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Teachers Perceptions of Using Persuasive Technologies to Prevent and Reduce the Incidence of Childhood Obesity

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Abstract

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by

John Edward Stephens

MS, University of Phoenix, 2005

BS, Oakwood College, 2003

Doctoral Submitted in Partial Fulfillment

of the requirements for the Degree of

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Abstract

Research of middle school health/physical education teachers' perceptions regarding using technology in educational settings to help prevent and reduce the incidence of childhood overweight and obesity is lacking. The purpose of this study was to gain insight into those perceptions because that insight could be used to encourage teacher promotion of technology-based childhood obesity prevention initiatives in educational settings. Ajzen and Fishbein's theory of planned behavior was used to support the conceptual framework. The research questions for this study were focused on teachers' perceptions regarding using technology in educational settings to help prevent and reduce the incidence of childhood overweight and the extent to which teachers are using technology for those purposes. In this generic qualitative study, data were collected from 10 middle school health/physical education teachers using individual interviews. Initial and pattern coding was used to conduct thematic analysis of the data using the constant comparative method. Data relevant to the research questions showed that although some health/physical education teachers do not use technology with their students, in classrooms, other teachers do. Teachers perceive technology can be used in health/physical education settings and are willing to do so although challenges, such as lack of training, do exist. Distance education for health and physical fitness was not successful during the COVID-19 pandemic. If teacher promotion of obesity prevention initiatives can be improved for students in and out of school settings, rates of student obesity could be reduced, which could drive social change in the form of improved mental, emotional, and physical health for children.

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Chapter 1: Introduction

Childhood obesity is considered an epidemic in the United States (Centers for Disease Control and Prevention [CDC], 2017c). Data from the National Health and Nutrition Examination Survey (NHNES) indicated that between 2007-2008 and 2013-2014 overall rates of childhood obesity in the United States remained stable at approximately 17%; however, during all other years between 1999-2000 and 2015-2016, there has been a significant overall increase in prevalence of overweight and obesity among children (Skinner et al., 2018). Among children of all ages, the prevalence of overweight increased from 28.8% in 1999-2000 to 35.1% in 2015-2016; the prevalence of Class I obesity increased from 14.6% to 18.5%, respectively; the prevalence of Class II obesity increased from 4.0% to 6.1%, respectively; and the prevalence of Class III obesity increased from 0.9% to 1.9%, respectively (Skinner et al., 2018). In 2011-2012, more than 1 million adolescents living in California were either obese (17%) or overweight (16%); although not statistically significant, these data represent a 2% increase from rates reported in 2001 (Wolstein et al., 2015).

The potential for overweight and obesity to negatively impact children's mental, emotional, and physical health (Institute of Medicine [IOM], 2012) has drawn considerable attention from researchers (CDC, 2017a). Organizations such as the CDC (2011b), the National Heart, Lung and Blood Institute (NHLBI, 2013), and the World Health Organization (WHO, 2017a, 2017b) have given attention to the problem of overweight and obesity. Although efforts to combat childhood obesity have been focused on ways to encourage children and adolescents to engage in healthy eating habits and

physical activity as a sustainable means of maintaining a healthy body weight (CDC, 2017a), other obesity related factors such as increased knowledge about physical activity (Merino-Campos & del Castillo Fernández, 2016), increased energy expenditure (Biddiss & Irwin, 2010), and improved motor skills associated with physical activities (Sheehan & Katz, 2012) have received considerable attention in the literature as essential to the discussion of childhood obesity. Research links media and technology use with negative psychological and physical issues (Rosen et al., 2014). Despite that research, the recent evolution in digital health and fitness technologies (DHFTs) and active video games makes using technology for promoting healthy physical activity and positively influencing other obesity related factors of particular interest for the purpose of preventing and reducing the incidence of childhood obesity. DHFTs are mobile and wearable digital devices and software used to monitor and promote health. Active video games are video games that require players to be active to play them (Boulos & Yang, 2013).

Pourzanjani et al. (2016) found a connection between the use of DHFTs and decreased rates of overweight and obesity among adults. Little research is available on the connection between the use of DHFTs and decreased rates of overweight and obesity among children although Yang et al. (2017) has begun conducting research in this area. “Smartphones, tablet computers, iPods and wearable patches and bands” (Lupton, 2013, p. 393) can become digital health devices if they connect to the Internet or in any other way display digital data about human health. Other DHFTs include pedometers, accelerometers, heart rate monitors, global positioning systems (GPS), and geographic

information systems (Heyward & Gibson, 2014). Many of these technologies are dependent on the use of the Internet, social media, mobile phones, tablets, iPods, and other fitness devices (Lupton, 2013). However, almost 95% of adolescents ages 13-17 have smartphones; of those adolescents, 45% go online several times a day and 45% go online almost constantly (Pew Research Center, 2018). Thus it was logical to assume that adolescents would have access to DHFTs which would make it possible for them to use DHFTs to try to improve their eating habits and physical activity and positively influence other obesity related factors. The research also has shown a connection between active video games and a variety of obesity related factors, including increased knowledge about physical activity (Merino-Campos & del Castillo Fernández, 2016); increased engagement in physical activity (Peng et al., 2012); increased energy expenditure (Biddiss & Irwin, 2010); and improved motor skills associated with physical activities (Sheehan & Katz, 2012).

