Physical Education Enrollment Impact on Mathematics and Reading Achievement in MTSS Tiers of Students in 7th and 8th Grade

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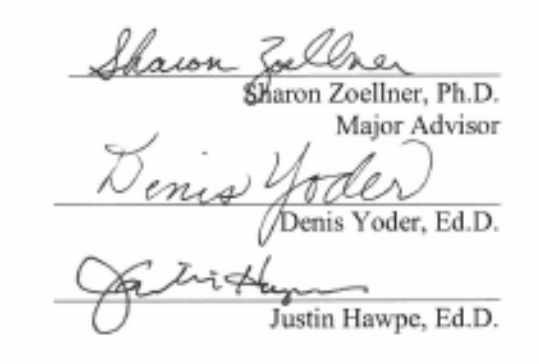

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Abstract

The quantitative causal-comparative study investigated whether enrollment in a school-based physical activity class was related to student achievement in mathematics and reading for grades seven and eight. The current study also compared students within similar academic performance categories according to the three tiers in the Multi-Tier System of Supports for student instruction to examine whether differential impacts of physical education courses existed among students of differing achievement levels. Achievement was measured by the gains scores in the fall to winter benchmark assessments on the AIMSweb assessment. The mean of the mathematics and reading AIMSweb fall to winter gains scores for middle school students in instructional Tier 1, Tier 2, and Tier 3 enrolled in physical education were compared to the mean of the mathematics and reading AIMSweb fall to winter gains scores for middle school students in Tier 1, Tier 2, and Tier 3 who were not enrolled in physical education in grades seven and eight.

The results of the study found no statistical significance as it relates to student's enrollment in physical education and the mean fall to winter gains scores on the mathematics and reading AIMSweb assessment. There also was no significant interaction or differential impact of physical education when comparing students across the three tiers of the Multi-Tier System of Supports instructional framework. Although statistical significance was not detected, there were some trends that may guide future research in examining how physical education can impact students with similar academic performance.

Dedication

This dissertation is dedicated to those who have sacrificed the most in my quest to complete this last chapter in my educational advancement. To my wife Amy, thank you for continuing to support and push me to finish this process. It has been a crazy four and a half years through three different job promotions, a move, and your own personal job promotion. You will always be my greatest advocate. To my kids Taryn and Brett, thank you for understanding why dad needed to be away at class, working on homework, or away working on a dissertation. I hope that the two of you can accomplish something similar in your future. Always know that you can be and do whatever you want in your life. All it takes is hard work, dedication, commitment, and a vision of what you want to accomplish.

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Anthony Fulton and Loren Hatfield, the three of us have a bond that I feel is unique. We have spent so much time together; we might as well be considered family. I value your friendship, professionalism and your willingness to collaborate and grow as educators. I hope that one day the three of us can work together and impact future educators, policy, pedagogy, and practice.

Table of Contents

List of Tables

Chapter 1

Introduction

Schools across the United States provide nearly 56 million students the opportunity to be involved in daily structured physical fitness activities (Sallis et al., 2012). Students who participate in physical education benefit from a variety of physical and mental health benefits (Gu, Chang, & Solomon, 2016). Hervert (1952) was one of the first researchers to conduct a study showing a positive connection between student achievement and physical fitness. Over the last half century, a variety of studies have been conducted resulting in mixed results on how physical education impacts student achievement (Centers for Disease Control and Prevention [CDC], 2010; Wittberg, Northrup, & Cottrell, 2012; Castelli, Hillman, Buck, & Erwin, 2007; Blom, Alvarez, Zhang, & Kolbo, 2011; Chomitz et al., 2009). In these studies, students were evaluated as a whole population group and students' achievement levels were not considered prior to measurement. When considering how physical education impacts student achievement, future research may need to be conducted examining students with similar academic performance levels. One way to accomplish this would be comparing the academic achievement of students who participated in physical education with those who did not participate. Furthermore, data could be enhanced by examining different levels of academic achievement of students when compared to their participation in physical education. Researchers could then examine academic achievement at three different tiered levels; on grade level, below grade level, and significantly below grade level. The AIMSweb (Pearson, 2009) assessment uses a similar approach when identifying students' academic ability by using "tiers" to evaluate students' academic performance in

mathematics and reading. Tier 1 includes students who have been identified as at or above grade level, students identified at the Tier 2 level are considered below grade level, and Tier 3 consists of students who are significantly below their cohort's level of academic achievement.

Background

The value of physical activity for students has both physical and cognitive impacts on students. Warburton, Nicol, and Bredin (2006) evaluated the current literature regarding physical activity and found that a variety of physical fitness activities can reduce cardiovascular disease, diabetes, certain cancers, and even osteoporosis. When examining the impact of physical fitness on adolescents, Ortega, Ruiz, Castillo and Sjostrom (2008) found that students' cognitive function may be directly impacted. Ortega et al. (2008) discovered that increasing physical fitness or physical activity in adolescents had a direct effect on serotonin and endorphins in the brain, which can directly impact the moods of students. With the understanding that physical education and physical activity can have a positive impact on students cognitively, it would be valuable to determine how school-based physical activity impacts student achievement for students at various academic performance levels. The CDC (2010) conducted a meta-analysis examining numerous studies that referenced academic achievement and school-based physical activity. The results of the meta-analysis indicated a positive correlation between academic achievement and school-based physical activity in over 50% of the studies, while just 49% of the studies found no correlation. Only 1% of the studies found a negative correlation between academic achievement and school-based physical activity (CDC, 2010).

When examining a variety of studies (Coe, Pivarnik, Womack, Reeves, & Malina, 2006; Castelli et al., 2007; Blom et al., 2011; Eveland-Sayers, Farley, Fuller, Morgan, & Caputo, 2009) concerning the benefits of student achievement related to school-based physical activity, data was collected by researchers on students as a whole and then disaggregated by gender, race, and socioeconomic status. Little research has been conducted to examine the benefits of school-based physical activity on academic achievement when comparing students who have similar cognitive, or more specifically, similar academic performance levels. Academic achievement for the current study was determined by the three tiers from cut scores associated with the AIMSweb mathematics and reading assessments and the Multi-Tier System of Supports (MTSS) instructional framework. The organization of students into instructional tiers according to the AIMSweb assessments are as follows: Tier 1, students who are on target for grade level expectations; Tier 2, students who are just below their targeted grade level and receive supplemental instruction; and finally Tier 3, students who are so far below targeted grade level that they need intense intervention support (Kansas Technical Assistance System Network [TASN], 2019). Studying the impact that enrollment in school-based physical activity could have on academic achievement should be analyzed in more detail if data is compared between students with similar academic achievement levels for mathematics and reading content areas.

A suburban school district in south central Kansas was chosen for the current study. The school district served more than 2,950 students in 2018 from three smaller communities, and parts of one large urban city. The school district has three elementary buildings serving kindergarten through third grade; one intermediate school that hosts

grades four and five; a middle school in which its teachers provide instruction for grades six through eight; and one high school. Specifically, student data was provided from the school district for the suburban middle school for the purpose of the current study. Students are assessed using the AIMSweb assessment to determine students' academic placement within the MTSS instructional framework. Students are assessed three times a year (fall, winter, and spring) and are identified for intervention support or enrichment based upon their score in relation to the national norm.

For the examination of school-based physical activity, it is important to acknowledge that the school does not require every student to enroll in physical education. Physical education is an elective that is offered to students by semester. Enrollment in a physical education course is the choice of the student, as a result there is a desire to participate in physical education activities (Suburban Middle School, 2019).

Statement of the Problem

The problem regarding research on the impact of academic achievement and its relation to school-based physical activity is that the results are inconclusive. Previous researchers have hypothesized that enrollment in a school-based physical activity could actually help students achieve academically. Yet, there have been mixed results from research examining the impact physical education has on academic achievement (CDC, 2010). The inconclusiveness of previous studies may have to do with the fact that researchers compared all students' assessment scores together by their participation in school-based physical activity. In examining research and literature reviews, research has not been conducted comparing students of similar academic achievement levels to one another when examining the relationship that enrollment in school-based physical

activity classes has on academic achievement. School district leaders need to know whether an elective course like physical education benefits their high, medium, and low academic achieving students. The problem addressed in the current study investigated whether academic achievement was impacted by school-based physical activity when comparing similar academically performing students.

Purpose of the Study

The purpose of the current quantitative causal-comparative study was to investigate how enrollment in a school-based physical activity class was related to student achievement in mathematics and reading for grades seven and eight. The current study also compared students within similar academic performance categories according to the three tiers in MTSS for student instruction to examine whether differential impacts of physical education courses existed among students of differing achievement levels. Achievement was measured by the means gains scores in the fall to winter benchmark assessments on the AIMSweb assessment. The means of the mathematics and reading AIMSweb fall to winter gains scores for middle school students by enrollment status in instructional Tier 1, Tier 2, and Tier 3 enrolled in physical education were compared to the mean of the mathematics and reading AIMSweb fall to winter gains scores for middle school students in Tier 1, Tier 2, and Tier 3 who were not enrolled in physical education in grades seven and eight.

Significance of the Study

The results of the current study will contribute to a larger body of research on the topic of physical education and its possible impact on academic achievement. The current study was unique because it compared AIMSweb mathematics and reading

assessment scores of students determined by the MTSS instructional framework identified tiers for instruction, whereas previous researchers have not focused on disaggregating by academic achievement. Results from the current study could assist school leaders in making decisions about scheduling that have a greater impact on academic achievement. Specific groups of students may or may not perform better academically when enrolled or not enrolled in physical education. Instructional practices from teachers in schools that participate in MTSS instructional framework may also be impacted dependent upon the results.

