THE EFFECT OF BLENDED LEARNING AND VIRTUAL LEARNING ON STUDENT PERFORMANCE IN HIGH SCHOOL PHYSICAL EDUCATION

by

Frances Elizabeth Caulder

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

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ABSTRACT

The relationship between blended, virtual, and traditional learning on student performance can significantly affect the future of physical education programs' curriculum and instructional methods. This causal-comparative research design study examines the difference in student performance measured by FitnessGram® scores between ninth-grade female physical education students who participate in an all-online/virtual learning instructional model, a blended learning instructional model, and a traditional face-to-face learning instructional model. Using a random sample of 143 students from six physical education classes from two high schools in a rural South Carolina school district, a one-way ANOVA was conducted to examine the difference in student performance measured by the FitnessGram® based on learning models. The results were not statistically significant, suggesting that there is no significant difference in student performance as measured by FitnessGram® scores among female ninth-grade physical education students who participate in an all-online/virtual learning instructional model, a blended learning instructional model, and a traditional face-to-face learning instructional model. Recommendations for future research will suggest a larger sample size, including male students, and further investigation identifying which student population benefits most from virtual physical education.

Keywords: blended learning, virtual learning, FitnessGram®, COVID-19, health-related fitness components

Dedication

I dedicate this dissertation to Amber and Addie, who have been my most profound inspiration and significant support. I thank you, Amber, for pushing me, loving me through this process, and accompanying me on this journey. God has blessed me with family and close friends who have continuously prayed over me. I'd also like to thank my parents for listening to my frustrations and for their continuous support for me to complete this process.

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I would like to acknowledge my best friend, Michelle. Thank you, Michelle, for the many hours you have sat beside me during this process, giving your best efforts to explain statistics.

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List of Abbreviations

Analysis of Variance (ANOVA)

Body Mass Index (BMI)

Centers for Disease Control and Prevention (CDC)

Comprehensive School Physical Activity Program (CSPAP)

Coronavirus-19 (COVID-19)

Learning Management System (LMS)

Moderate to Vigorous Physical Activity (MVPA)

National Association for Sport and Physical Education (NASPE)

Statistical Analysis System (SAS)

Self-Determination Theory (SDT)

The Society of Health and Physical Educators (SHAPE)

Theory of Expanded, Extended, and Enhanced Opportunities (TEO)

Virtual Physical Education (VPE)

CHAPTER ONE: INTRODUCTION

Overview

The purpose of this quantitative, causal-comparative study is to examine potential differences in FitnessGram® scores between ninth-grade female students who received blended learning instruction, those who received virtual learning instruction, and those who received traditional learning instruction. Chapter One provides background on Coronavirus-19 (COVID-19), the digital era, blended learning, virtual learning, and FitnessGram®. Also included in Chapter One is the purpose of the study, followed by the significance of the current study and research questions. The chapter concludes with a list of key terms and their definitions.

Background

The historical overview provides a brief history of previous pandemics that have affected education, the technological transformation in education, and the history of FitnessGram®. The society-at-large overview provides information on how society is affected by this robust educational transformation shifting the world into a virtual space precipitated robustly by COVID-19. The theoretical foundation is examined by applying the self-determination theory (SDT) and the theory of expanded, extended, and enhanced opportunities (TEO) for youth physical activity promotion and the comprehensive school physical activity program (CSPAP) framework.

Historical Overview

COVID-19 has not been the only pandemic. In the 20th century, two major pandemics were recorded: the Spanish influenza of 1918 and the Hong Kong flu of 1968 (Baldwin & Weder di Mauro, 2020). According to Howard Markel (2020), it was estimated that 675,000 people died due to the Spanish flu of 1918. He reported that, even then, health officials experienced difficulty

deciding whether it was safe for students to return to school while also considering the children's cognitive, social, and physical development (Markel, 2020).

The most recent pandemic, COVID-19, began in Wuhan, China in the winter of 2019 and catalyzed much illness and death throughout the world (Silva-Fiho et al., 2020). On March 11, 2020, the World Health Organization declared COVID-19 a pandemic and precipitating the practice of social distancing (Jeong & So, 2020). On March 19, 2020, the United States declared a national emergency, issuing a stay-at-home order for all citizens. By April 2020, over 95% of the population was subject to this order (An, 2020). This prompted not only businesses and entertainment venues to close but also school districts. Millions of people have been affected by this pandemic, and well over a million United States citizens have died. This virus has affected public health and citizens' economic, social, and emotional wellness (Valenzuela et al., 2020).

However, reopening school systems in the United States required a careful risk-benefit analysis that each state assessed and evaluated (Fricchione et al., 2021; Wong, 2021). Emerging factors such as COVID-spread, and Centers for Disease Control and Prevention (CDC) guidelines influenced policymakers and communities to reopen schools (Wong, 2021). Upon reopening for the 2020-2021 academic year, schools offered several instructional technology strategies that implemented virtual or blended learning opportunities creating an entirely new experience for both teachers and students (Coman et al., 2020; Jeong & So, 2020; Wong, 2021). Reopening options included traditional, blended, and virtual instruction authorized by state and district officials (Wong, 2021). In South Carolina, Governor Henry McMaster issued 6 million dollars of COVID relief funds to school districts so students could access broadband devices and computers to assist with their education (U.S. News, 2021).

With the advent of the digital era, technology has reduced the proximity gap to remote locations with reinforcement (Zakai, 2019). In 1983, the student-to-computer ratio for public schools was 168:1. Currently, most schools today have one computer per student (Warschauer, 2006). By the start of the 21st century, researchers knew that innovative technologies would broadly influence the nature of instructional methods (Warschauer, 2006). Before the COVID-19 pandemic, technologies were predicted to create more personalized and flexible learning experiences and the ability to collect and analyze data for enhanced decision-making (Cho et al., 2016). Although technologies are designed to elicit change, the primary purpose is to serve as a learning tool to improve education (Warschauer, 2006). Therefore, when COVID-19 affected the world in 2020, users became more dependent on new technologies, specifically in the educational realm.

Virtual learning in physical education was first introduced in 1997 in a K-12 Florida Virtual School (Beard & Konukman, 2020; Goad et al., 2019). Since then, there has been a positive trend in other states through legislation mandating the completion of online courses for high school graduation requirements (Beard & Konukman, 2020; Goad et al., 2019). In 2008, the United States Department of Education provided evidence from empirical research showing that students in a virtual or blended learning environment could perform better or average than those in similar traditional environments (Mosier, 2012).

In 2018, the Society of Health and Physical Educators (SHAPE) America published *Guidelines for Online Physical Education* providing guidelines and recommendations for appropriate practices for online physical education curricula. Virtual physical education (VPE) classes are alternative learning environments to traditional learning that provide quality physical education to students and meet graduation's high school requirements (SHAPE, 2018). As of

2016, only 31 states allowed high school physical education credits to be earned through VPE courses (Daum, 2020).

However, international attention on blended learning methods in physical education is relatively low, with only 137 peer-reviewed journal articles in Chinese and English literature as of December 31, 2019 (Shi & Zainuddin, 2020). Before COVID-19, research quality on blended learning in physical education was not a priority due to the nature of the physical classroom (Shi & Zainuddin, 2020). Nevertheless, once the COVID-19 pandemic protocols were initiated, physical education programs were not exempt from COVID-19 school regulations for the 2020-2021 academic year. Blended learning strategies in physical education have only been superficial until the pandemic. Physical education requires the visual assessment of physical performance in the classroom. Traditional high school physical education students typically meet the national and state standards via the sports education model and, for most states, by completing the state-mandated FitnessGram® assessment. The sports education model comprises several benefits, such as an increased level of strategic concepts in game units, opportunities for potentially marginalized students, and investment in physical education (Hastie, 1998).

The FitnessGram® is a digital platform designed to help physical educators assess, measure, record, analyze, and distribute the results of student fitness testing (Pluim & Gard, 2018). The FitnessGram® is designed and managed by The Cooper Institute and is the most widely implemented software system in the United States (Pluim & Gard, 2018). This test addresses the five health-related fitness components: aerobic capacity, body mass index (BMI), muscular strength, muscular endurance, and flexibility. Along with many other states, South Carolina administers the FitnessGram® as a state-mandated fitness test for physical education students in second grade, fifth grade, eighth grade, and high school.

Kenneth H. Cooper founded the FitnessGram® in 1970 at The Cooper Institute, a Dallas-based research facility that initially advocated for preventive medicine (Pluim & Gard, 2018). In 1981, Charles Sterling, former Director of Health and Physical Education of the Richardson Texas school system, joined the Cooper Institute and began the development of the FitnessGram® assessment (Pluim & Gard, 2018). During the Obama Administration, legislation required American schools to demonstrate how they were promoting student health and avoiding childhood obesity (Pluim & Gard, 2018). In 2015, the Every Student Succeeds Act was enacted and included the requirement for physical education and health, as it is part of the overall wellness of students (Williams et al., 2020).

Society-At-Large

Although blended learning methods have existed for almost two decades, due to the COVID-19 pandemic, blended learning is receiving more attention due to an increased application in public education (Um, 2021). Blended learning models provide a method for several instructional strategies and delivery methods through a combination of mixed methods of traditional classroom experiences and computer-mediated learning (Wang & Yang, 2015). As most of the United States began closing businesses and services and then later re-opening with a strong social-distancing policy, many education systems adopted blended learning as the primary mode for delivering instruction to students (Um, 2021). The quality of blended learning has become an increased interest for educational researchers as this approach is considered to produce improved student outcomes in education by allowing more flexibility, instant feedback, personalized attention, and enhanced monitoring and tracking of student progress (Um, 2021).

During the closing of school systems, children's sedentary lifestyles have worsened, increasing their risk of obesity (Wahl-Alexander & McMurray, 2021). The CDC concluded that

the BMI among children ages two to nineteen years nearly doubled during the COVID-19 pandemic (Lange et al., 2021). Once students enter high school, there is a shift in the physical education curriculum where the focus is on health-related fitness skills rather than on motor development and movement (Woodson-Smith et al., 2015). According to the CDC (2022), adolescents with obesity experience an increased risk of developing type 2 diabetes, heart disease, risk factors associated with heart disease (high blood pressure and high cholesterol), fatty liver disease, and joint problems. While research shows that participating in moderate to vigorous physical activity (MVPA) yields numerous health benefits, high school physical education offers one of the most utilized venues for conveying health-related fitness knowledge to adolescents (Williams et al., 2020).

As an increasing number of students are opting to enroll in physical education online, efficient online physical education curricula exist. Virtual delivery of physical education must align with national and state standards and provide sufficient rigor, depth, and breadth for students to produce increased learning outcomes (Williams et al., 2020). As VPE offers an optional delivery platform, those that choose to participate in VPE have reported enjoyment, choice of physical activities, and the flexibility provided through this learning environment (Williams et al., 2020).

Theoretical Foundations

The SDT (Ryan & Deci, 1980) and TEO (Beets et al., 2016) are applied to guide this quantitative, causal-comparative research. The SDT is based on intrinsic motivation and is used to explain the innate response that catalyzes student motivation. The application of the SDT increases student achievement in education when the three basic psychological needs of autonomy, competence, and relatedness are supported in the classroom (Ryan & Deci, 2020).

Furthermore, SDT's application in education confirms and supports basic psychological needs, facilitates students' intrinsic motivation, and enhances their well-being (Ryan & Deci, 2020). Since student engagement is a prerequisite for learning, the SDT aims to explain how technology in the classroom motivates students in blended and VPE environments (Chiu, 2022).

The TEO developed by Beets et al. (2016) provides a perspective to identify the solution for increasing MVPA amongst youth. The CSPAP provides a national framework for increased opportunities for students to engage in physical activity. In combination, TEO and CSPAP provide best practices when increasing the promotion of youth physical activity. With the rise of independent learning and student choice, physical education students can choose activities they will enjoy and are likely to continue performing outside of the physical education environment. The utilization of the CSPAP framework creates an opportunity for physical education teachers to support the public health benefits of high-quality blended and VPE curricula (Webster et al., 2021).

In physical education, successful student performance relies heavily on intrinsic motivational factors for student achievement. Although the TEO and the CSPAP program provided increased opportunities for students to engage in increased daily physical activity, the SDT argues that there is a need to enhance intrinsic motivation to engage students in learning. Therefore, when autonomy, competence, and relatedness are addressed in the physical education environment, it will lead to more opportunities for physical activity. Students will experience further opportunities to increase their student performance and improve their health-related fitness levels. Blended learning and virtual learning environments in physical education provide more opportunities for increased physical activity outside the traditional physical education environment by increasing family and community involvement (Webster et al., 2021).

Problem Statement

Although physical education programs experienced much adversity and change during the COVID-19 pandemic, this time of uncertainty provided a unique perspective on how blended and virtual learning environments affect student performance in traditional high school physical education environments. South Carolina public school systems, along with other states, re-opened with strict protocols due to the COVID-19 pandemic. Due to these protocols, traditional physical education classrooms were not allowed to participate in games, access equipment, dress out in locker rooms, and were required to maintain a social distance of six feet, but they were still required to administer the 2020-2021 FitnessGram® (South Carolina Department of Education [SC DOE], 2021).

As of December 31, 2019, there was insufficient international empirical research literature related to blended learning in physical education due to the active nature of the typical traditional physical education classroom (Shi & Zainuddin, 2020). Studies show that female adolescent physical education students are less motivated, resulting in a decline in participation in physical activities in traditional physical education in compared to male adolescent students (Kim & Hodge, 2021). Therefore, since females are the least gender-motivated group, it is imperative to ascertain which learning management system is most effective for student performance outcomes in high school physical education.

Although literature exists about blended learning models in the physical education classroom, there are no current studies on how FitnessGram® scores for female ninth-grade students regarding the difference between those who received blended learning or virtual learning instruction and students who received instruction in a traditional learning environment. However, a similar study in Jordan examined how blended learning improved fitness elements

on the King Abd Allah II Award for Physical Fitness in a sixth-grade classroom (Al Qudah et al., 2018). This measurement of fitness is similar to the Fitnessgram®; however, it does not include aerobic capacity or trunk extensor. It consists of two measurements of skill-related fitness: speed and agility (Al Qudah et al., 2018).

Another primary challenge regarding the high school physical education curriculum is conveying the value of physical education to students by maintaining health through physical activities, promoting communal consciousness through physical activities with peers, and development of sports education etiquette (Jeong & So, 2020). Furthermore, it is difficult to elicit an enjoyable and meaningful physical education experience without the social freedom of the traditional physical education environment. Specifically, it is challenging to convey the value of physical activity as an essential part of overall health without student-teacher physical interaction (Jeong & So, 2020). Therefore, physical education teachers were expected to implement blended learning methods in the physical education classroom without ample professional development or guidance. However, the problem is that the literature has not fully addressed how blended learning and virtual learning experiences affect ninth-grade female student performance on the FitnessGram® test for physical education students in public education.

Purpose Statement

The purpose of this quantitative causal-comparative research study is to measure the effects of blended learning methods and virtual learning methods on ninth-grade female student performance in a high school physical education course. The focus on high school physical education classrooms is due to the physical education requirement necessary for graduation. Due to the COVID-19 pandemic, blended learning and virtual learning models have increased in

public education. Regarding physical education programs that rely on psychomotor movement skills to implement an instructional sound curriculum, the implementation of blended and virtual learning methods for physical education courses continues to expand. However, in response to the COVID-19 pandemic, blended and virtual learning methods are now a more common instructional model for all public education curriculums. For this research study, the independent variable is the learning model. There are three learning models: traditional learning, blended learning, and virtual learning models. The dependent variable is the composite score on the Fitnessgram®. The tool used to measure student performance will be the FitnessGram® (The standardized test for measuring health-related fitness components: aerobic capacity, flexibility, BMI, muscular strength, and muscular endurance.)

Therefore, this quantitative, causal-comparative research study aims to determine if the blended learning instruction, virtual learning instruction, and those who received traditional learning instruction affects ninth-grade female physical education student's performance on components measured by the FitnessGram®

Significance of the Study

The physical education curriculum is designed to assess six skill-related components and five health-related components. The FitnessGram® is a prominently administered state assessment for physical education programs in the United States. The FitnessGram® measures the performance of the five health-related components (SHAPE America, 2021). A similar study from Jordan revealed how blended learning improved fitness elements in a sixth-grade physical education classroom (Al Qudah, 2020). However, this study examines a combination of skill and health-related fitness components. While the coronavirus has exposed children worldwide to an increased risk of childhood obesity due to extended quarantines, it is essential that physical

educators implement effective means to address health-related fitness. Educators can implement various learning models to battle childhood obesity, which correlates to numerous short and long-term illnesses (An, 2020). According to SHAPE America (2021), physical education programs that are delivered virtually should share the same purpose and planned outcomes as traditional face-to-face physical education learning environments (Webster et al., 2021).