Barriers to using technology, including active video games, in health/physical education settings exist. For example, (a) teachers may not accept using technology for educational purposes (Ertmer et al., 2012), (b) teachers may not accept using technology specifically in health/physical education settings, (c) teachers may lack the time or resources to implement technology in health/physical education settings (Lambert, 2016). Lambert (2016) and Whitney (2016) found that although barriers to using technology in health/physical education settings have been identified, educators in the field have supported using technology in these settings. Middle school level health/physical education educators may be in a unique position to bridge this gap using technology

available to them in their educational settings. However, at the time of this study, there was little literature available on the perceptions of these educators.

Therefore, the focus of this study was the perceptions of middle school health/physical education teachers regarding using technology in health education classrooms and physical education settings to promote healthy eating habits and physical fitness and to positively influence other obesity related factors (knowledge about physical activity, energy expenditure, and motor skills associated with physical activities) as a means of preventing and reducing the incidence of childhood overweight and obesity. Beyond filling a gap in the literature, insight gained from exploring teachers' perceptions is valuable in two distinct ways. First, that insight contributes to a better understanding of why middle school health/physical education teachers may or may not use technology in health education classrooms and physical education settings to promote healthy eating habits and physical activity and to positively influence other obesity related factors as a means of preventing and reducing the incidence of childhood overweight and obesity. Second, middle school health/physical education teachers' perceptions also provide insight for better understanding how teachers may be encouraged to use technology for those purposes and in those settings in particular.

With insight about teacher opportunities for using technology to promote healthy eating habits and physical activity among students and about reasons that teachers may or may not be using technology to promote healthy eating habits and physical activity and to positively influence other obesity related factors among students in the target district, school administrators may make informed decisions about how to increase teacher use of

technology to prevent and decrease the prevalence of childhood overweight and obesity. This scenario is one that, according to Pizzi (2016), could contribute not only to improved physical health but overall well-being and quality of life for children as well. It is in this potential to improve student health and quality of life that this study may be used to initiate social change.

The remainder of this chapter begins with a background discussion of literature related to the scope of the study and the gap in knowledge in the discipline (i.e., gap in the literature) that this study addresses. The background is followed by the study problem, purpose, research questions, conceptual framework, nature of the study, definitions, assumptions, scope, delimitations, and limitations. The chapter ends with a summary.

Background

This section includes discussions of two topics necessary for understanding the potential for using technology in schools as a means of preventing and decreasing the prevalence of childhood overweight and obesity. Those topics are the role of schools in preventing and reducing the incidence of obesity, and technology use in schools for obesity prevention. First, however, it is necessary to provide a clear description of the terms *overweight* and *obesity* as they are used in this study.

Defining Overweight and Obesity

In the last 2 decades, terminology referring to healthy weight for children has been inconsistent across health agencies and, in some agencies, has changed (Ogden & Flegal, 2010). In 1994, the CDC described two percentile ranges and prescribed terminology to those ranges (Ogden & Flegal, 2010). A body mass index (BMI) between

the 85th and 95th percentiles was said to indicate that a child may be overweight and requires additional testing to determine the child's condition; this BMI range was called *at risk of overweight* (Ogden & Flegal, 2010). A BMI above the 95th percentile was said to indicate that a child was overweight (Ogden & Flegal, 2010). At that time, the National Center for Health Statistics (NCHS) also used this same terminology; however, WHO warned that the term obesity should be used to describe children with high BMI (Ogden & Flegal, 2010). The argument for the use of the term obesity to represent high BMI was that obesity is associated with adiposity, or body fat, whereas overweight is associated with body size, which can be high due to reasons other than obesity and thus not necessitate clinical concern (Ogden & Flegal, 2010). The term obesity, it was argued, should be used in lieu of the term overweight to signal certain cause for clinical concern (Ogden & Flegal, 2010).

In 2005, the IOM expressed preference for the use of the term obese to describe children above the 95th percentile for BMI, and in 2007, the American Medical Association (AMA) did the same, while also reassigning the term overweight to the 85th to 95th percentile range (Ogden & Flegal, 2010). The AMA did suggest, however, that this more accurate terminology be saved for medical documentation and that to avoid stigmatizing patients, more sensitive terminology should be used in the clinical setting (Ogden & Flegal, 2010). Since that time, the American Association of Pediatrics and other respected health organizations, including the CDC and NCHS, have adopted the overweight/obesity terminology to refer to the 85th-95th and over 95th BMI percentile ranges, respectively (Ogden & Flegal, 2010). According to Ogden and Flegal (2010),

"obesity refers to excess body fatness. However, because body fat is difficult to measure, body weight is often used as a surrogate measure or indicator of obesity" (p. 1). "Overweight refers to weight in excess of weight standard" (Ogden & Flegal, 2010, p. 1). Body weight is typically represented as BMI for age categories, an adjusted weight measure calculated according to height (Ogden & Flegal, 2010). These changes in terminology are presented in Table 1.

Despite the general acceptance of calculating childhood overweight and obesity using CDC growth charts, calculating severe obesity in children using percentiles above the 95th percentile is not recommended (Freedman & Berenson, 2017). BMI has been found to be a poor indicator for overweight and obesity in young children (Vanderwall et al., 2017) and a poor predictor of severe obesity in young children (Flegal et al., 2009).

