness and wellness as well (Centers for Disease Control and Prevention [CDC], 2014; Perna et al., 2012). Considerable evidence suggests developing a physically active lifestyle at an early age can help to increase health related benefits by decreasing childhood obesity, depression, anxiety, diabetes, and cardiovascular disease (Barlow, 2007; Haegele, Zhu, & Kirk, 2018; U.S. Department of Health and Human Services [HHS], 2018b). Other benefits of physical activity for children include improved behavior in the classroom, better school attendance, enhanced academic performance, and more highly developed memory and problem-solving skills than their less active and less fit peers (Institute of Medicine, 2013; Tomporowski, Davis, Miller, & Naglieri, 2008; Trudeau & Shepard, 2008).

While those studies have established the potential realm of benefits of physical activity, other studies show that a school-age child's access to physical activity and health-related fitness varies by age, race, ethnicity, gender, and socio-economic status (SES). Nader, Bradley, Houts, McRitchie, and O'Brien (2008) report that physical activity levels during childhood tend to decrease as children age, and this pattern may extend into adulthood. Pate et al. found that from sixth to eight grade, black girls declined more in physical activity than white or Hispanic girls. Kwon, Mason, and Welch (2015) found boys and girls in majority Hispanic schools are engaged in less moderate-to-vigorous intensity physical activity and are more inactive during school hours compared to students in white or black majority schools. Fairclough, Body, Hackett, and Stratton (2009) suggested students with a lower SES tend to be less physically active than those with a higher ranked SES. Similarly, Fahlman, Hall, and Lock (2006) found a significant difference in multiple measures of health-related fitness based on race and SES in high school females.

While the CDC (2014) and others (American Academy of Pediatrics, 2018; U.S. Department of Health and Human Services, 2018c) recommend elementary aged children get at least 60 minutes of daily physical activity a day or 300 minutes per week, Perna et al. (2012) found that across the nation, no states reported their elementary schools consistently averaged more than 60 minutes of physical activity *per week*. In fact, Troianao et al. (2008), using findings based on the 2003-2004 National Health and Nutritional Examination Survey, reported only 42% of children ages 6-11 years met the recommended physical activity guidelines of 60 minutes every day. Their findings also showed that as children age, their level of physical activity declines dramatically, with only 8% of adolescents (ages 12-19 years) achieving the goal of 60 minutes/day.

The inconsistent and reduced time in which schools afford students opportunity for physical activity may most likely have been spurred in part by the No Child Left Behind (NCLB) Act of 2001with its requirements and pressure to make classroom time more rigorous. While NCLB intensified efforts across the United States to eliminate racial disparities in academic performance by requiring schools and districts to break out test scores by racial and ethnic groups, status as economically disadvantaged, disability, and limited English proficiency, it also imposed stringent corrective actions if schools and districts did not meet statewide proficiency goals (NCLB, 20 U.S.C.A. § 6301 et seq.). As a result, despite overwhelming research documenting the relationship between increased activity, fitness, and overall health benefits, legislative mandates associated with standardized testing have resulted in more school time devoted to academic instruction and less time to physical activity (Burton & VanHeest, 2007).

Since the advent of NCLB, many school districts have eliminated or curtailed recess (a form of physical activity) and in-class physical activity to increase instructional time (Cook, 2004; Mahar, Murphy, & Rowe, 2006). In turn, many school districts rely on physical education classes to provide physical activity during the school day (Carlson et al., 2013). For many elementary students, physical education is the only outlet they have to engage in physical activity during the school day and even then, school districts facing budget cuts often decrease physical education time in order to increase instructional time, particularly in mathematics and reading (Chomitz et al., 2009).

Even when state law dictates physical education should be part of the curriculum in schools, some states, for instance Massachusetts, no longer prescribe the amount of time students should spend in physical education classes. Sacheck et al. (2015) reported as of 2009, “almost half of the Massachusetts Commonwealth’s public-school students were not participating in any physical education classes, and in Boston [in particular], 30 percent of public schools were offering no physical education classes at all” (p. 4).

Problematically, physical education and physical activity, two widely used terms, are often used interchangeably because of inherent similarities and overlaps. They are in fact not synonymous. According to the 2016 Shape of the Nation report by the Society of Health and Physical Educators (SHAPE), physical education is based on a sequence of learning which includes health, nutrition, social responsibility, and the value of fitness of throughout one’s life. Although physical activity is a complex concept, the CDC (2014) defines its simplest form as any bodily movement produced by skeletal muscles that require energy expenditure. Walking, cleaning, or carrying are examples of ordinary physical activities, as well as more complex activities such as spontaneous indoor/outdoor play or involvement in organized team sports (Becker, Grist, Caudle, & Watson, 2018). While physical education certainly provides physical activity, it also provides the knowledge needed for individuals to stay healthy by combining locomotion with cognitive thought, also known as the psychomotor domain.

Policy, Fitness Evaluation, and Administrative Discretion

Physical activity and physical education, as presented in state education policy, are often combined or overlapped. For instance, the Texas Education Code (TEC) §28.002(a)2(C), administrative rules adopted by the State Board of Education, and the Texas Administrative Codes §74.1(a)(2)(C), §74.2 and §74.3, require all public schools to offer physical education in grades K-12. While school districts do have some discretion in arrangements and settings, they are required to establish objectives and implement an enrichment curriculum that includes all Texas Essential Knowledge and Skills (TEKS)-based standards. The TEC §28.002(d)(3) "requires that, on a weekly basis, at least 50 percent of the physical education class be used for actual student physical activity and that the activity be, to the extent practicable, at a moderate or vigorous level." Whereas, the TEC §28.002(l) requires students below Grade 6 to participate in moderate or vigorous physical activity for at least 30 minutes per day throughout the school year as part of the district's physical education curriculum or through structured activity during a campus's daily recess.

However, policy also allows school and district officials discretion as to whether this requirement is impractical due to scheduling concerns or other factors. As a result, a district and/or campus may use a weekly calculation of 135 minutes for student participation rather than the daily 30 minutes. However, regardless of the calculation, these formulas fall short of the recommended average of 60 minutes per day or 300 minutes per week of physical activity for peak benefits in fitness, academics, and wellness (Carlson et al., 2013; CDC, 2014; Esteban-Cornejo et al., 2017; SHAPE, 2016). Carlson et al. (2013) concluded that while policies (such as those in Texas) allow districts much flexibility, there is little in the policy itself to hold campuses and school districts accountable for enforcement of these physical activity mandates.

Physical Fitness Evaluation

In 2007, the Texas Legislature passed Senate Bill 530, mandating all public schools in the state conduct annual comprehensive health-related physical fitness evaluations (otherwise known as FitnessGram®) of students in Grades 3-12 (Safe Schools and Health and Safety, 2007a). The FitnessGram® measures five performance goals: (a) aerobic capacity, as measured by the 20 meter pacer test; (b) weight relative to height, as measured by body mass index (BMI); (c) abdominal strength and endurance, as measured by curl-ups; (d) upper body strength and endurance, as measured by 90° push-up; and (e) flexibility, as measured by the back-saver sit and reach (FitnessGram® Performance Standards, 2017).

Using 2007–2008 FitnessGram® data merged with academic data from the same school year, Welk et al. (2010) analyzed possible associations by grade and gender as well as SES, minority status, school size, school attendance, delinquency and academic achievement, as measured by the Texas Assessment of Knowledge and Skills. Although their results revealed more variability by school than by grade, stronger correlations for grade-level associations between academic achievements and two health-related fitness indicators (cardiovascular fitness and BMI) were also detected. Despite their observation of a positive association between fitness attainment and school performance, they attributed the "complex web of social, environmental, and financial factors” as a confounding variable which made it difficult for researchers to “determine independent associations between obesity or fitness and academic achievement” (p. S21). They also acknowledged fitness and academics are generally considered to be functionally and programmatically independent. As such, other mechanisms such as improved cognition, improved (or diminished) self-esteem, increased (or decreased time on task) may explain the effects of fitness on academics.

Still, the results from Welk et al.’s (2010) research showed stronger correlations leading them to suggest cognition for middle school youth may be impacted by activity/fitness. However, they also acknowledged their study was limited in several ways. First, rather than using individual-level data they used grade-level data. Second, they were only able to control for certain confounding variables. Thus, it is possible the effects were due to some variable other than gender, school, SES, school minority status, and school size. Third, this research team noted their study did not evaluate the amount of time students spent being physically active.

Administrative Discretion with Time

Some elementary school campuses in Texas provide students more than the legally mandated 135 minute minimum by exercising flexibility in local policies. Some districts like Austin Independent School District (AISD), Dallas Independent School District (DISD), and Houston Independent School District (HISD) enable elementary schools to achieve 300 minutes of physical activity per week by mandating 30 minutes of daily recess in addition to their regular daily schedule of 45 minutes of physical education class (EHAB Regulation, AISD, 2017; EHAB Legal, DISD, 2016; EHAB Regulation, HISD, 2012). Other districts in Texas, such as Corpus Christi Independent School District (CCISD) and Richardson Independent School District (RISD) use a standard legal policy for physical activity guidelines (EHAB Legal, CCISD, 2016; RISD Health FAQ, 2016). While both of these districts have not adopted a local policy concerning physical activity or mandatory recess to increase daily physical activity at the elementary level, the legal version of the policy allows individual campuses to choose how they will obtain the state mandate of 30 minutes of daily physical activity (or, 135 minutes per week). Interestingly, data gathered from an urban school district in South Texas indicate some campuses in these districts offer only the minimum 135 minutes of physical activity, while others provide either 225 minutes or as much as 300 minutes (R. Torres, personal communication, 2017; RISD Health FAQ, 2016). The three most common times identified in this internal survey were 135 minutes, 225 minutes, and 300 minutes.

Statement of the Problem

The concept of physical activity, the amount of recommended time, and their impact on physical fitness and academic achievement have been highlighted by major organizations such as the U.S. Department of Health and Human Services (2018a), the CDC (2014), and SHAPE (2016). Furthermore, research conducted by Perna et al. (2012), Barlow, (2007), Haegele et al. (2018), Chomitz et al. (2009), and Esteban-Cornejo et al. (2017), among others, supports the idea of scheduling physical activity during the school day. These studies indicated students need physical activity to improve academic achievement and overall physical fitness. To date, no research has investigated differing impacts on academic achievement and overall physical fitness resulting from the three most common weekly duration periods (135, 225, and 300 minutes), to identify which has the greatest impact on a student academic achievement and health-related fitness.

Theoretical Framework

The theoretical framework used in this study was the social-ecological model (SEM) which focuses on the social, institutional, and cultural contexts of people and their relationship to their environments (Bronfenbrenner, 1977, 1989, Bronfenbrenner & Morris, 2007; Stokols 1992, 1996). Bronfenbrenner first introduced a conceptual model for understanding human development in 1977, later formalizing it as a theory in 1989. The original nesting model is referred to as Bronfenbrenner's ecological systems theory and includes five environmental systems that a child encounters throughout his/her lifespan. These five systems include the microsystem—the smallest and most immediate environment in which the child lives (e.g. home, school, daycare); the mesosystem—interactions and connections between different microsystems (e.g. linkages between home, school, family, and church); the exosystem—which consists of two or more settings where one is environment which may still affect the child indirectly (e.g. parents' workplace, larger neighborhood, extended family); the macrosystem—the largest and most distant collection of people and places; and the chronosystem—the dimension of time which influences both change and constancy in the child's environment (e.g. change in family structure, parental employment). In 2005, Bronfenbrenner added public policy, which comprises policy and laws, to the outer most environment of the SEM.