Delimitations

Lunenburg and Irby (2008) stated that delimitations are "self-imposed boundaries set by the researcher on the purpose and scope of the study" (p. 134). The following delimitations were imposed for the current study:

1. This study focused on seventh and eighth grade students from a large suburban school district.
2. The assessment instrument chosen for this study was the AIMSweb assessments. The suburban school district administered the AIMSweb assessments to measure both mathematics and reading achievement at the middle school level.
3. Mathematics and reading scores from the AIMSweb assessments were analyzed as they related to enrollment in a physical education elective course that are not required for all students at the suburban middle school.

Assumptions

According to Lunenburg and Irby (2008), assumptions are "postulates, premises, and propositions that are accepted as operational for purposes of the research" (p. 135). The following assumptions were accepted for the purpose of this research:

1. Participating students completed the AIMSweb assessments for mathematics reading with their greatest effort to achieve the highest score possible.
2. The data provided by the district was accurate for the time period assessed.
3. The AIMSweb assessments were administered to students in the district with fidelity following the required testing environment and procedures.
5. All students were equally engaged in their mathematics, reading, and physical education courses.
6. Students received quality instruction across curriculum content areas in mathematics, reading, and physical education.

Research Questions

The research questions are indicators of unanswered questions in the literature and guide the direction of the study (Lunenburg & Irby, 2008). To investigate whether participation in optional school-based physical education had an impact on academic achievement for mathematics and reading when comparing similar instructional tiers or levels, the following research questions were developed:

RQ1. To what extent does participation in physical education impact seventh and eighth grade students' academic achievement as measured by fall to winter gains scores on the mathematics benchmark AIMSweb assessment, and is there a differential impact

based on physical education participation among students designated at Tier 1, Tier 2, and Tier 3 of the MTSS instructional framework for mathematics in 2018?

RQ2. To what extent does participation in physical education impact seventh and eighth grade students' academic achievement as measured by fall to winter gains scores on the reading benchmark AIMSweb assessment, and is there a differential impact based on physical education participation among students designated at Tier 1, Tier 2, and Tier 3 of the MTSS instructional framework for reading in 2018?

Definition of Terms

"Key terms need to be clarified if they are paramount to the study and referenced or used continuously throughout the dissertation" (Lunenburg & Irby, 2008, p. 118). It is important to understand how the terms are being used in the study. The following terms are defined for the purpose of the study.

Multi-Tier System of Supports (MTSS). "A coherent continuum of evidence-based system-wide practices to support a rapid response to academic and behavioral needs with frequent data-based monitoring for instructional decision-making to empower each Kansas student to achieve high standards (Kansas State Department of Education, 2007, p. 1)."

Tier 1: Students who have been identified as at or above grade level (Kansas Technical Assistance System Network, 2019).

Tier 2: Student academic levels are considered below grade level and receive supplemental instruction (Kansas Technical Assistance System Network, 2019).

Tier 3: Student academic achievement levels are significantly below their cohort's targeted grade level and they need intense intervention support (Kansas Technical Assistance System Network, 2019).

Organization of the Study

This study is comprised of five chapters. Chapter 1 contained an introduction to the study, the background, a statement of the problem, the purpose of the study, the significance of the study, delimitations, assumptions, research questions, and definitions of terms. Chapter 2 includes the review of the research and literature regarding physical education and academic achievement. A description of the methodology used, research design, selection of participants, measurement, data collection procedures, data analysis and hypothesis testing, as well as limitations can be found in Chapter 3. Chapter 4 provides the presentation of the findings in the current study including the descriptive statistics, results of the hypothesis testing, and additional analysis results. Chapter 5 contains a review of the study including the major findings, a discussion of how these findings relate to the literature, and a conclusion that includes implications for action and recommendations for future research.

Chapter 2

Review of the Literature

The current study was conducted to examine the relationship between participation in physical education and student achievement when comparing similar academically proficient students. To better understand how participation in physical education affects student achievement, a historical review was conducted about how physical education in the United States started and how students are affected by physical education today. To further comprehend the impact of physical education and academic achievement, a review was conducted to understand how physical fitness impacts the physical, cognitive, social, and emotional health of adolescents. The literature review contains information about how researchers have measured the correlation between physical education and academic achievement in previous studies and establish what previous studies have revealed. Information from this literature review will provide a perspective of why it is essential to examine students with similar academic achievement levels and compare students who participated in physical education versus those who did not participate in physical education.

A History of Physical Education

Physical education in the United States was first implemented in the 1820s when schools in Massachusetts began teaching gymnastics, hygiene, and care of the body as part of the curriculum in schools (Lumpkin, 1994). The first school that made physical education an essential addition to their curriculum was the Round Hill School in North Hampton, Massachusetts. Boston Public Schools became the first school system to adopt district-wide mandatory physical exercise for students in 1853 (Lumpkin, 1986). In

1866, California became the first state to pass a law requiring students to have physical education in schools (Lumpkin, 1994). The California law required students to have exercise periods twice per day.

In November of 1885, William Anderson, a concerned instructor, recognized that there was little formalized training for the profession of a physical educator (Siedentop, 2009). To be an instructor, one needed a brief understanding of medicine and some experience in gymnastics. Inspired by his desire to create a forum to further the knowledge and practice of the teaching of physical education, Anderson organized a meeting where individuals in the gymnastics field met to discuss the methods of teaching and measurement (Lee & Bennett, 1985). The group was comprised of clergy, newspaper men, principals, college presidents, and physical educators who were interested in physical training. The group realized the importance of creating an organization dedicated to physical education in schools. The Association for the Advancement of Physical Education was created and has evolved into the American Alliance for Health and Physical Education Recreation and Dance (AAHPERD). AAHPERD has become the leading physical education advocacy association in the United States (Play and Playground Encyclopedia, 2018). As the country moved into the 20th century, organized physical education programs in schools, colleges, and universities began to take shape (Lumpkin, 1986).

After World War I and World War II, the economy was changing and so was the physical fitness of the American youth. The perception was that youth in the United States were becoming overweight and lazy. President Dwight D. Eisenhower, a former West Point graduate, valued the importance of physical fitness. As a result, Eisenhower

created the Council on Youth Fitness in 1956. The council lacked organization and direction from the federal government, and it was not until 1961 under the direction of President John F. Kennedy that the council received the direction and support needed to impact the youth of America (John F. Kennedy Presidential Library and Museum Website, 2019). A month into his presidency, Kennedy renamed the organization the President's Council on Physical Fitness and Sport. Under President Kennedy's guidance, the government led in the adoption of a physical education curriculum and by the 1961-1962 school year, a quarter of a million students across the country were piloting the federal government's new physical education curriculum. The nation recognized the value and importance of having an active physical education curriculum that encouraged physical activity for long-term health and wellness (John F. Kennedy Presidential Library and Museum, 2019).

As the decades passed, physical fitness developed into a more systematic approach in schools, yet childhood obesity was still a concern. In 1984, the U.S. Office of Disease Prevention and Health Promotion of the Public Health Service published the National Children and Youth Fitness Study (Ross & Gilbert, 1985). According to the report, one-third of children in the United States were not physically fit. By the end of the decade, the American Academy of Pediatrics (1987) found that up to 50% of children in the United States lacked the necessary exercise to develop heart and lung capacity that was considered healthy. The American Academy of Pediatrics (1987) placed blame on the reduction of schools' physical education budgets, school administrators deemphasizing physical education, and a lack of commitment to get adolescents involved in lifelong aerobic fitness activities such as running and swimming.

Physical activity in schools has evolved to encompass a variety of activities throughout the school day. Students have the opportunity to participate in recess, physical education class, extracurricular activities, and supplemental exercise activities in non-physical education classes. Although there are a variety options for students to benefit in physical activity, the CDC (2017) stated that the majority of adolescents were not meeting the minimum recommended requirements for daily physical activity. The CDC recommended that school-aged adolescents should receive 60 minutes of moderate to vigorous activity every day (U.S. Department of Health and Human Services, 2008). The emphasis on physical education today is not the same as it was in the mid to late 20th century.

The CDC (2014) conducted a study on the physical activity behaviors of adults and youth on a national and a state level. Just over 15% of youth nationwide reported having no physical activity, while less than 30% of students had daily physical education in schools. These numbers reflect that only 28% of states have adopted policy guides on the amount of time students have to spend with moderate to vigorous, intense physical activity in physical education classes. In the state of Kansas, 14.5% of youth reported no physical activity and just under 28% of reported youth have daily physical education (CDC, 2014).

When considering recess as a form of school based physical activity in schools, only thirty percent of states have a mandated policy on student participation in recess (CDC, 2014). In the publication, Shape of the Nation, the Society of Health and Physical Educators (2016) reported that eight of 50 states require elementary schools to provide daily recess. The Center on Education Policy (2008) stated that because of No Child Left

Behind, 20% of school districts across the nation reduced time for recess by an average of fifty minutes per week. According to guidelines by the U.S. Department of Health and Human Services (2008), adolescent children should participate in 60 minutes of physical activity per day.

In 2017, the CDC reported, 46% of high school students surveyed participated in 60 minutes or more of physical activity per day on 5 or more days per week. The CDC found that just over 15% of respondents said they were not physically active for 60 minutes on at least one day during the week (CDC, 2017). These numbers are reflective of the time spent in extracurricular activities, often times after school, at the high school level. As a result, high school students are receiving more opportunities for school-sponsored physical activity than younger-aged adolescents.

Physical Fitness and Adolescent Health

As children enter their pre-kindergarten through 12th grade schooling, students are continually changing both physiologically and cognitively. Just as exposure to mathematics and reading impacts academic achievement, exposure to physical activity can positively impact physical health (Aberg et al., 2009). Fogelholm's (2010) systematic review of 36 studies from 1990 to 2010 highlighted that higher levels of physical activity equated to lower levels of mortality risk. Unfortunately, the national data for school-age adolescent trend toward negative physiological development. Ogden, Lamb, Carroll, and Flegal (2010) reviewed national data from the United States from 2005-2008 on childhood obesity as it related to socioeconomic status and race. Ogden et al. (2010) found that low-income children are more likely to be obese than children who come from higher-income families. Ogden et al. (2010) also found that parent education

level had an impact on their child's preponderance toward obesity. The higher the education of the parents, the lesser a child's chances are of being obese (Ogden et al., 2010).