The Role of Schools in Preventing and Reducing the Incidence of Obesity

The idea that schools are in a distinct position to impact the incidence of obesity by promoting healthy nutrition and physical activity (CDC, 2017c) is not new. Almost 2 decades ago, Bogden (2000), on behalf of the National Association of State Boards of Education (NASBE), called for increased attention to the role of schools in children's health. The rationale behind this call for action was simple; according to Bogden, "health and success in school are interrelated. Schools cannot achieve their primary mission of education if students and staff are not healthy and fit physically, mentally, and socially" (p. 58). Since the NASBE first called upon schools to become engaged in children's health, support for this idea has come through national level legislation as well as government and private organizations.

Table 1

Historic Progression of Terminology Related to Overweight and Obesity

Source	Year	BMI 85-95	BMI over 95	Recommendation
CDC	1994	at risk of overweight	overweight	
NCHS	1994	at risk of overweight	overweight	
CDC	2002	at risk of overweight	overweight	
WHO	1995		overweight (for "high" BMI)	Do not use obese to describe BMI; only use to describe actual adiposity (body fat)
Institute of Medicine	2005		obese	
American Medical Association	2007	overweight	obesity	Only use overweight and obesity for documentation and in the clinic setting use more neutral terms to avoid hurting feelings
American Academy of Pediatrics		overweight	obesity	
NCHS & CDC	2010-ongoing	overweight	obesity	

Legislative Support

National level legislation such as the Healthy, Hunger-Free Kids Act of 2010, and the Every Student Succeeds Act demonstrates continued support of schools in promoting healthy eating habits and physical fitness to prevent and reduce the incidence of obesity (Every Student Succeeds Act, 2015). The Healthy, Hunger-Free Kids Act of 2010 was a

law designed to promote child nutrition and access to school meal programs (Food Research & Action Center [FRAC], 2017a); although the law expired in 2015 and its reauthorization is currently under review in the House of Representatives and Senate, programs funded by the 2010 act continue to operate and support healthy eating and good nutrition for school-aged children (FRAC, 2017a). According to the Every Student Succeeds Act (2015), one general principle of effective school activities is that they "serve to improve healthy eating and nutrition, and physical fitness" (Sec. 4105, b, 1, A, i). Further, the Every Student Succeeds Act considers childhood obesity as a characteristic of communities in distress, a designation that affords those communities access to funds from federal grants (Every Student Succeeds Act, 2015).

In addition to national level legislation, federally funded programs and projects have been designed specifically to help schools promote physical fitness and influence other obesity related factors to prevent childhood obesity. Examples of federally funded programs include the Presidential Youth Fitness Program and Let's Move! The Presidential Youth Fitness Program (2013) is a program designed to promote quality physical education in schools; the program was initiated in 2012 by Former First Lady Michelle Obama and is supported by the National Foundation on Fitness, Sports and Nutrition. Let's Move! is a program designed to help schools create active environments for children; this program was another initiative of Former First Lady Michelle Obama (White House, 2013). Examples of federally funded projects include Eat Well & Keep Moving and Planet Health. Eat Well & Keep Moving is an elementary school-based curriculum project focused on nutritious diets and physical activity promoted by

knowledge and skills offered in a supportive school learning environment for children; the federally funded program is a joint effort of the Harvard School of Public Health and Baltimore Public Schools (Human Kinetics, 2016). Also developed by the Harvard School of Public Health, but designed for middle school children, Planet Health (2007) is a curriculum project focused on knowledge and skills, not only about nutritious diets and physical activity but about core academic subjects as well.

Organizational Support

Shortly after the NASBE called upon schools to become engaged in children's health, the CDC demonstrated its support for this idea by publishing a report outlining the school's role in preventing childhood obesity (Wechsler et al., 2004). The role of schools in preventing childhood obesity has been the impetus for the development of school-based childhood obesity prevention programs such as Growing Health Kids (Vierregger et al., 2015), the Healthy Schools Program (Alliance for a Healthier Generation, 2017), and NFL Play 60 FitnessGram® (Cooper Institute, 2014b). The role of schools in preventing childhood obesity has become a critical element of school meal programs provided to children from low-income families by the United States Department of Agriculture, Food and Nutrition Service (2017). The role of schools in preventing childhood obesity remains an important focus in current discussions on childhood obesity prevention for the Harvard School of Public Health (2017) and the IOM (2012). The CDC (2017c) also maintains a section on its website dedicated to healthy schools and continues to promote the idea that "schools play a critical role in improving the dietary and physical activity behaviors of children and adolescents" (para. 1). From the healthy

school page, users can navigate to other pages on nutrition, physical activity, and obesity prevention, where they can find a plethora of overweight and obesity prevention strategies and guidelines for teachers, schools, communities, and state policy makers (CDC, 2017c).