According to Stokols (1992, 1996), applying an ecological multilevel perspective such as SEM is crucial to gaining a holistic understanding of policy and practice enactment. This study includes policy and practice that allows different campuses within one district to dedicate different amounts of time for student's physical activity. The use of SEM as a theoretical frame allows for four assumptions: (a) physical activity engagement is multi-faceted concerning both the physical environment and the social environment, (b) environments are multidimensional and complex, (c) human-environment interactions can be described at varying levels of organization, and (d) the interrelationships between people and their environment are dynamic. Applying SEM as a theoretical frame allowed the researcher to organize the discussion and provide recommendations relative to policy and practice enactment, based on the findings.

Purpose of the Study

The purpose of the study was to examine the impact of physical activity time on academic achievement in mathematics and reading, as measured by the State of Texas Assessments of Academic Readiness (STAAR), and four fitness performance measures, as measured by FitnessGram®, among third grade students in an urban school district in South Texas.

Third grade was chosen for three reasons. First, in the state of Texas, third grade students take the STAAR assessment in reading and mathematics for the first time. Second, third grade students also take their FitnessGram® for the first-time establishing foundational levels to build on in the future. Third, the researcher believed by looking at third grade STAAR and FitnessGram® data, the independent impact of each physical activity time variable in this study could be meaningfully analyzed in connection to STAAR and FitnessGram® outcomes.

The study was guided by the following research questions:

1. Does the amount of physical activity impact standardized academic achievement in mathematics among third graders?
2. Does the amount of physical activity impact standardized academic achievement in reading among third grades?
3. Does the amount of physical activity impact the fitness performance goals among third graders?

4. What is the extent of the bivariate association between fitness performance goals and academic achievement in mathematics and reading?

Operational Definitions

For the purpose of this study, the measurement of major variables were, amount of total physical activity time (physical education time plus recess time for a combined total of physical activity time), fitness scores derived from the five assessed areas (aerobic capacity, BMI, abdominal strength and endurance, upper body strength and endurance, and flexibility), and reading and mathematics test scores derived from the STAAR standardized assessments.

Glossary of Terms

Abdominal Strength and Endurance – refers to the strength and endurance of the abdominal muscles (FitnessGram® Performance Standards, 2017). According to FitnessGram® Performance Standards (2017) abdominal strength and endurance are important in promoting good posture and correct pelvic alignment. For the purposes of this study, curl-ups will be used to measure this performance goal.

Aerobic Capacity – refers to the capacity of the cardiopulmonary systems to deliver oxygen to muscles, enabling them to work longer and harder (Heyward & Gibson, 2014; Porcari, Bryant, & Comana, 2015). For the purpose of this study, a 20-meter pacer test was used to measure this performance goal. Pacer is a multistage fitness test adapted from the 20-meter shuttle run test published by Leger and Lambert (1982; FitnessGram® Performance Standards, 2017).

Body Mass Index (BMI) – refers to the ration of weight relative to height. Essentially, BMI can indicate if the weight of a person is appropriate for their height (FitnessGram® Performance Standards, 2017). BMI cannot measure fat directly, but it can help assess health risks related to a body weight that is too great or too little for the height. The CDC (2018) defined normal to healthy BMI as an individual's BMI score falling between the 5th through 85th percentile on their flow chart (CDC, 2010a; CDC, 2010b). The normal to healthy percentile for 8-10 year-old boys is 14 to 19 (CDC, 2010a). The normal to healthy percentile for 8-10 year-old girls is 15-20. For the purpose of this study, the BMI calculation was used to measure this goal (Heyward & Gibson, 2014).

FitnessGram® –- a health-related physical fitness assessment created by the Cooper Institute. FitnessGram® measures aerobic capacity, BMI, abdominal strength and endurance, upper body strength and endurance, and flexibility (FitnessGram® Performance Standards, 2017; Kahan & McKenzie, 2017).

Flexibility – refers to adequate joint flexibility to maintain functional health (FitnessGram® Performance Standards, 2015). For the purpose of this study, a trunk lift test was performed to measure this performance goal.

Health Fitness Zone (HFZ) – FitnessGram® Performance Standards (2015) state the passing status of 'health fitness zone' is achieved when a student meets health-related fitness components based on criterion-referenced scores FitnessGram® provides for an individual test for a fitness area (Kahan & McKenzie, 2017).

Needs Improvement (NI) – refers to the student who did not meet the performance goal based on criterion-referenced standard scores (FitnessGram® Performance Standards, 2017).

Need Improvement–Health Risk (NIHR) – refers to the student who did not meet the performance goal based on criterion-referenced standard scores. Scoring in this range indicates a greater health risk of secondary disease related to obesity and poor exercise habits (FitnessGram® Performance Standards, 2017; Kahan & McKenzie, 2017).

Physical Activity – refers to the total amount of time (physical education class, recess), or opportunity, a child receives at school in which the child can actively engage in physical movement for longer than 5 minutes at a time.

Physical Education – refers to the scheduled class time a school campus has given its student body for them to participate in physical education class (Cooper et al., 2016).

Social-Ecological Model (SEM) – refers to the interrelationships between physical activity and the social, physical and policy environments. (Bronfenbrenner (1977, 1989; Bronfenbrenner & Morris, 2007; Stokols, 1992, 1996).

State of Texas Assessment of Academic Readiness (STAAR) – refers to the standardized annual state mandated assessment of academic readiness. For the purpose of this study, reading and mathematics were analyzed for third and fifth grade South Texas students (Texas Education Agency, 2017).

Upper Body Strength – FitnessGram® Performance Standards (2015) refers to the strength and endurance of the muscles in the upper body. For the purpose of this study, a 90° push-up was used to measure this performance goal.

Delimitations, Limitations, and Assumptions

The study was delimited to third grade students in one urban school district in South Texas. This grade was chosen because it was the first time Texas public school students took both the STAAR assessment in reading and mathematics as well as the FitnessGram®. The data were delimited to 2016-2017 STAAR test scores in reading and mathematics. The study was also delimited to physical education teachers administering the FitnessGram® goals. Due to the non-experimental nature of the study and the non-probability sampling technique, no causal inferences were drawn and external validity was limited to study participants.

It was assumed the data obtained from the school district for STAAR and FitnessGram® were accurate and teachers who administrated the STAAR examination followed all state mandated guidelines. It was also assumed physical education teachers who administrated the FitnessGram® followed the Cooper Institute guidelines.

Texas assesses public education students through a standardized test known as the STAAR. This test evaluates reading and mathematics in third through fifth grade students (TEA, 2017a). Therefore, when considering the research purpose and questions, this study was best prepared to investigate the three different weekly physical activity times (135, 225, and 300 minutes) being used in an urban school district in South Texas. Third grade students were examined as it is the first year of state testing in individal academic performance and fitness. Further, this study investigated the three different alloted physical activity times and their related potential impact on individual academic achievement in reading and mathematics as measured by STAAR scores. Lastly, this study examined three different alloted physical activity times and their potential impact and the four FitnessGram® fitness performance measures analized in this study.

Significance of the Study

In 2018-2019, a total of 1,247 school districts in the state of Texas could have possibly benefited from the results of this study. This study aimed to contribute to our understanding of associations among physical activity time, academic performance, and fitness for individual third grade students enrolled in three different campuses in a large city school district, an approach that has not been adequately researched. The study has the potential to provide school district leaders, campus administrators, and educational policymakers with findings about the impact of physical activity time on students' performance on STAAR reading and mathematics, and the four fitness performance measures areas of the FitnessGram®.

CHAPTER II: REVIEW OF THE LITERATURE

This chapter provides a review of the literature related to the intersections between physical activity, academics, and fitness that operate between research, policy, and practice. The primary purpose of this study was to examine the impact of physical activity time on academic achievement in mathematics and reading, as measured by the STAAR, and four fitness performance measures, as measured by FitnessGram®, among 3rd grade students in an urban school district in South Texas. The chapter is divided into four sections. The first section provides an historic overview of physical activity and physical education in public schools, to include legislative activity and the role of higher education. The second section presents research focused on the intersection between physical activity, environment, demographics, and culture. The third section offers an examination of academic assessments and fitness performance instrument used in Texas. The fourth section presents the social-ecological model as the theoretical framework used to inform this study. A summary ends the chapter.

Historical Overview

The intersection between public school education and student engagement in physical activity and physical education during school hours has much history. DeGroot (1939) stated physical exercise for students is conducive to the health and stamina of their bodies, as well as for the mind. Kennard (1977) wrote that the amount physical activity time students receive has changed since the inception of America's public education system. More recent literature (Carlson et al., 2013; Esteban-Cornejo et al., 2017; Perna et al., 2012), has affirmed these observations. This section of Chapter Two provides an overview explaining how physical activity and physical education in schools have developed and changed over time.

Following the growing popularity of calisthenics and gymnastics in European physical education programs, schools in the United States began incorporating physical activity during the school day. In 1823, a private school in Northampton, Massachusetts became the first to offer physical activity in everyday student curricula, followed by a public-school district in Cincinnati, Ohio in 1855 (Swanson & Mary, 1995). As time passed, more school districts followed suit (Kennard, 1977).

During the 1930s, educator Thomas Wood (as cited in Kennard, 1977) criticized the physical education curriculum stating it was narrow and limiting. Wood believed teaching students only about personal hygiene and bodily health exercises was not only detrimental to their academic development, but deprived students of a holistically complete education. As such, Wood pushed to create a new, more inclusive, physical education class that included teaching fundamental movements and many locomotor skills that would progress eventually into games of a more complex nature (Kennard, 1977).

Legislative Activity

In 1865, California became the first state to pass physical activity legislation (Swanson & Mary, 1995). John Swett, Superintendent of public education of the state of California, believed physical activity needed to be present in the course of a school day (Newman & Miller, 1990). Swett influenced legislation that mandated California students be provided two exercise periods per day (Newman & Miller, 1990). However, it would not be until the early 1900s that other states would enact similar legislation requiring physical activity to be included in the school day.

According to Newman and Miller (1990), physical education and health became a national concern during the time between the early 1900s and the early 1930s as evidenced by the increasing number of states which mandated physical education class either once or twice a day. In 1921, only 17 states had some type of state policy but by 1930 that had grown to 39 states which had passed physical education and health policies. Moreover, they found a similar increase in the preparation of physical education teachers. Over a five-year span, from 1925 to 1930, the number of normal (teacher preparation) schools training physical education teachers increased from 92 to 210 (Newman and Miller, 1990).

However, the interest in physical education state policy legislation and participation in public schools began to decline in the 1930s (Newman & Miller, 1990; Swanson & Mary, 1995). According to Newman and Miller (1990), the great depression significantly affected school and district budgets causing approximately 40% of public schools to drop their physical education programs.

In 1944, the Educational Policies Commission (a prestigious group of policymakers co-sponsored by the National Education Association and the American Association of School Administrators) stated physical education was indispensable to health (Newman & Miller, 1990). This assertion gave another layer of state and federal-inspired-support to physical education and spiked interest in returning servicemen going back to school (Newman & Miller, 1990). However, it was not until the end of World War II that physical activity or physical education class became popular again (Swanson & Mary, 1995).

According to Newman and Miller (1990), the United States' military discovered many draftees were not qualified for service due to poor physical fitness. This served as a catalyst for states to reinvest in physical activity and education in public schools. This renewed interest, coupled with federal initiatives supporting veterans as they returned to the workforce resulted in the number of physical education teachers increasing from 495 to 7,548. Newman and Miller (1990) credit federal policies such as the 1918 Veterans Rehabilitation Act (Vocational

Rehabilitation Act, P.L. 65-178) and the 1944 Servicemen's Readjustment Act (also known as the G. I. Bill) for the increased number of physical education teachers. These acts directly helped veterans obtain a higher education and facilitated their return to the domestic workforce.

Newman and Miller (1990) and Swanson and Mary (1995) suggested other federal policies impacted the evolution of physical education as a discipline and influenced how students obtained or engaged in physical activity. During the 1970s many acts such as Title IX of the Educational Amendment Act of 1972, the Rehabilitation Act of 1973 (section 504), the Equal Educational Opportunities Act of 1974, and Public Law 94-142 (the Education for All Handicapped Children Act of 1975) were passed. Each had a direct influence on how physical activity was offered to students and how it should be engaged for equality and equity (Newman & Miller, 1990).