Studying the possible relationship between blended, virtual, and traditional learning on student performance can significantly impact the high school physical education curriculum. It is necessary for students to receive quality physical education instruction; however, due to COVID-19, many students were unable to participate in the traditional classroom setting. The inability to participate may be attributed to anxiety, long-term effects of having COVID-19, or parental concern about participation in an environment where physical contact is expected and unavoidable. There is no known research on how blended or virtual learning affects student performance measured by the Fitnessgram®. This empirical data can impact future physical education programs' curriculum and instructional methods in the post-COVID-19 era.

Research Question

RQ: Is there a difference in student performance as measured by FitnessGram® scores among ninth-grade female physical education students who participate in an all online/virtual learning instructional model, a blended learning instructional model, and a traditional face-to-face learning instructional model?

Definitions

1. *Autonomy*: offers individuals a sense of ownership or control within their environment (Van den Broeck et al., 2016).

2. *Back-Saver sit and reach test:* a test designed to use a sit-and-reach box and measuring the flexibility of hamstrings by placing one leg at a time to the box and having the student reach using a measuring scale to determine the length of flexibility in inches (Welk & Meredith, 2007).
3. *Blended Learning*: is a combination of instructional strategy that invokes traditional face-to-face learning and computer-mediated learning experiences in a classroom setting (Um, 2021).
4. *Body Mass Index*: is collected height and weight data used to measure body composition (Welk & Meredith, 2007).
5. *Competence*: is an understanding of how to attain external and internal outcomes (Deci et al., 1991).
6. *Comprehensive School Physical Activity Program Framework*: multi-component approach for planning and organizing physical activity opportunities for students to incorporate the nationally recommended sixty minutes of physical activity into every day (SHAPE America, 2021).
7. *C*oronavirus-*19*: an infectious disease caused by a newly discovered (Silva-Filho et al., 2020).
8. *Curl-up Test:* a test that measures muscular endurance by having students perform an accurate curl-up to the FitnessGram® Curl-up Test cadence without more than 1 error (Welk & Meredith, 2007).
9. *Fitnessgram®:* a digital platform that is designed to help physical education teachers assess, measure, record, analyze, and distribute the results of a student fitness test (Pluim & Gard, 2018).

10. *Health-related Fitness Components*: aerobic capacity, body composition, muscular strength, muscular endurance, and flexibility (SC DOE, 2014).
11. *Health-related physical fitness*: a person's ability to meet age and gender criteria on five designated physical fitness components: aerobic capacity, body composition, muscular strength, muscular endurance, and flexibility (SC DOE, 2014).
12. *Pacer Test*: (Progressive Aerobic Cardiovascular Endurance Run) is a multistage fitness test adapted from the 20-meter shuttle run that progresses in intensity and is used to evaluate aerobic capacity (Welk & Meredith, 2007).
13. *Physical Education*: An instructional program delivered by a certified physical education teacher, designed to teach national and state standards to develop physically educated individuals (SC DOE, 2014).
14. *Push-up Test*: this test measures muscular strength by having students perform an accurate 90◦ push up to the FitnessGram® Curl-up Test cadence without more than 1 error (Welk & Meredith, 2007).
15. *Relatedness*: provides a sense of secure connectedness with others in their environment (Deci et al., 1991).
16. *Trunk lift test*: this test is designed to measure the flexibility of the body's trunk in participants by having them lie face down on a mat, hand by their side with palms facing up, and lift their chin off the floor as high as possible forcing their trunk into extension by flexing the back (Welk & Meredith, 2007).
17. *Self-Determination Theory:* a theory that concentrates on three primary innate needs for motivational behavior centered on the need for competence, relatedness, and autonomy (Deci et al., 1991).

18. *Virtual learning*: online instructional modes of access for learners in a different geographical location other than a traditional classroom (Moore et al., 2011).

CHAPTER TWO: LITERATURE REVIEW

Overview

This literature review discusses Deci and Ryan's (1980) self-determination theory (SDT) and Beets et al.'s (2016) theory of expanded, extended, and enhanced opportunities (TEO) for youth physical activity promotion. The SDT has been applied as a theoretical framework of human motivation. The TEO provides a perspective designed to identify the solution for increasing moderate to vigorous physical activity (MVPA) amongst youth. The comprehensive school physical activity program (CSPAP) provides a multi-component model that optimizes a multitude of opportunities for students to receive the Centers for Disease Control and Prevention (CDC) recommendation of 60 minutes of physical activity each day. The literature review focuses on the effects of blended learning methods and virtual learning methods on student performance measured by the FitnessGram® due to the increased technology instructional delivery in physical education due to Coronavirus-19 (COVID-19). The literature review discusses traditional physical education, female physical education students, and the FitnessGram®. Furthermore, the literature focuses on the effects of COVID-19 on current physical education classrooms, more specifically regarding standards-based instruction and student performance. To conclude, blended learning and virtual learning are explained regarding the physical education curriculum, and a gap is identified, showing the necessity for this study.

Theoretical Frameworks

The theoretical framework consists of Deci and Ryan's (1980) self-determination theory which analyzes and explains intrinsic motivation in humans. The second theory explored is the theory of expanded, extended, and enhanced opportunities for youth physical activity promotions by Beets et al. (2016). This theory provides perspective to recognize various solutions for

increasing MVPA amongst youth. Lastly, the comprehensive school physical activity program framework presents a multi-component approach for planning and organizing physical activity opportunities for students to achieve 60 minutes of physical activity each day.

Self-Determination Theory

The theoretical framework of SDT was pioneered by Deci and Ryan (1980) established two types of motivational behaviors: conscious and mindless. This theory was developed from previous research regarding intrinsic and extrinsic motivation (Hui et al., 2019). Research shows that the SDT provides an evidence-based theoretical framework (Carson & Chase, 2009; Cormack et al., 2020; Johnson et al., 2020; Wingrove et al., 2020). Conscious motivational behavior is classified as self-determination behavior where motivated actions are self-determined, engaged through free will, recognized by oneself, and is regulated by choice (Deci et al., 1991). According to Deci et al. (1991), the SDT concentrates on three primary innate needs for motivational behavior: competence, relatedness, and autonomy. Furthermore, these areas of competencies serve as the three psychological needs concerning motivation and wellness (Ryan & Deci, 2017, 2000). However, in the educational context, these three innate needs are applied to the learning environment (Hui et al., 2019).

Saugy et al. (2019) and White et al. (2021) further recognized the relevance of the application of the SDT in physical education classrooms regarding an increase in fitness levels and a promotion of lifelong fitness in high school students. Through Saugy et al. (2019) and White et al.'s (2021) research, it was determined that the three basic psychological needs within this framework provided a more joyful and meaningful physical education experience because students were provided a sense of choice/ownership and a meaningful rationale with minimum instruction, acknowledging the mastery of a caring and supportive environment.

The SDT presents a guiding framework for the dynamic human need for autonomy, competence, and relatedness (Cormack et al., 2020). Within this framework, SDT predicts that by applying autonomously, the motivating experiences will result in a higher quality of engagement and reduce exhaustion, burnout, and negative feelings (Ryan & Deci, 2017). Furthermore, this theory has been theoretically connected with positive psychology associated with human inherent developmental tendencies that are innate to psychological needs, which are the foundation of self-motivation (Wingrove et al., 2020). Situating this study within the theoretical framework of SDT for motivating students to engage in blended learning and virtual learning methods will be significant to the study. Theoretically, when the SDT is applied to the blended learning environment, research showed that learning motivation is enhanced when a suitable instructional design is used, such as cultivating learning attitudes to include situational interest, which will affect behavioral engagement (Hui et al., 2019).

Current research predicts that a technology-supported curriculum satisfies the basic needs of autonomy, competence, and relatedness in blended and online environments despite the lack of human interaction (Chiu, 2022). The online environment provides a stronger sense of autonomy and competence for students by allowing the choice of a broader range of media and support for relatedness, allowing additional opportunities for communication between students and teachers (Chiu, 2022).

Competence

Competence includes an understanding of attaining external and internal outcomes (Deci et al., 1991). Van den Broeck et al. (2016) described competence as a basic psychological need for perceiving mastery over a specific skill or the environment. Competence also aligns with other theories, such as social cognitive theory, because it promotes self-efficacy and tends to

explore and manipulate learning environments (Van den Broeck et al., 2016). Therefore, when students lack confidence, it can threaten their self-esteem (Wingrove et al., 2020).

Relatedness

Relatedness provides a sense of secure connectedness with others in their environment (Deci et al., 1991). Certain connectedness motivates due to a developed relationship, in this case, between teacher and student. According to Van den Broeck et al. (2016), relatedness is an innate human psychological need that is satisfied by showing care or concern for others. This intrinsic desire ultimately enables a sense of community through relationships (Van den Broeck et al., 2016). Regarding relatedness, it is crucial that students feel a sense of belonging and purpose (Wingrove et al., 2020). Relatedness was an essential support during times of school closure, and digital technology supports a variety of communication tools for students and teachers (Chiu, 2022).

Autonomy

The most significant psychological need of the SDT is autonomy. Autonomy offers individuals a sense of agency within their environments (Van den Broeck et al., 2016). According to Van den Broeck et al. (2016), autonomy is about a sense of volition and a sense of choice. Ultimately, this central construct is the student's self-regulation that affects trust levels (Wingrove et al., 2020).

In recent decades, the SDT has been applied to many motivational aspects of education, specifically physical education. Standage et al. (2005), extended this theory to the perceptions of competence-supported, relatedness-supported, and autonomy-supported satisfactory motivational needs. It focused on how each need influenced motivational factors in physical education. It was concluded that when all three motivational needs are satisfied, there is optimal psychological

functioning (Ryan & Deci, 2017; Standage et al., 2005). When aligned with a physical education classroom, researchers also found that the SDT presents a creative, high-quality learning environment associated with positive cognitive and affective outcomes (Ryan & Deci, 2017; Standage et al., 2005).

As blended learning models of instruction have expanded, the SDT has provided a theoretical framework supporting student engagement in learning technologies (Chiu, 2021; Hui et al., 2019; Sergis et al., 2018). Since student engagement is energized by motivation, blended learning opportunities can lead to increased motivation levels in student learning (Chiu, 2021). Both blended learning and virtual learning instruction increased student engagement as supported by the SDT. Online opportunities offer autonomous environments by nurturing student needs, interests, and preferences by allowing students agency in their cognitive engagement (Chiu, 2021). By adopting a warm and caring approach in the online environment, students and teachers can create a positive relationship that helps students feel connected to the course content (Chiu, 2021). Relatedness-supportive teachers foster an environment that optimizes behavioral and emotional engagement (Chiu, 2021).

Moreover, relatedness-support assists in enhancing competence and allows students to feel challenged during cognitive engagement (Skinner et al., 2008; Chiu, 2021). Therefore, recent research provides empirical implications contributed by the SDT as evidence that technological design can increase student motivation supported by the three innate psychological needs (Chiu, 2021; Sergis et al., 2018). Technological design offers different strategies for competence, relatedness, and autonomy by respecting and accepting individual interests, allowing for peer collaborations, and fostering trusting relationships in a collaborative learning environment (Chiu, 2021).

Theory of Expanded, Extended, and Enhanced Opportunities for Youth Physical Activity Promotion

Beets et al. (2016) developed the TEO to provide perspective to identify the solution for increasing MVPA amongst youth. Each of the three mechanisms described in this theory promotes an increase in MVPA among youth by expanding activities designed to replace sedentary activities with rigorous activities, providing more time for physical activity, and enhancing the existing physical activity intended to increase the amount of physical activity (Beets et al., 2016). Moller et al. (2014) indicated that students who participated in a sport-focused school allocated for more physical education classes experienced an increase in MVPA compared to students who attended traditional schools.

An increasing amount of empirical research indicated how these three mechanisms could increase physical activity levels among youth (Beets et al., 2016; Cardon et al., 2008; Meyer et al., 2014; Moller et al., 2014). The most common connection among the three components of this theory is the incorporation of extension and enhancement (Beets et al., 2016). Due to this connection, extra time is allocated for physical activity, promoting efficient physical activity opportunities typically facilitated by a physical education teacher or specialist. Several empirical research studies showed increased levels of moderate to physical activity levels amongst elementary students when more days of physical education during a week were allocated (Beets et al., 2016; Moller et al., 2014).

However, for the most significant increase of MVPA, all three mechanisms of TEO are necessary to promote physical activity among youth. Meyer et al. (2014) conducted a three-year physical activity examination to assess a school-based physical activity program in Switzerland where increased physical activity was implemented. In this school-wide initiative, students were

led in three to five physical activity breaks in an academic setting, offering expanded physical activity time. Extension and enhancement components were addressed, along with two additional physical education classes per week for the school-based physical activity program. This study showed more than a seven-point increase in MVPA (Meyer et al., 2014).

Essential considerations when utilizing TEO in-school programs that desire to increase physical activity opportunities include the theory's practicality in interrupting the academic routine (Beets et al., 2016). To not interrupt the academic routine, teachers would be required to incorporate physical activity into their academic routine instead of considering them as separate entities requiring a certain amount of involvement and commitment (Beets et al., 2016). Policymakers such as school administration would consider additional physical education classes, presumably reducing time for other priority areas (Beets et al., 2016). Another consideration for improving MVPA among youth is whether attendance should be considered voluntary or compulsory (Beets et al., 2016). Students who are least motivated to participate in physical activity increase MVPA when they have no choice but to participate in physical activities versus voluntarily participating outside of school (Beets et al., 2016).

Consequently, when the option exists for youth to attend a voluntary experience such as an after-school program, evidence demonstrates increased physical activity engagement (Marttinen et al., 2021). However, the option to participate in a voluntary program is typically beyond the control of the minor, and reasons for not attending may include parental responsibilities, cost, or transportation (Beets et al., 2016). Monetary costs can become problematic concerning classroom teacher training necessary to deliver high quality, rigorous physical activity tasks, purchasing equipment, and other professional development to include more physical activity during the day (Beets et al., 2016).

In recent literature, the TEO for youth physical activity promotion has provided a significant and emerging rationale for implementing online and blended learning models in physical education (Killian et al., 2019). Physical activity can be expanded, extended, and enhanced through these instructional methods. Both blended and virtual physical education instruction provides additional methods for more physical activity opportunities when compared to traditional instructional delivery only (Killian et al., 2019). The emergence of new technologies and universal student access enables teachers to redefine how, when, where, and with whom physical education occurs (Killian et al., 2019).

Comprehensive School Physical Activity Program Framework

According to SHAPE America (2021), the CSPAP framework is a multi-component approach for planning and organizing physical activity opportunities for students to incorporate the nationally recommended 60 minutes of physical activity into every day. This national framework consists of five components to actively engage students in moderate to vigorous physical activity: 1) physical education, 2) physical activity during school, 3) physical activity before and after school, 4) staff involvement, and 5) family and community engagement (SHAPE America, 2021). There are two goals of CSPAP: to provide a variety of school-based opportunities for 60 minutes of MVPA every day and to provide coordination among the CSPAP components to maximize comprehension, application, and practice of skills learned in physical education (SHAPE America, 2021). This model is the CDC national framework for physical education and physical activity in the United States (Webster et al., 2021).

Physical activity is an essential lifestyle factor known to promote implications on the overall well-being of children and adolescents. Adequate amounts of physical activity include the prevention of childhood obesity, benefits children’s genetic development, and supports

mental health and academic achievement (Mooses et al., 2021). Furthermore, updated research shows that schools that enforce wellness programs as a healthy system saw increased student attendance, reduced behavioral issues, and improved academic performance (Lee & Welk, 2021).

The World Health Organization firmly supports and recommends children engage in at least 60 minutes of physical activity per day (Mooses et al., 2021). The adoption of the CSPAP allows schools to become the powerful agent of ensuring that students are given opportunities to seize adequate physical activity while at school and promoting physical activity outside of school. In a recent study by Lee and Welk (2021), it was found that principal support was the catalyst for the CSPAP implementation within a school; with the leading component ensuring that quality physical education was taught.