Trust for America's Health and the Robert Wood Johnson Foundation (TFAH & RWJF, 2016), two well-established and well-respected organizations devoted to health and disease prevention, jointly publish a report series on the state of obesity in the United States. In their reports, TFAH and RWJF (2013, 2014, 2015, 2016) regularly review current school-based policies and provide examples of successful programs for preventing and reducing the incidence of childhood obesity. The majority of policies and programs reviewed are related to nutrition and physical fitness (TFAH & RWJF, 2013, 2014, 2015, 2016). Additionally, the Society of Health and Physical Educators (2013) has defined national physical education standards for students in Grades K-12, standards that were still in use at the time of this study.

Challenges to Promoting School Involvement in Obesity Prevention

As demonstrated previously, various federally driven legislation and federally funded programs exist to encourage school involvement in promoting physical fitness and influencing other obesity related factors to prevent and reduce the incidence of obesity. However, not all federally initiated efforts may have equal impact on outcomes in schools. TFAH and RWJF (2016) stated the following:

> The federal government can set national goals, recommendations and nutrition standards that are tied to schools' participation in federally-supported programs or

> compliance with grant requirements for other federal programs. For other policies, including physical education and activity and wellness programs, the more than 14,000 school districts in the country have primary jurisdiction — or "local control." (p. 56)

This situation allows schools to choose not to implement some of the suggested recommendations or strive to meet the proposed goals and standards despite the good intentions of such legislation and programs (IOM, 2012). Because organizations typically have no direct impact on school funding, schools also have complete control over whether they implement recommendations posed by organizations, whether federal or otherwise (IOM, 2012). In addition, because the goals, recommendations, and standards proposed by federally funded agencies are inherently meant to be broad in scope, they typically do not provide resources or include specific strategies for achieving the expected outcomes they propose (IOM, 2012). One reason for this lack of specificity may be due to the lack of evidence for obesity prevention aligned with professionals and policy makers making decisions about childhood obesity prevention strategies (IOM, 2010).

Technology Use in Schools for Obesity Prevention

Using technology in schools specifically for the purpose of obesity prevention is not a topic typically addressed in national goals, recommendations, and nutrition standards established by federally funded education agencies such as the Healthy, Hunger-Free Kids Act of 2010 and the Every Student Succeeds Act. The CDC, however, is one federally funded institution that does address using technology for preventing and

reducing the incidence of childhood obesity. To help school achieve this impact, the CDC (2011b) published a set of dietary and physical activity guidelines for schools. Particularly related to the focus of this study is Guideline 5, which is Implement Health Education that Provides Students with the Knowledge, Attitudes, Skills, and Experiences Needed for Healthy Eating and Physical Activity (CDC, 2011b). Within this guideline is the suggestion to "use classroom instructional methods and strategies that are active, engage all students, and are relevant to their daily lives and experiences" (CDC, 2011b, p. 36). One suggestion for promoting active, engaging, and relevant health education is to integrate computer-based instruction into health education lessons in the classroom (CDC, 2011b). The suggestion to incorporate computer-based instruction into health education classrooms hints at the potential for using DHFTs and active video games for these same purposes. However, I observed that similar to the language used in national goals, recommendations, and standards for healthy eating habits and physical activity, this guideline from the CDC does not include specific strategies for incorporating technology into health education classrooms or physical education settings (see CDC, 2011b).

Given the lack of specificity about how schools can incorporate technology into health education classrooms or physical education settings as a means of preventing and reducing the incidence of childhood overweight and obesity, it was not surprising that at the time of this study little was known about middle school health/physical education teachers' perceptions regarding the use of those technologies to achieve those outcomes. This gap in knowledge (i.e., gap in the literature) was the focus of this study.

Childhood Overweight and Obesity at the Study Site

The site for this study was a medium-sized K-8 school district located in a rural city in California. At the time of this study, the target site measured students' levels of physical fitness using FitnessGram®, a physical fitness assessment developed by The Cooper Institute (California Department of Education [CDOE], 2016). The assessment is made up of five components: aerobic capacity, body composition, abdominal strength, trunk extension strength, and upper body strength (Cooper Institute, 2014a). The body composition score is calculated using body fat percentage (i.e., skinfold measurement and bioelectric impedance analysis) and BMI (Cooper Institute, 2014a). Although the CDOE (2015) does provide fitness performance standards for both body fat and BMI, on the physical fitness assessment reports, the CDOE only includes students' body fat and BMI scores as composite body composition scores. For this reason, students' body composition scores cannot be used as an exact measure of overweight or obesity as defined by NCHS and CDC. However, because BMI is used to calculate body composition, students' body composition scores do provide an indication of students' overall health with regard to weight.

At the time of this study, the most current local, county, and state physical fitness assessment scores (2015-2016) showed that children in the school district had better body composition scores than students in the county in which the school district is located and better than students in the state overall (see Table 2). Despite this evidence about the condition of children's physical health in the school district, in a private verbal discussion with me on March 28, 2019, the district superintendent stated that "childhood obesity

remains a prevalent issue in our community." The district superintendent also suggested that this lack of tolerance for obesity in the school district reflects an understanding on the part of administrators and staff that healthy kids learn better than unhealthy kids and that all children in the school district deserve equal opportunities to learn. In a private verbal discussion with me on April 24, 2019, the school district nurse mirrored the district superintendent's sentiments about student health and learning. Furthermore, the district superintendent suggested that administrators and staff at the target school recognize that it is the schools' responsibility to "provide an environment that supports healthy behaviors."