Title IX protected individuals from discrimination based on gender concerning academics or school sponsored extra-curricular activities, including athletics (U.S. Department of Education, 2018d). Title IX directly impacted how female and male students engage in physical activity in over 16,500 school districts in the United States and over 7,000 higher education institutions (U.S. Department of Education, 2018d). According to Acosta and Carpenter (2012), prior to Title IX only 1 in 27 girls engaged in sports. Acosta and Carpenter (2012) stated since Title IX became law in 1972, the number of girls participating in sports is now 1 in every 2.5 girls.

Each of the aforementioned acts focused on providing equal and equitable access to all aspects of public education, including how students obtain physical activity during the school day (through physical education class, recess, or in class physical activity breaks). Since the implementation of these acts, engagement and participation by the whole student body has increased (Newman & Miller, 1990; Swanson & Mary, 1995). However, none of the acts provided direction on the appropriate amount of time students should engage in physical activity (Newman & Miller, 1990; Swanson & Mary, 1995).

Interestingly, Newman and Miller (1990) and Swanson and Mary (1995) discussed how physical education and physical activity have always been an important part of public education, although they noted the caveat that both depend on availability of funds for their support. Currently, similar issues remain. In 2017, the San Diego Unified School District had a $124 million dollar budget gap. The first department to see drastic cuts was physical education (Long, 2017). Similar cuts were experienced by the physical education staff in the Portland Public School District in Oregon and as well as public school districts North Carolina (Long, 2017). These state and local education agencies stated they needed to reduced school budgets and try to remain academically balanced (Long, 2017). These are neither new nor isolated events. When money has been available at state and local district levels, policymakers have found value in offering physical activity stating it was indispensable to the health of students (Newman & Miller, 1990)

Besides budget issues, the NCLB Act of 2001 has likely contributed to current incidences of erratic and reduced physical activity time (Burton & VanHeest, 2007; Mahar et al., 2006). If schools or districts did not meet annual standards, provisions in NCLB implemented rigorous corrective actions. Unfortunately, when corrective actions are placed on schools or districts, it is often at the expense of physical education classes and recess. For instance, Cook (2004), stated schools in Clark County, Nevada eliminated 15 to 20 minutes of recess to accommodate to "today's testing and assessment climate" (p. 7). Legislative mandates and administrative decisions associated with a culture of standardized testing have resulted in more school time devoted to academic instruction and tutorials and less time dedicated to physical activity and wellness (Burton & VanHeest, 2007). In fact, for many elementary students, physical education class is the only outlet they have to obtain physical activity during the school day (Chomitz et al., 2009). As a way to increase instructional time, many school districts have opted to eliminate recess and in-class physical activity in favor of mathematics and reading (Cook, 2004; Mahar et al., 2006).

The Role of Higher Education

According to Newman and Miller's (1990) work, early attempts to include physical activity in a more structured format during the school day was limited to personal hygiene and bodily health exercises. Newman and Miller (1990) contend the curricular approach to physical activity in public schools did not change significantly for well over a century. This change, a focused curricular approach, also happened within the higher education setting as well. Klavora (2018) noted that in 1990 the American Academy of Physical Education made an official recommendation to change the name of the higher education departments that house all the sub-disciplines of physical education to kinesiology. The name change was described by Whitson and Macintosh (1990) as the scientization of physical education. Whitson and Macintosh's (1990) statement is meant to entice the perspective, or ideological approach, to physical education away from sport production to an organized curriculum based on sub-disciplined research and physical activity education. Adopting kinesiology as a discipline had a profound impact on how physical education was conceptualized and subsequently taught in public schools although it would be several decades before most higher education institutions formally changed department names from physical education to kinesiology (Klarvora, 2018). While some universities like the University of Texas—Austin changed its name from physical education to kinesiology in 1991, other institutes of higher education were slower to respond. For example, Cornell College did not adopt the name until 2003, and the University of Nebraska at Omaha only began using the name in 2017 (Klarvora, 2018).

Klarvora (2018) contends the name change directly impacts the progressive, sub-discipline (biomechanics, exercise physiology, sport psychology, motor development and learning) approach to teaching and applying physical education and activity in public schools. Perna et al. (2012) suggested there is no coincidence that the name change, along with the scientization of physical education, came a wealth of new approaches for implementing physical education. In turn, this expanded what is being taught in physical education classes and how students obtain physical activity in public schools. As well, it called into question some of the current state policies relative to physical education and physical activity.

Physical Activity, Environment, and Demographics, the Testing Culture

Associations between physical activity, environment, demographics (race, ethnicity, and socio-economic status), and the testing culture are multifaceted and manifest in many ways. Despite the myriad of health benefits for children who engage in 60 or more minutes of daily moderate to vigorous physical activity, inactivity remains a significant public health concern. Children and adolescents can spend upwards of half of their waking hours in school and in some cases accumulate up to 40% of their daily physical activity at school (Hobin, Leatherdale, Manskie, Robertson-Wilson, 2010). Thus, school becomes a critical environment to not only promote physical activity behaviors but ensure access and opportunity for children to engage in structured and unstructured physical activity. In 2012, the Institute of Medicine recommended making physical activity a public health priority and called for a whole school approach. Demment, Wells, and Olson (2015) contended “decisions that impact how environments are created or used are central to increasing healthy behaviors" (p. 100). Supportive school policies and schools with certain environmental factors such as adequate space, facilities, equipment, and supervision, lend themselves to girls and boys being more likely to choose to be physically active (Sallis, Conway, & Prochaska, 2001).

Children who live in rural communities are likely to be less physically active than their metropolitan peers (Lutfiyya, Lipsky, Wisdom-Behounek, & Inpanbutr-Martinkus, 2007). According to Bronfenbrenner and Morris (2007), schools in rural communities may be one of the few places policy and environmental interventions could impact children and adolescents outside of the home. Similarly, high-poverty minority groups do not get adequate physical activity (Cohen et al., 2017) leaving schools uniquely positioned to provide means and ways for increased physical activity levels. However, students and schools in low socio-economic communities struggle. For instance, Hispanic children in Texas are disproportionality represented among those living in poverty and are more likely to not have access to healthy foods or green spaces (Lovasi, Hutson, Guerra, & Neckerman, 2009). Stovitz, Steffen, and Boostrom (2008) found 38% of all Hispanic adolescents studied were, or were at risk for being overweight according to BMI measurements. According to Carlson et al. (2014), schools in these communities are less likely to have supportive physical activity practices compared to wealthy communities. Beyond the schools themselves, students from low socio-economic homes tend to be less physically active and less involved in sporting activities than those from higher socio-economic homes (Fairclough et al., 2009).

One of the benefits of having physical activity supported in the schools is that academic success and health related fitness can improve. This is especially important considering childhood inactivity leads to health concerns and academic achievement gaps are more prevalent among racial and ethnic groups in low socio-economic communities. Burrows et al. (2014) stated students identified as low socio-economic status who participated in four or more hours of weekly physical activity saw an increase in academic performance. Similarly, Stovitz et al. (2008) found an increased amount of physical activity time, obtained in physical education class, team sports, or any other extracurricular activity, was attributed to higher fitness and health related measures.

Torbeyns et al. (2017) found increasing both the amount and intensity of physical activity a student participates in every day had positive and significant benefits for cognitive performance, brain functioning, and academic performance. Specifically, they had students ride bike desks in their classrooms to increase their energy expenditure and physical activity time to 4 hours a week. Torbeyns et al. (2017) stated children and adolescences should obtain at least 60 minutes of moderate physical activity per day, something the CDC (2014), U.S. Department of Health and Human Services (2018a), and SHAPE (2016) have also recommended. However, Torbeyns et al. (2017) stated that upwards of 80% of 10-15-year-olds are physically inactive. This can be a result of policies that restrict or severely diminish non-academic classes to help struggling students, schools, or districts focus on passing standardized tests (Marques et al., 2017; Torbeyns et al., 2017). While physical activity has been, and is currently, being reduced in schools across the US, evidence of physical activity and its positive and significant association with academic performance is evident (Fedewa & Ahn, 2011; Singh et al., 2012; Torbeyns et al., 2017).

Marttinen, McLoughlin, Fredrick, and Novak (2017) and Santana et al. (2017) specifically studied how physical activity effected the academic performance on state mandated standardized tests and common core standards. Marttinen et al. (2017) found significant associations in academic performance on common core assessments when physical activity breaks were implemented during class, increasing the total amount of physical activity the student receives. Furthermore, Marttinen et al. (2017) found attitudes of the administration and teachers implementing classroom activity breaks were important as they influenced the perceived importance of the activity break by the students. Once more, like Singh et al. (2012), Fedewa and Ahn (2011), Torbeyns et al. (2017), and Marttinen et al. (2017) also advocated better policy development for physical activity based on current research and the association of physical activity and academic performance.

Questions remain as to how much physical activity is enough to have the greatest impact for students to elicit a measurable increase in fitness levels as measured by FitnessGram®. According to Daly-Smith. McKenna, Radley, and Long (2010), the greatest impact on student fitness scores come from children engaging in 60 minutes a day of physical activity. Furthermore, they stated physical activity performed by students needed to be at least 30 minutes of moderate-to-vigorous physical activity per day (Daly-Smith et al., 2010). The accruement of physical activity can come from any break a student has that allows them to increase their heart rates. Daly-Smith et al. (2010) stated any additional physical activity beyond 30 minutes of daily moderate-to-vigorous physical activity per day can reduce the likelihood of 10–12-year old students being labeled obese.

Brusseau and Hannon (2015) found similar results when schools allotted more time for physical activity. Specifically, they found the inclusion of recess and classroom activity breaks played a large role in increasing the total number of physical activity minutes students were able to obtain during a school day. Accordingly, this factor, among others, played a significant role in fitness levels. When the school and teachers allowed more opportunities for students to become physical active, fitness indicators such as BMI, cardiovascular fitness, and overall strength and endurance measurements were healthier (Brusseau & Hannon, 2015). Importantly, Brusseau and Hannon's research suggests physical activity must be integrated into classroom lessons to allow children to move and get active after periods of inactivity. Moreover, they stressed the importance of having daily recess as it benefits not only physical fitness levels for students, but also their attentiveness and time-on-task. Research conducted by Brusseau and Hannon (2015), Daly-Smith et al. (2010) Welk et al. (2010), and Stovitz et al. (2008) attributed extra time dedicated to physical activity to increased fitness levels in all of their respective participant populations.

Academic Assessments and Fitness Performance Instrument

The STAAR test is designed to measure the readiness for success in students for specific academic courses and as well as their eventual college and career readiness (TEA, 2017a). For the purposes of this study, the 2016-2017 STAAR scores in mathematics and reading for 3rd grade students were used.

STAAR Reliability and Validity

The psychometric properties of the STAAR test indicate both the reliability and validity of standardized test. According to *Technical Digest*, reliability indicates the precision of the test scores and also reproduces consistent test results across testing conditions (TEA, 2017a). Reliability coefficients for the STAAR test were calculated based on one test administration and are known as internal consistency measures (TEA, 2017a). Two different types of internal consistency measures were used to estimate the reliability of the STARR: (a) the Kuder-Richardson 20 (KR20) for multiple-choice test items only, and (b) a stratified coefficient alpha (also known as Cronbach's alpha) for mixed multiple-choice and constructed-response items (TEA, 2017a).