As a conceptual framework, CSPAP provides quality physical education across all CSPAP components providing a minimum of 60 minutes of physical activity each day (Webster et al., 2021). The outcome of this framework includes students achieving grade-level physical education outcomes, accumulating 60 minutes of physical activity, and promoting lifelong participation in physical activity (Webster et al., 2021). By bringing physical education into the family and community environment, students are more likely to be motivated to participate in physical activity (Webster et al., 2021). This framework is designed to give a variety of opportunities for youth to participate in physical activity in different environments throughout the day (Lee & Welk, 2021).

Related Literature

While the COVID-19 pandemic altered or hindered many traditional ways of life, education was no exception to the transformation. School systems became more technologically

dependent on instructional delivery. Blended learning and virtual learning became a new norm that both teachers and students had to adapt to quickly. Although schools offered new platforms for instructional delivery, state-mandated testing continued to be a requirement for high school curricula, specifically in South Carolina (SC DOE, 2021). Physical education courses were not exempted from the state-mandated test, the FitnessGram® (SC DOE, 2021). The related literature further examines the traditional physical education learning environments, female physical education students, the FitnessGram®, blended learning, blended learning in physical education, virtual learning, and virtual learning in physical education.

Physical Education

Traditionally, physical education learning environments are typically in the school gymnasium or outside on open fields where students access adequate space for physical activities. The physical education curriculum promotes physically literate students through highly effective physical education programs (SHAPE America, 2021). An efficient and skillfully designed physical education classroom promotes the unique potential to address all three of Bloom's domains of psychomotor, cognitive, and affective learning (Hunt & Metzler, 2017). As SHAPE America (2021) outlined, the components of a physical education classroom include environment, curriculum, suitable instruction, and student assessment. A major significant aspect of the instructional framework of a physical education curriculum is regular participation in a fitness-enhancing physical activity explicitly focused on aerobic capacity, muscular strength, muscular endurance, bone strength, flexibility, and enjoyment/social/personal meaning (SHAPE America, 2021). Well-designed physical education programs provide an enjoyable learning experience, meet all students' needs, and emphasize lifelong health-enhancing skills through self-management for a lifetime of physical activity (SHAPE America, 2021).

According to “The Essential Components of Physical Education” (SHAPE America, 2021), appropriate physical education instruction includes a student-centered approach incorporating a wide variety of practices with adequate equipment and space so that all students are provided the opportunity to have an appropriate and proper engagement to practice tasks.

According to Bessa et al. (2021), achievements in physical education are due to an empowering education that encourages and prepares students to thrive in a dynamic and collaborative environment where key competencies are identified as self-direction, self-confidence, adequate communication, and cooperation. In the traditional physical education environment, students are expected to gain physical activity content, knowledge, and skills through cognitive understanding, physical performance, and by participating in lifetime activities outside the classroom setting (Shen, 2014). Motivation for encouraging student performance in the physical education setting is centered on the SDT specifically focused on creating an environment that promotes autonomy, relatedness, and competence (Deci & Ryan, 1980; Saugy et al., 2019; Shen, 2014; White et al., 2021).

The most recent World Health Organization 2020 Guidelines on Physical Activity and Sedentary Behavior (Bull et al., 2020) along with the recent edition of the Physical Activity Guidelines for School-Aged Children and Adolescents (U. S. Department of Health & Human Services, 2018) included the highly recommend 60 minutes of daily MVPA to maintain or improve current physical fitness levels (Ha et al., 2021). The leading contributor associated with poor cardiovascular health and childhood obesity is the progression of a sedentary lifestyle (Ha et al., 2021; Melero-Canas et al., 2021). However, the latest research indicated that the average health-related fitness levels for youth in the United States have been declining due to an increase in activities that promotes sedentary behavior (Ha et al., 2021).

According to research, 77% of overweight children were overweight or obese adults. This is why it is imperative to address physical activity levels in today's youth to prevent cardiovascular disease later in life (Melero-Canas et al., 2021). According to the National Physical Education Academic Standards, Standard 3 states, "The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing physical activity and fitness" (SHAPE America, 2021). Of the five national physical education standards, Standard 3 focuses on improving health-related fitness skills that enhance students' physical wellness and has shown that regular physical activity reduces the development of heart disease, certain cancers, and depression by promoting psychological well-being (Vaughn et al., 2019) As of 2013, obesity was declared a disease by the American Medical Association which has increased health awareness for several professional health organizations (An, 2020; Melero-Canas et al., 2021; Vaughn et al., 2019). Therefore, it has become a national concern to implement high-quality physical education programs and construct more effective pedagogical practices that promote health-related fitness skills and physical activity (Vaughn et al., 2019).

Physical education programs are divided into elementary, middle, and high school curricula. As most elementary and middle school curriculum focuses on motor development and movement skills, high school physical education programs focus primarily on health-related fitness skills. The U.S. Department of Health and Human Services indicated that physical activity among high school students drastically decreased, putting students at a higher risk of developing health issues due to becoming obese (Woodson-Smith et al., 2015).

Therefore, the curriculum shift between elementary and middle school to high school physical education is an essential focus for increasing the amount of physical activity levels of high school-aged males and females (Woodson-Smith et al., 2015). Specifically, female high

school physical education students have shown the least amount of student engagement resulting in lower physical activity levels during class (Murphy et al., 2014; Woodson-Smith et al., 2015).

Female Physical Education Students

The World Health Organization reports that 81% of adolescents are not meeting the recommended guidelines of 60 minutes of MVPA, consequently demonstrating a more significant decline in adolescent females compared to males (Kim & Hodge, 2021; Rosselli et al., 2020). While Title IX of the Education Amendments Act of 1972 grants equality for males and females in federally funded education programs, females in physical education perceive the course as a male subject and report negative perceptions about physical education (Kim & Hodge, 2021).

Reported perceived barriers to gender decline in physical activity among adolescents are related to current physical condition and physical activity levels (Rosselli et al., 2020). More than any other age, it is during adolescents that sedentary time increases, and physical activity levels decrease in females (Cowley et al., 2021; Rosselli et al., 2020). In part, this decline is the lack of enjoyment in physical education class for adolescent females (Gil-Arias et al., 2021; Kim & Hodge, 2021; Trabelsi et al., 2021).

Recent studies show that the decline in adolescent female enjoyment of physical education is due in part to the lack of interest in the physical activities offered during class (Gil-Arias et al., 2021; Kim & Hodge, 2021; Trabelsi et al., 2021). Furthermore, females demonstrate a lack of enjoyment when participating in sports education, whereas males report higher levels of enjoyment (Cowley et al., 2021; Gil-Arias et al., 2021). Adolescent females are often hindered by motivational factors that commonly facilitate motivation in males, such as competition and strength gains (Cowley et al., 2021). The pressing challenge to incorporate physical activities

that are interesting to female physical education students will encourage enjoyment in class (Engels & Freund, 2020 & Trabelsi et al., 2021).

Although a correlation exists between the enjoyment of participating in physical education and engaging in physical activity leisurely, the problem exists between selecting physical activities that provide enjoyment for females during class. Research provides evidence that the social aspect is a significant contributor to enjoying physical education (Engels & Freund, 2020; Mitchell et al., 2015). Engels and Freund (2020) found that personal competence and social aspects could be encouraged to enhance enjoyment in physical education.

Kim and Hodge's (2021) study uncovered that female students found no relevance in the physical activity opportunities in class to their lives, desiring more leisurely activities in noncompetitive sports or individualized physical activities. Dai et al. (2020) suggested that adolescent females showed an increase in engagement in physical-activity-based curriculum that aimed to improve body image. Furthermore, Trabelsi et al. (2021) suggested that adolescent females' motivation to participate in physical education increases when students are allowed to foster peer-to-peer feedback using video technology. Although video technology increases participation, the satisfaction of emotional engagement is also suggested as a contributing factor for adolescent females (Trabelsi et al., 2021).

A significant amount of literature addresses the common barriers that contribute to the decline of physical activity levels in adolescent females. High school physical education programs are not always single-gender classes; therefore, physical education teachers must address the barriers between gender by providing a mixed curriculum to include more individualized physical activities (Cowley et al., 2021; Dai et al., 2020, Rosselli et al., 2020). The application of the SDT fosters an increased desire for adolescents to increase physical

activity in the physical education classroom. Specifically, adolescent females need relatedness by gratifying the social aspect of physical education (Gil-Arias et al., 2021; Engels & Freund, 2020; Mitchell et al., 2015; Sevil et al., 2016).

FitnessGram®

Although the COVID-19 pandemic impeded how the physical education classroom could be conducted, it did not pause state assessments. As many schools in the United States are now not only required to assess, record, and report on students' academic competencies, they are now requiring the same for health and well-being competencies (Gard & Pluim 2017). The FitnessGram® program offered by The Cooper Institute is the most psychometrically sound assessment available in the field of physical education (Morrow et al., 2010; Pluim & Gard, 2018; Welk, 2017).

The Cooper Institute, a scientific-based research facility, has spent many years providing research to create a criterion-referenced test that assesses an individual's health-related fitness levels by age and gender (The Cooper Institute, n.d). This assessment provides a battery of validated field-based, health-related fitness tests and health-related criterion-referenced standards that ultimately helps physical education teachers track and produce individualized student reports for students, parents, and administration (De Arruda et al., 2020; The Cooper Institute, 2017). Many state organizations have identified the FitnessGram® as the ultimate standardized evaluation for health-related fitness skills in elementary, middle, and high school physical education programs mainly in part of its adherence to science (Gard & Pluim, 2017; Ha et al., 2021; Lee et al., 2020; Welk, 2017). Similar to other state academic mandates, many states require a collection of student fitness data and implement a report of these results to parents, school community, and state departments of education (Gard & Pluim, 2017; Ha et al., 2021).

These results revealed increasing accountability and a clear reaction to widespread concern about children's well-being (Gard & Pluim, 2017).

Research demonstrated that the FitnessGram® is a reliable and valid teacher-administered assessment under the guidance of trained teachers (Barton et al., 2017; Morrow et al., 2010; Welk, 2017; Welk et al., 2011). Approximately 300 peer-reviewed FitnessGram® journal articles scientifically analyze this health-related fitness assessment (Gard & Pluim, 2017). According to Lee et al. (2020), Morrow et al. (2010), and Pluim and Gard (2018), the FitnessGram® is a digital platform allowing teachers the opportunity to collect, record, distribute, and analyze student's physical fitness results which have been concluded to be a turning point in physical education programs. The FitnessGram® provides criterion-referenced standards that yield a health benefit or reduce health risks (Lloyd et al., 2003). This test is designed to evaluate the five-health related fitness components: aerobic capacity, which is measured through the PACER test or the 1-mile run; body composition, which is measured through a bioelectric impedance device or the calculation of height and weight values; flexibility, measured through the sit-and-reach test and the trunk lift; muscular strength, measured by the push-up test or the flex arm hang; and muscular endurance, measured through the curl-up test (Pluim & Gard, 2018).

According to research from The Cooper Institute, the FitnessGram® provides scientific validity to school-based programs that these health-related fitness initiatives indeed work. Furthermore, students highlighted in the health-related fitness zone® demonstrated decreased illnesses related to sedentary lifestyles (The Cooper Institute, 2021). Once students complete Fitnessgram testing, test results place them in one of three zones: healthy fitness zone®, needs improvement zone®, and health risk zone®. The healthy fitness zone® indicates that the

individual is fit and in good overall health, meeting the criterion-referenced standards for their age and gender (The Cooper Institute, 2021). The needs improvement zone® indicates the potential for future health risks if this fitness component does not improve. The health risk zone® indicates that the individual has an increased probability for future health issues more so than the needs improvement zone if they do not improve their physical fitness. Each fitness zone is based on specific potential health risks considering various age and gender differences.

Research indicated a relationship between physical activity and higher levels of cardiorespiratory fitness, increased muscular strength, and lower body composition for students who participated in physical activity daily (Barton et al., 2017). However, it is the amount of physical activity an individual receives that research concluded to be associated with these benefits, such as 60 minutes of physical activity time is associated with increased cardiorespiratory fitness levels (Barton et al., 2017; Jones et al., 2020; Meyer et al., 2021). The FitnessGram® provides an assessment of personal health-related fitness skills. The school system has been identified as an important environment for promoting MVPA and assessing students' health-related fitness levels (Jones et al., 2020).

Data are continually being assessed based on state adoption programs where longitudinal studies from such states as Texas and Georgia (in agreement with state education agencies) have provided data that has shown significant shifts in fitness levels (Welk, 2017). Appropriate uses for the FitnessGram® are intended to teach students about different types of intensities regarding exercise, how to self-monitor or track fitness results, and to learn about health-related fitness and criterion-referenced health standards (Ha et al., 2021; Welk, 2017). Ultimately, data from FitnessGram® results can build tailored programs in physical education classrooms that promote

an increased level of MVPA and decrease health risk factors that can become detrimental to one's future health (Ha et al., 2021).

Coronoavirus-19 Impact

The novel coronavirus or COVID-19 has tragically shaped humanity in the 21st century and brought about much mental and social collateral damage from the lasting effects of this disease (Pacheco et al., 2020). As noted by the World Health Organization, the most vulnerable populations were those with chronic illness and the elderly (Pacheco et al., 2020). According to Rezaei et al. (2021), the most common cause of death is acute respiratory distress syndrome and multi-organ dysfunction syndrome in patients suffering from COVID-19.

In December 2019, the coronavirus emerged in Wuhan, China, and generated much sickness and death worldwide (Silva-Fiho et al., 2020). On March 11, 2020, the World Health Organization declared a pandemic, and social distancing became a part of everyday life (Jeong & So, 2020). By April 2020, over 95% of the U.S. population was issued a stay-at-home order that radically changed our lifestyle (An, 2020; Domokos et al., 2020). Such changes included decreased gathering sizes and mandated face mask ordinances in public places throughout the United States and other countries (Lim et al., 2021; Salomon et al., 2021). To decrease the spread of COVID-19, many government agencies demanded quarantines, contact tracing, and an economic shutdown (Howard, 2020).

Due to this unprecedented situation, schools began responding by offering a diverse school curriculum through virtual learning or blended learning opportunities creating an entirely new experience for teachers and students (Coman et al., 2020; Jeong & So, 2020). Despite all the advances in medicine and technology, this virus still leaves many questions and new discoveries.

COVID-19 and Physical Education

Stay-at-home orders and social distancing have made it difficult for children and adolescents to achieve adequate amounts of daily physical activity. Recent research concluded that 78.8% of surveyed teachers noted that they believed their students were obtaining less physical activity during the pandemic than on a typical day of school (Pavlovic et al., 2021). In other research, a study showed that since the pandemic, students who were receiving adequate levels of physical activity at school decreased from 64% to 20% of physical activity due to family factors such as parental lifestyles, the lack of high quality online physical education resources, and community factors (Webster et al., 2021). The CDC reported students K-12 that were overweight or obese before the pandemic nearly doubled their BMI during the pandemic (Lange et al., 2021). The COVID-19 pandemic impacted many physical education programs worldwide and affected the amount of physical activity undertaken by K-12 students in the U.S. (Pavlovic et al., 2021). Due to the pandemic, physical education programs which rely primarily on physical activity were moved to online platforms. Jeong and So (2020) reported implications of online physical education classes for middle and high school students were found to lack teacher experience, evaluating student performance, and conveying the value of physical education. However, distance learning was the preferred solution to the pandemic and has enabled individuals to benefit from their educational rights in many countries worldwide (Kaya, 2021).

Due to the COVID-19 pandemic, children are further exposed to an increased risk of childhood obesity due to social distancing and global stay-at-home orders (An, 2020; Fang et al., 2021). Studies have already concluded that students have significant weight changes over summer breaks (Pavlovic et al., 2021). As a result, current research is developing on the effects

of decreased amounts of physical activity during the pandemic and how it relates to students becoming more at risk of developing physical illnesses (Fang et al., 2021). The COVID-19 pandemic affected the amount of time students could participate in physical activity. It limited the space typically required to move efficiently and, in some cases, changed the behavior of sports play altogether, such as eliminating competition (Fang et al., 2021).

As a nation progresses with newer technologies, this offers new possibilities for education (Webster et al., 2021). However, much skepticism exists about online physical education programs due to the lack of evidence-based research (Pavlovic et al., 2021; Webster et al., 2021). It is essential to recognize the difference between online learning and emergency remote teaching. According to Ucok-Sayrak and Brazelton (2021), online learning requires sufficient planning and design, while emergency remote teaching is a momentary modification of current instructional delivery in response to a crisis.