Table 2

Local, County, and State Body Composition Scores for Grades 5 and 7 (2015-2016)

	Grade 5 NI[a] (%)	Grade 5 NIHR[b] (%)	Grade 5 Total NI and NIHR (%)	Grade 7 NI[a] (%)	Grade 7 NIHR[b] (%)	Grade 7 Total NI and NIHR (%)
			2013-2014			
State	19.5	21.0	40.5	19.4	19.1	38.5
County	20.1	21.6	41.7	19.0	20.4	39.4
Local	16.9	17.2	34.1	15.2	12.1	27.3
			2014-2015			
State	19.4	20.9	40.3	19.4	19.1	38.5
County	19.6	21.5	41.1	19.7	20.3	40.0
Local	17.2	16.3	33.5	15.3	14.6	29.9
			2015-2016			
State	19.7	20.7	40.4	19.1	19.0	38.1
County	20.2	20.6	40.8	19.8	19.6	39.4
Local	14.9	0.2	15.1	16.1	0.7	16.8

[a]Needs improvement. [b]Needs improvement-health risk.

The distribution of a health newsletter focused on alternatives to food as a reward in the classroom and the implementation of the *100 Mile Club*, both in 2014, demonstrated administrator and staff commitment to developing an environment that supports healthy behaviors. Inspired by a special education teacher in 1993, the 100 Mile Club (2017) is an inactivity and obesity prevention program that encourages children to be active by walking, jogging, or running. Students earn points for each mile that they complete, and points accumulate on an annual basis; success is measured using four milestones: 25, 50, 75, and 100 miles (100 Mile Club, 2017).

Evidence that administrators and staff in the school district have assumed responsibility for developing an environment that supports healthy behaviors also was found in district policies outlining academic expectations for comprehensive health education, physical education and activity, and student wellness. Underlying those policies was a core belief that health education should provide students the knowledge, skills, and behaviors they need to lead healthy, productive lives, including a sense of respect for one's health and the self-responsibility necessary to maintain it. Because the wellness policy was a response to nutrition-focused legislation called the Healthy, Hunger-Free Kids Act, references to obesity in that policy were focused on food and nutrition, such as ensuring healthy foods that are available at the school, as well as expectations for physical activity to help students meet state standards of fitness. Every August at the start of the school year, the school district superintendent has reminded parents of the purpose and value of the wellness policy and has informed them about changes imposed on the policy from the previous year. Despite these policies that clearly

support healthy eating habits and physical activity as a means of preventing and decreasing the incidence of obesity in the school district, the policies have not contained language that describes specifically how educators are to achieve these expectations. That being the case, there was no opportunity for the district to suggest that educators use technology for those purposes.

Need for the Study

This study was needed because at the time of this study there was a gap in the literature on childhood overweight and obesity reduction and prevention. More importantly, this study is valuable in a practical sense in that it could promote social change. Data collected in this study provide a better understanding of how technology can be used in health education classrooms and physical education settings at the middle school level to promote healthy eating habits and physical activity, and influence other obesity related factors that contribute to the maintenance of healthy weight, which may help prevent and decrease the incidence of childhood overweight and obesity. Additionally, this study is important because it provides a better understanding of how using technology for those purposes can be encouraged at the middle school level. By reducing the incidence of childhood overweight and obesity, children may experience not only improved physical health but overall well-being and quality of life as well (Pizzi, 2016).

Problem Statement

Pourzanjani et al. (2016) stated that there is a connection between overweight and obesity and the use of DHFTs among adults. Biddiss and Irwin (2010), Merino-Campos

and del Castillo Fernández (2016), Peng et al. (2012), and Sheehan and Katz (2012) found a connection between active video games and factors related to childhood obesity. In addition, Sheehan and Katz (2012) have called upon physical educators to consider ways they can use DHFTs to promote physical activity. Collectively, this literature provided evidence of the potential for educators to use DHFTs and active video games to positively influence obesity related factors that could help prevent and reduce the incidence of childhood overweight and obesity.

To effectively promote teachers' use of DHFTs and active video games for this purpose, it is important to understand their perceptions regarding the use of technology for these purposes. However, because there was a gap in the literature, those perceptions were unknown. Therefore, the problem addressed in this study was that the perceptions of middle school health/physical education teachers regarding using technology in educational settings to promote healthy eating habits and physical activity and to positively influence other obesity related factors that could help prevent and reduce the incidence of childhood overweight and obesity was unknown.

Purpose of the Study

The purpose of this generic qualitative study was to fill the gap in the literature regarding middle school health/physical education teachers' perceptions about the use of technology in educational settings to promote healthy eating habits and physical activity, and to positively influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity. This study can be described as exploratory in nature. By conducting this study, data were collected that

provided insight into the perceived value of using technology in educational settings to promote healthy eating habits and physical activity and to positively influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity.

Research Questions

There were four guiding research questions for this study. The research questions were focused on teachers' perceptions. The four questions are

RQ1. What are middle school health/physical education teachers' perceptions regarding their capacity (perceived behavioral control) to use technology to prevent and reduce the incidence of childhood overweight and obesity?

RQ2. What are middle school health/physical education teachers' perceptions regarding the value (attitude toward the behavior) of using technology to prevent and reduce the incidence of childhood overweight and obesity?