Body mass and obesity do not just correlate with socioeconomic status, as studies have found there is also a connection to physical health and physical activity in adolescents (Duncan, Schofield, Duncan, & Rush, 2008; Riddoch et al., 2009). The amount of physical activity in which adolescents perform has an impact on their physiological health. Researchers reviewed how different levels of physical activity impact body mass and determined that all types of physical activity will have a positive effect on children's physiological health (Steele, van Sluijs, Cassidy, Griffin, & Ekelund, 2009; Mark & Janssen, 2011). Further research shows that both vigorous physical activity and moderately vigorous physical activity have favorable associations to body mass index (Mark & Janssen, 2011). Mark and Janssen (2011) studied the physical activity levels of 8 to 17-year-old males and females. The vigor level of the physical activity measured by Mark and Janssen (2011) was determined by the duration and intensity of the movement. The higher level of intensity of movement, the greater the impact on the body mass index for adolescents. Total fat and trunk measurements of the highest intensity level participants were 34 points lower than the measurement of the lowest physical activity participants.

Davis et al. (2007) researched the impact exercise had on obese students' cognitive function. Ninety-four obese students from the ages of 7 to 11 were chosen and divided into three exercise groups; low-dose exercise group which consisted of 20 minutes of aerobic exercise per session, a high-dose exercise group, which consisted of

40 minutes of aerobic exercise, and a no-exercise control group. There were 56 females and 38 males who participated in the study. The average age of the participants was 9.2 years. The average body mass index of the children who participated was 25.8. The exercise was equivalent in intensity and the only thing that differed was the duration in time of the daily exercise. The goal of the daily exercise was for the children to reach a heart rate greater than 150 beats per minute. Cognitive processes of planning, attention, and simultaneous and successive cognitive processing improved for those who exercised more (Davis et al., 2007).

Obesity levels have additional impact on the body including the heart health of children. Cardiovascular disease does not typically present itself until later in life, but there is evidence that cardiovascular disease will find its onset during the years that students are in school (Berenson et al., 1998). Berenson et al. (1998) studied the corpses of individuals from the age of 2 to 39 who died from cardiovascular disease. More specifically, Berenson et al. (1998) examined the risk factors associated with cardiovascular disease in young people. Berenson et al. (1998) concluded there was a need to determine how to reduce the opportunities for cardiovascular disease in adolescents, especially as risk factors increased.

Kriemler et al. (2010) performed a study examining how increased physical activity impacted cardiovascular disease risk factors. Five hundred and two students from 15 elementary schools participated in the study. One group of students received increased physical education lessons each week, daily short activity breaks, and physical activity homework. Their results were compared to that of a controll group who received

no additional physical education opportunities. Kriemler et al. (2010) found that the cardiovascular risks decreased more in the intervention group than the control group.

Warburton et al. (2006) determined that physical activity could assist in the overall health of not just cardiovascular disease, but also diabetes, cancer, and osteoporosis. Warburton et al. (2006) conducted a narrative review of the literature in examining data regarding the role of physical activity as it relates to chronic diseases. In conclusion, Warburton et al. (2006) recommended that individuals increase opportunities for physical activity, including frequency and levels of physical activity, to lower the risk of chronic diseases. Developing this foundation of assisting students in preventing long-term diseases will help students live long and healthy lifestyles beyond their formal educational years.

Physical Activity and Social, Emotional, and Mental Health

The social and emotional health of students has been a focus of the KSDE with the implementation of the department's Kansans Can Vision for Education (KSDE, 2018). Social and emotional growth helps students with problem solving, decision making, self-awareness, social awareness, intrapersonal, and interpersonal abilities (KSDE, 2018). Physical activity can have positive effects on these social and emotional characteristics. Physical education and the activities involved have been shown to help with depression, anxiety, moodiness, and self-esteem (Ortega et al., 2008).

Broman-Fulks, Berman, Rabian, and Webster (2004) conducted a study where 54 participants with high anxiety participated in six 20-minute treadmill exercise sessions. The participants included 41 females and 13 males. The requirements to participate in the study included scoring a 25 or higher on the Anxiety Sensitivity Index, be at least 18

years of age, and be in good health. Participants also could not be receiving psychotherapy, psychotropic medication, and could not be enrolled in an aerobic exercise program (Broman-Fulks et al., 2004). Twenty-nine participants conducted high intensity aerobic exercises on the treadmill while 25 participated in low aerobic treadmill exercise activity. The participants conducted a self-assessment of anxiety levels prior to exercise and after exercise. Results indicated that both the high intensity and low intensity exercises reduced anxiety in participants (Broman-Fulks et al., 2004).

The positive correlation between physical activity on mental health is also found in academic achievement. Xiang et al. (2017) found a connection between mental health and academic achievement in middle school students. One hundred and forty-four students were recruited from two middle schools for the purpose of the study. The researchers determined that physical fitness in school exhibited a significant association with depression and academic achievement. Xiang et al. suggested that students who were physically fit also showed positive mental functioning and academic achievement (2017). This information depicts the importance of physical fitness both physically and mentally, but it is also important to understand why physical fitness helps students cognitively.

The physiological benefits of exercise and physical fitness is apparent, but how does it affect the cognitive functioning of students? According to Jensen (2000), research regarding the functioning of the brain has shown that physical fitness enhances the learning process for students. When students move and participate in specific physical activities, they release chemicals such as noradrenaline and dopamine to the brain. Jensen (2000) stated that these energize students making them feel confident about their

learning. It also improves their ability to store additional information allowing a greater ability to remember new concepts or ideas being taught. When students feel energized and confident in their learning, they are more likely to achieve academically.

Biddle and Assare (2011) completed a meta-analysis examining reviews of physical activity and mental health in adolescents of school-aged children. The analysis included five articles that reviewed evidence pertaining to physical activity and depression, four articles that focused on anxiety, three articles about self-esteem and seven articles that focused on cognitive functioning. Biddle and Assare (2011) found that physical activity is likely to have positive psychosocial outcomes. The most significant outcome was found in students' increase in self-esteem over the short term. There was also evidence that students who were physically active were less likely to suffer from mental health problems and may have enhanced cognitive functioning.

Mixed Findings of Physical Activity and Academic Achievement

With research supporting the premise that physical fitness and physical education has a positive impact physically and cognitively on adolescents, researchers investigated the impact physical education had on student achievement. When examining the link between physical education and achievement, the research is mixed. Eveland-Sayers et al. (2009) studied 134 students' mathematics and reading scores in the third, fourth and fifth grades using the *TerraNova* standardized academic achievement test. Students' performance in 1-mile timed runs, body mass index, sit and reach, and curl-ups were used as variables to compare to academic achievement. The findings were mixed as students who ran a fast 1-mile time had better mathematics scores, while the relationship between reading/language arts and mile times were not significant. There was not a significant

relationship between body mass index and academic achievement in mathematics or reading/language arts. There was a significant relationship when examining muscular fitness (combination of sit-and-reach and curl-ups) and mathematics scores but not for reading/language arts.

A longitudinal study that examined the significance of physical education and academic achievement of students from their kindergarten years through fifth grade resulted in mixed findings (Carlson et al., 2008). Carlson et al. (2008) examined the association of the time spent in physical education class and students' standardized test scores in mathematics and readings. Carlson et al. (2008) found a small but significant benefit for female students regarding mathematics and reading scores as the amount of time in a physical education class increased. There were no significant findings for male achievement scores as it related to the amount of time in physical education.

Howie (2013) collected data about 96 fourth and fifth grade students in an elementary school in South Carolina. The students were randomly selected to see how five activity breaks of 10 or 20 minutes each day affected students academically compared to those students who received 10 minutes of a classroom lesson. Students who received the activity breaks participated in moderate-to-vigorous activity. Students completed short mathematics assessments before and after each activity. The students who received 10 minutes of exercise breaks obtained higher mathematics scores than students who received a sedentary lesson. Howie (2013) found differences when comparing gender, intelligent quotients, fitness, body mass index, behavior, and school engagement, but there was not a significant main effect.

Many schools have reduced physical education time to increase core content instruction which includes mathematics, reading, science, and social studies. Researchers (Coe et al., 2006) began to ask whether students who were not in physical education classes benefitted from additional core instruction when examining standardized test scores and grades in core classes. Coe et al. (2006) completed a study, which examined grades and standardized test scores from four core classes of 214 sixth grade students. Coe et al. (2006) compared students who were enrolled in physical education classes with students who were not enrolled in physical education classes and found mixed results regarding physical education's impact on grades and standardized test scores. With regard to grades, Coe et al. (2006) found significance between students' grades in core content classes when performing a vigorous activity in physical education. Grades in core content classes were not affected by students who were moderately active when comparing them to students enrolled or not enrolled in physical education. Data regarding standardized test scores showed no significance when related to physical education enrollment or physical activity.

As some studies have mixed results, others have a positive connection between academic achievement and school-based physical activity. The FITNESSGRAM™ is a fitness report card that was adopted in 1982 by The Copper Institute (2014) and is widely used in physical education classes to measure a student's aerobic capacity, body mass index, abdominal strength and endurance, trunk strength and flexibility, upper body strength and endurance, and flexibility. Van Dusen, Kelder, Kohl, Ranjit, and Perry (2011) conducted a study where 254,743 elementary, middle, and high school students' data were used to examine standardized mathematics and reading achievement scores in

association with the components of the FITNESSGRAM™. Van Dusen et al. (2011) found that there was a positive linear association between the fitness tests in the FITNESSGRAM™ and standardized mathematics and reading scores. The highest interquartile difference was cardiovascular fitness.