Validity evidence of the STAAR was organized into five categories: (a) test content, (b) response processes, (c) internal structure, (d) relations to other variables, and (e) consequences of testing (TEA, 2017a). According to TEA (2017a), STAAR validity evidence comes from the established test development process and judgements by content experts pertaining to the connection that items tested match items being taught through the TEKS statewide curriculum standards. Validity of the test content within STAAR follows a blueprint, test-development process each year to support validity evidence. This process includes: (a) development of items based on reporting categories and item guidelines, (b) reviewing items on more than one occasion for appropriateness of content and difficulty and to eliminate potential bias, (c) collecting and reviewing data on field-test items to determine appropriateness for inclusion, (d) building tests to pre-defined criteria, and (e) university-level experts who review high school assessments for accuracy of the advanced content (TEA, 2017a).

FitnessGram®

The FitnessGram® test is a comprehensive fitness assessment battery specifically designed to test youth (FitnessGram® Performance Standards, 2017). The FitnessGram® was adopted in Texas in 2008. Through collaboration between the Copper Institute (the inventor of the FitnessGram®) and the TEA, reporting results of this testing battery to TEA became mandatory in 2008 (Safe Schools and Health and Safety, 2007b). In the state of Texas, FitnessGram® is tested during physical education class. In this study, four FitnessGram® fitness performance measures were examined: (a) aerobic capacity, as measured by the 20 meter pacer test; (b) weight relative to height, as measured BMI; (c) abdominal strength and endurance, as measured by curl-ups; (d) upper body strength and endurance, as measured by 90° push-up; and (e) flexibility, as measured by the back-saver sit and reach (FitnessGram® Performance Standards, 2017).

Martin, Ede, Morrow, and Jackson (2010) stated FitnessGram® is a beneficial and user-friendly testing program for Texas physical educators to gather important health and fitness information about students in Grades 3–12. Findings from Martin et al. (2010) suggested either a master FitnessGram® administrator or a regular physical education coach could administer the FitnessGram® and gather reliable valid data. Miller et al. (2016) also found teacher preparation and application of the FitnessGram® to be reliable and valid in their research as well. Both Martin et al. (2010) and Miller et al. (2016) suggested the FitnessGram® was a highly effective tool to measure youth fitness. Martin et al. (2010) found issues relating to FitnessGram® specifically concerning support in test implementation, data entry, and professional development time. Miller et al. (2016) suggested teacher attitude, experience using the FitnessGram®, and perceptions on physical activity and exercise itself may have a large effect on test implementation. Furthermore, Miller et al. (2016) and Martin et al. (2010) found large class sizes to be common in physical education which made testing students slow and tiresome. However, both Miller et al. (2016) and Martin et al. (2010) found FitnessGram® can be implemented with accuracy in many situations and most coaches in Texas have a positive attitude about using it.

FitnessGram® has developed criterion and norm-based classifications cognizant of age and gender, which are used to classify students in one of three categories that rank their physical well-being or determine when students face potential heal risks (Beets & Pitetti, 2006; FitnessGram® Performance Standards, 2017; Kahan & McKenzie, 2017; Tucker et al., 2014). Healthy fitness zone status indicates students are sufficiently fit to be considered in good overall health. The second level, needs improvement, refers to students who may *potentially* face future health risks if their level of fitness does not improve. Students in this category should not only be encouraged to increase physical activity, they typically also need to change their diet. The third level, health risk, suggest a student has a higher *probability* of future health risks unless both activity and dietary habits are changed. Students classified as health risk face a more urgent need to make these changes to avoid future health risks (Beets and Pitetti, 2006; FitnessGram® Performance Standards, 2017; Kahan & McKenzie, 2017; Tucker et al., 2014). Students receive an outcome result rating (healthy fitness zone, needs improvement, or health risk) for the aerobic portion of the test and for each of the five performance tests they participate in.

Further, Tucker et al. (2014) suggested an association between sedentary behavior and health fitness zone levels. Interestingly, they found scores in the needs improvement or health risk levels for two or more components were good predictors of how sedentary a student was in their physical activity time at and away from school. On the other hand, students who scored in the healthy fitness zone range on three or more components exhibited a strong correlation with higher school attendance, lower incidence of negative classroom behaviors, and better academic performance (Tucker et al., 2014).

FitnessGram® Reliability and Validity

The standards FitnessGram® uses are norm and criterion referenced and are established for children and youth for each of the health-related fitness components (FitnessGram® Performance Standards, 2017; Hobayan, Patterson, Sherman, & Wiersma, 2014). According to the FitnessGram® Performance Standards (2017), the normative and criterion referenced standards are associated with a healthier life. The total number of laps, push-ups, and sit-ups completed for the Pacer, BMI, and the total number reached on the sit and reach by each student are used to determine a student's health-related fitness score.

According to Morrow, Martin, and Jackson (2010), and Looney and Gilbert (2012), the reliability and validity of the FitnessGram® test being administered by coaches were significant in modified kappa, phi coefficient, and chi square analyses. A modified kappa indicated moderate to substantial agreement with reliability and validity of the FitnessGram® test being administered by coaches. Phi coefficients and chi square results were significant concerning reliability and validity of the FitnessGram® test being administered by coaches. According to Morrow, Jackson, Disch, and Mood (2005) acceptable reliability factors of ≥ 0.70 for psychomotor tests are traditionally acceptable. Morrow et al. (2010) found that all fitness tests were above 0.70 and acceptable based on percent agreements for modified kappa, phi coefficients, and significant chi squares.

Social-Ecological Model

The theoretical framework used in this study was the SEM, first developed by Bronfenbrenner (1977, 1989, 2005), and later applied by Stokols (1992, 1996) in the discipline of health promotion programs. The SEM paradigm has its origins in biology and sociology and is grounded in certain core principles concerning interrelations among environmental conditions, human behavior, and well-being (Stokols, 1992). Bronfenbrenner (1977) first developed an ecological systems theory, or human ecological theory as it is sometimes called, which focused on the importance of the interaction between an individual and his environment. Figure 1 illustrates an adaption of Bronfenbrenner's ecological system theory. Later, policy was included in the macro system so as to understand how law, regulations, and policies work as integral part of one's environment (Bronfenbrenner, 2005). This figure illustrates the nesting and multiple levels of environmental interaction for an individual.

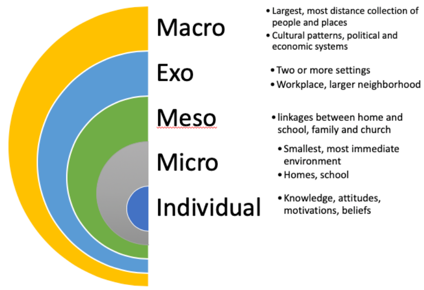

Figure 1. An Adaption of Bronfenbrenner's Ecological Systems Theory.

Researchers have utilized, refined, and applied some variation of SEM across different disciplines including health promotion (Stokols, 1992, 1996), social and behavior (Bronfenbrenner, 2005), and social marketing (Collins, Tapp, & Pressley, 2010) to name a few. In these fields, systematic attempts are made to apply an ecological approach to the study of associations, relationships of particular units of the environments with particular behaviors (individual and collective). Regardless of discipline, the main premise of the model is that behavior is shaped through a complex interplay of environmental determinants at different levels. Sallis, Bauman, and Pratt (1998) refer to this as a "person's interaction or transaction, with their physical and sociocultural environments" (p. 380).

Stokols (1992) used a social ecological analysis of health promotive environments to evaluate transactions between individual and collective behaviors and available health resources and/or constraints that may exist within a specific environment. Stokols' (1992, 1996) work has helped to delineate specific environmental leverage points for health promotion, policies and interventions. For example, Stokols (1992) suggested each level of environmental design, from the microenvironmental setting (e.g. corporate or institutional facilities) to larger environmental contexts (e.g. urban and international regions) poses specific opportunities for individual-focused and environmental-focused intervention strategies to promote healthy behavior. Stokols (1996) recognized (a) multiple factors influence behaviors, (b) environments are multidimensional and complex, (c) human-environment interactions can be described at varying levels of organization, and (d) the interrelationships between people and their environment are dynamic. According to Stokols (1992, 1996), the environments of persons and whole communities are construed as multidimensional, bringing together the social, cultural and physical components.

There is a host of research in which SEM was used to study physical activity. For instance, Sallis et al. (1998) looked at seven published articles where SEM was used to take a critical look at how environment and policy impacted the behavior of adolescents and young adults pertaining to their engagement in physical activity. In their analysis, Sallis et al. (1998) found physical activity increased when signs were placed in the environment encouraging physical activity. Similarly, when signs such as *take the stairs* are placed near elevators more people opt to use the stairs than in the absence of signs encouraging physical activity. Furthermore, they concluded policy intervention helps to encourage more physical activity within a community setting. Sallis et al. (1998) stated policy should be constructed to compensate for introduced barriers that may be present within a local community or its policies that limit engagement in physical activity.

According to Sallis et al. (2006), his model suggests higher levels of physical activity can be expected when physical activity is supported by both environments and policies. And, when social norms and social support for engagement in physical activity are strong, individuals are motivated and educated to be physically active (Sallis, Owens, & Fischer, 2008).

One of the SEM strengths Sallis et al. (1998) and Stokols (1992) discussed in their research was the complex problem of motivating people to become more physically active and healthy is beyond the ability of a single influencer. They contend multiple influencers sway students and community members to participate in health promotion and physical activity, just as multiple factors influence how students obtain knowledge of fitness and participate in physical activity in schools.

According to Jensen (2009), children living in poverty and those coming from a low SES need physical activity at a higher level than children who come from a higher SES. Jensen (2009) stated most schools classified as Title I have a higher rate of families with a lower SES. Furthermore, these schools tend to focus more on core academics (Jensen, 2009). Jensen (2009) found students in Title I schools were more likely withheld from physical activity in favor of pull-outs. Pull-outs were meant to have the student focus on specific tested academics and came in place of their physical education class or recess (Jensen, 2009). Others, such as Murray and Ramstetter (2013), Wrench and Garrett (2017), and Kirby, Levin, and Inchley (2013) concur that either physical fitness, academic achievement, or both, are greatly affected among students coming from families of social disadvantage and poverty.

For the purpose of this study, and to the extent possible within this study, policy environment refers to legislation which has the potential to affect physical activity within a school . Important to this study is understanding how policy can take form in local, state, school board action, or campus oversight (Mehtälä, Sääkslahti, Inkinen, & Poskiparta, 2014; Ward, 2016). Three environments, as shown in Figure 2, factor into the discussion of the findings. These are (a) the social environment, (b) the physical environment, and (c) the individual.

The social environment surrounds the individual. This includes the culture and society within which the student lives and interacts. Larsen, Pekmezi, Marquez, Benitez, and Marcus (2013) suggested that Latinas' involvement in physical activity received very little social support and was greatly influenced by their cultural expectations and environmental influences.

The physical environment includes everything an individual can physically interact or engage with to induce physical activity (Larsen et al., 2013). According to Kahan and McKenzie (2017), key predictors of physical activity in elementary school students in low SES or Title I schools may be strongly linked to physical environment. While some environments are constructed to induce students to become more physically active other environments do the complete opposite. A thorough description of each campus has been provided relative to its specific physical environment.

The individual is the center of this SEM model, as seen in Figure 2. Data were collected relative to individuals' gender, race/ethnicity, SES, involvement in special programs (e.g. special education, English language learner), fitness, and academic scores. However, data were not collected relative to individuals' knowledge, attitudes, motivation, etc., and, as such, discussion relative to this area is limited.

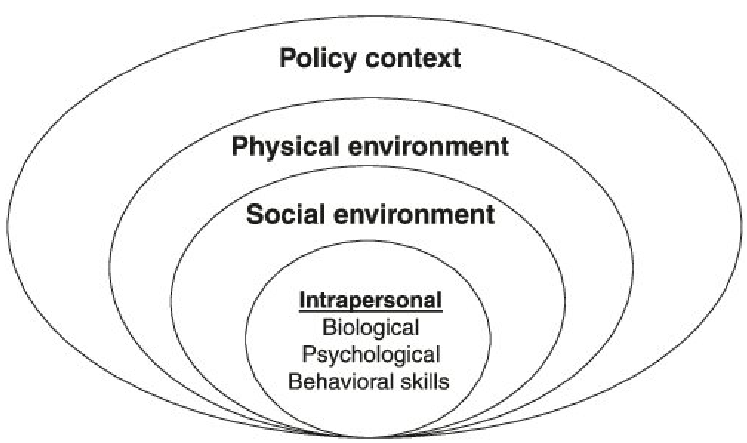

Figure 2: The Four Components of the SEM for Physical Activity and Health.