RQ3. What are middle school health/physical education teachers' perceptions regarding the influence of others (subjective norm) on their use of technology to prevent and reduce the incidence of childhood overweight and obesity?

RQ4. What are middle school health/physical education teachers' perceptions regarding the actual control they have over their use of technology to prevent and reduce the incidence of childhood overweight and obesity?

Theoretical Framework

The theoretical framework for this study was the theory of planned behavior developed by Ajzen and Fishbein (1972). According to Ajzen and Fishbein (1972), the

theory of planned behavior is not a theory about behavior; rather, it is a theory about behavioral intent and the decision-making processes associated with that intent. However, because behavioral intent (i.e., a person's plan for behaving in a certain way) is the immediate precursor to behavior, it often is used for understanding people's decision-making processes associated with particular behaviors (Ajzen, 2012) and for predicting actual behavior (Ajzen, 1985). According to the theory, behavioral intent is the outcome of three factors: subjective norm, attitude toward the behavior, and perceived behavioral control (Ajzen, 2012; Ajzen & Fishbein, 1972). Behavior is the outcome of behavioral intent mediated by actual control over the behavior (Ajzen, 2012; Ajzen & Fishbein, 1972). The details of the theory are provided in Chapter 2.

The theory of planned behavior has been associated with substantial changes in behavior motivated by health interventions delivered via the Internet (Webb et al., 2010) and active video games (Merino-Campos & del Castillo Fernández, 2016). Therefore, the theory was appropriate to use in this study, where the focus was on the potential to use DHFTs and active video games to promote change in health conditions among middle school children. Specifically, the theory of planned behavior, which was influenced by Bandura's social cognitive theory and concept of self-efficacy (Ajzen & Fishbein, 1972), provided a way of understanding why this population may or may not choose to use technology with students in educational settings as a means of preventing and reducing the incidence of childhood overweight and obesity. The four main variables of the theory are represented in the four research questions posed for this study.

Nature of the Study

This study was a generic qualitative study. Narrative, phenomenological, grounded theory, ethnographic, and case study research methods were not appropriate for this study. Although the problem in this study was a lack of literature, the underlying problem that made that lack of literature a concern was childhood overweight and obesity. Therefore, the focus of this study was the potential for using technology in educational settings to help improve healthy eating habits and physical activity and positively influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity. To collect data on this topic, one-on-one interviews were conducted with 10 middle school health/physical education teachers. Initial and pattern coding described by Saldaña (2009) was used to conduct thematic data analysis using the constant comparative method for generic qualitative research as outlined by Percy et al. (2015).

Definitions

Active video game: According to Baranowski and Frankel (2012), active video games, "also called exergames, are video games designed primarily to make a profit, but they also happen to require/facilitate physical activity by players" (p. 35). Exergames that require a stationary console and television are restricted to indoor use; however, other exergames are made to be played on mobile devices and, therefore, are intended to be played outside (Boulos & Yang, 2013). In this study, the term *active video game* is used to describe exergames unless clarification is required.

Digital health/fitness devices/technologies: In the literature, the terms *digital health devices, digital health technologies, digital fitness devices,* and *digital fitness technologies* are used almost interchangeably to refer to "mobile and wearable digital devices and related Web 2.0 apps [software applications] and social media tools . . . [used for] monitoring, measuring and representing the human body" (Lupton, 2013, p. 393). For the purposes of this study, any digital device or associated applications used to monitor body functions will be referred to jointly as DHFTs.

Mobile health (mHealth) technology: According to Lupton (2013), mHealth technology is term adopted by medical and health professionals to refer to digital health technologies designed for preventive medicine and the promotion of public health. Typically, mHealth technologies have the capacity to connect to the Internet, thus allowing health professionals to monitor patient body function and record physical activity (Lupton, 2013).

Nutrition: Nutrition refers to "the intake of food, considered in relation to the body's dietary needs. Good nutrition, an adequate, well balanced diet combined with regular physical activity, is a cornerstone of good health" (WHO, 2017c, para. 1).

Obesity: "Obesity refers to excess body fatness. However, because body fat is difficult to measure, body weight is often used as a surrogate measure or indicator of obesity" (Ogden & Flegal, 2010, p. 1). Body weight is typically represented as BMI for age categories, an adjusted weight measure calculated according to height (Ogden & Flegal, 2010). According to the NCHS and CDC (Ogden & Flegal, 2010), obesity is represented by a BMI over the 95th percentile.

Overweight: "Overweight refers to weight in excess of weight standard" (Ogden & Flegal, 2010, p. 1). According to the NCHS and CDC (Ogden & Flegal, 2010), obesity is represented by a BMI between the 85th and 95th percentiles.

Physical activity: Physical activity refers to "any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level" (CDC, 2015a) which is typically associated with the enhancement of health.