In a similar study, Blom et al. (2011) evaluated students in 3rd through 8th grades in Mississippi on their ability to achieve fitness zones on the FITNESSGRAM™ and compared the results to their standardized test scores from the Mississippi Curriculum Test. The Mississippi Curriculum Test measured achievement in mathematics and language arts. An additional variable included absenteeism and the correlation between healthy fitness zones and absenteeism. Blom et al. (2011) found that students who achieved higher levels of fitness zones had a greater probability to achieve a higher score on the Mississippi Curriculum Test. Students with the highest healthy fitness zones were three to four times more likely to achieve higher scores on the Mississippi Curriculum Test compared to students' who had zero healthy fitness zones. Blom et al. (2011) also found that students who had zero healthy fitness zones were over four times more likely to have eight or more absences during the academic year.

Students across the country are required to complete a variety of standardized assessments to measure academic achievement. Castelli et al. (2007) used Illinois state assessment scores in mathematics and reading as a means to evaluate academic achievement and compared it to a variety of physical fitness activities in physical education classes. Castelli et al. (2007) examined 259 third through fifth grade students' state assessment scores and compared them to a variety of physical fitness variables that students participated in during a physical education class. Physical activities included

push-ups, sit and reach, curl-ups, pacer test, and body mass index. Castelli et al. (2007) found that aerobic capacity showed a positive association with mathematics and reading achievement scores in state assessments.

In California, students are administered the state mandated FITNESSGRAM™ assessment in grades five, seven, and nine. In 2001, students' physical fitness data from the FITNESSGRAM™ including aerobic capacity, body mass index, abdominal strength and endurance, trunk strength and flexibility, upper body strength and endurance, and flexibility was compared to scores on the spring Stanford Achievement Test. The California State Department of Education (2005) found that there was an association between higher levels of fitness and higher achievement scores. Furthermore, students who met more than three of the minimum fitness requirements of the FITNESSGRAM™ during a physical education class showed the most significant gains in mathematics and reading. Female students had higher mathematics and reading scores than their male counterparts, especially when meeting more fitness requirements. In addition, students showed higher achievement in the mathematics assessment than reading, especially when more fitness requirements were met (California Department of Education, 2005).

Chomitz et al. (2009) examined mathematics and reading scores from the Massachusetts Comprehensive Assessment System of students in fourth, sixth, and eighth grades. Chomitz et al. (2009) compared mathematics and reading assessment data with the number of physical fitness tests passed during enrollment in a physical education class. Chomitz et al. (2009) determined that students were more likely to pass the standardized mathematics and reading assessment as they passed more physical fitness classes in physical education with $p < .0001$ and $p < .05$.

Not all researchers have found significant improvements in academic achievements. Earney, Berg, and Wallert (2015) examined how activity breaks impacted student achievement in mathematics and reading in a first-grade classroom. Data were collected from 38 students using teacher feedback, student self-assessment, a teacher log, and weekly mathematics and reading probes. Each break consisted of four minutes in length and included a variety of exercises. The results were not significant, as reading scores only improved slightly and mathematics scores remained the same. Although teachers and students enjoyed the breaks in the classroom, a statistically significant increase in academic achievement was not present.

In a similar study with middle school-aged students, Wells (2012) conducted movement breaks with eighth-grade students daily to determine the impact on student achievement with regard to grades. Sixty students were divided into three classes and taught by the same teacher and student teacher. Data were collected over a 5-week period. The teachers collected pre- and post-intervention data. The movement breaks included sit and stand activities next to students' desks, or actions that were a part of the learning activity. The findings were determined to not be statistically significant and students' grades declined by two percentage points post intervention.

Ahamed et al. (2007) utilized the Canadian Achievement Test to determine the impact physical activity had on academic achievement in the areas of reading, language, writing, spelling and mathematics. Students involved in the study included 143 boys and 144 girls. Students were divided into an intervention group and a usual practice group. The intervention group received an additional 47 minutes of physical activity per week. There was no statistical significance found between the intervention group and the usual

practice group, nor was there a statistically significant difference between assessment results among boys and girls.

Carlson et al. (2008) completed a longitudinal study of the impact physical education had on student achievement in mathematics and reading. Carlson et al. (2008) followed a cohort group of 5,316 kindergarten students as they completed their elementary schooling. The amount of time spent weekly in physical education was compared to the students' mathematics and reading scores. Physical education did not affect academic achievement negatively in mathematics or reading among the kindergarten students. Increased amounts of physical education were positively associated with an academic benefit for females. Increased amounts of time in physical education was not positively or negatively associated with academic achievement among males.

Bass, Brown, Laurson, and Coleman (2013) compared the results of the Illinois Standards Achievement Test to a variety of physical fitness tests of approximately 1200 students in sixth and eighth grades. BMI, body fat percentage, pacer laps, curl-ups, push-ups, and the sit and reach test results were compared to the state's standardized test scores of those same students in mathematics and reading. The relationship between fitness tests in a physical education class and academic achievement for both male and female students was not statistically significant.

Multi-Tier System of Supports and Its Impact on Physical Education

There are a variety of assessment methods that measure student achievement in core content classes. Some systems are formative while others are a comprehensive summative assessment. The state of Kansas uses both assessment measures. The focus

of the current study will be on the AIMSweb assessment as it relates to the MTSS instructional framework. KSDE adopted the MTSS instructional framework model in 2007 and laid the foundation for defining a set of practices and principles that would address concerns of academic and behavioral problems in schools (TASN, 2015). The purpose of the Kansas MTSS instructional framework system was to create a system where early identification and intervention could occur to provide support for all students (TASN, 2015). The Kansas MTSS instructional framework recommends school districts divide students into tiers where students who are on grade level are considered Tier 1. Students who are below grade level but can be caught up with interventions are considered Tier 2. Students who need additional intervention support due to being significantly below their peers are considered Tier 3. A norm reference target score that changes for each benchmark assessment each year determines a student's tier level (TASN, 2019).

With the enactment of the No Child Left Behind Act (US Department of Education, 2019) and the 2007 adoption of Kansas' MTSS instructional framework, schools and school districts have increased their attention to assess and evaluate student performance level scores in core classes. Educators are disaggregating data, under the guidance of the MTSS instructional framework, to determine the interventions that are needed for students to find greater success in schools. One of the more popular forms of formative assessments for mathematics and reading in the state of Kansas is the AIMSweb assessment (KSDE, 2015). The AIMSweb assessment divides students into the three MTSS tiers based upon the data collected in the assessment. Students can be monitored through the three benchmark assessments in the fall, winter, and spring or they

can be progress monitored weekly. The benchmark assessments and progress monitoring evaluations assess skills directly, monitor progress, determine school and individual student needs, and pinpoints future instructional needs (Pearson, 2009).

School districts have used assessment data to determine school-wide instructional practices that best meets the academic needs of every students. The instructional practices that had the most significant change or emphasis were those of core courses such as mathematics and reading. The primary focus of educators became improving students' academic achievement in mathematics and reading, while physical education and elementary recess became less relevant (Cawelti, 2006). Due to initiatives like the MTSS instruction framework, district and building leaders were faced with finding time to provide interventions at the expense of some non-core course classes, including physical education (Saunders, 2015). The Center on Education Policy (2006) referenced a narrowing of curriculum options when they found 71% of school districts stated they had reduced instructional time in at least one subject to increase time in mathematics and reading. The Center on Education Policy (2006) also reported that some school districts chose to take students who were struggling academically and increase the amount of time in mathematics and reading instruction. As a result, students were pulled from exploratory or elective subjects like physical education. Cawelti (2006) stated that schools need to restore the balance in their instructional practices. The intense focus on mathematics and reading instruction is causing burnout for teachers and is developing students who have limited knowledge, understanding or even a care for important events, science, arts, or physical health (Cawelti, 2006).

Teachers are not the only ones feeling the demands of mathematics and reading instruction. National Public Radio, the Robert Wood Johnson Foundation, and the Harvard School of Public Health (2013) conducted a survey on parents' perceptions about whether schools are giving appropriate emphasis to a variety of curricular areas. National Public Radio, the Robert Wood Johnson Foundation, and the Harvard School of Public Health (2013) found that 25% of parents felt that physical education is receiving too little emphasis from their children's school. This was second only to art/music. The three areas of emphasis that received the least concern were test prep, English, reading, writing, and mathematics.

There is an increased emphasis on adding instructional time to mathematics and reading in a tiered instructional system like MTSS, and a reduction in the need for classes like physical education. At the same time, childhood obesity continues to rise. The CDC (2015) reported that in 2012, more than one-third of children and adolescents were overweight. The percentage of adolescents who were obese at ages 12 to 19 years increased from 5% in 1980 to nearly 21% in 2012 (CDC, 2015).

Indeed, the impact that physical activity, and more specifically physical education, has on students is positive physiologically (Steele, van Sluijs, Cassidy, Griffin, & Ekelund, 2009; Mark & Janssen, 2011) as well as mentally (Biddle & Assare, 2011; Xiang et al., 2017). Yet, the research regarding the impact that physical education has on academic achievement varies (CDC, 2010). Schools continue to reduce the amount of time in physical education (Saunders, 2015). Reducing physical education allows school districts to meet their instructional needs for programs such as the MTSS instructional framework and increase instructional time in mathematics and reading (Center on

Education Policy, 2006). Determining the impact that physical education has on academic achievement still poses a challenge for researchers and schools alike.

Summary

Chapter 2 presented a broad perspective of the literature relevant to the study. The review contained a history of physical education in schools as well as the impact physical fitness has on adolescent health. In addition, further information was provided regarding how physical education affects student's social, emotional, and mental health. Chapter 2 also revealed how research is mixed regarding how school-based physical activity impacts academic achievement. Positive, mixed, and little to no correlation were found in the research regarding the relationship of physical education and academic achievement. Finally, Chapter 2 examined the MTSS instructional framework and its impact on physical education.