Summary

Chapter II has presented the pathway physical educators, administrators, legislators, and students have traveled to address questions this study researched. To move forward, with purpose, our past must be known. In knowing the past, researchers and practitioners can move forward with scientific purpose to understand what contributes to fluctuating physical activity our Texas public education students have, and continue to, endure. Research indicates students benefit, both academically as well as in their physical fitness, when increased amounts of physical activity are provided by legislation and/or the practice of administrators. The research questions in this study set out to analyze how much physical activity Texas students need to obtain the most beneficial rewards in academic achievement and physical fitness.

Therefore, the literature reviewed for this study included an historical overview of physical education and physical activity comprised of legislative activity and the role of higher education, followed by an examination of research concerned with associations between physical activity, environment, demographics (race, ethnicity, and socio-economic status), and our present culture of standardized testing. Interestingly, the literature has shown there is a renewed focus on the use of scientific research to educate and inform administrators and policymakers. An overview of the two instruments, STAAR and FitnessGram®, as well as related research was included in the literature review. Finally, the theoretical framework of SEM was presented with an exploration of its use in a variety of disciplines. Considering these components together, the literature review has informed this study in light of its finding relative to academic achievement and physical fitness associations with physical activity time.

CHAPTER III: METHODS

Introduction

The purpose of the study was to examine the impact of physical activity time on academic achievement in mathematics and reading, as measured by the STAAR, and four physical fitness performance goals, as measured by FitnessGram®, among 3rd grade students in an urban school district in South Texas. The study was guided by the following research questions:

1. Does the amount of physical activity impact standardized academic achievement in mathematics among 3rd graders?
2. Does the amount of physical activity impact standardized academic achievement in reading among 3rd grades?
3. Does the amount of physical activity impact the fitness performance goals among 3rd graders?
4. What is the extent of the bivariate associations between fitness performance goals and academic achievement in mathematics and reading?

Research Design

The study employed an ex-post facto, causal-comparative research design (Gall, Gall, & Borg, 2015), which is conducted to examine differences among groups that differ on the independent variable based on the dependent variable(s). There are two possible orientations utilizing a causal-comparative research design, retrospective and prospective (Gall et al., 2015; Gay, Mills, & Airasian, 2012). A retrospective orientation begins with the outcome and is conducted to identify the antecedents. A prospective orientation, on the other hand, begins with the a priori identified independent variables(s) and examines its/their impact on the dependent variable(s). The study utilized a retrospective orientation. Due to the non-experimental nature of the design, no causal inferences were drawn.

In this study, the independent variable was the physical activity time with three levels: (1) 135, (2) 225, and (3) 300 minutes of physical activity per week. The characteristics-present group was the one receiving 135 minutes of physical activity, the minimum TEA mandates for the state of Texas. The comparison groups had received 225 and 300 minutes of physical activity. The outcome measures were the four fitness measures, namely, BMI, pushup, curl-up, and trunk life, as recorded by FitnessGram®, and the STAAR mathematics and reading achievement scores.

Subject Selection

The subjects for the study were recruited from three elementary schools, hereafter referred to as Schools A, B, and C, in an urban school district in South Texas. The study was delimited to the 2016-2017 academic year due to the availability of accurate physical activity data. The non-probability sample consisted of 70, 49, and 63 3rd graders in Schools A, B, and C, respectively. Permission to conduct the study was obtained from the Institutional Review Board at Texas A&M University-Corpus Christi and the external research committee from the school district in which the study takes place (Appendix A).

In the 2016 – 2017 school year, the three campuses had similar demographics, as shown in Table 1. Schools A, B, and C had 626, 347, and 508 students, respectively. The overwhelming majority of students were Hispanic (School A, 92.80%, School B, 76.90%, and School C, 87.20%) and economically disadvantaged (School A, 94.90%, School B, 74.60%, and School C, 99.20%) in school C. The special education percentages were 8.60%, 6.10%, and 6.70% in Schools A, B, and C, respectively. The at-risk percentage for School A was 67.30%, 54.80% for

School B, and 66.70% for School C. School A had the highest percentage of English Language Learners (ELLs), 21.20%, followed by School C, 7.30% and School B, 4.30%. The attendance rates for Schools A, B, and C were 94.80%, 95.80%, and 95.60%, respectively and all were rated as Met Standard per the state's accountability system (TEA, 2018a; TEA, 2018b; TEA, 2018c).

Table 1

A Profile of the Participating Schools

	School A n = 626	School B n = 374	School C n = 508
Ethnicity			
Hispanic	92.80%	76.90%	87.20%
White	5.60%	17.00%	6.90%
African American	1.30%	2.90%	5.70%
Special Education	8.60%	6.10%	6.70%
At-Risk	67.30%	54.80%	66.70%
English Language Learners	21.20%	4.30%	7.30%
Economically Disadvantaged	94.90%	74.60%	99.20%

Notes: Weekly Minutes of Physical Activity per School
School A: 135, Characteristic-Present Group
School B: 225, Comparison Group
School C: 300, Comparison Group

Instrumentation

FitnessGram® is a fitness performance assessment created by the Cooper Institute to assess fitness level in five (5) different areas in youth. Subjects are assessed in a variety of health-related physical fitness tests, measuring muscle strength, muscular endurance, flexibility, and BMI. The standards that FitnessGram® uses are criterion-referenced and associated with a healthier lifestyle that are established for children and youth for each of the health-related fitness components. For the purpose of the study, four (4) fitness performance measures were used, the

BMI, the total number of pushups, the total number of curl-ups, and the total number reached of trunk lifts were used to operationalize fitness performance.

The STAAR tests are designed to measure what students have learned and to show if they are able to apply the knowledge and skills, as defined by the TEKS (TEA, 2017b). For the purpose of the study, the 2017 STAAR total scores in mathematics and reading for 3rd grade students were used. The proportion of correct answers to the total number of questions was used to measure STAAR academic achievement.

Achievement in 3rd grade STAAR mathematics is measured by four (4) reporting categories and a total of 32 items. Reporting category one consists of eight (8) items and assesses numerical representations. Reporting category two (2) has 13 items and assesses computations and algebraic relationships. Reporting category three (3) is measured by seven (7) items and assesses geometry and measurement. Reporting category four (4) consists of four (4) items and assesses data analysis and personal financial literacy.

Achievement in 3rd grade STAAR reading is measured by three (3) reporting categories and consists of 34 test items. Reporting category one (1) contains five (5) items and assesses the understanding across genres. Reporting category two (2) includes 15 items that determine the understanding/analysis of literary texts. Reporting Category three (3) consists of 14 items that assess understanding/analysis of informational texts.

Reporting categories along with external validity have both been studied for passing criteria that established the STAAR standard expectations and informed the STAAR Standard Setting Policy Committee process (TEA, 2017b).

Data Collection

The abovementioned data were requested from the Office of Assessment and Accountability in the study's school district, which provided the researcher with demographic data on age, gender, ethnicity, and socio-economic, fitness performance data on weight in pounds, height in inches, BMI, pushups, curl-ups, and trunk lifts, and the total number of questions answered correctly in STAAR mathematics and reading achievement tests. The cases with complete data for all variables were included in the study.

Data Analysis

Data were exported into the Statistical Package for the Social Sciences, which was used for the purpose of data manipulation and analysis (IBM Corp, 2017). Descriptive statistics were employed to summarize and organize all data, including frequency and percentage distribution tables, measures of central tendency, and measures of variability. The proportion of the total number of test questions answered correctly to the total number of questions in mathematics and reading was used to measure student achievement.

A series of chi-square test of independence was performed to compare the three schools on the basis of gender, ethnicity, and socio-economic status (Field, 2018). The non-parametric test involves inferences about the independence of the modes of classification in a contingency table (a two-way table showing the contingency between two variables where the variables have been classified into mutually exclusive categories and the cell entries are frequencies). The null hypothesis is that the two modes of classification on which the contingency table is based are independent of each other.

A series of one-way analysis of variance (ANOVA) was performed to compare the three schools based on the continuous data, namely, measures of academic achievement and fitness performance. Levene's F was used to test the homogeneity of variances assumption; Welch F was used to examine the mean differences if the assumption had not been met. Tukey's Honestly Significant Test (HSD) and Games-Howell procedures were used for the purpose of post-hoc analysis if the assumption had or had not been met, respectively. Effect size was computed by $\sqrt{(k-1)F/N}$, where k is the number of groups, F is the F-ratio, and N is the total sample size, and was described as 0.10 = small effect, 0.25 = medium effect, and >0.40 = large effect (Stevens, 2009). Additionally, a series of one-way analysis of covariance (ANCOVA), with age as the covariate, was performed to examine group differences based on mean scores, adjusted by age, which was treated as a potential confounding variable. All ANOVA and ANCOVA models were tested at the 0.05 level of significance. Field (2018) was used as the guide to conduct the investigation of the general linear models.

A series of Pearson Product-Moment Correlation Coefficient was performed to examine the bivariate associations between measures of fitness performance and academic achievement. Additionally, a series of first-order partial correlation coefficient determined the magnitude and direction of the simple associations, independent of age, which, as indicated earlier, was a potential extraneous variable. Since a large number of correlation coefficients had to be computed, the level of significance was set at 0.01 to reduce the probability of making Type I Errors (Field, 2018).

Summary

The study was non-experimental; thus, no causal inferences were drawn. Existing data were used. A series of univariate statistical techniques were employed to analyze the data. Practical significance of the findings was examined. External validity was limited to the study's participants due to the non-probability nature of sampling.

CHAPTER IV: RESULTS

The ex-post facto, causal-comparative research design enabled the researcher to answer the following research questions: (1) Does the amount of physical activity impact standardized academic achievement in mathematics among 3rd graders? (2) Does the amount of physical activity impact standardized academic achievement in reading among 3rd grades? (3) Does the amount of physical activity impact the fitness performance goals among 3rd graders? (4) What is the extent of the bivariate associations between fitness performance goals and academic achievement in mathematics and reading?

A Profile of the Subjects

The study took place in an urban school district in South Texas. The comparison group (School A, 135 minutes of weekly physical activity) and the characteristic-present groups (School B, 225 and School C, 300 minutes of weekly physical activity) consisted of 70, 49, and 63 3rd grade students, respectively, for the total of 182 students. The majority of the students in School A were males (51.40%), while females formed the majority in School B (55.10%) and School C (54.00%). There were no statistically significant differences among the three schools based on gender, $\chi^2(2, N = 182) = 0.94$, $p = 0.62$. There were 162 Hispanics, 19 Whites, and 1 African American. For the purpose of the study, ethnicity was dichotomized into Hispanic and Non-Hispanic. The majority of the students were Hispanic (92.90%, School A), (87.80%, School B), and (85.70%, School C). Group differences on the basis of ethnicity were not statistically significant, $\chi^2(2, N = 182) = 1.84$, $p = 0.40$. The overwhelming majority of the students in all schools were on a free or reduced lunch (School A, 87.10%; School B, 85.70%; School C, 76.20%) and the differences were not statistically significant, $\chi^2(2, N = 182) = 3.17$, $p = 0.20$. Results are summarized in Table 2.