Assumptions

In this study, it was assumed that teachers would be honest in their responses during interviews. It was necessary to make this assumption because there was no way to know for sure whether teachers were being honest. It was possible that teachers may not have been completely honest in their responses during interviews for a variety of reasons, including, for instance, their interest in appearing to be an innovative teacher or their interest in providing answers they assume would be helpful to me. However, teachers are professionals who, it was logical to assume, value knowledge and, therefore, provided honest responses to the interview prompts. Additionally, prior to asking participants to respond to the interview prompts, I reminded them of the value of responding honestly. For these reasons, I concluded that the data collected from teachers in this study accurately reflected conditions as they existed at the target school at the time the data were collected, including teachers' descriptions about their use of technology and technological skills.

Scope and Delimitations

This study was limited to the exploration of two specific aspects of teacher use of technology for the prevention and reduction in the incidence of childhood overweight and obesity. First, this study was limited to middle school health/physical education teachers' perspectives regarding using technology with students in educational settings to promote healthy eating habits and physical activity and to influence obesity related factors (knowledge about physical activity, energy expenditure, and motor skills associated with physical activities). Second, this study was limited to the exploration of the ways, if any, and to the extent, if at all, elementary school teachers and middle school health/physical education teachers in the target district were using technology in educational settings to promote healthy eating habits and physical activity among students as a means of preventing and reducing the incidence of childhood overweight and obesity. Additional obesity related factors were not considered. The use of technology for purposes other than promoting healthy eating habits and physical activity and influencing obesity related factors also were not considered.

This study was delimited to middle school health/physical education teachers. Middle school teachers of other subjects, and preschool and high school teachers were not included in this study. Initially, only middle school teachers from the target school district were invited to participate in this study. However, to achieve a sample size of 10, it was necessary to include one teacher from outside the district. Finally, this study was delimited to educational settings. Settings outside of schools in the target district will not be considered.

Limitations

This study was limited by the use of a generic qualitative design. Critics of the study design claim it lacks methodological rigor because it does not conform to the traditions of any one established methodology (Caelli et al., 2003; Kahlke, 2014). However, Kahlke (2014) has argued that generic qualitative studies blend aspects of multiple research designs and that rigor can be established through strong alignment with the research framework. Additionally, Caelli et al. (2003) suggested that credibility in generic qualitative research can be established by (a) providing clear discussions of the theoretical framework and analytical lenses used to interpret the data, (b) aligning the study methods with the study methodology, and (c) consciously implementing strategies to develop rigor.

In this study, I ensured rigor by (a) providing a clear discussion of the theoretical framework, (b) aligning all aspects of the study with the theoretical framework, and (c) aligning the study methods and methodology. Additionally, I made a conscious effort to ensure that this study is not only credible but dependable, confirmable, and transferable as well. In these ways, I established the overall trustworthiness of the study. A more detailed discussion of trustworthiness is provided in Chapter 3.

A second limitation in this study was the collection of qualitative data from only a small group of 10 middle school teachers using interviews. Because the study sample for interviews was purposive and one of convenience, the participants were not chosen randomly. For this reason, findings from this study are not generalizable to larger populations, such as teachers in other school districts, the state, or the United States in

general. However, because new information about teachers' perceptions were generated, the collected data were considered valuable.

It was possible that only middle school health/physical education teachers with similar characteristics would agree to participate in this study. For example, it was possible that the only middle school health/physical education teachers who agreed to participate in this study were teachers who were in the youngest age brackets. However, because teachers were asked to provide demographic information about themselves, I was able to determine that the study sample was not unnaturally homogenous. Additionally, I was transparent with regard to describing the sample.

A third limitation in this study was the types and sources of data that were used to answer the study's research questions, which were focused on the perceptions of middle school health/physical education teachers in the target district. Because people's perceptions cannot be determined through observation, the use of observations to collect data to answer the research questions was not logical. For the same reason, collecting data from other staff members in the school district was not a logical choice for collecting data to answer the research questions. Therefore, data were collected using interviews.

Although this study was limited by the types and sources of data that could be used to answer the study's research questions, steps were taken to ensure that study findings accurately reflect the conditions present at the school, including the use of member checking and a second coder. Therefore, the concern that the limiting of collected data to one type of data and one source of data would result in the inability to answer the research questions thoroughly or with accuracy was minimal. The steps that

were taken to ensure the accurate collection and interpretation of data are discussed in more detail in Chapter 3.

Researcher bias also can be a limitation in qualitative research because it can influence the interaction between the researcher and the participants during data collection and influence the interpretation of data during analysis (Merriam & Tisdell, 2016). During the interview process, researchers can mitigate the influence of researcher bias by "taking a stance that is nonjudgmental, sensitive, and respectful of the respondent" (Merriam & Tisdell, 2016, p. 130). During data analysis, researchers can mitigate the influence of their potential personal biases by reflecting on those biases and remaining vigilant that they do not allow their biases to shape their interpretations of the data (Merriam & Tisdell, 2016).

When beginning this study, I recognized a personal bias for the use of technology in educational settings to promote healthy eating habits and physical activity and to positively influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity. As a teacher in the target district, I had first-hand knowledge of incidents of childhood obesity in the target school district, and as a technophile, I had a personal affinity for using technology in new and innovative ways. Therefore, I found the idea of using technology to help promote healthy eating habits and behaviors in the children I teach both obvious and logical. However, I minimized the influence of this personal bias during the interview process by remaining actively cognizant of my attitude toward and treatment of participants so that I remained nonjudgmental, sensitive, and respectful at all times. I minimized the influence of this

personal bias during data analysis by remaining aware of those biases so that I ensured I did not project my biases into my interpretation of the findings.