In March 2020, the remote teaching response in physical education during the COVID-19 pandemic was problematic for teachers delivering instruction in an online format during the nationwide shutdown (Varea & Gonzalez-Calvo, 2021). Recent research by Varea and Gonzalez-Calvo (2021) reported implications from pre-service physical education teachers who were forced to switch from traditional face-to-face instructional delivery to emergency remote teaching in the middle of their final practicum. Their research focused on the loss of physical education identity and the lack of online resources during the COVID-19 nationwide shutdown. Physical education students were no longer dressing in sports attire to perform movement skills when movement skills were required. Due to the lack of physical space in some homes, certain movement skills were limited. Physical education teachers at the time had minimal resources on

how to efficiently deliver their physical education curriculum in an online format (Varea & Gonzalez-Calvo, 2021).

Fang et al. (2021) examined the pandemic's effects on the well-being of college students enrolled in physical education courses. This study specifically focused on the correlation between the well-being of students and quality of life, revealing significant data that concluded that students who participated in physical activity had positive relationships and better quality of life (Fang et al., 2021).

Blended Learning

Blended learning is a thoughtful integration of a traditional face-to-face classroom environment entwined with the online learning experience (Rasheed et al., 2020; Shu & Gu, 2018). The term blended learning is traced back to a 1999 press release by EPIC Learning in Atlanta that originally termed blended learning as incorporating any combination of traditional instructional learning and the use of technology, including film, CD-ROM, audio, etc. (Cronje, 2020). However, in recent research, the term blended learning subsides with "the appropriate use of a mix of theories, methods, and technologies to optimize learning in a given context" (Cronje, 2020, p. 120). According to a recent meta-analysis of 674 articles, the convergence between online and offline environments offers a vast opportunity to enhance engagement and learning (Dziuban et al., 2018; Shu & Gu, 2018). Research also indicates that one main contribution of successfully blended learning models has been institutional support for planning and course design (Dziuban et al., 2018). The coupling of online learning with traditional face-to-face learning provides flexible use of online services, allowing additional time for practice (Nortvig et al., 2020).

Furthermore, blended learning provides an opportunity for online assessment systems that increase student learning performances and student engagement (Lu et al., 2018). Through learning management systems (LMS), online data can easily be collected, stored, and evaluated, which is one of the advantages of incorporating blended learning methods into educational classrooms (Lu et al., 2018). LMS platforms were implemented inconsistently during pre-COVID (Colley, 2021). At best, LMS platforms were implemented to house course materials (such as storing the course syllabus) or as a space to continue engagement outside the classroom (Colley, 2021). Currently, LMS platforms create the opportunity to shape online spaces and contribute to facilitating student engagement in a learning environment (Colley, 2021).

In education, blended learning opportunities increase flexibility, delivery, pedagogical affluence, cost-effectiveness, engagement, and interaction (Rasheed et al., 2020). Key challenges that must be addressed when designing an effective blended learning course are incorporating flexibility, stimulating interaction, facilitating the learning process, and fostering an effective learning environment (Boelens et al., 2017). Although most educational research pertaining to blended learning has been noted in higher education, there is expanding interest in research on blended learning environments in the K-12 educational setting (Killian et al., 2019). Blended learning is an efficient way to increase learner independence and personalization without losing the essential social interaction goals that face-to-face learning supports (Cappi et al., 2019). In other words, blended learning provides the opportunity to alter the roles of students and teachers. However, research indicated that for an improved educational experience, the implementation, pedagogy, and the design of the course gives quality to the online experience (Calderon et al., 2021).

One of the most noted advantages of the blended learning environment distinguished through research is the convenience of the online format, allowing students to practice and learn skills in their own time (Hunma, 2018; Nortvig et al., 2020). This advantage satisfies the human need for autonomy and self-regulation, motivating student learning. However, one of the most concerning disadvantages of blended learning environments researched has been the lack of teacher feedback students received during the online portions of the blended learning environment, which is linked to student retention (Nortvig et al., 2020). Outside of instruction, another challenge with novel technologies is the digital divide representing those that do not have access to educational technologies (Dziuban et al., 2018).

Blended learning and virtual learning opportunities have dramatically increased for the 2020-2021 academic school year due to the COVID-19 pandemic. Furthermore, the post-COVID world continues to incorporate virtual space where technology continually creates a more dynamic and creative learning environment considered a community-centered space (Colley, 2021). Under the guiding framework of CSPAP, blended learning processes make possible the addressing of community-centered spaces by creating virtual spaces in which the traditional classroom is not conducive under physical restraints. When applying the theoretical framework of the SDT (Deci & Ryan, 1980) to the blended learning experience, the educational environment is more conducive to the student learning process. A blended learning environment gives students significant autonomy tailored to self-regulated learning (Vanslambrouck et al., 2019). By promoting concrete modules, blended learning provides flexible, pedagogical affluence (Cappi et al., 2019; Rasheed et al., 2020). This is an excellent incentive for the current Generation Z (D.O.B. 1995-present) population that must satisfy their need for technology at their fingertips (Chism & Wilkins, 2018). Ultimately, the blended learning environment offers

two fundamental essentials that provide the opportunity to enhance student learning: socialization and personalization. Students can experience social interaction with peers and instructors while also gaining personalization through the dynamic, creative space of their learning process through an organized online format (Boelens et al., 2017; Colley, 2021).

Blended Learning in Physical Education

There has been little attention given to blended learning in practice-based subject areas over the years because practice-based instruction generally requires a physical environment for collaboration efforts (Nortvig et al., 2020). However, according to research, blended learning opportunities have become an innovative technology tool that enhances the physical education experience by allowing students to use fitness apps and fitness trackers, receive additional instruction via YouTube videos and participate in fitness video instruction (Chism & Wilkins, 2018; Coyle et al., 2019; Van Dam et al., 2019). According to Coyle et al. (2019), in a meta-analysis study conducted by the Department of Education, blended learning was more effective in K-12 schools when students were allowed to work in group settings with teacher interaction than virtual learning alone. Curricular strengths for applying blended learning methods in a physical education classroom include collaboration opportunities, ownership, student choice, which creates a flexible classroom environment, the ability to learn new physical activities, peer evaluations, and a sense of mastery (Chism & Wilkins, 2018; Van Dam et al., 2019). With the emergence of smartphones, people have instant access to information, which has created a mobile learning environment that gives access to this information anytime and anywhere (Goad et al., 2019). Mobile fitness apps provide various lifetime activities that support wellness curriculums (Goad et al., 2019).

In recent research, Van Dam et al. (2019) analyzed the procedure of incorporating blended learning activities in a university physical education setting to increase student enjoyment of the physical activity and decrease student anxiety over working out. Online videos are implemented as a model to offer self-instruction. Once the individuals were comfortable learning a new skill, they could practice with peers based on the video instruction (Van Dam et al., 2019). By using a five-phase approach suggested by Van Dam et al. (2019): 1) video instruction, 2) peer practice, 3) validation of student understanding, 4) students teaching peers, and 5) modified games and comprehension, researchers found that students perceived an enjoyed experience to learning new physical activities through a blended format. A separate study by Melero-Canas et al. (2021) found blended learning in physical education classes based on teaching personal and social responsibility model and gamification increased the parameters of both personal fitness and physical activity amongst students decreasing sedentary behaviors that are linked to higher body compositions. Specifically, these enhancements through blended learning instruction showed positive results in cardiorespiratory fitness, speed, and agility.

Blended learning opportunities in K-12 physical education classrooms offer potential learning enhancements to students by giving them opportunities to extend and enhance their psychomotor learning skills outside the context of the gym (Killian et al., 2019). Subsequently, physical education teachers can use LMS to create and distribute online assessments to examine student engagement and learning through summative and formative assessments (Killian et al., 2019).

Virtual Learning

Virtual learning, distance learning, and e-learning are common terms that are slightly different by region that describe online instructional modes of access for learners in a different

geographical location other than a traditional classroom (Moore et al., 2011). Virtual learning has been described as either an asynchronous environment, which accommodates teacher and student interaction according to their own scheduled time, or synchronous environment that provides immediate feedback and teacher/student interaction (Adedoyin & Soykan, 2020; Powers, 2001). It is through internet technologies that bring virtual learning opportunities to educational systems transforming teaching and learning (Moore et al., 2011; Tsai, 2013). Since educators have accessed the internet as a research learning tool, publishing tool, and a source for engaging in other social networking and multimedia platforms (Siemens, 2011). Although the world experienced a rapid technology transformation in society with the emergence of access to high-speed internet, educational systems were slow to embrace virtual learning opportunities (Van Oostveen et al., 2019).

However, in response to the COVID-19 pandemic, educational systems worldwide began to turn to technology as a source for instructional delivery. During this pandemic, institutions focused on innovative resolutions, namely asynchronous and synchronous online learning to optimize educational endeavors using programs such as Zoom, Google Meets, and Microsoft Teams (Adedoyin & Soykan, 2020; Almarzooq et al., 2020). These systems offered an easy interface that allowed student collaboration, secured cloud systems, and accessible outlets within a comprehensive range for all educational needs (Almarzooq et al., 2020). Amidst the COVID-19 era, virtual learning platforms significantly reformed and innovated the art of teaching and student engagement while providing a sense of community (Almarzooq et al., 2020). This contemporary transformation in education is transforming traditional face-to-face learning environments applying teacher-centered methods to virtual or blended learning environments using learner-centered methods worldwide (Adedoyin & Soykan, 2020). The research concluded

that to have an effective virtual learning experience, there must be a cautiously organized application of effective design and planning of instructional development (Adedoyin & Soykan, 2020; Bozkurt & Sharma, 2020).

Virtual Learning in Physical Education

In the past, virtual physical education (VPE) served its purpose as an alternative to traditional face-to-face physical education in K-12 schools by a selection out of convenience, perceived low skill ability, motivated by the application of technology, students with disabilities, or alienation (Kwon, 2020; Mosier, 2012). However, with the development of newer technologies, physical education teachers can use multimedia websites, 3D animations, and online learning systems as a teaching tool for teaching complex movement skills (Lin et al., 2020; Papastergiou & Gerodimos, 2013). Mobile fitness apps can capture physical activity movement skills and provide an accurate demonstration along with verbal cues (Goad et al., 2019). When mobile learning tools are combined with mobile video analysis apps such as CoachMyVideo or Coach's Eye, learners are provided with instant visual feedback and assurance that skills are being performed correctly (Goad et al., 2019). Consequently, to assess these movement skills, students must perform live or record a video of their movement skills as evidence and submit it to the instructor (Lin et al., 2020). Research showed that VPE environments not only could enhance efficiency of learning, but it was also appealing to students (Lin et al., 2020). Researchers Hung and Chen (2016) and Hung et al. (2018) found that when using tablets as an instructional platform for teaching VPE units on table tennis and badminton, it increased student motivation and enhanced the skill level of students. Tekakpinar and Tezer (2020) showed how an outdoor sports curriculum was efficient in improving student performances and student motivation through an online management system.

Nevertheless, the difficulty lies in VPE programs when the novel COVID-19 virus affected people's daily lives worldwide, and social distancing became vital to community health (Beard & Konukman, 2020; Kaya, 2021). The COVID-19 era abruptly seized public education worldwide and forced many school systems to turn to virtual education (Beard & Konukman, 2020; Jeong & So, 2020; Kaya, 2021). Prior to the mandatory shift to online education, many argued that online methods were inadequate to traditional educational methods (Beard & Konukman, 2020). However, according to Jeong and So (2020), one of the main attributions to this inadequacy was that teachers lacked experience in professional development regarding how to implement an effective physical education online curriculum by conveying appropriate physical education instruction, assessment, and evaluation through an online management system. Furthermore, there is a need to provide physical educators with professional development on competent online design and delivery, best online practices, and external accountability (Webster et al., 2021). Although VPE has existed for years, there is still a lack of high-quality online physical education resources that are aligned to support standards-based curricula (Webster et al., 2021).

Prior to COVID-19, the National Association for Sport and Physical Education provided examples illustrating how online physical education could potentially promote achievement of the physical education national standards (Mohnsen, 2012). According to Mohnsen (2012), these were the following suggestions: Standard 1. Development of Motor Skills: students can view a video of the proper technique of new motor skill and, with adequate practice, submit logs of student evidence of them performing the motor skill; Standard 2. Understanding of Movement Concepts: students can participate in a virtual field trip to a professional spring baseball training and document the relationship between the experience and motor learning concepts; Standard 3.

Physical Activity Participation: students can wear heart rate monitors while exercising and upload their data to a software program; Standard 4. Physical Fitness: students can participate in a WebQuest to increase their understanding of health-related fitness and create a fitness plan for submission; Standard 5. Social Behavior: students can participate in a web-based simulation to observe social interaction and then demonstrate the social learning skill observed. Some of these suggestions are outdated and financially unfeasible for many physical education programs, and new recommendations are necessary.

In 2018, SHAPE America issued guidelines for VPE programs that addressed the intent of how technology is a great teaching tool when implemented effectively by teachers and students (Daum, 2020; Goad et al., 2019). Although the standards are the same for traditional physical education and VPE, teachers will have a challenging time teaching in an online environment if they have the same expectations as a traditional physical education learning environment (Daum, 2020; Webster et al., 2021). Simply adopting technology alone does not make for an effective learning experience. Therefore, it is highly encouraged to access SHAPE America's *Initial Guidelines for Online Physical Education* for the following: curriculum content, instructional design, technology, assessment, and site management (Daum, 2020; Goad et al., 2019). While VPE programs shared the same responsibilities as traditional physical education programs, there was evidence of a struggle to meet physical education content standards (Webster et al., 2021).

Literature suggested that for student achievement in VPE to occur, there must be an optimizing level of teacher-student interaction. Beard and Konukman (2020) suggested several ways for teacher-student interaction to provide specific, positive, and consistent feedback using email, video messaging, and weekly bulletins. Another principle suggested for VPE instruction is

creating opportunities for student collaboration through group projects, peer reviews, or discussion forums (Beard & Konukman, 2020). Opportunities for active learning scenarios where students can participate in virtual field trips and additional outside physical resources such as TED Talks/videos and mindful activities are all components of VPE (Beard & Konukman, 2020). Therefore, it may become beneficial for teachers to integrate indirect teaching styles and provide student choice in virtual classroom environments (Wahl-Alexander & McMurray, 2021).

The VPE provides a unique opportunity to address and apply the CSPAP. With the support of school administration, VPE programs can promote physical activity through family and community engagement (Webster et al., 2021). The VPE opens the door to bringing physical education into the home where family members can engage in physical activity with their child (Webster et al., 2020; Webster et al., 2021). Additionally, VPE courses can promote physical activity through the use the use of recreational parks, or community centers (Webster et al., 2021).

Summary

The theoretical framework of motivation by Deci and Ryan (1980) and the influence of the CSPAP (SHAPE America, 2021) guide this research. It is through the theoretical framework of the SDT and CSPAP framework that more proficient pedagogical physical education content will be utilized through blended learning and virtual learning experiences to enhance student values on becoming physical literature individuals by adhering to their innate psychological needs. The SDT framework is an analytical instrument for determining the motivational factors in a blended and virtual learning environment. Beets et al.'s (2016) TEO offers a lens to identify the solution for increasing MVPA amongst students in a physical education environment.

The effects sustained in physical education due to the COVID-19 pandemic has transformed how physical education is taught in public schools. Although restrictions that impeded the types of physical movement in the physical education classroom, local and national officials demanded that physical education students continue physical evaluation through the standardized test FitnessGram®, regardless of the limits placed within the traditional physical education classroom setting.

Therefore, for the purposes of this topic, the SDT will provide a framework to be applied as an analytical tool for promoting motivational behaviors in blended learning models of instruction and virtual learning models of instruction to enhance female student performance in a high school physical education environment. By satisfying physical education students' psychological need for competence, relatedness, and autonomy, students will be more apt to implement blended learning methods and virtual learning models in the physical education classroom to determine how it effects student performance. The CSPAP framework presents a comprehensive physical activity model that can optimize physical activity, specifically through the family and community component in blended learning and virtual learning models in physical education, supporting the goals of CSPAP by bringing physical education into students' homes. Considering TEO (Beets et al., 2016), it provides a solution to increase MVPA among today's students by extending, expanding, and enhancing physical activity opportunities during a school day and not just during physical education class. Therefore, when students are provided more opportunities to experience physical activity, the likelihood of increasing their health-related fitness levels is elevated.