Table 2

A Profile of Subjects, Categorical Values

Demographic Characteristic	School A n = 70		School B n = 49		School C n = 63	
	f	%	*f*	%	*f*	%
Gender [a]:						
Female	34	48.60	22	44.90	34	54.00
Male	36	51.40	27	55.10	29	46.00
Ethnicity [b]:						
Hispanic	65	92.90	43	87.80	54	85.70
Non-Hispanic	5	7.10	6	12.20	9	14.30
Socio-economic Status [c]:						
Free/Reduced Lunch	61	87.10	42	85.70	48	76.20
Full Paid Lunch	9	12.90	7	14.30	15	23.80

Notes: Weekly Minutes of Physical Activity per School
School A: 135, Characteristic-Present Group
School B: 225, Comparison Group
School C: 300, Comparison Group
[a] $\chi^2(2, N = 182) = 0.94, p = 0.62$
[b] $\chi^2(2, N = 182) = 1.84, p = 0.40$
[c] $\chi^2(2, N = 182) = 3.17, p = 0.20$

The 3rd graders ranged in age from 8 to 10 years old. School B was the oldest ($M = 9.06$, $SD = 0.52$), followed by School A ($M = 8.60$, $SD = 0.65$) and School C ($M = 8.57$, $SD = 0.64$). The homogeneity of variances assumption was not met, *Levene's F* = 13.93, $p < 0.01$, and Welch F showed that age difference were statistically significant, $F(2, 117) = 13.13$, $p < 0.01$. Games-Howell post hoc analysis of pairwise comparisons showed that age differences between School B and Schools A and C were statistically significant; not statistically significant between Schools A and C.

The average weight, in pounds, differences among School A (*M* = 79.47, *SD* = 22.99), School B (*M* = 73.69, *SD* = 17.39), and School C (*M* = 74.75, *SD* = 22.89) were not statistically significant $F(2, 179) = 1.27$, $p = 0.28$; the homogeneity of variances assumption was met, *Levene's* $F(2, 179) = 1.37$, $p = 0.26$. Additionally, the average height, in inches, differences among School A (*M* = 53.38, *SD* = 3.12), School B (*M* = 52.23, *SD* = 2.30), and School C (*M* = 53.27, *SD* = 3.78) were not statistically significant, $F(2, 179) = 2.17$, $p = 0.12$; the homogeneity of variances assumption was met, *Levene's* $F(2, 179) = 2.51$, $p = 0.08$. Results are summarized in Table 3.

Table 3

A Profile of Subjects, Continuous Variables

Demographic Characteristic	School A n = 70		School B n = 49		School C n = 63	
	Mean	SD	Mean	SD	Mean	SD
Age [a] (years)	8.60	0.65	9.06	0.52	8.57	0.64
Weight [b] (lbs)	79.47	22.99	73.69	17.39	74.75	22.89
Height [c] (in)	53.38	3.12	52.23	2.30	53.27	3.78

Notes: Weekly Minutes of Physical Activity per School
School A: 135, Characteristic-Present Group
School B: 225, Comparison Group
School C: 300, Comparison Group
[a] $F(2, 117) = 13.13$, $p < 0.01$
[b] $F(2, 179) = 1.27$, $p = 0.28$
[c] $F(2, 179) = 2.17$, $p = 0.12$

Group Comparisons

To answer the study's research questions 1 – 3, the three schools were compared based on academic achievement, as measured by STAAR mathematics and reading scores, and fitness performance, as measured by BMI, pushups, curl-ups, and trunk lift. Due to the exploratory nature of the study, the level of significance was set at 0.05.

Academic Achievement

As reported earlier, age differences among the three schools were statistically significant; however, age was not statistically associated with either the mathematics ($r = -0.14$, $p = 0.06$) or reading ($r = -0.06$, $p = 0.43$) scores; thus, it was ruled out as a confounding variables.

Academic achievement in mathematics was measured by the proportion of correct answers to the total number of questions; there were 32 questions. The homogeneity of variances assumption was met, *Levene's* $F(2, 179) = 0.82$, $p = 0.44$. A One-Way ANOVA showed that there were statistically significant differences among the three schools with respect to mathematic scores, $F(2, 179) = 5.14$, $p = < 0.01$. The Tukey post hoc pairwise comparisons of the means showed that School C ($M = 0.51$, $SD = 0.21$) was outperformed by both School B ($M = 0.63$, $SD = 0.20$) and School A ($M = 0.62$, $SD = 0.23$) and the differences were statistically significant. The difference between Schools A and B were not statistically significant. The effect size was medium (0.24).

Academic achievement in reading was measured by the proportion of correct answers to the total number of questions; there were 34 questions. The homogeneity of variance assumption was met, *Levene's* $F(2, 179) = 0.71$, $p = 0.49$, and a One-Way ANOVA showed that group differences were statistically significant, $F(2, 179) = 4.52$, $p < 0.05$. Specifically, post hoc analysis of the data showed that School B ($M = 0.62$, $SD = 0.20$) had the highest scores, followed by School A ($M = 0.55$, $SD = 0.23$), and school C, ($M = 0.50$, $SD = 0.21$). The difference between Schools B and C was statistically significant; the other pairwise comparisons were not statistically significant. Results are summarized in Table 4. The effect size was medium (0.22).

Table 4

Comparison of STAAR Reading and Mathematics Scores

STAAR Category	School A n = 70 M*	SD	School B n = 49 M*	SD	School C n = 63 M*	SD	*F*	*p*
Mathematics [a]	0.62	0.23	0.63	0.20	0.51	0.21	5.14	<0.01
Reading [b]	0.55	0.22	0.62	0.20	0.50	0.23	5.52	<0.05

Notes: Weekly Minutes of Physical Activity per School
School A: 135, Characteristic-Present Group
School B: 225, Comparison Group
School C: 300, Comparison Group
* Proportion of correct answers to the total number of questions
[a] Statistically significant pairwise comparisons: School A > School C and School B > School C
[b] Statistically significant pairwise comparison: School B > School C

Fitness Performance

Fitness performance was operationalized by four variables, namely, (1) BMI, (2) the total number of pushups, (3) the total number of curl-ups, and (4) the total number reached on trunk lift, which must be measured once a year. The BMI and total number of pushups and curl-ups were measured by the FitnessGram® compact disc, and a meter stick was used to measure trunk lift during the specified physical education class.

The homogeneity of variances assumption was not met for pushups, $F(2, 179) = 15.32$, $p < 0.01$, curl-ups, $F(2, 179) = 58.44$, $p < 0.01$, and trunk lift, $F(2, 179) = 51.28$, $p < 0.01$; it was met for the BMI, $F(2, 179) = 0.36$, $p = 0.70$. Welch F was used to compare the schools based on measures of fitness performance; Games-Howell test was employed for the post hoc analysis. These two robust tests take into consideration that the variances are unequal.

There were no statistically significance differences among the three schools with respect to BMI, $F(2, 115) = 0.93$, $p = 0.40$ (School A, $M = 19.36$, $SD = 4.36$; School B, $M = 18.88$, $SD = 3.93$), and School C, $M = 18.33$, $SD = 4.35$). The effect size was small (0.10).

The differences among the three schools based on the average of the total number of pushups were statistically significant, $F(2, 91) = 63.24$, $p < 0.01$. The post hoc analysis of the data showed that both School B ($M = 9.92$, $SD = 4.89$) and School A ($M = 13.76$, $SD = 6.04$) outperformed School C ($M = 5.81$, $SD = 2.00$) and the differences were statistically significant. The difference between Schools A and B was also statistically significant. The effect size was large (0.83).

School differences based on the average of the total number of curl-ups were statistically significant, $F(2, 91 = 97.88$, $p < 0.01$. School B had the highest average score ($M = 30.60$, $SD = 14.02$), followed by School A ($M = 18.07$, $SD = 6.85$) and School C ($M = 8.65$, $SD = 3.48$). All pairwise comparisons were statistically significant. The effect size was large (1.04).

The differences based on the average of the total number reached on trunk lift were also statistically significant, $F(2, 87) = 23.65$, $p < .01$. Both Schools A ($M = 11.77$, $SD = 0.82$) and C ($M = 11.90$, $SD = 0.35$) outperformed School B ($M = 10.24$, $SD = 1.66$) and the differences were statistically significant. The difference between Schools A and C was not statistically significant. Results are summarized in Table 5. The effect size was large (0.50).

Simple correlations between age and curl-ups ($r = 0.17$, $p < 0.05$) and trunk lift ($r = -0.16$, $p < 0.05$) were statistically significant. The relations with BMI ($r = 0.04$, $p = 0.55$) and pushups ($r = 0.01$, $p = 0.88$) were not statistically significant. To determine if age could have affected the outcome measures, a series of One-Way ANVOCA, with age as the covariate, was performed. The results remained the same, BMI: $F(2, 178) = 0.98$, $p = 0.38$; pushups: $F(2, 178) = 47.68$, $p < 0.01$; curl-ups: $F(2, 178) = 83.52$, $p < 0.01$; trunk lift: $F(2, 178) = 39.89$, $p < 0.01$.

Table 5

Comparison of Fitness Performance Measures

	School A n = 70		School B n = 49		School C n = 63		
	M	SD	M	SD	M	SD	*Welch F*
BMI	19.36	4.35	18.88	3.93	18.33	4.35	0.93
Pushup [a]	13.76	6.04	9.92	4.89	5.81	2.00	63.24*
Curl-Up [b]	18.07	6.85	30.57	14.02	8.65	3.48	97.88*
Trunk Lift [c]	11.77	0.82	10.24	1.66	11.90	0.35	23.65*

* p 0.01

Notes: Weekly Minutes of Physical Activity per School
School A: 135, Characteristic-Present Group
School B: 225, Comparison Group
School C: 300, Comparison Group

[a] Statistically significant pairwise comparisons: School A > Schools B and C; School B > School C

[b] Statistically significant pairwise comparisons: School B > Schools A and C; School A > School C

[c] Statistically significant pairwise comparisons: Schools A and C > School B

Correlational Analysis

To answer the 4th research question, a series of simple correlation coefficients and 1st order partial correlation coefficients were computed to examine the extent of the associations between academic achievement and fitness performance. The level of significance was set at 0.01 to reduce the probability of making Type I errors due to performing multiple tests.

Table 6 shows all the simple correlations between mathematics and reading scores on one hand and measures of BMI, pushups, curl-ups, and trunk lift on the other hand for all subjects.

Table 6

Correlation Matrix, Academic Achievement with Fitness Performance, n = 182

Academic Achievement	BMI	Pushup	Curl-Up	Trunk Lift
Mathematics	0.17	0.25*	0.21*	-0.06
Reading	0.13	0.14	0.28*	-0.10

* $p < 0.01$

As noted earlier, age was a potential confounding variable. A series of 1st order partial correlation coefficients was performed to examine the extent of the abovementioned associations, independent of age. Results, as shown in Table 7, were consistent with the ones based on simple correlations, that is, the measure of curl-ups was associated with both mathematics and reading scores ($p < 0.01$), the measure of pushups was associated with mathematics, and none of the other correlations was statistically significant.

Table 7

1st Order Partial Correlation Matrix, Academic Achievement with Fitness Performance, Controlling for Age, n = 182

Academic Achievement	BMI	Pushup	Curl-Up	Trunk Lift
Mathematics	0.18	0.25*	0.24*	-0.09
Reading	0.14	0.15	0.29*	-0.12

* $p < 0.01$

All simple and 1st order partial correlational analyses were performed for each school. The level of significance was set at 0.01 to reduce the probability of making Type I errors due to performing multiple tests. As can be seen in Tables 8 and 9, other than the 1st order partial correlation coefficient between pushups and mathematics in School A, none was statistically significant at the 0.01 level.