Chapter 3

Methods

The purpose of the current quantitative causal-comparative study was to investigate how enrollment in a school-based physical activity class was related to student achievement in mathematics and reading for grades seven and eight. The current study also compared students within similar academic performance categories according to the three tiers of the MTSS instructional framework to examine whether differential impacts of physical education courses existed among students of differing achievement levels. Achievement was measured by the gains scores in the fall to winter benchmark assessments on the AIMSweb assessment. The means of the mathematics and reading AIMSweb fall to winter gains scores for middle school students in instructional Tier 1, Tier 2, and Tier 3 enrolled in physical education were compared to the mean of the mathematics and reading AIMSweb fall to winter gains scores for middle school students in Tier 1, Tier 2, and Tier 3 who were not enrolled in physical education in grades seven and eight. Chapter 3 provides the research design and statistical analyses used to address the research questions and hypotheses for this study. This chapter also includes an overview of how participants were selected, the measurement instruments employed, as well as the procedures by which the data was collected. Finally, the limitations of the study are outlined.

Research Design

A causal-comparative quantitative research design was utilized for this study to examine the impact of the concurrent enrollment in a physical education elective course on 7th and 8th grade student achievement in mathematics and reading. The dependent

variables examined were fall to winter composite gains scores in mathematics and reading as measured by AIMSweb benchmark assessments. The independent variables by which the dependent variable was grouped included Physical Education Enrollment Status (Enrolled, Not Enrolled) and the Instructional Tier (1 on or above grade level, 2 below grade level, or 3 significantly below cohorts grade level) of MTSS at which the students were categorized according to their scores on the fall AIMSweb assessments for mathematics and reading.

Selection of Participants

The population for this quantitative study included seventh and eighth grade students who completed the fall and winter AIMSweb benchmark assessments for mathematics and reading at a suburban school district during the 2018-2019 school year. A requirement for inclusion into the study was that students had scores on both the fall and winter AIMSweb benchmark assessments in mathematics and reading. Inclusion into both benchmark assessments was needed to ensure computation of gains scores from fall to winter in the benchmark assessments. Students without both scores in either subject were omitted from the analysis. Purposive sampling was employed for the study, examining how academic achievement, more specifically gains scores, in mathematics and reading were impacted by enrollment in physical education classes using AIMSweb composite scores.

Measurement

Physical education is an elective course in the suburban school district used in the current study. According to a conversation with the school counselor, enrollment in the semester long physical education courses occurs based upon student interest and/or the

need to fill a schedule with available courses. Infinite Campus™ was the student information software used to compile the data of those students enrolled in physical education for the fall semester of 2018 versus those who were not enrolled in the optional or elective physical education courses.

The AIMSweb benchmark assessments were employed to measure student academic performance in both mathematics and reading (AIMSweb Plus, 2019). The AIMSweb assessments are national standardized tests that assist in identifying students who are at risk of not succeeding at grade level in mathematics and reading (Pearson, 2009). The assessment results can help educators personalize instruction, evaluate progress, and determine annual academic growth for students. The content items that compose the AIMSweb test questions are aligned with Curriculum Based Measurement (Pearson, 2009). Curriculum Based Measurement is a simple, effective, and a scientifically proven way to assess student's mathematics and reading skills (Shinn, 2009). Curriculum Based Measurement and the AIMSweb assessment have been found to support Common Core State Standards in mathematics and reading (Shinn, 2009). The assessment is timed and administered during three benchmark testing windows throughout the academic year, as well as including a component for monitoring weekly progress. The National Center on Response to Intervention gave the AIMSweb assessment its highest rating for validity and reliability in the mathematics and reading progress monitoring screeners and assessments (Pearson, 2009). The ratings were established through the use of a set criteria for scientifically evaluating the rigor for progress monitoring tools (Pearson, 2009). For the purpose of this study, data was collected on students' benchmark assessments in the fall and winter of 2018.

Data Collection Procedures

A proposal for research was submitted to the Baker University Institutional Review Board Committee and approved on March 25, 2019 (Appendix A). A request for approval to conduct research was sent to the Assistant Superintendent of the suburban school district on April 4, 2019 (Appendix B). Seventh and eighth grade student enrollment in physical education for the first semester of the 2018-2019 school year was collected. Student AIMSweb data for the fall and winter administrations was compiled by the school district upon completion of the second mathematic and reading assessments during the 2018-2019 school year. The Director of Technology from the suburban school district extracted the archived data and provided it in a Microsoft Excel data file. Students were matched by physical education status and fall/winter scores for both mathematics and reading. The fall instructional tiers for both content areas categorized by the AIMSweb cut scores were delineated and fall to winter gains scores were calculated. Student names were removed from the data and supplemented with non-identifying numbers. The data was saved on a password encrypted external hard drive for three years, and then destroyed.

Data Analysis and Hypothesis Testing

Archived quantitative data from the AIMSweb assessment and students' schedules were compiled and provided by the suburban school district. The data was compiled and organized into a Microsoft Excel worksheet and imported into the latest version of IBM SPSS Statistics Faculty Pack 25 for Windows. The data collected was analyzed to answer the research questions. Two research questions which included four separate hypotheses were tested for statistically significant differences among middle

school students' AIMSweb assessment fall to winter gains scores in mathematics and reading compared to enrollment status in physical education. AIMSweb mathematics and reading mean gains scores were also compared for differential impact by examining the combination of physical education enrollment status with each instructional level for Tier 1, Tier 2, and Tier 3 students.

RQ1. To what extent does participation in physical education impact seventh and eighth grade students' academic achievement as measured by fall to winter gains scores on the mathematics benchmark AIMSweb assessment, and is there a differential impact based on physical education participation among students designated at Tier 1, Tier 2, and Tier 3 of the MTSS instructional supports for mathematics in 2018?

***H1*.** There is a difference between those students who participated in elective physical education courses and those who did not participate when comparing mean mathematics AIMSweb benchmark fall to winter gains scores for seventh and eighth grade students.

H2. There is a differential impact among seventh and eighth grade students who participated in physical education and those who did not participate when comparing mathematics AIMSweb benchmark fall to winter gains scores for Tiers 1, 2 and 3 of the MTSS instructional support categories for mathematics.

A 2x3 factorial Analysis of Variance (ANOVA) was conducted to address H1 and H2. The two-way ANOVA was selected because it tests the main effect of each independent variable on the dependent variable, as well as the interaction effect of the individual levels of each independent variable and the possibility of those combinations leading to differential effects on the dependent variable. The mean of the mathematics

AIMSweb fall to winter gains scores for middle school students in mathematics instructional Tier 1, Tier 2, and Tier 3 who were enrolled in physical education were compared to the mean of the mathematics AIMSweb fall to winter gains scores for middle school students in mathematics instructional Tier 1, Tier 2, and Tier 3 who were not enrolled in physical education. The level of significance was set at .05, and significant results would require post hoc pairwise comparisons with a Bonferroni adjustment for increasing alpha levels due to multiple tests being conducted to identify for which groups the differences existed.

RQ2. To what extent does participation in physical education impact seventh and eighth grade students' academic achievement as measured by fall to winter gains scores on the reading benchmark AIMSweb assessment, and is there a differential impact based on physical education participation among students designated at Tier 1, Tier 2, and Tier 3 of the MTSS instructional supports for reading in 2018?

H3. There is a difference between those students who participated in elective physical education courses and those who did not participate when comparing mean reading AIMSweb benchmark fall to winter gains scores for seventh and eighth grade students

H4. There is a differential impact among seventh and eighth grade students who participated in physical education and those who did not participate when comparing reading AIMSweb benchmark fall to winter gains scores for Tiers 1, 2, and 3 of the MTSS instructional support categories for reading.

A 2x3 factorial Analysis of Variance (ANOVA) was conducted to address H3 and H4. The two-way ANOVA was selected because it tests the main effect of each

independent variable on the dependent variable, as well as the interaction effect of the individual levels of each independent variable and the possibility of those combinations leading to differential effects on the dependent variable. The mean of the reading AIMSweb fall to winter gains scores for middle school students in reading instructional Tier 1, Tier 2, and Tier 3 who were enrolled in physical education were compared to the mean of the reading AIMSweb fall to winter gains scores for middle school students in reading instructional Tier 1, Tier 2, and Tier 3 who were not enrolled in physical education. The level of significance was set at .05, and significant results would require post hoc pairwise comparisons with a Bonferroni adjustment for increasing alpha levels due to multiple tests being conducted to identify for which groups the differences existed.

Limitations

According to Lunenburg and Irby (2008), "limitations of a study are not under the control of the researcher. Limitations are factors that may have an effect on the interpretation of the findings" (p. 133). The potential limiting factors in the study included the sample size, and the demographics of the site selected. The sample for this research was limited to one suburban school district that used the AIMSweb assessments. The sample size of the study may limit the generalizability of the research results because a greater population size may adjust the findings. A different outcome may have been found if more than one school that administered the AIMSweb assessment had participated in the study. While the sample size was sufficient, a larger sample size that included multiple schools may have provided different results. A second limitation was the demographics of the sample site. Although not an emphasis in the study, the demographics of the selected suburban school from south central Kansas may provide

different results than schools having different demographics thus limiting the generalizability of the results to other schools or populations. Additionally, a different assessment could have been used to measure mathematics and reading achievement, and more specifically mathematics and reading gains scores. Students who are not enrolled in physical education may be active either before or directly after school. Finally, if data was collected for the entire year (fall to spring benchmarks) rather than one semester (fall to winter), the data may have yielded different results.

Summary

The methodology for the current study was described in Chapter 3. The chapter included the research design, selection of participants, measurement, instruments, data collection procedures, data analysis and hypothesis testing, and limitations. Chapter 4 includes the explanation of the descriptive statistics, hypotheses testing and additional analysis results, and a summary.