National and local physical education content standards state that students must be able to efficiently perform specific movement skills to be considered physically literate. Blended

learning models and virtual learning experiences in physical education classes can provide opportunities for students to feel more confident in mastering these concepts and fitness movements in a safe, socially distant space. Providing blended learning and virtual learning opportunities based on the theoretical framework of the SDT and TEO can potentially influence student performance which could be measured by the FitnessGram®. When implemented efficiently, blended learning and virtual learning opportunities can create a joyful and meaningful learning experience for physical education students.

CHAPTER THREE: METHODS

Overview

The purpose of this quantitative, causal-comparative research study is to measure the effects of blended learning methods and virtual learning methods among ninth-grade female student performance in a high school physical education course. Guided by the self-determination theory (SDT) and the theory of expanded, extended, and enhanced Opportunities (TEO) for youth physical activity promotion, the data collected addressed the effects of student performance in these different environments.

Design

The purpose of this quantitative, causal-comparative research design was to examine differences via active inquiry of investigation to draw a causal inference concerning independent and dependent variables (Schenker & Rumrill, 2004). In a causal-comparative research study, researchers seek to find cause-and-effect relationships among individuals where an independent variable is available or unavailable and then seek to determine if there is a difference in the independent variable and determine its effects on the dependent variable via the comparison of two or more groups (Salkind, 2010).

Causal-comparative research explains educational phenomena via cause-and-effect relationships while implementing at least one categorical variable and comparing two or more groups (Gall et al., 2007; Salkind, 2010). There are several steps in a quantitative, causal-comparative research design that begins with forming a research problem and hypothesis, selecting comparison groups, data collection, data analysis, and concludes with an interpretation of findings (Gall et al., 2007). Through causal-comparative research designs, the investigation of the magnitude of differences between or among groups is examined, and the formation of

comparison groups is an essential factor of causal-comparative research (Gall et al., 2007; Schenker & Rumrill, 2004). Furthermore, drawing two groups from the same population is beneficial when investigating possible patterns of behaviors in which the critical variable is present or absent (Gall et al., 2007). Therefore, the causal-comparative research design is the most practical way to form groups to measure the difference between multiple independent variables and produce clearer, coherent statistical results.

The purpose of this study is to investigate the difference in student performance measured by FitnessGram® scores among ninth-grade female physical education students that received instruction through blended, virtual, and traditional learning instructional models. According to Gall et al. (2007), one limitation of the causal-comparative research design is the data collected are tentative, and the researcher must proceed with caution when performing inferences. In this case, there are possible alternative interpretations of the results. The safest interpretation was to not claim a causal relationship but to suggest a causal relationship (Gall et al., 2007). Tentative data can be valuable when data are difficult to obtain and allows for more definitive conclusions about causal relationships (Gall et al., 2007).

The independent variable is the learning model. There are three learning models: traditional learning, blended learning, and virtual learning models. Blended learning combines instructional strategies that invoke face-to-face learning with computer-mediated learning experiences in a classroom (Um, 2021). Virtual learning methods provide online instructional modes of access for learners in different geographical locations other than the traditional classroom (Moore et al., 2011). The dependent variable is the composite score on the Fitnessgram® measuring the five health related fitness components. The FitnessGram® is a digital platform designed to help

physical educators assess, measure, record, analyze, and distribute students' health-related fitness testing results (Pluim & Gard, 2018).

Research Question

The following research question was developed to guide the research study and direct the process of data collection and statistical analysis.

RQ: Is there a difference in student performance as measured by FitnessGram® scores among ninth-grade female physical education students who participate in an all online/virtual learning instructional model, a blended learning instructional model, and a traditional face-to-face learning instructional model?

Hypothesis

The following hypothesis was developed to guide the quantitative research study and direct the process of data collection and statistical analysis.

H_0. There is no difference in student performance as measured by FitnessGram® scores among female ninth-grade physical education students who participate in an all online/virtual learning instructional model, a blended learning instructional model, and a traditional face-to-face learning instructional model.

Participants and Setting

This section will address the population and participants of this causal-comparative research study. Furthermore, it will identify the groups and setting.

Population

The population for the study is ninth-grade female physical education students from a school district located in the upstate of South Carolina during the fall and spring semester of the 2021-2022 school year. The school district is part of a rural community with a population of

2,979 high school students, with 51% of students being male and 49% of students' female (SC DOE, 2021). In 2021, there were 10,168 students enrolled and 777 teachers employed in the district (SC DOE, 2021). The student-to-teacher ratio for core classes are 18:1 (SC DOE, 2021). The average teacher salary for teachers in this district is $54,713. The district is comprised of 74.4% Caucasian students, 11.5% Hispanic students, 9.4% African American students, 0.6% Asian students, 0.1% Native American students, and 3.9% multiracial students (SC DOE, 2021). The district has an 84% graduation rate (SC DOE, 2021).

Participants

The participants are selected from six physical education classes within two high schools in this South Carolina school district. Physical education courses were randomly selected and students within each course were randomly assigned a learning model. For this study, the number of participants sampled was 141, which met the required minimum for a medium effect size. According to Gall et al. (2007), the sample size of 141 students is greater than the 126-participant minimum when assuming a medium effect size with .7 statistical power, $\alpha = 0.05$.

According to the South Carolina Department of Education (2021), all high school students are required to take Physical Education 1 to fulfill graduation requirements. Most high schools in South Carolina implement the required graduation physical education course during the freshmen year. According to the South Carolina Department of Education (2021), secondary physical education students must receive a total of 225 minutes of physical education per week within the physical education course.

Groups

Each group will consist of approximately 50 participants to maintain similarities. The ninth-grade female student physical education sample for the 2021-2022 school year consisted of

a total of 141 female students ages 13 to 15 divided into six 90-minute blocks within the two high schools. The six chosen ninth-grade physical education classes were divided into three groups labeled A, B, and C. This study's sample, (N = 141) comprised three groups, Group A: traditional instructional model (n = 50); Group B: blended instructional model (n = 48); and Group C: virtual instructional model (n = 43).

Setting

One high school included in the study was part of a rural community with a population of 879 students, 51% male and 49% female. The school's racial demographics are 90% Caucasian, 5% Hispanic, 2% African American, and 3% of two or more races. At the time of this investigation, 47% of students qualified for free lunch based on socioeconomic status and 8% qualified for reduced lunch (SC DOE, 2021).

The second high school within this district is an inner-city high school. The racial demographics of this high school are 64.9% Caucasian, 8.1% Hispanic, 20.2% African American, and 3% of two or more races. At the time of this investigation, 45% of students qualified for free lunch based on socioeconomic status and 6% qualified for reduced lunch. This inner-city high school within the same school district has a population of 1,011 students with 50% male and 50% female (SC DOE, 2021).

Instrumentation

The instrument administered for this research study is the FitnessGram®. This software-based program will collect and record the results for each participant in a secure digital database. Permission to access these data has been granted by district administration with the understanding that participant names will be omitted from the study (Appendix G).

FitnessGram®

The instrument administered for this research study is the FitnessGram® designed by The Cooper Institute and is an approved measure for overall health. This instrument has been administered in numerous studies (De Arruda, 2020; De Arruda et al., 2021; Ha et al., 2021; Lee et al., 2020) as a valid instrument in measuring health-related fitness components in recent empirical research. In recent research, criterion-referenced FitnessGram® cut-points support international criterion-referenced cut-points (Lee et al., 2020; Mahar et al., 2018). The FitnessGram® is endorsed by the American College of Sports Medicine and has determined the reliability and validity of the FitnessGram® (Lee et al., 2020). According to the latest FitnessGram® Administration Manual, individualized testing and institutional testing can be designed based on the primary objectives of the program (Ha et al., 2021). According to Gogoi & Bhattacharyya (2020), the FitnessGram® is comprised of five health-related fitness components: aerobic capacity, muscular endurance, muscular strength, flexibility, and BMI. These indicated an excellent reliability rating for the FitnessGram® test (Gogoi & Bhattacharyya, 2020).

The battery of test for the FitnessGram® includes the 20-meter pacer test (aerobic capacity), curl-up test (muscular endurance), push-up test (muscular strength), sit-and-reach test (flexibility), trunk lift test (flexibility), and body mass index (BMI) (body composition) (Turek, 2015). When associated with good health, the criterion-referenced standards have been established for students for each health-related fitness component (Welk & Meredith, 2007). The test includes a Cronbach's alpha reliability rating of α=0.9. The Pacer test is reliable at α=0.959. The curl-up test has a reliability rating of α=0.949. The push-up test has a reliability rating of α=0.941. The trunk lift is reliable at α=0.914. Finally, the sit-and-reach test, measuring flexibility has a reliability rating of α=0.73. A report is produced upon data entry into the FitnessGram®

software, where it collects scores on the following: aerobic capacity, muscular endurance, muscular strength, flexibility, and body composition. Research concluded that the FitnessGram® is a reliable and valid way to assess health-related fitness components (Morrow et al., 2010).

The researcher will assess student performance giving a score of zero (not in the healthy fitness zone) or one (in the healthy fitness zone) for each individual test. The composite score is found by finding the sum of the individual scores of each test. The possible range for composite scores is zero to seven. A student's composite health score places them in one of three zones: healthy fitness zone®, needs improvement zone®, and health risk zone®. A score of zero represents the worst score meaning they scored in the high-risk zone® for all components of the FitnessGram® test. The composite fitness score was collected to analyze the scores of each individual in the sample. A score between zero and three will be determined as a high-risk zone® for all components of the FitnessGram® test. A score between four and six will be determined as needs improvement zone® on the FitnessGram® test. A score of seven represents the best score meaning they scored in the healthy fitness zone® for all components of the FitnessGram® test.

Permission to administer the FitnessGram® assessment is provided as part of state testing for physical education programs in South Carolina (SC DOE, 2021). Local administration at the district level has given permission to access data for the FitnessGram® with the understanding that student names will be omitted from the study. The healthy fitness zone has historically been administered by the FitnessGram® to signify levels of fitness that meet health-related fitness standards (Welk et al., 2011). The Cooper Institute has listed FitnessGram® standards for Healthy Fitness Zones for ages five through seventeen or older females. The healthy fitness zone® for the 20-meter Pacer test is a minimum of 23 laps for 13 to 14-year-old girls and a minimum of 32 laps for 15-year-old girls. The healthy fitness zone® for the curl-up test is a

minimum of 18 curl-ups for 13 to 15-year-old girls. The healthy fitness zone® for the push-up test is a minimum of 7 curl-ups for 13 to 15-year-old girls. The healthy fitness zone® for the trunk lift test is a minimum of 12 inches for 13 to 15-year-old girls. The healthy fitness zone® for the back-saver sit and reach test is a minimum of 10 inches for both right and left sides for 13 to 15-year-old girls (Welk & Meredith, 2007).

Procedures

Approval for conducting this quantitative, casual-comparative research study was received from Liberty University Institutional Review Board (Appendix A). Once approved by Liberty University Institutional Review Board, consent was obtained from district and school administrators, followed by instructor consent for the three physical education courses (Appendix B). For this study, data were collected from the 2021-2022 academic school year from six ninth-grade female physical education classes by recording each student's results from the FitnessGram® test. Each physical education class met five days per week for 90-minute block periods, Monday through Friday during the Fall or Spring Semester of 2021- 2022 (Appendix C). Each course was arranged into three groups (Group A-traditional learning instruction, Group B -blended learning instruction, Group C -virtual learning instruction). The participants were selected from two high schools within the same school district. Once physical education courses were selected by the researcher, each class was assigned a learning model. Each assigned group completed either a traditional two-week unit of study in preparation of the FitnessGram®, a virtual two-week instruction, and the blended two-week instruction (Appendix C).

All three groups were presented with the same information regarding how to perform the health-related fitness skills. However, the mode of instruction varied per group. Group A was

assigned a two-week FitnessGram® unit of study using traditional learning methods. Students were presented with an in-class demonstration of the health-related fitness skills followed by teacher feedback with adequate amounts of in-class practice time. Group B was assigned a two-week unit of study using blended learning methods in preparation of the FitnessGram®. The blended learning group was given a combination of traditional instruction methods along with online methods. Blended Learning students were allowed to utilize videos prepared by The Cooper Institute and YouTube videos that showed the proper techniques of how to perform each test on the FitnessGram®, accessed via Canvas, as well as teacher and student demonstration. The instructor provided specific, corrective feedback in person and monitored practice time during class. Group C was assigned a two-week unit of study using only virtual learning methods in preparation for the FitnessGram®. This type of virtual learning model for this group utilized videos prepared by The Cooper Institute and YouTube videos that show the proper techniques of how to perform each test on the FitnessGram® and was administered to all students via Canvas. Virtual students then recorded and submitted their practice sessions through Canvas to receive teacher feedback. On the day of the FitnessGram® test, students submitted a live video of their FitnessGram® test with the instructor viewing and grading their performance over Google Meets documenting individual scores on a hardcopy (Appendix F) before implementing into the Fitnessgram® software. Physical education teachers assessed student performance according to Meredith and Welks (2007), *FITNESSGRAM® ACTIVITYGRAM®: Test Administration Manual* in which the test administrator will identify performance errors (Appendix D). Individual tests will be collected and scored based on students achieving the healthy fitness zone or not achieving the healthy fitness zone (Appendix E).

All curriculum for the Fitnessgram® preparation was consistent; however, it was presented via different instructional modes. The first seven days of instruction were designed to prepare students for the FitnessGram® through a series of multiple exercise activities that promote health-related fitness. These exercises included exercises for upper body strength: push-ups, planks, and other plyometric exercises. Aerobic capacity exercises are identified as a series of medium and high-intensity cardiovascular exercises such as jogging, sprinting, walking, high stepping, and jumping exercises that increase resting heart rate over an extended period. Exercises that promote muscular endurance are curl-ups, crunches, bicycles, planks, and oblique rotations. Flexibility exercises consist of proper warm-ups, cool-downs, yoga, and meditation.

FitnessGram® testing days are designated as the last three days of the unit. Testing day 1 is designated for BMI testing, aerobic capacity testing, and flexibility testing. Testing day 2 is designated for muscular strength testing and muscular endurance testing. Day 3 is for make-up testing for students that missed day one or day two of the FitnessGram® test. Once all testing was completed, data was collected and inputted into the FitnessGram® software program and submitted for administrational approval by the curriculum administrator and district administrator. All FitnessGram® data and scores were safely secured in the FitnessGram® software program designed by The Cooper Institute. Only physical education teachers and administrators can access this secure program via a state-issued password and district code.

Data Analysis

The data analysis technique appropriate for this causal-comparative study is a one-way analysis of variance (ANOVA). Following descriptive statistics, a one-way ANOVA was conducted to determine potential statistical differences in one dependent variable comprised of three groups (Gall et al., 2007). Therefore, the rationale for conducting the one-way ANOVA test

is to determine the statistical difference between the composite score of ninth-grade female physical education students measured via FitnessGram® and learning model. The learning model is disaggregated into three groups: traditional learning, blended learning, and virtual learning. Data will be gathered from the instruments and analyzed using Statistical Analysis System (SAS). Data screening was conducted to ensure fidelity of data entry. Extreme outliers were identified via a Box and Whisker plots for each learning model. Extreme outliers were suppressed.

When conducting a one-way ANOVA, the tenability of the following assumptions is required: normal distribution of data, and equal variances. The assumption of normality was addressed via Kolmogorov-Smirnov assessment due to the sample size. The *p*-value is determined by the Kolmogorov-Smirnov tests for normality of distribution. Levene's test of equality of error variance was conducted to address the Assumption of equal variance (Warner, 2013). The variance of the composite scores among each learning model will be compared to determine if the assumption of equal variance is tenable. Again, the *p*-value determined by the Levene's statistics was assessed to determine if the variance of composite scores in each learning model was different from the variance of composite scores in the population. The effect size was reported via the η_p^2 statistic. In keeping with Warner (2013) and Gall et al. (2007), the sample size of 150 is greater than 126 when assuming a medium effect size, 0.7 statistical power $\alpha = 0.05$. The null hypothesis will be rejected at the 95% confidence level.

CHAPTER FOUR: FINDINGS

Overview

The data, assumption testing, and results of this quantitative study are included in this chapter. Descriptive statistics for this study were analyzed between the three learning environments: traditional learning, blended learning, and virtual learning. The sample sizes for each model were $n = 50$ for traditional learning, $n = 48$ for blended learning, and $n = 43$ for virtual learning. Student performance was measured as a composite score of 7 categories across three learning models: traditional, blended, and virtual. A one-way analysis of variance (ANOVA) was conducted to determine potentially significant differences between models in student performance as measured by the FitnessGram® test.