Table 8

Correlation Matrix, Academic Achievement with Fitness Performance by School

Academic Achievement	BMI	Pushup	Curl-Up	Trunk Lift
School A (n = 70)				
Mathematics	0.20	0.30	0.10	-0.12
Reading	0.15	0.18	0.23	-0.16
School B (n = 49)				
Mathematics	-0.05	0.02	0.20	0.11
Reading	0.06	0.09	0.26	0.14
School C (n = 63)				
Mathematics	0.24	-0.01	-0.08	0.10
Reading	0.14	-0.05	-0.02	0.04

Notes: Weekly Minutes of Physical Activity per School
School A: 135, Characteristic-Present Group
School B: 225, Comparison Group
School C: 300, Comparison Group

Table 9

1st Order Partial Correlation Matrix, Academic Achievement with Fitness Performance, Controlling for Age by School

Academic Achievement	BMI	Pushup	Curl-Up	Trunk Lift
School A (n = 70)				
Mathematics	0.22	0.34*	0.05	-0.15
Reading	0.16	0.19	0.20	-0.18
School B (n = 49)				
Mathematics	-0.09	0.01	0.16	0.15
Reading	0.01	0.09	0.22	0.19
School C (n = 63)				
Mathematics	0.26	-0.02	-0.05	0.10
Reading	0.14	-0.05	-0.03	0.04

Notes: Weekly Minutes of Physical Activity per School, * $p < 0.01$
School A: 135, Characteristic-Present Group
School B: 225, Comparison Group
School C: 300, Comparison Group

Summary

School C, which had the largest minutes of weekly physical activity, had the lowest academic achievement scores in mathematics and reading. Specifically, both Schools A (135 minutes of weekly physical activity) and B (225 minutes of weekly physical activity) outperformed School C in mathematics, School B did better in reading, and these differences were statistically significant. With respect to fitness performance, although some statistically significant differences were found among the three schools, no uniform pattern was noted, suggesting the randomness of the findings. Additionally, correlational analyses of the data, with one exception (pushups in relation to mathematics, controlling for age, in School A), showed no statistically significant relations between fitness performance and academic achievement.

CHAPTER V: SUMMARY, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

Introduction

Chapter five includes four sections. The first section consists of a summary of the study including an overview, research questions, a review of the methodology, and the findings. The second section includes conclusions based on the findings. The third section discusses interpretations in relation to the study and related research examined in the literature review. The final section provides recommendations for practical application and further research in the area of impact of physical activity time on academic achievement and fitness.

Summary of the Study

Despite professional standards and research recommendations that students receive an average of 60 minutes per day or 300 minutes per week of physical activity for optimizing benefits in academics, fitness, and overall wellness (CDC, 2014; SHAPE, 2016; Carlson et al., 2013; Esteben-Cornejo et al., 2017), Texas school districts are only obligated to offer 30 minutes of physical activity daily or a total of 135 minutes weekly. Due to discretionary administrative practices, some campuses may offer physical activity above the legally mandated minimum. This study investigated the three most common physical activity durations (135, 225, and 300 minutes/week), to better understand which has the greatest impact on a student academic achievement and health-related fitness. Utilizing an ex-post facto, causal comparative design, the study was conducted to examine the impact of physical activity time on academic achievement in mathematics and reading, as measured by the STAAR, and four physical fitness performance goals, as measured by FitnessGram®, among 3rd grade students in an urban school district in South Texas.

The study was guided by the following research questions:

1. Does the amount of physical activity impact standardized academic achievement in mathematics among 3rd graders?
2. Does the amount of physical activity impact standardized academic achievement in reading among 3rd grades?
3. Does the amount of physical activity impact the fitness performance goals among 3rd graders?
4. What is the extent of the bivariate associations between fitness performance goals and academic achievement in mathematics and reading?

A total of 182 students from three schools were examined. These schools included: (1) the comparison group School A (N = 70), which provided 135 minutes of weekly physical activity; and (2) the characteristic-present groups School B (N = 49) and School C (N = 63), which provided 225 and 300 minutes of weekly physical activity, respectively. The amount of physical activity time students were given per week constituted the independent variable which then allowed comparison of the 2016-2017 STAAR mathematic and reading scores and four physical fitness performance measures from FitnessGram® that all three schools conducted.

Utilizing the Statistical Package for Social Sciences, descriptive statistics were employed to summarize and organize all data, including frequency and percentage distribution tables, measures of central tendency, and variability. A series of chi-square tests of independence was performed to compare the three schools on the basis of gender, ethnicity, and socio-economic status. A series of one-way ANOVAs was performed to compare the three schools based on the continuous data, namely, measures of academic achievement and fitness performance. A series of Pearson Product-Moment correlation was performed to examine bivariate associations between measures of fitness performance and academic achievement.

To answer Research Question 1, academic achievement in mathematics was measured by the proportion of correct answers to the total number of questions (32). The results indicated School C (*M* = 0.51, *SD* = 0.21), which provided 300 minutes of physical activity per week, was outperformed by both School B (*M* = 0.63, *SD* = 0.20) and School A (*M* = 0.62, *SD* = 0.23), and the differences were statistically significant. The difference between Schools A and B was not statistically significant.

To answer Research Question 2, academic achievement in reading was measured by the proportion of correct answers to the total number of questions (34). The analysis of the data showed that School B (*M* = 0.62, *SD* = 0.20) had the highest scores, followed by School A (*M* = *0*.55, *SD* = 0.23), and School C, (*M* = 0.50, *SD* = 0.21). The difference between Schools B and C was statistically significant; the other pairwise comparisons were not statistically significant.

To answer Research Question 3, fitness performance was operationalized by four variables, namely, (1) BMI, (2) the total number of pushups, (3) the total number of curl-ups, and (4) the total number reached on trunk lift, which must be measured once a year. There were no statistically significant differences among the three schools with respect to BMI, $F(2, 115) = 0.93$, $p = 0.40$ (School A, *M* = 19.36, *SD* = 4.36; School B, *M* = 18.88, *SD* = 3.93, School C, *M* = 18.33, *SD* = 4.35). The differences among the three schools based on the average of the total number of pushups were statistically significant, $F(2, 91) = 63.24$, $p < 0.01$. The post hoc analysis of the data showed that both School B (*M* = 9.92, *SD* = 4.89) and School A (*M* = 13.76, *SD* = 6.04) outperformed School C (*M* = 5.81, *SD* = 2.00) and the differences were statistically significant. The difference between Schools A and B was also statistically significant. School differences based on the average of the total number of curl-ups were statistically significant, $F(2, 91 = 97.88, p < 0.01$. School B had the highest average score ($M = 30.60$, $SD = 14.02$), followed by School A ($M = 18.07$, $SD = 6.85$) and School C ($M = 8.65$, $SD = 3.48$). All pairwise comparisons were statistically significant. The differences based on the average of the total number reached on trunk lift were also statistically significant, $F(2, 87) = 23.65$, $p < .01$. Both Schools A ($M = 11.77$, $SD = 0.82$) and C ($M = 11.90$, $SD = 0.35$) outperformed School B ($M = 10.24$, $SD = 1.66$) and the differences were statistically significant. The difference between Schools A and C was not statistically significant. The measure of curl-ups was associated with both mathematics and reading scores ($p < 0.01$).

To answer Research Question 4, a series of simple correlation coefficient and 1st order partial correlation coefficients were computed to examine the extent of the associations between academic achievement and fitness performance. The fitness measure of pushups was associated with mathematics, none of the other correlations was statistically significant.

Conclusions

Although some statistically significant differences were found among the three schools, no uniform pattern was noted, suggesting the randomness of the findings. Based on the results, third grade students who attended School C with 300 minutes per week of physical activity time did not outperform third grade students who attended School B with 225 minutes or School A with 135 minutes of weekly physical activity time with regard to mathematics and reading. Regarding the four fitness measures, School C was outperformed, significantly, by School A and School B in pushups and curl-ups. School C significantly outperformed School B in trunk lift.

Third grade students who attended School B outperformed third grade students at School A in mathematics and reading, however, the results were not statistically significant between the two schools. Additionally, correlational analyses of the data, with one exception (pushups in relation to mathematics, controlling for age, in School A), showed no statistically significant relations between fitness performance and academic achievement.

Discussion

While much of the literature has established the benefits of an average of 60 minutes per day or 300 minutes per week of physical activity in schools, the results of this study were mixed, if not random. Discussion points are presented in light of results of the study, existing literature, and the day-to-day school operations.

Competing Initiatives

Multiple scenarios are possible for how each campus scheduled physical activity time, while still maintaining their reported physical activity time. For instance, School B (225 minutes) and School C (300 minutes) may have front loaded (Monday, Tuesday, Wednesday) or back loaded (Wednesday, Thursday, Friday) their physical activity during the week. Another scenario could be the amount of time students must remain in a classroom before engaging in physical activity. Mahar et al. (2006) suggested longer periods of instructional time without a physical activity break may be detrimental to academic performance and overall cognitive performance.

These scenarios may be explained by local, state, and federal initiatives that may impede physical activity time. No restrictions on the number of initiatives were present on any given campus, meaning time dedicated to physical activity (135, 225, or 300 minutes) may not be protected consistently (either weekly and/or through the school year). Academic initiatives, stemming from the NCLB Act of 2001 and state accountability policies likely contribute to erratic and/or reduced physical activity time (Burton & VanHeest, 2007; Mahar et al., 2006). As such, campus principals may pursue academic initiatives to improve achievement for perennially underperforming students.

Pullout programs. Each campus in the study was identified as a Title I campus in the 2016-2017 school year and served students receiving special education services (School A: 8.60%, School B: 6.10%, School C: 6.70%). English language learners were also present on all campuses (School A: 21.20%, School B: 4.30%, School C: 7.30%). Students receiving services through federally protected programs such as Title I, special education, and bilingual education may be pulled from a class for individualized or small group instruction. According to Jensen (2009), students who attend schools designated as Title I have a tendency to focus on specific tested academics and withhold physical activity from the student in favor of pull-outs. While a student can be pulled out for any type of service that the student's individualized education plan may call for, at many campuses students are pulled out of class for tutorials for state standardized tests, to make up work that a student have done poorly on, as a consequence for bad behavior, and to make up work that a student may have missed during an absence (Siegel, 2007; Vazou & Skade, 2017; Wrench & Garrett, 2017; Zavacky & Michael, 2017). Data were not collected relative to the number of times a third-grade student was pulled from class or if the student missed physical activity time due to a pullout situation.

When a campus is rated as in need of improvement due to state accountability standards, administrators and teachers look for innovative ways to help students academically so that they may pass the state assessment. Studies have shown taking students away from recess and physical education classes to work on mathematics and reading does not improve those students' scores (Siegel, 2007; Zavacky & Michael, 2017). Therefore, if pullouts were happening at

School B and School C it could have affected the actual total number of minutes each student engaged in physical activity.

Health and wellness initiatives. Other competing initiatives that may contribute to the total amount of physical activity time students authentically engage in per week are health and wellness initiatives. Districts across Texas and the nation are asked by independent companies to participate in their health and wellness initiatives. If the district or campus decides to participate, the health and wellness companies reward individual campus with some kind of recognition if they meet certain standards for physical activity, nutrition, mental and emotional wellness, and established policy for physical activity. Some of the standards revolve around how much physical activity times students receive per week, while others deal with what is being sold on campus in vending machines, or for school fundraisers. Sometime, these companies monetize rewards to campuses, or districts, if they meet certain levels or benchmarks. Other times, they may reward students, coaches, and campuses with equipment they need to have for a more effective program. In either case, the health and wellness initiatives provided by these companies can act as a powerful motivation tool to reach and meet the standards of each health and wellness initiative. In doing so, exaggeration of physical activity time, food being sold on campus, or any other variable that the health and wellness initiative companies are asking may take place. If that were to have happened in this study, it may explain the mixed results.

Median Household Income

This study used an SES measure based on Texas Education Agency's definition of student groupings and categorized them as either receiving a reduced or free lunch, or parents paying for their lunch. In other words, students who received a reduced or free lunch were considered economically disadvantaged. Students whose families paid for lunch were not considered to be economically disadvantaged. The percent of students who were identified as economically disadvantaged at School A was 94.90%, School B was 74.60%, and School C reported 99.20%. It may be that using a median household income may provide another level of analysis that might have been more specific to barriers that could have been masked in the way TEA measured the SES.