Chapter Four

Results

The purpose of the current quantitative causal-comparative study was to investigate how enrollment in a school-based physical activity class was related to student achievement in mathematics and reading for grades seven and eight. The current study also compared students within similar academic achievement categories according to the three-tiered system of the MTSS instructional framework to examine whether differential impacts of physical education courses existed among students of differing achievement levels. A 2 x 3 factorial Analysis of Variance (ANOVA) was conducted to address the main impact of physical education enrollment on mean gains scores, and the differential impact of physical education enrollment by the three different academic instructional tiers on mean gains scores. Achievement was measured by the fall to winter composite gains scores on the AIMSweb mathematics and reading benchmark assessments. The mean of the mathematics and reading AIMSweb fall to winter gains scores for middle school students in instructional Tier 1, Tier 2, and Tier 3 who were enrolled in physical education were compared to the mean of the mathematics and reading AIMSweb fall to winter gains scores for middle school students in instructional Tier 1, Tier 2, and Tier 3 who were not enrolled in physical education in grades seven and eight. The factorial ANOVA also tests for interaction effect by combining all possible levels of each independent variable to examine whether students of differing academic levels' mean gains were differentially impacted by physical education enrollment. Chapter 4 provides the descriptive statistics associated with the current research study and the results of the statistical analyses regarding the four hypotheses.

Descriptive Statistics

The descriptive statistics sought and collected for the current study included seventh and eighth grade students' enrollment in physical education, the instructional tier in which they were categorized based on their fall mathematics and reading AIMSweb scores, as well as their fall to winter gains scores on those tests. There was a total of 452 seventh and eighth grade students at the suburban school district middle school with 434 students completing the mathematics AIMSweb assessment during the fall and winter benchmark assessments. Table 1 shows the number of students who took the mathematics AIMSweb assessments. Of the 434 students who completed the assessment, 303 or 69.8% of those seventh and eighth grade students were not enrolled in a physical education class, while 131 or 30.2% were enrolled in a physical education class. Students were also further divided into AIMSweb Tier placements, as it related to their enrollment into physical education classes. As per fall administration results of the mathematics assessment, there were 216 students classified as Tier 1, 54 as Tier 2, and 33 students as Tier 3 who were not enrolled in physical education. Those students who were enrolled in physical education classes included 99 classified as Tier 1, 18 as Tier 2, and 14 students as Tier 3.

Table 1

Frequencies and Percentages by Fall Mathematics Instructional Tier and Physical Education Enrollment Status

Instructional Tier	No Physical Education	Physical Education	Total (Within Tier)
Tier 1	216 (71.3%)	99 (75.6%)	315 (72.5%)
Tier 2	54 (17.8%)	18 (13.7%)	72 (16.6%)
Tier 3	33 (10.9%)	14 (10.7%)	47 (10.8%)
Total	303 (69.8%)	131 (30.2%)	434 (100%)

There were 452 seventh and eighth grade students who completed both the fall and winter reading AIMSweb assessment. Of those 452, 318 students or 70.4% were not enrolled in a physical education class, and 134 students or 29.6% were enrolled in a physical education class during the fall semester (see Table 2). As per fall administration results of the reading assessment, 341 students were classified as Tier 1, 60 as Tier 2, and 51 students as Tier 3 who were not enrolled in physical education. There were 250 students classified as Tier 1, 38 as Tier 2, and 30 students who were classified as Tier 3 who were not enrolled in a physical education course. Those students who were enrolled in physical education classes included 91students classified as Tier 1, 22 as Tier 2, and 21 students classified as Tier 3. The combined seventh and eighth grade fall to winter gains score variables for the reading and mathematics AIMSweb assessments were computed by subtracting the fall composite scores from the winter composite scores as a measure of student academic progress during the semester in those subjects.

Table 2

Frequencies and Percentages by Fall Reading Instructional Tier and Physical Education Enrollment Status

Instructional Tier	No Physical Education	Physical Education	Total (Within Tier)
Tier 1	250 (78.6%)	91 (67.9%)	341 (75.4%)
Tier 2	38 (11.9%)	22 (16.4.6%)	60 (13.2%)
Tier 3	30 (9.4%)	21 (15.6%)	51 (11.2%)
Total	318 (70.4%)	134 (29.6%)	452 (100%)

Hypothesis Testing

The hypothesis testing was performed to address the two research questions with a total of four hypotheses. Statistical data analysis was conducted to test each hypothesis. The results of the hypothesis testing are detailed below.

RQ1. To what extent does participation in physical education impact seventh and eighth grade student's academic achievement as measured by fall to winter gains scores on the mathematics benchmark AIMSweb assessment, and is there a differential impact based on physical education participation among students designated at Tier 1, Tier 2, and Tier 3 of the MTSS instructional supports for mathematics in 2018?

***H1*.** There is a difference between those students who participated in physical education and those who did not participate when comparing mathematics AIMSweb benchmark fall to winter gains scores for seventh and eighth grade students.

H2. There is a differential impact among seventh and eighth grade students who participated in physical education and those who did not participate when comparing mathematics AIMSweb benchmark fall to winter gains scores for Tiers 1, 2, and 3 of the MTSS instructional support categories for mathematics.

A 2 x 3 factorial ANOVA was conducted to address H1 and H2. Levene's test for equality of group mean variance rendered a statistic of 0.498 with $p = 0.778$, meaning the statistical assumption of homogeneity of variance was met for the analysis. For H1, the main effect of physical education enrollment, the mean fall to winter gains scores for seventh and eighth grade students on the AIMSweb mathematics assessment were compared between those who participated in physical education and those students who did not. Results for H1 showed no significant main effect for physical education status on mean gains scores in mathematics with F (1, 2.69) = 0.13, $p = 0.75$. Therefore, physical education status did not render a statistical difference between the mean mathematics fall to winter gains score of students enrolled in physical education (M = 6.90, SD = 13.13) and those not enrolled in physical education (M = 6.75, SD = 16.26). Even though physical education students' mean gains scores were slightly higher than those not in physical education, H1 was not supported because a significant difference did not exist in mean AIMSweb mathematics fall to winter gains scores between students enrolled in physical education that semester and students not enrolled in physical education. Table 3 shows the mean gains scores, standard deviations, and number of students in each grouping for the AIMSweb mathematics gains scores from fall to winter benchmark testing.

Table 3

Descriptives for AIMSweb Mathematics Mean Gains Scores by Physical Education Status and Instructional Tier

	Enrolled in PE			Not Enrolled in PE			Total		
Instructional Tier	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Tier 1	99	5.90	13.41	216	5.26	16.61	315	5.46	15.66
Tier 2	18	9.89	12.64	54	6.72	13.19	72	7.51	13.04
Tier 3	14	10.14	11.30	33	16.55	15.46	47	14.64	14.53
Total	131	6.90	13.13	303	6.75	16.26	434	6.79	15.37

For H2, the interaction effect for physical education status by mathematics instructional tier was tested by comparing the mean fall to winter gains scores on the AIMSweb mathematics assessment for each combination of the two levels of physical education status and three levels of MTSS instructional tiers. Results for H2 showed no significant interaction effect between physical education status and mathematics instructional tier with F (2, 428) = 1.22, p = .296. Thus, the mathematics mean gains scores of students categorized at each of the three instructional tiers were not differentially impacted by physical education status, as none of the group comparisons rendered a statistical difference and H2 was not supported. No post-hoc pairwise comparisons were necessary.

Even though no statistically significant differences existed, the group means did vary somewhat depending upon mathematics instructional tier and physical education participation when examining gains scores of fall to winter AIMSweb benchmark testing in mathematics (see Table 3). Mathematics mean gains scores for students in Tier 1 who

did not participate in physical education (*M* = 5.26, *SD* = 16.61) were similar to those students who did participate in physical education (*M* = 5.90, *SD* = 13.41). Mathematics mean gains scores for students in Tier 2 who did not participate in physical education (*M* = 6.72, *SD* = 13.19) were slightly smaller than those students who participated in physical education (*M* = 9.89, *SD* = 12.64). Mathematics mean gains scores for students in Tier 3 who did not participate in physical education (*M* = 16.55, *SD* = 15.46) were somewhat larger than those who did participate in physical education (*M* = 10.14, *SD* = 11.29). There were patterns, though not significant, for these group mean gains scores on the AIMSweb mathematics assessment for students who did and did not participate in physical education by mathematics instructional tier.

RQ2. To what extent does participation in physical education impact seventh and eighth grade student's academic achievement as measured by fall to winter gains scores on the reading benchmark AIMSweb assessment, and is there a differential impact based on physical education participation among students designated at Tier 1, Tier 2, and Tier 3 of the MTSS instructional supports for reading in 2018?

H3. There is a difference between those students who participated in physical education and those who did not participate when comparing reading AIMSweb benchmark fall to winter gains scores for seventh and eighth grade students.

H4. There is a differential impact among seventh and eighth grade students who participated in physical education and those who did not participate when comparing reading AIMSweb benchmark fall to winter gains scores for Tiers 1, 2, and 3 of the MTSS instructional support categories for reading.

A 2 x 3 factorial ANOVA was conducted to address H3 and H4. Levene's test for equality of group mean variance rendered a statistic of 1.484 with $p = 0.194$, meaning the statistical assumption of homogeneity of variance was met for the analysis. For H3, the main effect of physical education enrollment, the mean fall to winter gains scores on the AIMSweb reading assessment for seventh and eighth grade students who participated in physical education were compared to those students who did not participate. Results for H3 showed no significant main effect on mean gains scores in reading for physical education status with F (1, 2.42) = 11.65, $p = 0.08$. Therefore, physical education status did not render a statistical difference between the mean reading fall to winter gains scores of students enrolled in physical education ($M = 6.79$, $SD = 29.58$) and those not enrolled in physical education ($M = 1.75$, $SD = 30.43$). Even though physical education students' mean gains scores were slightly higher than those not in physical education, H3 which stated that a significant difference existed in mean AIMSweb reading fall to winter gains scores between students enrolled in physical education that semester and students not enrolled in physical education, was not supported. Table 4 shows the mean gains scores, standard deviations, and number of students in each grouping for the AIMSweb reading gains scores from fall to winter benchmark testing.