Research Question

RQ: Is there a difference in student performance as measured by FitnessGram® scores among ninth-grade female physical education students who participate in an all-online learning instructional model, a blended learning instructional model, and a traditional face-to-face learning instructional model?

Null Hypothesis

H_0: There is no difference in student performance as measured by FitnessGram® scores among female ninth-grade physical education students who participate in an all online/virtual learning instructional model, a blended learning instructional model, and a traditional face-to-face learning instructional model.

Descriptive Statistics

For this study, ninth grade female students enrolled in two rural high schools in South Carolina were selected as participants. Their physical fitness performance was measured via the

FitnessGram® Test. Students' ages ranged from 13 to 15 years. The sample sizes for each model were: $n = 50$ for traditional learning, $n = 48$ for blended learning, and $n = 43$ for virtual learning. Student performance was measured as a composite score of 7 categories across 3 learning models: traditional, blended, and virtual. For traditional learning, the *M*= 5.3 and *SD*=0.2. For blended learning, *M*=5.8 and *SD*=0.2. For virtual learning, *M*=5.7 and *SD*=0.2. For the combined data, the *M*= 5.6 and *SD*=0.1.

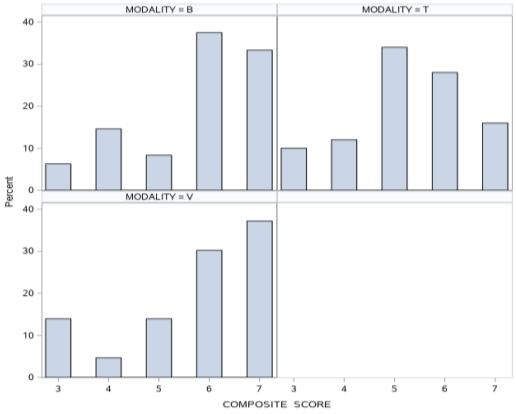
Results

Assumptions

The one-way ANOVA tests required assumptions of normality and equal variances tenability. The Kolmogorov-Smirnov test was conducted to test the assumption of normality. Levene's test for equality of variances was conducted to test the assumption of equal variances. The one-way ANOVA test is also not robust against outliers. After performing data screening, it was determined that the outlier was due to poor sampling and could be removed from the data set. This allows for the one-way ANOVA test to still run with fidelity.

Figure 1

Histograms of Composite Score by Model



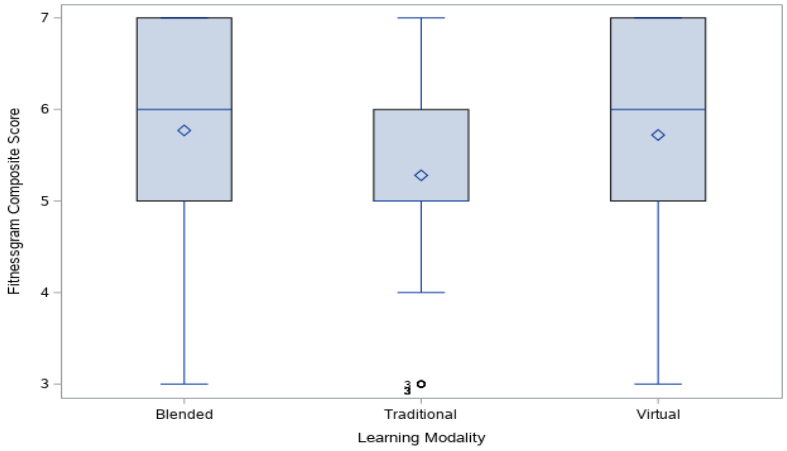
Note. Composite Score measured within each model: Virtual, Traditional, and Blended

Data screening included examining histograms of each data set for normality (Figure 1). The traditional model is roughly symmetric. However, the blended and virtual models both present a negative skew.

Mean comparison boxplots were constructed to determine if outliers were present in the data. The boxplots were generated to ascertain potential differences between the learning models. The boxplots indicated that only the traditional model dispersion presented outliers. The original boxplot showed an outlier in the traditional learning model (Figure 2).

Figure 2

Mean Comparison Boxplots for FitnessGram® Test by Learning Model

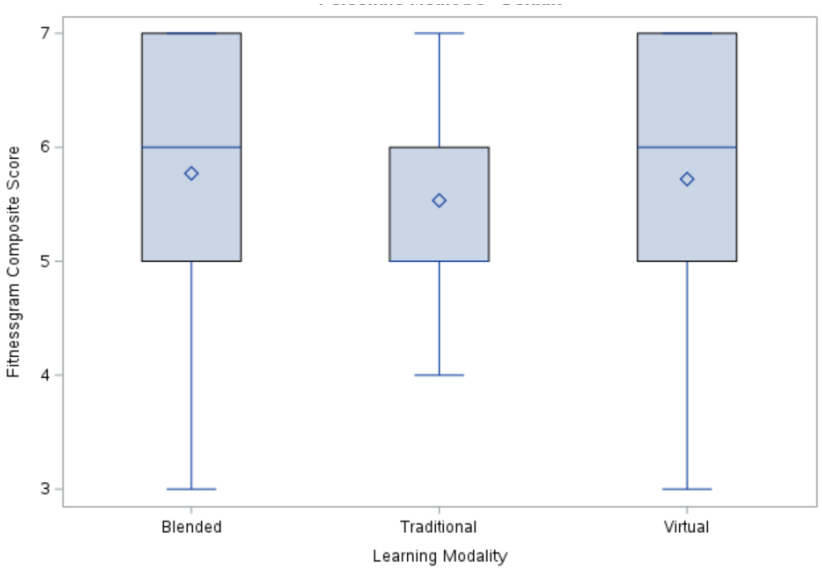


Upon further inspection, this student was absent during one of the testing days and could not make up the test. She scored 0 on that test, and her composite score was lower than it could have been. Therefore, her composite score was lower than her peers in the same class. Since this resulted from poor sampling, this outlier can be removed from the data set and the same analysis can be performed without that outlier present in the data. Figure 3 presents the same original data without outliers. These boxplots depict a similar mean value; however, the one-way ANOVA

test will be conducted to determine if the mean values are close enough to be considered to have "no difference" between them. The blended and virtual models show a nearly identical distribution, while the traditional model shows a higher minimum and slightly more variability within the composite scores.

Figure 3

Mean Comparison Boxplots for FitnessGram® Test by Learning Model without Outliers



Levene's test for equality of variances was conducted to test the assumption of equal variances. Levene's test for equality of variances was tenable based on this analysis, $F(2,138) = 0.80, p = 0.45$. (Table 1)

The Kolmogorov-Smirnov test was conducted to test the assumption of normality due to the large sample size ($n > 50$). The results of the Kolmogorov-Smirnov test for assumption of normality demonstrated the assumption of normality was violated.

Table 1

One-Way ANOVA - Assumption for Equal Variances

Source	*df*	Sum of Squares	Mean Square	*F*
Model	2	6.3603	3.1801	0.80
Error	138	546.3	3.9586	

However, the one-way ANOVA test is sufficiently robust against normality with large sample sizes since the Type I error rate remains close to the alpha in the event of violations (Gall et al., 2007). Table 2 depicts the results of the one-way ANOVA. These results indicated non-significance $F(2,138) = 2.22, p = 0.11, \eta^2 = 0.03$. The null hypothesis failed to be rejected, $\alpha = 0.05$.

Table 2

ANOVA Results

Source	*df*	Sum of Squares	Mean Square	*F*	η^2
Model	2	7.1017	3.5508	2.22	0.03
Error	138	221.2103	1.60297		
Corrected Total	140	228.312			

CHAPTER FIVE: CONCLUSIONS

Overview

This chapter summarizes the findings of this causal-comparative research. The implications of this research study and its limitations are identified. Prospects for future research are recommended. This study is consistent with previous research regarding blended and virtual learning models.

Discussion

This study investigates the difference in student FitnessGram® performance among ninth-grade female physical education students who received instruction via blended, virtual, and traditional models. Participants were randomly sampled from six ninth-grade female physical education classes within a rural South Carolina school district. There were 141 participants sampled, meeting the minimum required for a medium effect size. The six ninth-grade physical education classes were divided into groups labeled A, B, and C: Group A: traditional instructional model (n = 50); Group B: blended instructional model (n = 48); and Group C: virtual instructional model (n = 43). The independent variable is the learning model: traditional instructional model, blended instructional model, or virtual instructional model. The dependent variable is the composite score on the FitnessGram® measuring the five health-related fitness components: aerobic capacity, muscular endurance, muscular strength, flexibility, and body composition.

The research question provided the basis for investigating the difference in student performance measured by the FitnessGram® among ninth-grade female physical education students participating in traditional, blended, or virtual instructional learning models. The results of the one-way ANOVA indicated non-significance $F(2.22), p = 0.11, \eta^2 = 0.03$. The null

hypothesis failed to be rejected, $\alpha = 0.05$. The results suggest no significant difference in student performance as measured by FitnessGram® scores among female ninth-grade physical education students who participate in an all-online/virtual learning instructional model, a blended learning instructional model, and a traditional face-to-face learning instructional model. The effect size is small, which means that the independent variable models slightly affect the composite score of ninth-grade physical education students.

The literature is consistent with the correlation between physical activity and overall well-being. Evidence has indicated that K-12 physical education courses can effectively enhance physical activity by improving cardiorespiratory and muscular fitness and is associated with enhancing physiological, developmental, cognitive function, and social health benefits in children (Kliziene et al., 2021). The frequency of physical activity positively relates to better health outcomes, positively correlating with overall well-being. (Fromel et al., 2022; Kliziene et al., 2021; Li et al., 2022). Consequently, the COVID-19 pandemic underscored the importance of physical activity and the overall well-being of the individuals whose lives were disrupted by the virus. Irrespective of K-12 school reliance on hybrid, online, or restricted traditional learning as a response to the pandemic, physical activity, and physical education activities were vital, providing a well-rounded education and the opportunity to improve health outcomes for all students.

The rapid transition from traditional learning environments to virtual learning environments caused many obstacles for educators. With minimum training, educators transformed their curriculum to suit the virtual, hybrid or restricted traditional environment. Physical education teachers were no exception to this transition; however, due to the

instructional psychomotor domain of learning, additional challenges were presented in the execution of physical movement, coordination, and motor-skill development.

The virtual curriculum design and pedagogy affect the parallel between virtual physical education learning environments and traditional learning environments regarding student performance. Virtual learning environments must continue providing learning opportunities related to the psychomotor, cognitive, and affective learning domains to indicate good physical education (Killian et al., 2019). The virtual curriculum must provide for purposeful physical education by developing skills, knowledge, and attitudes required to engage in lifetime physical activity, which, in turn, provides for a more positive physical education experience (Murfay et al., 2022). Quality physical education provides opportunities for students to improve their health-related fitness by improving or maintaining adequate levels of physical activity. Therefore, it is essential for virtual learning curriculums to include FitnessGram® testing as an approach to assess physical fitness in the school-based environment.

Virtual learning environments allow students to develop cognitive independence. At the high school level, research indicates that physical education students are more likely to report experiencing an enjoyable experience when the instructor adopts a more autonomy-supportive teaching style (Murfay et al., 2022). An autonomy-supportive teaching style provides structure and an interactive dialogic approach between teacher and students where there is a collaborative and purposeful expectation for instruction (Yang et al., 2022). Grounded and supported by the self-determination theory, research indicates that when high school students are encouraged to activate greater cognitive independence through autonomy-supportive teaching strategies, students tend to develop more vital life skills such as self-discipline, accountability, perseverance, and determination, by comprising tasks on the topic, using numerous sources of

information through search and investigation, process information, and formulate messages on the topic (Kayrgozhin et al., 2022; Yang et al., 2022).

Both blended and virtual learning models provide an adequate alternative to traditional learning models and indicate no statistical difference in student performance among the learning models (Barbour, 2019; Finlay et al., 2022; Iuliano et al., 2021). According to Iuliano et al. (2021), virtual learning models present as an adequate compromise to the traditional learning models during the COVID-19 pandemic; however, concerning the acquisition of performance skills, traditional learning models were preferred by students. Virtual learning models also present an adequate alternative to traditional settings due to convenient and accessible resources via digital media, allowing teaching to be in segmented modules and the opportunity for providing instant feedback (Ashour, 2020). Therefore, an educational approach that provides learning opportunities that address psychomotor, cognitive, and affective learning domains offers a more purposeful physical education experience rather than solely addressing fitness themes (Cruickshank et al., 2022; Cruickshank et al., 2021).

In recent research, Finlay et al. (2022) examined experiences and perceptions of virtual and blended learning models in university sports science courses. They found that although there were no reported differences between blended and virtual learning experiences, participants experienced more favorable perceptions of blended learning over traditional and virtual learning models. Block et al. (2006) found that virtual learning was an acceptable and adequate compromise to traditional learning methods when measuring achievement. Melton et al. (2009) demonstrated that blended learning models were acceptable and preferred over traditional models in general health courses. This preference for blended learning could have alluded to higher cognitive processes promoted by student-centered learning approaches by providing more

flexible interaction and learning support (Manca & Ranieri, 2016; Wang et al., 2022). Prior research indicates that blended learning is a preferred learning model for students, and this current study indicates no significant difference in performance for blended, virtual, or traditional learning models. Therefore, blended and virtual learning models can be considered acceptable and adequate alternatives to traditional learning models. While blended is a preferable choice for students, this study indicates that performance will not be affected in blended or virtual learning models.

Implications

Although evidence exists that overall student achievement was affected by COVID-19 regardless of the learning model, the application of digital technologies in education has inevitably advanced because of the COVID-19 pandemic (Fisher et al., 2022; Francom et al., 2021; Shamir-Inbal & Blau, 2021). While blended learning models permit teachers to employ various instructional strategies, blended and virtual learning models are successful depending on the teacher, student, and instructional approaches (Barbour, 2019; DiFancesca & Spencer, 2022; Fischer et al., 2022). While digital technology trends are expanding exponentially in K-12 settings, the K-12 physical education literature still requires expansion. Virtual physical education environments tend to present a limited focus on the dominant psychomotor learning domain (Yu & Ha, 2021). Considering that more than half the states in America allow students to earn physical education graduation credits through online courses, it is essential that the learning outcomes in the virtual physical education environment closely mirror the traditional physical education environment to enforce high-quality physical education that provides learning opportunities through appropriate instruction, presenting meaningful and challenging content, and student and program assessment (SHAPE America, 2016). In response to the COVID-19

pandemic, the Cooper Institute released the online FitnessGram® learning modules that can be incorporated into blended and virtual learning models. The quality of content delivery in physical education courses can be improved through professional development opportunities. More professional development opportunities for physical education instructors during teacher in-service days are necessary for equipping physical educators with professional methods for delivering effective physical education content in a virtual environment. State physical education organizations equip members with professional instructional webinars, conferences, and workshops devoted to making resources accessible for quality content delivery.

To mirror traditional physical education environments, students must provide evidence of physical activity in synchronous and asynchronous virtual physical education environments. Today's students have smartphones or smart watches that can deliver free fitness tracking applications such as Map My Run or My Walk by Under Armour®, enabling a person to track aerobic exercise with a built-in GPS. This information can be uploaded as a physical activity assessment measuring distance, duration, and pace. Implementing a fitness tracking application is an accessible way to provide evidence of student physical activity performance within the virtual learning environment. Also, per the comprehensive school physical activity program framework (CSPAP) guidance, the best practices for implementing a comprehensive physical activity program are incorporating family and community engagement in the virtual physical education curriculum design. Connecting parental and community involvement concurrently enhanced physical education learning outcomes and physical activity participation by creating physical activity opportunities within the community, such as community hikes, 5K running competitions, or kayaking competitions (Webster et al., 2021).

Physical education teacher education programs can no longer limit their instructional methods to traditional learning environments. However, they must include instructional delivery methods for blended and virtual physical education environments to close the gap between traditional learning methods and 21st-century education. To be well-prepared, 21st-century physical education teachers must be proficient in blended and virtual curriculum design and understand how to create an information-rich environment using multiple learning platforms (Chang & Reekie, 2021; Webster et al., 2021). There is no uniform learning management system for K-12 public schools in the United States. Therefore, to effectively establish a virtual physical education curriculum, virtual physical education teachers must understand how to navigate multiple learning management systems (i.e., Canvas, Google Classroom, and Blackboard), understand how to promote practical fitness tracking applications such as Map My Run or Apple fitness tracking technology, provide practical feedback promptly, and learn how to deliver curriculum both synchronous and asynchronous virtual physical education environments.