Research in low-income families has suggested lower median household incomes may provide unseen barriers to students in academics and fitness performance (Burns, Brusseau, & Fu, 2017; Ucus, Garcia, Esteraich, & Raikes, 2019). Some of these barriers include the amount of parental involvement in low-income families in the student's education and after school activities (Ucus et al., 2019). Low-income and single parent homes present more barriers relative to academic achievement and fitness performance due to a myriad of reason related to the social environment, physical environment, as well as the individual and policy context of the school, district, and state (Kahan & McKenzie, 2017; Wrench & Garrett, 2017). Understanding these barriers through the lens of median household incomes may have helped to explain why the data did not follow national trends for increased physical activity time and academic achievement and fitness performance.

Social-Ecological Model (SEM)

The SEM was used as a theoretical frame in this study to explain how an individual engages in physical activity, which takes into consideration an individual's environmental conditions, human behavior, and well-being (Stokols, 1992). As discussed in Chapters I and II, the physical activity lens of the SEM this study used was first developed as an ecological systems theory that focused on the importance of the interaction between an individual and their environment (Bronfenbrenner, 1977).

For the purpose of this study, the policy context or environment (the last component in Figure 2, Chapter II) refers to legislation that has the potential to affect physical activity within a school. Policy (a collection of laws and rules) governs the operation of education systems. It affects how schools and districts are run administratively. Examples include school size, class size, teacher certification, curricular content, and physical activity. The SEM model acknowledges how the policy component affects student engagement in physical activity within the school environment. Children living in poverty and coming from a low SES need physical activity at a higher level than children that do not live in poverty or come from a higher SES (Jensen, 2009; Ucus et al., 2019). Conversely, this study's findings did not coincide with those from Jensen's (2009) or Ucus et al.'s (2019) studies and found no consistent pattern of improved academic performance or enhanced fitness performance in schools with more physical activity time. While School B outperformed School A in both reading and mathematics, the differences were not statistically significant. School B did, however, significantly outperformed School C in reading and mathematics. Policy and administrative practice must be taken into consideration and may have influenced the mixed findings of this study.

Texas Education Code §28.002(l) concerning the minimum number of physical activity minutes Texas students must receive allows for districts and campuses to satisfy 135 minutes of physical activity in any way they need to fit their campus needs. Campus autonomy is important for administrators to address and meet the needs of each student. The autonomy in decision making, like creating master schedules, which allows teachers to create and implement their own lesson plans and strategies in their classrooms, and how to move money to meet the needs of their departments, are evaluated in many cases to see if those decisions increased academic performance. Academic performance is evaluated in Texas by the STAAR test. The STAAR test and its ratings for each campus hold the district and the individual campus administrators accountable for their decisions. Unfortunately, schools tend to focus more on core academics and less on physical activity due to pressures of federal funding and obtaining passing ratings from the state and federal evaluation systems (Jensen, 2009).

In contrast, there is no system in place to hold campus leaders, district leaders, or policy leaders in the state of Texas accountable for the amount of physical activity students get, whether it is the minimum 135 minutes per week at the elementary level, or any other amount of time the district or campus implements. Researchers who use SEM as a framework have stated policy and its implementation, or lack of proper implementation, can greatly affect how the individual will engage within their personal and community environments (Jensen, 2009; Sallis et al., 1998). How the physical activity policy was implemented in the urban school district in South Texas may explain the randomness of the results. No information could be found as to how the state of Texas, or any of the over 1,200 other districts, make sure all students actually receive the amount of physical activity their district, or campus, has established.

At the time of this study, each of the campuses had self-reported physical activity time. However, no evaluation or accountability is present at the district or state level to ensure that TEC §28.002(l) is being followed with fidelity. The immediate question that arises from this realization is: are *all* third-grade students at School B and School C actually receiving the amount of physical activity time that was self-reported by each of the participating campuses in the urban school district in South Texas. If not, that could possibly explain the inconsistency of the findings. SEM explains that policy, and how it is implemented, affects how students and individuals will engage in physical activity (Jensen, 2009; Sallis et al., 1998). If policy set at the state and amended at the district and campus level cannot be truly held accountable, then the amount of physical activity these students actually received is truly unknown. In this frame, School C's students may have not engaged in 300 minutes of physical activity per week, consistently, which may explain why the data from School C, and somewhat from School B, are not aligned with the majority of current research.

Further, the social environment component of SEM can help explain the engagement in physical activity of students in Title 1 schools, as all three schools in this study were Title 1 in 2016-2017. It is that social environment, or school culture, the students must live in and interact with every school day. If the school culture does not support physical activity, or the importance of physical activity, the student is far less likely to be motivated to engage in it (Larsen et al., 2013). Kahan and McKenzie (2017) stated the social environment, including its physical set up, is a key predictor of physical activity in elementary schools. A lack of how this component can affect student's engagement in physical activity in Title 1 schools with high low-income families could have played a large part in the mixed findings of this study as compared to current literature.

Implications

According to the literature, the school with the most amount of physical activity per week should have had higher average academic measures and fitness measures. This was not the case. Even though the results of this study are mixed and do not conform consistently to existing literature, it is hard to argue that increased physical activity time does not influence increased academic achievement and fitness performance. In fact, the study's findings actually support this premise, albeit with a recommendation for school leaders to observe, evaluate, and hold physical activity/education programs accountable to ensure students not only receive the mandated amount of physical activity time, but also ensure protect the time consistently.

Does this mean physical activity does not matter? No. There is far too much scientific evidence that contrasts this idea. The bigger picture that may be taken from this is that physical activity/education programs may not have the oversight necessary to ensure how and when students actually receive physical activity. District and campus administrators might also glean from this study that their actions, attitudes, and decisions about physical activity can have a very direct impact on how their students engage in physical activity, as delineated through SEM.

Recommendations for Future Research

The study's delimitation, limitations, assumptions, and findings offer opportunities for further research.

Specifically, this study did not take into consideration the cardiovascular endurance measures FitnessGram® in its battery of tests to measure student fitness performance. The reason for this component not being measured was that the data set were incomplete within each school. Therefore, cardiovascular endurance should be investigated in future research.

Future research should include direct observation of the physical activity time students are engaging in at the schools. Investigating the allotted physical activity time would take away any assumption that students were not being given what was reported by the coaches in the internal survey and proper accountability that all students were present for physical activity time, whether it was recess or physical education class. This approach would allow the researcher to know if students are being pulled out of physical education classes or recess.

Furthermore, future studies should take an experimental approach to looking at the different times physical activity time and its impact on academic achievement and fitness performance. Using this approach, an intervention can be used and closely monitored by the researchers.

In addition, future research should consider median household income data. While SES was used in this study, median household income data might have provided more specific data about the diversity of population between these three schools.

School effect should be taken into consideration in future investigations.

How long students are engaged in moderate to vigorous cardiovascular activity during their total physical activity time should be taken into consideration in future investigations.

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LIST OF APPENDICES

Appendix A

IRB Approval

TEXAS A&M UNIVERSITY CORPUS CHRISTI

OFFICE OF RESEARCH COMPLIANCE
Division of Research and Innovation
6300 OCEAN DRIVE, UNIT 5844
CORPUS CHRISTI, TEXAS 78412
O 361.825.2497

Human Subjects Protection Program — Institutional Review Board

Date: February 6, 2019

TO: Lynn Hemmer, College of Education and Human Development

CC: George Woods, College of Education and Human Development College of Graduate Studies (gradcollege@tamucc.edu)

FROM: Office of Research Compliance

SUBJECT: Exempt Determination

On February 6, 2019, the Texas A&M University-Corpus Christi Institutional Review Board reviewed the following submission:

Type of Review:	Exempt
Title:	Examining the Impact of Physical Activity Time on Physical Fitness and Academic Achievement among 3rd graders
Principal Investigator:	Lynn Hemmer
IRB ID:	13-19
Funding Source:	None
Documents Reviewed:	Woods_Hemmer IRB Protocol_2.06.19.revised

Texas A&M University-Corpus Christi Institutional Review Board reviewed the project and based on the information provided has determined the research meets exempt category: 45 CFR 46.104(d)(4) (Secondary research for which consent is not required).

Therefore, this project has been determined to be exempt from IRB review. You may proceed with this project.

Reminder of Investigator Responsibilities: As principal investigator, you must ensure:

1. **Informed Consent: Ensure informed consent processes are followed** and information presented enables individuals to voluntarily decide whether to participate in research.
2. **Amendments**: This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. **Any planned changes require an amendment** to be submitted to the IRB to ensure that the research continues to meet criteria for exemption. The Amendment must be approved before being implemented.

3. **Completion Report: Upon completion of the research project (including data analysis and final written papers), a Completion Report must be submitted**.
4. **Records Retention: All research related records must be retained for three (3) years** beyond the completion date of the study in a secure location. At a minimum these documents include: the research protocol, all questionnaires, survey instruments, interview questions and/or data collection instruments associated with this research protocol, recruiting or advertising materials, any consent forms or information sheets given to participants, all correspondence to or from the IRB or Office of Research Compliance, and any other pertinent documents.
5. **Adverse Events**: Adverse events must be reported to the Research Compliance Office immediately.
6. **Post-approval monitoring**: Requested materials for post-approval monitoring must be provided by dates requested.

Please do not hesitate to contact the Office of Research Compliance with any questions at irb@tamucc.edu.

Respectfully,
Anissa Ybarra
Digitally signed by Anissa Ybarra Date: 2019.02.06
16:07:47 -06'00'
Office of Research Compliance

Appendix B

External Research Review Committee

Approval Letter

Urban School District in South Texas

June 19, 2019

Mr. George Woods Ill
Doctoral Candidate
College of Education
Texas A&M University, Corpus Christi
6300 Ocean Drive
Corpus Christi, TX 78412

Dear Mr. Woods:

The members of the ‘urban school district in South Texas’ External Research Review Committee granted you **Approval** to conduct your doctoral dissertation research entitled *Examining the Impact of Physical Activity Time on Physical Fitness and Academic Achievement Among 3rd Graders* in an ‘urban school district in South Texas’.

Additionally, the **Approval** indicates that your request meets all research/evaluation and FERPA standards. In that connection, we also appreciate having received your IRB proposal from Texas A&M, Corpus Christi.

This **Approval** also allows the three principals in the ‘urban school district in South Texas’ identified in your *Application for External Research* the option of participating in your research. No campus principal or teacher is required to participate in external research in our ‘urban school district in South Texas’. Final permission is at their discretion.

Mr. Woods, please contact each of the 3 elementary school principals in order to receive written permission to conduct your research on the ‘urban school district in South Texas’ *Principal Consent Form*. I have attached their directory and the consent form to the email to you and Dr. Hemmer.

Once the campus principal agrees and you have sent that completed consent form to us, you may then contact the teachers on that campus using the ‘urban school district in South Texas’ *Teacher Consent Form* that must be submitted to this office prior to your investigation. As you know it is at the discretion of each teacher to participate. That consent form is also attached to the email.

Further, please complete, sign, date, and with each principal’s signature return the ‘urban school district in South Texas’ Researcher/Investigator Confidentiality Agreement. When we return from the summer break, we will establish a shared, hosting arrangement for you through Google Cloud so that you may submit all the required forms and any other pertinent documents to her via the Internet making it possible for you to have unlimited data space during your research.

It is a pleasure to welcome you to the District as a researcher as you begin your investigation, Mr. Woods. At the conclusion of your work, please provide us with a copy of the final study. We want to share your findings with educators across our 'urban school district in South Texas'.

Sincerely,
S. B., MS Senior Director

Authors note:

All identifying information was removed from this approval letter. The district's name used for this study (which was present in the original approval letter) was replaced with 'urban school district in South Texas.' Additionally, all names of personal from this district were abbreviated to protect identity.