Table 4

Descriptives for AIMSweb Reading Mean Gains Scores by Physical Education Status and Instructional Tier

Instructional Tier	Enrolled in PE			Not Enrolled in PE			Total		
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Tier 1	91	-0.04	28.68	250	1.82	28.02	341	-1.44	28.16
Tier 2	22	23.23	35.80	38	8.13	29.29	60	13.67	32.37
Tier 3	51	20.62	19.45	30	23.47	32.85	51	22.29	27.91
Total	134	6.79	30.42	318	1.75	29.58	452	3.25	29.89

For H4, the interaction effect for physical education status by reading instructional tier was tested by comparing the mean fall to winter gains scores on the AIMSweb reading assessment for each combination of the two levels of physical education status and three levels of MTSS instructional tiers. Results for H4 showed no significant interaction effect between physical education status and reading instructional tier with F (2, 446) = 1.59, p = .205. Thus, the reading mean gains scores of students categorized at each of the three instructional tiers were not differentially impacted by student physical education status, as none of the group comparisons rendered a statistical difference and H4 was not supported. No post-hoc pairwise comparisons were necessary.

Even though no significant differences existed, the group means did vary somewhat depending upon reading instructional tier and physical education participation when examining gains scores of fall to winter AIMSweb benchmark testing in reading (see Table 4). Reading mean gains scores for students in Tier 1 who did participate in physical education (M = -.04, SD = 28.68) were similar to those who did not participate

in physical education (*M* = -1.82, *SD* = 28.02). Reading mean gains scores for students in Tier 2 who participated in physical education (*M* = 23.23, *SD* = 35.80) showed slightly lower mean gains than students who did not participate in physical education (*M* = 8.13, *SD* = 29.29). Reading mean gains scores for students in Tier 3 who did participate in physical education (*M* = 20.62, *SD* = 19.45) were similar to students who did not participate in physical education (*M* = 23.47, *SD* = 32.85).

The results from the statistical analysis did not render any significant main effects for physical education participation or any significant interaction effects between physical education participation and instructional tier that impacted the mean gains scores for either mathematics or reading. Although the data analysis did not produce significant findings, there were some physical education status group trends identified upon examining the mean fall to winter gains scores for the mathematics and reading assessments at each of the three instructional tiers. The mean gains scores for reading were larger for Tier 2 students who were enrolled in physical education versus those who were not enrolled in physical education. That trend was not found for the mean gains scores of students at Tier 1 or Tier 3 on the reading assessment. Tier 3 students enrolled in physical education actually had a lower mean gains scores than students not enrolled in physical education. Regarding the mathematics assessment, there were larger mean gains scores for Tier 3 students when compared to students at Tier 1 and Tier 2. Students at Tier 3 who were not enrolled in physical education had higher mean gains scores than students who were enrolled in physical education. Students at Tiers 1 and 2 who were enrolled in physical education showed just slightly higher mean mathematics gains scores than those who were not enrolled in physical education.

Summary

Chapter 4 included a summary of the descriptive statistics for students enrolled in physical education versus students who were not enrolled in a physical education class, as well as the descriptive statistics of students classified at instructional Tiers 1, 2, and 3 by their fall mathematics and reading AIMSweb composite scores. The chapter also included the statistical analysis results for hypothesis testing and presented general patterns seen in the group mean fall to winter gains scores for mathematics and reading. Chapter 5 includes the interpretations of the results and a summary of the major findings, and a synopsis about how the results are related to the literature review presented in Chapter 2. Chapter 5 also includes implications of the major findings, and suggestions for future research.

Chapter Five

Interpretation and Recommendations

Physical activity is beneficial to students neurologically (Ortega et al., 2008), as well as physically (Gu et al., 2016). Enrollment in daily physical education showed a sharp decline in the late 1990s, and less than one-third of students received daily physical education as the country moved into the twenty-first century (Ogden, Flegal, Carroll, & Johnson, 2002). With the implementation of No Child Left Behind as a national education policy, there was a greater emphasis placed on standardized assessments (Cawelti, 2006). Researchers have previously investigated the impact that physical education had on academic achievement, specifically with mathematics and reading (Castelli et al., 2007; Blom et al., 2011; Chomitz et al., 2009). The findings of previous research has been varied when comparing all students' physical activity with mathematics and reading achievement (CDC, 2010; Wittberg et al., 2012). The current study was conducted to examine the impact of school-based physical activity on academic achievement and growth when comparing similar academically performing students in grades seven and eight under the MTSS instructional framework. This chapter consists of a summary of the current study through a brief overview of the problem, a review of the purpose statement, and research questions addressed in the previous chapters. Also included is a summary of the methodology and major findings, followed by a review of the findings as they relate to the researched literature. This chapter also includes implications for action, recommendations for future research, and concluding remarks.

Study Summary

In an analysis of the impact of physical education on academic achievement, the CDC (2010) discovered that nearly half of the studies investigated observed a positive relationship between physical education and academic achievement. The other half of studies found no positive correlation between academic achievement and physical education. The current study grouped students in a tiered format using the MTSS instructional framework. Students were assessed in mathematics and reading using the AIMSweb benchmark assessments. Students' mathematics and reading gains scores from fall to winter benchmark assessments were compared with their enrollment in physical education. This study was conducted to examine whether there was a difference in mean gains scores among students by enrollment status in physical education, and by the combination of physical education enrollment and the three academic instructional tiers for mathematics and reading. The following sections provide an overview of the problem, purpose statement and research questions, review of the methodology, and major findings.

Overview of the problem.

Evidence regarding the impact of school-based physical activity on academic achievement has been inconclusive. Some previous researchers have found that enrollment in a school-based physical activity could actually help our students achieve academically, although the findings have been mixed (CDC, 2010). The inconclusiveness of studies may have to do with the fact that researchers compared all students' assessment scores by their participation in school-based physical activity. In

examining research and literature reviews, researchers have not compared students of similar academic performance to one another when examining the relationship that enrollment in school-based physical activity classes has on academic achievement. School districts need to know whether physical education benefits their Tier 1, Tier 2, and Tier 3 students. The problem addressed in the current study examined whether academic achievement was impacted by school-based physical activity when comparing similar academically performing students.

Purpose statement and research questions. The purpose of the current quantitative causal-comparative study was to investigate how enrollment in a school-based physical activity class was related to student achievement in mathematics and reading for grades seven and eight. The current study also compared students within similar academic performing categories, according to the three tiers of the MTSS instructional framework, to examine whether differential impacts of physical education courses existed among students of differing achievement levels. Achievement was measured by the gains scores in the fall to winter benchmark assessments on the AIMSweb assessment. The means of the mathematics and reading AIMSweb fall to winter gains scores for middle school students by enrollment status in instructional Tier 1, Tier 2, and Tier 3 enrolled in physical education were compared to the mean of the mathematics and reading AIMSweb fall to winter gains scores for middle school students in Tier 1, Tier 2, and Tier 3 who were not enrolled in physical education in grades seven and eight. Two research questions and four hypotheses were developed and tested to address the purpose of this study.

Review of the methodology. A quantitative causal-comparative study was employed to investigate whether enrollment in physical education had an impact on student mathematics and reading assessment scores when comparing similar academically able students. Students in grades seven and eight at a suburban school district middle school in south-central Kansas were administered the AIMSweb mathematics and reading assessments in both fall and winter years. The students were placed into three instructional tiers using the MTSS instructional framework based on the mathematics and reading scores on the fall assessment, and gains scores were calculated from fall to winter benchmark testing results. The gains scores were grouped by those enrolled in physical education and those not enrolled in physical education. These groups were also separated into three instructional tiers in order to examine the possible differential impact by academic achievement level and enrollment in physical education. Two 2 x 3 factorial ANOVA were conducted to determine whether there was a main effect that led to significant differences between the mean fall to winter gains scores in both mathematics and reading based on physical education enrollment status. The interaction effect tested for differential impact based on all possible combinations of mathematics and reading instructional tiers and physical education enrollment status. The significance level for statistical impact was set at .05 for the purpose of this study to analyze the four hypotheses and answer the two research questions.

Major findings. The results of the data analysis found that students enrolled in physical education classes did not render significantly different mean gains scores for mathematics or reading than their peers who were not enrolled in physical education. It was hypothesized that there was a difference between mean fall to winter gains scores of

those who participated in physical education and those who did not participate when comparing reading and mathematics AIMSweb benchmark fall to winter gains scores for students in grades seven and eight. Even though no statistically significant differences existed, the group means did vary somewhat depending upon mathematics instructional tier and physical education participation when examining gains scores of fall to winter AIMSweb benchmark testing in mathematics. Results for students in Tier 1 who did participate in physical education (M = 5.90, SD = 13.41) were similar to those students who did not participate in physical education (M = 5.26, SD = 16.61). Results for students in Tier 2 who participated in physical education (M = 9.89, SD = 12.64) were slightly larger than for those students who did not participate in physical education (M = 6.72, SD = 13.19). Results for students in Tier 3 saw a somewhat smaller mean gains score for those students who did participate in physical education (M = 10.14, SD = 11.29) compared to students who did not participate in physical education (M = 16.55, SD = 15.46). There were patterns, though not significant, for these group mean gains scores on the Aimsweb mathematics assessment for students who did and did not participate in physical education by mathematics instructional tier.

Even though no significant differences existed, the group means did vary somewhat depending upon reading instructional tier and physical education participation when examining gains scores of fall to winter AIMSweb benchmark testing in reading Results for students in Tier 1 were similar between students who did participate in physical education (M = -.04, SD = 28.68) and those who did not participate in physical education (M = -1.82, SD = 28.02). Results for students in Tier 2 who participated in physical education (M = 23.23, SD = 35.80) rendered slightly higher mean gains than

students who did not participate in physical education (*M* = 8.13, *SD* = 29.29). Results for students in Tier 3 who did participate in physical education (*M* = 20.62, *SD* = 19.45) compared to students who did not participate in physical education (*M* = 23.47, *SD* = 32.85) rendered similar mean gains scores.