Physical education teachers must understand the in-depth planning, organization, and communication skills required to implement synchronous and asynchronous virtual physical education environments considering the course has yet to be developed in the learning management system (Phelps et al., 2022). To assist physical educators with planning, organization, and communication in a curriculum that profoundly relies on student performance in the psychomotor learning domain, SHAPE America (2020), released practical strategies for instructors to develop connections, assess curriculum, communicate expectations, implement consistency, and provide accessible content for all learners. Practical strategies should include content focusing on social-emotional learning, various levels of physical activity, family physical activities, choice-based activities, measurable fitness logs, outdoor pursuits, activity swaps with

peers, and creating a fitness or dance routine (SHAPE America, 2020). Most importantly, the virtual physical education environment must continue to promote a quality physical education experience for students that prepares students with confidence and skills to live a lifetime of physical fitness.

It is essential to recognize the students that may find a virtual physical education environment more suitable to their needs. Students with disabilities who would typically not experience success in traditional physical education classrooms but can navigate technology can benefit from a virtual physical education environment. These students can experience a safer movement space and self-navigate the course at a suitable pace (Black et al., 2022; Fernandez et al., 2016; Webster et al., 2021). However, these students must have the necessary resources to maintain access to high-speed internet, a mobile fitness tracking device, and support from a partner willing to record skill-related content (Chang & Reekie, 2021). Additionally, virtual physical education may also benefit students with debilitating socio-emotional anxiety. Flick et al. (2022) confirmed that social anxiety and negative self-esteem positively correlate to peer victimization. Traditional physical education pedagogy uniquely addresses the psychomotor domain of learning, subjecting students to perform or test physical skills in the presence of others and eliciting a social environment with more significant peer interaction (Flick et al., 2022). Inadvertently, the traditional physical education setting can foster social anxiety and amplify students' sense of social self-consciousness, which is a result of variability in maturation rates and the need for peer acceptance (Cox et al., 2011; Cox et al., 2013; Flick et al., 2022; Simonton et al., 2022). Unfortunately, there is a connection between peer victimization and increased depression and adolescent suicide attempts (Alabi, 2022; Mahumud, 2022). Virtual physical education learning environments can support a caring and individualized learning environment,

improving students' socioemotional climate and fostering more engagement in physical activity (Simonton et al., 2022).

Limitations

Even though causal-comparative research was the appropriate design for this study, there were inherent limitations. The design only included female high school physical education students enrolled in one small school district in a rural community. Therefore, the results cannot be generalized to the entire population. Another limitation of the research was time and resources. To maintain fidelity among learning models, instructors were limited to collecting data on students at one distinct moment and could only collect data once per semester. Collecting data at one moment limits the number of participants that can be selected for the study. For this study, collecting data only once per semester is a time limitation. To obtain a sufficient participants, data will need to be collected over multiple semesters, prolonging the time needed to complete the study. The circumstance warranted two semesters to achieve the appropriate number of sample participants. In a more prominent school district, with more available freshmen-level physical education classes, data could be collected in one semester while obtaining an appropriate number of participants to conduct the study.

Consequently, the small sample size led to a limitation of the violation of the assumption of normality. The Kolmogorov-Smirnov test produced significant results violating the assumption of normality, considering several outliers were also present in the original data. The one-way ANOVA is robust against assumption violations for large sample sizes, so the study could still provide valid results. However, larger sample size could rectify this issue. Given adequate time, more participants could be included, thus producing results that meet the assumption of normality.

Another limitation of the research was the student effort when performing the FitnessGram® test. There are several reasons why students may not have performed their best on the FitnessGram® test. Considering the hormonal adolescent female population, the unstable emotional climate was a working factor in student performance, especially considering that females have considerably lower levels of engagement than males (Gairns et al., 2015). Some students may not like participating in physical activity and choose not to perform to the best of their ability. Some students may not have felt well and been able to perform at the same level if they were well. Finally, some students may have experienced an emotionally taxing day, which could have affected their performance. Ensuring optimal performance when administering the test is impossible; however, one solution would include administering the Fitnessgram® test several times throughout the semester. This factor could demonstrate results throughout the semester and provide students multiple opportunities to improve their scores.

Recommendations for Future Research

Continuous research is necessary for investigating the effects of virtual physical education learning models' impact on student performance measured by the FitnessGram®. There is a need to investigate the population of students that will benefit from a virtual physical education environment instead of a traditional physical education environment. The following are recommendations for future research:

1. To best familiarize students with the FitnessGram® test, students and teachers can measure longitudinal performance by administering a pre-test and a mid-evaluation before the final FitnessGram® evaluation. Future research should include administering the test multiple times throughout the semester to measure

the effect better. Consequently, this will provide optimal performance scores on the FitnessGram® test.

2. Future research should investigate how males, as compared to females, perform across the three learning models. While many studies exist on gender barriers in physical education, males tend to enjoy a more positive experience with physical education (Bass, 2010; Cox et al., 2011; Cox et al., 2013; Gairns et al., 2015). Therefore, males may score higher than females on the FitnessGram®.
3. A qualitative research study can add to the literature to address high school students that benefit most from a virtual physical education opportunity as opposed to students that would not benefit from virtual physical education. A survey can identify students who may benefit from virtual versus traditional learning models. Mental and emotional health is an expanding concern for high school educators. Concerns regarding body image are more prevalent in a physical education classroom than in a traditional academic classroom (Alabi, 2022; Flick et al., 2022).
4. The study was conducted in one small, rural school district, so further research should be conducted across various geographical locations in the United States. Consequently, increasing the population size could rectify violated assumptions.

In conclusion, future research should consider a state-wide longitudinal study on how different learning models affect student performance on the FitnessGram®. Future research should focus on designing and implementing virtual and blended learning approaches. A qualitative study could explore the advantages and disadvantages of the virtual socioemotional climate and ensure the effectiveness of learning outcomes in physical education.

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Appendix A

Dear Frances Caulder, Steven McDonald,

The Liberty University Institutional Review Board (IRB) has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and no further IRB oversight is required.

Your study falls under the following exemption category, which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:104(d):

(ii) Information, which may include information about biospecimens, is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained directly or through identifiers linked to the subjects, the investigator does not contact the subjects, and the investigator will not re-identify subjects;

Please note that this exemption only applies to your current research application, and any modifications to your protocol must be reported to the Liberty University IRB for verification of continued exemption status. You may report these changes by completing a modification submission through your Cayuse IRB account.

If you have any questions about this exemption or need assistance in determining whether possible modifications to your protocol would change your exemption status, please email us at irb@liberty.edu.

Sincerely,
G. Michele Baker, MA, CIP
Administrative Chair of Institutional Research
Research Ethics Office

Appendix B

Dear Frances,

Your application to conduct research in the School District of Oconee County has been approved. You must complete all research activities by June 30, 2023. You will need to request an extension from the Director of Applied Data if you need to continue research activities beyond that date. Please remember the district reserves the right to terminate the study at any time if circumstances change or the district administration feels it is in the best interest of our students, their families, or staff.

Principals always have final approval of all research activity conducted on their campus and may deny permission to conduct research even if the proposal has been approved by the district. The principals of the schools involved have been copied on this letter. You may contact them directly to determine if they are willing to let you conduct your research.

Please remember that participation in research activities by district employees is always voluntary and at their own discretion. Finally, you must submit a copy of all final reports, dissertations, or publications based on this research to me upon completion of your study.

Respectfully,

John G. Arnold, Ph.D.

Director of Applied Data

Cc: Brandon Blackwell,
Principal West-Oak High
School

Appendix C

Physical Education Lesson Plans

Traditional Physical Education Lesson Plans

Traditional Physical Education: Day 1	Title: Introduction to the Fitnessgram®

Standard of Learning	Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance. Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness. • HS.N.3.3: Strive to achieve the specific age and gender-specific, health-related fitness standards while participating in a health-related fitness assessment. • HS.N.3.4: Identify personal health-related fitness goals and implement a plan to achieve and/or maintain personal fitness.
Goal	Students will understand the purpose of incorporating and maintaining health-related fitness in their lives.
Prerequisite	Prior knowledge of the FITT principle, Principle of Progression, Use it or Lose it Principle
Task 1	Teacher Lecture in the Classroom • The importance of health-related fitness. • What is the purpose of the Fitnessgram®? • How can I include health-related fitness in my daily life?
Task 2	• On the overhead, show the class the Standards for Healthy Fitness Zone for their gender and age group. • Discuss the difference between Healthy Fitness Zone, Needs Improvement, and At-Risk
Assessment	• Create health-related fitness goals and detail what this goal is targeted to improve • Explain why it is important to include health-related fitness skills in a workout and the importance of monitoring your progress. • Map out each Fitness Component addressed in the FitnessGram® and label the passing criteria for that component to meet the Healthy Fitness Zone

Traditional Physical Education: Day 2	Title: Muscular Endurance & Muscular Strength

Standard of Learning	Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance. • HS.N.2.1: Identify the critical elements and learning cues of skills performed. Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness. • HS.N.3.3: Strive to achieve the specific age and gender-specific, health-related fitness standards while participating in a health-related fitness assessment. • HS.N.3.4: Identify personal health-related fitness goals and implement a plan to achieve and/or maintain personal fitness.
Goal	Students will be able to perform a curl-up with efficient technique and understand how this health-related fitness skill improves muscular endurance.
Task 1	Model and Perform Curl-ups, Model and Perform Push ups
Task 2	Explore other core exercises that promote muscular endurance that are modified from the curl-up. Explore other upper body exercises that promote muscular strength that are modified from the push-up.
Task 3	Design and perform a workout using the health-related fitness skills that addresses the FITT principle.
Assessment	# 1 On paper, list the cues for performing the health-related fitness skill. List the prominent errors when performing the health-related fitness skill. • Peer Assessment: Provide feedback for a classmate while you observe each other's health-related fitness skill. • Teacher Visual Assessment: Execute the health-related fitness skill. #2 With a partner, analyze each other's workout created from Task 3 and decide which exercises you will perform as part of your daily workout. Perform your workout when you have created a "new" workout together that emphasizes muscular endurance and muscular strength.

Traditional Physical Education: Day 3	Title: Aerobic Capacity

Standard of Learning	Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance. • HS.N.2.1: Identify the critical elements and learning cues of skills performed. Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness. • HS.N.3.3: Strive to achieve the specific age and gender-specific, health-related fitness standards while participating in a health-related fitness assessment. • HS.N.3.4: Identify personal health-related fitness goals and implement a plan to achieve and/or maintain personal fitness.
Goal	Students will be able to understand the meaning of aerobic capacity and how this health-related fitness skill improves cardiorespiratory fitness.
Task 1	Teacher Lecture on the correlation between aerobic capacity and cardiorespiratory fitness
Task 2	Explore various types of cardiorespiratory exercises: Walking, jogging, HIIT workouts, step climbing, jumping rope
Task 3	Design a workout using the health-related fitness skills that addresses the FITT principle.
Assessment	• Student Assessment: Student's will assess their current cardiorespiratory fitness level by performing a 16 minute and 30s Walk Jog test for beginners using the Tabata clock. 1:30s of walking: 45s of jogging.

Traditional Physical Education: Day 4	Title: Flexibility

Standard of Learning	Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance. • HS.N.2.1: Identify the critical elements and learning cues of skills performed. Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness. • HS.N.3.3: Strive to achieve the specific age and gender-specific, health-related fitness standards while participating in a health-related fitness assessment. • HS.N.3.4: Identify personal health-related fitness goals and implement a plan to achieve and/or maintain personal fitness.
Goal	Students will be able to understand the health benefits of flexibility and explore various flexibility exercise movement skills.
Task 1	Teacher led discussion on the benefits of increasing one's flexibility. Discuss the difference between static stretches and dynamic stretches.
Task 2	Explore yoga and Pilates movements and provide time for students to practice.
Task 3	Create a warm-up using dynamic stretches and a cool-down that utilizes static stretches.
Assessment	• Peer Assessment: Share and perform 3 exercises that focus on flexibility with a partner. Provide partner feedback on the exercises that produced the best results. Prepare to share with the class.

Traditional Physical Education: Day 5-7	Title: Health-Related Fitness Workouts

Standard of Learning	Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance. • HS.N.2.1: Identify the critical elements and learning cues of skills performed. Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness. • HS.N.3.3: Strive to achieve the specific age and gender-specific, health-related fitness standards while participating in a health-related fitness assessment. • HS.N.3.4: Identify personal health-related fitness goals and implement a plan to achieve and/or maintain personal fitness.
Goal	Students will analyze their health-related fitness skill workouts they individually designed and create a maximum of three different workouts utilizing each health-related fitness skill addressing the FITT principle.
Task 1	Warm-up
Task 2	Perform student design health-related fitness skill workout designed using the FITT principle.
Task 3	Cool-down
Assessment	• Day 5: Self-Assessment- exercise reflection to include what you liked most, what you liked least, and something you will change. • Day 6: Share your workout with a friend, decide whose workout you will perform, and critique it at the end of the lesson. • Day 7: Share your workout with a group of no more than 4, decide whose workout you will perform, and critique it at the end of the lesson.

Blended Physical Education Lesson Plans

Canvas Course

Blended Physical Education: Day 1	Title: Introduction to the Fitnessgram®

Standard of Learning	Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance. Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness. • HS.N.3.3: Strive to achieve the specific age and gender-specific, health-related fitness standards while participating in a health-related fitness assessment. • HS.N.3.4: Identify personal health-related fitness goals and implement a plan to achieve and/or maintain personal fitness.
Goal	Students will understand the purpose of incorporating and maintaining health-related fitness in their lives.
Prerequisite	Prior knowledge of the FITT principle, Principle of Progression, Use it or Lose it Principle
Task 1	The importance of health-related fitness. VIDEO1 • What is the purpose of the Fitnessgram®? • How can I include health-related fitness in my daily life?
Task 2	• Watch Video 2 • Standards for Healthy Fitness Zone for their gender and age group Healthy Fitness Zone Chart • Discuss the difference between Healthy Fitness Zone, Needs Improvement, and At-Risk
Assessment	Create a chart using Google Docs or Google Sheets: • Listing personal health-related fitness goals and explain what this goal is targeted to improve. • Explain why it is important to include health-related fitness skills in a workout and the importance of monitoring your progress. • Map out each Fitness Component addressed in the FitnessGram® and label the passing criteria for that component to meet the Healthy Fitness Zone

Blended Physical Education: Day 2	Title: Muscular Endurance & Muscular Strength

Standard of Learning	Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance. • HS.N.2.1: Identify the critical elements and learning cues of skills performed. Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness. • HS.N.3.3: Strive to achieve the specific age and gender-specific, health-related fitness standards while participating in a health-related fitness assessment. • HS.N.3.4: Identify personal health-related fitness goals and implement a plan to achieve and/or maintain personal fitness.
Goal	Students will be able to perform a curl-up with efficient technique and understand how this health-related fitness skill improves muscular endurance.
Task 1	Watch Video: Muscular Strength & Muscular Endurance Model and Perform Curl-ups, Model and Perform Push ups
Task 2	Using Youtube, explore other core exercises that promote muscular endurance that are modified from the curl-up. Explore other upper body exercises that promote muscular strength that are modified from the push-up.
Task 3	Design a workout using the health-related fitness skills that addresses the FITT principle. (Include new core exercises you discovered using the internet.)
Assessment	#1 Watch the first 2 minutes of the Curl-up Video and Push-up Video Using your Chromebook video camera, record your curl-up and push-up performance. Watch your video and analyze what was done right? Were there errors? What can be improved? • Teacher Visual Assessment: Execute the health-related fitness skill. #2 With a partner, analyze each other's workout created from Task 3 and decide which exercises you will perform as part of your daily workout. Perform your workout when you have created a "new" workout together that emphasizes muscular endurance and muscular strength.

Blended Physical Education: Day 3	Title: Aerobic Capacity

Standard of Learning	Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance. • HS.N.2.1: Identify the critical elements and learning cues of skills performed. Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness. • HS.N.3.3: Strive to achieve the specific age and gender-specific, health-related fitness standards while participating in a health-related fitness assessment. • HS.N.3.4: Identify personal health-related fitness goals and implement a plan to achieve and/or maintain personal fitness.
Goal	Students will be able to understand the meaning of aerobic capacity and how this health-related fitness skill improves cardiorespiratory fitness.
Task 1	Aerobic Capacity Video Understanding aerobic capacity
Task 2	Explore various types Beginner HIIT workouts using youtube. Make a list of all the exercises your like and briefly describe them in a google doc.
Task 3	Design a workout using the health-related fitness skills that addresses the FITT principle. The recommended guidelines are found at ACSM Guidelines for Cardiorespiratory Training
Assessment	#1 Student Assessment: Student's will assess their current cardiorespiratory fitness level by performing a 16 minute and 30s Walk Jog test for beginners using the Tabata clock. Teacher will blow the whistle to signify the start of 1:30s of walking: 45s of jogging for the total time. #2 Using YouTube, Perform 10 minutes of a beginner's HIIT workout with a group of no more than 4. Submit an exercise reflection on what you like most about this exercise and what health benefits does this type of exercise promote?

Blended Physical Education: Day 4	Title: Flexibility

Standard of Learning	Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance. • HS.N.2.1: Identify the critical elements and learning cues of skills performed. Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness. • HS.N.3.3: Strive to achieve the specific age and gender-specific, health-related fitness standards while participating in a health-related fitness assessment. • HS.N.3.4: Identify personal health-related fitness goals and implement a plan to achieve and/or maintain personal fitness.
Goal	Students will be able to understand the health benefits of flexibility and explore various flexibility exercise movement skills.
Task 1	Watch The Importance of Flexibility Video.
Task 2	Using the internet, YouTube yoga and Pilates movements and provide time for students to practice.
Task 3	Watch Static vs Dynamic Stretching: Which is Better? (Evidence-Based) Create a warm-up using dynamic stretches and a cool-down that utilizes static stretches.
Assessment	• Peer Assessment: Share and perform 3 exercises that focus on flexibility with a partner. Provide partner feedback on the exercises that produced the best results. Prepare to share with the class.

Blended Physical Education: Day 5-7	Title: Health-Related Fitness Workouts

Standard of Learning	Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance. • HS.N.2.1: Identify the critical elements and learning cues of skills performed. Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness. • HS.N.3.3: Strive to achieve the specific age and gender-specific, health-related fitness standards while participating in a health-related fitness assessment. • HS.N.3.4: Identify personal health-related fitness goals and implement a plan to achieve and/or maintain personal fitness.
Goal	Students will analyze their health-related fitness skill workouts they individually designed and create a maximum of three different workouts utilizing each health-related fitness skill addressing the FITT principle.
Task 1	Warm-up: you can use YouTube to search for dynamic warm-ups.
Task 2	Perform student design health-related fitness skill workout designed using the FITT principle. Exercises can be searched and modified using the internet.
Task 3	Cool-down: you can use the internet to search for static stretches
Assessment	• Day 5: Self-Assessment- exercise reflection to include what you liked most, what you liked least, and something you will change • Day 6: Share your workout with a friend, decide whose workout you will perform, and critique it at the end of the lesson. • Day 7: Share your workout with a group of no more than 4, decide whose workout you will perform, and critique it at the end of the lesson.

Virtual Physical Education Lesson Plans

Canvas Course

Virtual Physical Education: Day 1	Title: Introduction to the Fitnessgram®

Standard of Learning	Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance. Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness. • HS.N.3.3: Strive to achieve the specific age and gender-specific, health-related fitness standards while participating in a health-related fitness assessment. • HS.N.3.4: Identify personal health-related fitness goals and implement a plan to achieve and/or maintain personal fitness.
Goal	Students will understand the purpose of incorporating and maintaining health-related fitness in their lives.
Prerequisite	Prior knowledge of the FITT principle, Principle of Progression, Use it or Lose it Principle
Task 1	The importance of health-related fitness. VIDEO1 • What is the purpose of the Fitnessgram®? • How can I include health-related fitness in my daily life?
Task 2	• Watch Video 2 • Standards for Healthy Fitness Zone for their gender and age group Healthy Fitness Zone Chart • Discuss the difference between Healthy Fitness Zone, Needs Improvement, and At-Risk
Assessment	Create a chart using Google Docs or Google Sheets: • Listing personal health-related fitness goals and explain what this goal is targeted to improve • Explain why it is important to include health-related fitness skills in a workout and the importance of monitoring your progress. • Map out each Fitness Component addressed in the FitnessGram® and label the passing criteria for that component to meet the Healthy Fitness Zone

Virtual Physical Education: Day 2	Title: Muscular Endurance & Muscular Strength

Standard of Learning	Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance. • HS.N.2.1: Identify the critical elements and learning cues of skills performed. Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness. • HS.N.3.3: Strive to achieve the specific age and gender-specific, health-related fitness standards while participating in a health-related fitness assessment. • HS.N.3.4: Identify personal health-related fitness goals and implement a plan to achieve and/or maintain personal fitness.
Goal	Students will be able to perform a curl-up with efficient technique and understand how this health-related fitness skill improves muscular endurance.
Task 1	Watch Video: Muscular Strength & Muscular Endurance Model and Perform Curl-ups, Model and Perform Push ups
Task 2	Using Youtube, explore other core exercises that promote muscular endurance that are modified from the curl-up. Explore other upper body exercises that promote muscular strength that are modified from the push-up.
Task 3	Design a workout using the health-related fitness skills that addresses the FITT principle. (Include new core exercises you discovered using the internet.)
Assessment	#1 Watch the first 2 minutes of the Curl-up Video and Push-up Video Using your Chromebook video camera, record your curl-up and push-up performance. Watch your video and analyze what was done right? Were there errors? What can be improved? • Teacher Visual Assessment: Record the health-related fitness skill and submit to canvas for teacher critique. #2 Share your google workout design with a classmate and analyze each other's workout created from Task 3 and provide feedback stating which exercises you like, which exercise looks the most difficult, and make 2 suggestions to their design. #3Record and Perform your workout with the new suggestions from a classmate emphasizing muscular endurance and muscular strength.

Virtual Physical Education: Day 3	Title: Aerobic Capacity

Standard of Learning	Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance. • HS.N.2.1: Identify the critical elements and learning cues of skills performed. Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness. • HS.N.3.3: Strive to achieve the specific age and gender-specific, health-related fitness standards while participating in a health-related fitness assessment. • HS.N.3.4: Identify personal health-related fitness goals and implement a plan to achieve and/or maintain personal fitness.
Goal	Students will be able to understand the meaning of aerobic capacity and how this health-related fitness skill improves cardiorespiratory fitness.
Task 1	Aerobic Capacity Video Understanding aerobic capacity
Task 2	Explore various types of Beginner HIIT workouts using YouTube. Make a list of all the exercises your like and briefly describe them in a google doc.
Task 3	Design a workout using the health-related fitness skills that addresses the FITT principle. The recommended guidelines are found at ACSM Guidelines for Cardiorespiratory Training
Assessment	#1 Student Assessment: Student's will assess their current cardiorespiratory fitness level by uploading the TimerPro App to their smart phone and performing a 16 minute and 30s Walk /Jog test for beginners using the Tabata clock. Students will on their own use this app to signify the start of 1:30s of walking: 45s of jogging for the total time. Students will write a 7 sentence reflection assessing their cardiorespiratory fitness level and how they can improve it. They must include health benefits for maintaining a healthy cardiorespiratory fitness level. #2 Using Youtube, Perform 10 minutes of a beginner's HIIT workout with a group of no more than 4. Submit an exercise reflection on what you like most about this exercise and what health benefits does this type of exercise promote? Record your performance and submit it to canvas.

Virtual Physical Education: Day 4	Title: Flexibility

Standard of Learning	Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance. • HS.N.2.1: Identify the critical elements and learning cues of skills performed. Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness. • HS.N.3.3: Strive to achieve the specific age and gender-specific, health-related fitness standards while participating in a health-related fitness assessment. • HS.N.3.4: Identify personal health-related fitness goals and implement a plan to achieve and/or maintain personal fitness.
Goal	Students will be able to understand the health benefits of flexibility and explore various flexibility exercise movement skills.
Task 1	Watch The Importance of Flexibility Video.
Task 2	Using the internet, YouTube yoga and Pilates movements and provide time for students to practice.
Task 3	Watch Static vs Dynamic Stretching: Which is Better? (Evidence-Based) Create a warm-up using dynamic stretches and a cool-down that utilizes static stretches.
Assessment	• Peer Assessment: Record your performance of 5 exercises that focus on flexibility. Holding each exercise for 10 seconds.

Virtual Physical Education: Day 5-7	Title: Health-Related Fitness Workouts

Standard of Learning	Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance. • HS.N.2.1: Identify the critical elements and learning cues of skills performed. Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness. • HS.N.3.3: Strive to achieve the specific age and gender-specific, health-related fitness standards while participating in a health-related fitness assessment. • HS.N.3.4: Identify personal health-related fitness goals and implement a plan to achieve and/or maintain personal fitness.
Goal	Students will analyze their health-related fitness skill workouts they individually designed and create a maximum of three different workouts utilizing each health-related fitness skill addressing the FITT principle.
Task 1	Warm-up: you can use YouTube to search for dynamic warm-ups.
Task 2	Perform student design health-related fitness skill workout designed using the FITT principle. Exercises can be searched and modified using the internet.
Task 3	Cool-down: you can use the internet to search for static stretches
Assessment	• Day 5: Self-Assessment- Record your exercise workout. Include an exercise reflection including what you liked most, what you liked least, and something you will change. • Day 6: Share your workout with a classmate, decide whose workout you will perform, and critique it at the end of the lesson: what was best, what can be improved, new suggestions. • Day 7: Create a new workout including all health-related fitness skills. Record your performance and write a reflection on why this workout benefits your health-related fitness skills and how you explain the benefits of including this workout in a weekly routine.

Appendix D

FITNESSGRAM® Testing Errors

(The Cooper Institute, 2007)

The PACER (Progressive Aerobic Cardiovascular Endurance Run) Test

- Student fails to reach the line before the beep for the second time.

PACER Test Healthy Fitness Zones

Girls Age Range

13	23-51
14	23-51
15	32-51
16	32-61
17	41-61

Curl-up Test

Form errors include:

- heels lifting up off the surface
- not getting the back off the surface
- head and back not returning to the surface
- inability to maintain the proper pace.

After the first form error, students will get a chance to make the correction. After the second form error the test is concluded.

Curl –up Test Healthy Fitness Zones

Girls	Age	Range
	13	18-32
	14	18-32
	15	18-35
	16	18-35
	17	18-35

Push-Up Test

Form errors include:

- not achieving 90 degrees
- not maintaining the proper pace
- not maintaining the correct straight back body position,
- not extending arms fully enough
- touching the body to the surface

After the first form error students get the opportunity to make the correction.
After the second form error the test is concluded. Push-Up Test Healthy Fitness Zones

Girls	Age	Range
	13	7-15
	14	7-15
	15	7-15
	16	7-15
	17	7-15

Sit and Reach Test

Form errors include:

- not reaching forward evenly
- not keeping the fingertips even,
- knee of the leg being tested comes up
- If there is a form error the student is allowed 3 attempts.

Sit and Reach Test Healthy Fitness Zones

Girls	Age	Range
	13	10-12”
	14	10-12”
	15	12+”
	16	12+”
	17	12+”

Trunk Lift Test

Form errors include:

- not keeping the eyes down on the mat/fixed object and having the feet come off the mat
- ballistic movements

If a form error occurs, the student is allowed 3 attempts.

Girls	Age	Range
	13	9-12”
	14	9-12”
	15	9-12”
	16	9-12”
	17	9-12”

Body Composition Test

- Fitnessgram® Software calculates BMI by student’s height and weight.

Body Composition Healthy Fitness Zones

Girls	Age	Range
	13	24.5-14.9%
	14	25-15.4%
	15	25-16%
	16	25-16.4%
	17	26-16.8%

Appendix E

FITNESSGRAM TEST RUBRIC

SKILLS	ACHIEVED HFZ	DID NOT ACHIEVE HFZ
20 M PACER TEST		
CURL-UP TEST		
PUSH-UP TEST		
TRUNK LIFT		
SIT AND REACH TEST (LEFT)		
SIT AND REACH TEST (RIGHT)		

- The test stops when the participant can no longer continue.
- The test stops when 2 errors occur for the given test.

Appendix F

Fitnessgram® Class Score Sheet

Class Score Sheet

Teacher: ________________________ Class: ____________________ Test Date: __________

Student	AGE	HT	WT	PACER	CURL-UP	PUSH-UP	SIT-N-REACH (LEFT)	SIT-N-REACH (RIGHT)	TRUNK LIFT

Appendix G

Permission to use FitnessGam® Data

FitnessGram® Privacy Policy

Updated January 26, 2018

I. Introduction

The FitnessGram® Software ("FitnessGram® Software"), a fitness education assessment program software that we include as part of the Services, including any applications, is owned and operated by The Cooper Institute® ("The Cooper Institute®," "we" or "our"). This Privacy Policy ("Policy") includes the following defined terms, in addition to other capitalized words in the Policy:

> "Customer" or "you" means School Districts, State Educational Agencies, students (including Children), and Parents who access data using the FitnessGram® Software under the FitnessGram Hosting Terms of Use, which is available at https://myhealthyzone.fitnessgram.net ("FitnessGram® TOU").
>
> "Child" or "Children" means a child or children under the age of 13.
>
> "FitnessGram® Software" means, collectively, all of the present and future FitnessGram® Software packages or programs including, without limitation, FitnessGram®, MyHealthyZone™, ActivityGram®, Healthy Fitness Zone®, and ActivityLog, and their related components. The FitnessGram® Software is licensed, not sold, only in accordance with the FitnessGram® TOU.
>
> "Parent" means a parent or legal guardian.
>
> "Personal Information" means any student information defined as personally identifiable information under Family Educational Rights and Privacy Act ("FERPA") or as personal information under the Children's Online Privacy Protection Act ("COPPA").
>
> "School District" means a local educational agency, school network, independent school or other school system and its employees.
>
> "State Educational Agency" or "SEA" means the educational agency primarily responsible for the supervision of public elementary and secondary schools in any of the 50 states, the Commonwealth of Puerto Rico, the District of Columbia or other territories and possessions of the United States, as well as a national or regional ministry or department of education in other countries, as applicable.

Our Customers' privacy is important to us, and we recognize that Customers of the FitnessGram® Software may include Children. As required by COPPA, we provide this Policy to inform Parents and other Customers about our privacy practices including how The Cooper Institute® collects, uses, and discloses Personal Information.

In the course of providing the FitnessGram® Software, we take numerous measures to maintain the security and confidentiality of Personal Information collected or stored by the FitnessGram® Software on behalf of our Customers including Children, School Districts, and State Educational Agencies. In doing so, we enable our Customers to control use, access,

sharing and retention of Personal Information in compliance with FERPA, COPPA, and other applicable privacy laws and regulations.

By using the FitnessGram® Software, you expressly agree to the FitnessGram® TOU and consent to the collection, use and disclosure of Personal Information collected on behalf of you as outlined in this Policy. Please read the Policy carefully, and if you have any questions, feel free to contact us using the information provided at the end of the Policy.

A. Scope of this Policy

This Policy describes:

- what information is collected from and on behalf of our Customers via the FitnessGram® Software;
- how the FitnessGram® Software uses that information;
- with whom the FitnessGram® Software shares that information; and
- what steps the FitnessGram® Software takes to safeguard this information and ensure that our Customers remain in control of their data at all times.

1. Types of Information Collected

There are three types of information FitnessGram® Software collects and stores on behalf of our Customers:

- information provided by Customers to support the use of our products;
- information provided by Children, students, teachers and other school personnel in the course of using our products; and
- usage data including date and time of visits, browser type and operating system type.

Information provided by our Customers. The FitnessGram® Software requires some basic information about who is in a classroom and who teaches the class. For example, when a teacher logs into the FitnessGram® Software, a list of students associated with that teacher may be displayed in the application. The FitnessGram® Software references this information from a database that contains roster information (e.g. name, grade level, gender, date of birth, school ID numbers) that the School District supplied to the FitnessGram® Software.

Information collected through our products. Our Customers use the FitnessGram® Software to track student data and provide personalized feedback to students to help promote lifelong health and wellness. Students (including Children) and teachers use our products to engage in a variety of educational experiences. This information falls into several different categories listed below along with examples for each category:

- Fitness data. FitnessGram® collects information on the five components of health-related fitness including aerobic capacity, body composition, muscular strength, muscular endurance, and flexibility. The purpose of the data collected is to educate and create awareness for student's level of fitness.