In summary, the data analysis did not produce significant findings, but there were some physical education status group trends identified upon examining the mean fall to winter gains scores for the mathematics and reading assessments at each of the three instructional tiers. When examining data from Tier 1 students, those students who were enrolled in physical education had an average gain score that was slightly higher in both mathematics and reading compared to those students not enrolled in physical education. Students who were identified as Tier 2 did show the highest gains scores difference in both mathematics and reading, suggesting that students performed better on the assessment if they were enrolled in physical education. The opposite was true when examining the results of students in Tier 3, in that students who were not enrolled in a physical education class had higher average gains scores in both mathematics and reading AIMSweb benchmark assessments.

Findings Related to the Literature

This section reviews the current study's findings as it relates to the literature regarding the impact of school-based physical education on academic achievement when comparing similar academic ability students. Although research is limited regarding physical education and academic achievement when comparing similar academically performing students, there have been mixed findings on school-based physical activity and academic achievement. Castelli et al. (2007) found mixed results in their research.

Aerobic fitness was associated with achievement in mathematics and reading, while strength and flexibility fitness were not relative to general academic achievement in mathematics and reading. Coe et al. (2006) found that students in the sixth grade had similar academic grades regardless of their enrollment in a physical education class. In an elementary setting, Earney et al. (2015) examined the impact that physical activity had on mathematics and reading achievement when students conducted a physical activity break before the start of instruction. Earney et al. (2015) collected data from weekly probes and found that mathematics scores remained fairly consistent while reading scores only slightly improved. Eveland-Sayers et al. (2009) collected data from third through fifth-grade students in middle Tennessee to determine the relationship between physical activity and academic achievement. There was a negative association between the one mile run times and the mathematics scores, yet a positive correlation between muscular fitness and mathematics scores. Furthermore, an inverse relationship was found between the one mile run times in both mathematics and reading scores with girls, but no significant association was evident with boys. Ahamed et al. (2007) found that increased physical activity did not have statistical significance when compared to standardized assessment scores. In fact, the students who did not receive additional time for physical activity scored higher than those who received the intervention.

A positive connection between school-based physical activity and academic achievement was identified in additional studies. Howie (2013) found that classroom exercise breaks were beneficial to mathematics performance scores with elementary-aged students. Chomitz et al. (2009) found that there was a significant relationship between fitness and academic achievement in grades four through eight. More specifically,

students who passed more physical fitness tests in school had a greater chance to pass the Massachusetts Comprehensive Assessment System in both mathematics and English. Blom et al. (2011) found a significant positive correlation between physical fitness and academic achievement in standardized test scores in language arts and mathematics for students in grades three through eight in the state of Mississippi.

Conclusions

The results of the current study indicate that further research is needed to examine how school-based physical activity impacts student achievement. More specifically, whether or not enrollment in physical education class impacts mathematics and reading assessment mean gains scores when examining student's academic achievement. Research results continue to be mixed when examining school-based physical activity and academic achievement. The current study adds to the debate on whether and how academic achievement is impacted by school-based physical activity. The results of the current study did not indicate statistical significance, trends were discovered that may warrant further examination. Future researchers should conduct a deeper investigation into the trends observed in the current study to explore the impact of physical education courses on students with similar academic performance.

Implications for action. The results of the current study indicate there is not a significant impact on student achievement in mathematics and reading through participation in school-based physical activity when comparing similar academically able students in grades seven and eight. The findings of this study have implications for school district and building level administrators in the areas of school scheduling. School district leaders and building level administrators may take this information into

consideration when making curricular and instructional decisions, as well as staffing decisions for their schools. Schools may alter their daily schedules and provide less time for physical education instruction and more time for core content instruction.

The current study also implies a need to further examine how schools utilize enrichment and intervention courses for mathematics and reading. A greater emphasis has been placed on standardized tests with regard to student achievement. School district leaders and building administrators could use the data found in the current study to reinforce the need for additional enrichment in intervention courses for mathematics and reading. Instructional time may be reduced for physical education instruction and increased for mathematics and reading as a result of the study. Although not found statistically significant, the trend in the data for Tier 2 students may cause school district leaders and building administrators to consider increasing school-based physical activity for those students who are just below grade level achievement in mathematics and reading. The data also may lead to school leaders removing Tier 3 students completely out of physical education in order to further assist students in mathematics and reading achievement

Recommendations for future research. Future research should focus on assessing gains scores throughout the entire year, fall to spring, for mathematics and reading assessments rather than just fall to winter. Extending the amount of time for an entire school year may allow for further academic gains by students. Assessing the gains scores achieved by students from the beginning of the year to the end of the school year allows teachers time to teach all standards of the curriculum, as well as provide additional

intervention and enrichment support that may aid in students' mathematics and reading achievement.

A second recommendation for other studies would be to increase the number of participants in the study. Future research could utilize additional grade levels, including elementary age students, where gains in mathematics and reading scores may be more prevalent. Additional districts and schools could also be included to increase the total population of student data collected for the study. A better understanding of academic achievement as it is affected by school-based physical activity when comparing students tiered students using the MTSS instructional framework could be obtained through similar quantitative studies on a larger scale.

In the current study, only organized physical education classes were investigated. Different types of physical activity and or physical education classes could result in different achievement scores in mathematics and reading. A traditional physical education class may or may not garner the same results as a weightlifting class for seventh and eighth grade students. Activities within a physical education class may or may not result in different achievement gains scores in mathematics and reading for all three tiers of students. Interscholastic extra-curricular activities, as well as those that are not sponsored by school districts, could also be included as variables to expand the design of current study.

The investigation of student achievement in the current study, with regard to fall to winter mean gains scores on the mathematics and reading AIMSweb assessments, did not include demographic data. Further insight and understanding could be gained from additional investigation about how school-based physical activity impacts student

achievement in mathematics and reading gains scores when examining groups by gender, race/ethnicity, and/or socio-economic status. These demographic variables, in addition to a larger sample size, may provide researchers additional information regarding the impact of school-based physical activity on academic achievement and growth when comparing similar academically performing students using the MTSS instructional framework.

The current study utilized the AIMSweb assessments as a tool for measuring mathematics and reading achievement growth. Future research could employ additional standardized assessments to measure academic achievement. Although the AIMSweb assessment is a standardized assessment, teachers may use state curriculum standards to drive instructional practices. School districts tend to alter state standards to narrow or focus instruction to meet the needs of individuals or groups of students. As a result, an assessment that is more closely aligned to state or a school district's instructional standards may be a better choice for assessing academic achievement or growth.

Concluding remarks. The purpose of the current study was to examine the impact of school-based physical activity on student academic achievement and growth. More specifically, to investigate whether similar academically achieving students, grouped by instructional tier or level, were impacted on mathematics and reading assessment growth based upon their enrollment in a physical education class. Although the data analysis did not result in statistical significance, results provided further direction for future research. Through the information provided in the literature review, it has been shown that there are both physiological and cognitive advantages to school-based physical activity for students. The results of the current study continue to support the

mixed findings with regard to the relationship between academic achievement and school-based physical activity.

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Appendices

Appendix A: Baker University IRB Approval

Baker University Institutional Review Board

March 25th, 2019

Dear Ronald Barry Jr. and Sharon Zoellner,

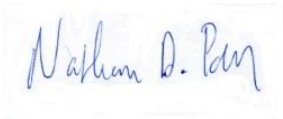
The Baker University IRB has reviewed your project application and approved this project under Exempt Status Review. As described, the project complies with all the requirements and policies established by the University for protection of human subjects in research. Unless renewed, approval lapses one year after approval date.

Please be aware of the following:

1. Any significant change in the research protocol as described should be reviewed by this Committee prior to altering the project.
2. Notify the IRB about any new investigators not named in original application.
3. When signed consent documents are required, the primary investigator must retain the signed consent documents of the research activity.
4. If this is a funded project, keep a copy of this approval letter with your proposal/grant file.
5. If the results of the research are used to prepare papers for publication or oral presentation at professional conferences, manuscripts or abstracts are requested for IRB as part of the project record.

Please inform this Committee or myself when this project is terminated or completed. As noted above, you must also provide IRB with an annual status report and receive approval for maintaining your status. If you have any questions, please contact me at npoell@bakeru.edu or 785.594.4582.

Sincerely,



Nathan Poell, MA
Chair, Baker University IRB

Baker University IRB Committee
Scott Crenshaw
Erin Morris, PhD
Jamin Perry, PhD
Susan Rogers, PhD

Appendix B: Participating School District Request for Research Approval

[redacted] <[redacted]@ .net> Thu, Apr 4, 2:41 PM

to me

We can assist.

[redacted]
Assistant Superintendent
[redacted]
(316) 755-7000
From: Ron Barry <rbarry@usd440.com>
Sent: Wednesday, April 3, 2019 7:46 PM

Subject: Request for Data

[redacted],

Please allow me to introduce myself, my name is Ronald Barry and I am a Doctoral Student at Baker University. I am currently working on my doctoral dissertation and am in search of a school district who is willing to join me in my research regarding "Comparing Physical Education Enrollment with Academic Achievement in MTSS Tiers of Students in 7th and 8th As Measured by Raw Aimsweb Scores."

The purpose of the study is to investigate how enrollment in a physical education class is related to student achievement in grades seven and eight when comparing students with similar academic abilities. The results of this study will be useful to determine whether physical education benefits high, medium and low academic achieving students. The study will utilize Aimsweb assessment raw scores in mathematics and reading for the winter and fall benchmarks as well as physical education enrollment status for 7th and 8th grade students from [redacted] USD [redacted], during the 2018-2019 school year.

I am contacting you to determine if USD [redacted] would be interested in providing data for this study. Included with this request is my Baker University Institutional Review Board request and approval letter. I look forward to hearing back from you regarding this matter and hope to be in contact with you soon.

Regards,

Ronald Barry
Doctoral Student
Baker University