Significance

This study is important in academia because it filled a gap in the literature. However, this study has practical implications for social change at the local level as well. The prevention and reduction in the incidence of childhood overweight and obesity in the target district is important because childhood overweight and obesity may negatively impact children's mental, emotional, and physical health. "Children who are overweight or obese are at serious risk for being stigmatized, bullied, or marginalized, and they often are medically compromised" (Pizzi, 2016). They also may suffer from low self-esteem, negative body image (IOM, 2012), and depression (Morrison et al., 2015). In addition to sleep apnea, hypertension, orthopedic problems (IOM, 2012), and less well-known kidney disorders, obesity can lead to Type 2 diabetes and fatty liver disease (National Institute of Diabetes and Digestive and Kidney Diseases [NIDDKD], 2017) and have detrimental effects on the brain (Reinert et al., 2013). Obesity also may lead to cardiovascular diseases and cancer (WHO, 2017c). Ultimately, the presence of these comorbidities among children who are overweight or obese may contribute to obesity in adulthood (Mayo Clinic, 2016) and shortened life spans (IOM, 2012). In addition, historically, children who are overweight and obese have been found to be less successful academically when compared to their peers who are not overweight or obese (Howie & Pate, 2012; Taras & Potts-Datema, 2005). This condition may be due, in part, to the fact that children who are extremely obese (Rappaport et al., 2011), obese, or overweight

have higher rates of absenteeism when compared to their peers who are not overweight or obese (Geier et al., 2007; Taras & Potts-Datema, 2005).

Research conducted by Pourzanjani et al. (2016) has shown a connection between the use of DHFTs and decreased rates of overweight and obesity. Reach conducted by Biddiss and Irwin (2010), Merino-Campos and del Castillo Fernández (2016), Peng et al. (2012) and Sheehan and Katz (2012) has shown a connection between active video games and childhood obesity related factors. This study is important because study findings provided insight into the ways middle school health/physical education teachers are using technology to promote students' healthy eating habits and physical activity as a means of preventing and reducing the incidence of childhood obesity in the target district.

Research also has shown that barriers to using technology impact the degree to which teachers use technology in their classrooms despite the level of acceptance teachers have for technology and their motivation for using it (Ertmer et al., 2012). In this regard, results from this study provided insight into middle school health/physical education teachers' perceived value of using technology to promote students' healthy eating habits, physical activity, and other obesity related factors as well as barriers to putting that practice into action in their classrooms. Results of this study also indicated other barriers to using technology in middle school health education classrooms and physical education settings in the target district. These insights can be used by administrators in the target district to make informed decisions about how to best promote teachers' use of technology not only as a means of reducing the incidence of childhood overweight and obesity but as a proactive measure for preventing it as well.

The proactive approach to controlling an epidemic through preventive measures is referred to as the vaccine approach (Chen, 2012). This proactive vaccine approach is the inverse of the medicine approach, which is focused on controlling an epidemic through illness management (Chen, 2012). The potential for technology to be used as a vaccine in a preventive capacity against the occurrence of overweight and obesity in the target district reflects IOM's (2012) philosophy regarding this epidemic: "It is untenable to wait any longer until people are already sick, requiring that most of our efforts and funding be devoted to crisis intervention for diseases that could have been prevented or made less severe" (p. ix). Taking action to prevent and reduce the incidence of childhood obesity in the target district is a first step to ensuring the mental, emotional, and physical health of all students in the target district and to helping them reach their greatest academic potential.

Summary

The problem addressed in this study was that there was a gap in the literature regarding the perceptions of middle school health/physical education teachers regarding using technology in educational settings to promote healthy eating habits and physical activity and to positively influence other obesity related factors that could help prevent and reduce the incidence of childhood overweight and obesity. Although filling a gap in the literature would not in and of itself promote social change, this study is still important in that regard. In particular, this study has the potential to promote social change in the target district.

At the target district in this study, the rate of student obesity was a concern. Despite the fact that administrators and staff have been proactive in their efforts to create an environment that supports health education, physical education, healthy behaviors, and student wellness, the perceptions of middle school health/physical education teachers regarding using technology in classrooms and physical educational settings to promote physical activity and influence obesity related factors that could help prevent and reduce the incidence of childhood overweight and obesity were unknown. This condition was problematic because technology such as DHFTs and active video games have been shown to be effective for increasing physical activity and influencing other obesity related factors associated with maintaining a healthy weight, including knowledge about physical activity, energy expenditure, and motor skills associated with physical activities. If health/physical education teachers could have been using technology to help prevent and decrease the incidence of childhood overweight and obesity in the target district but were not doing so, a valuable opportunity for helping improve the lives of children was being wasted. This study was a first step toward exploring the potential to use technology in health/physical education settings as a means of improving student outcomes regarding overweight and obesity. Chapter 2 includes a description of the literature search strategy for the literature review, detailed information about the conceptual framework for this study, and an exhaustive review of current research related to the key concepts of this study.

Chapter 2: Literature Review

The literature has shown that technology such as DHFTs and active video games can help increase children's levels of physical activity and help with weight reduction. However, at the time of this study, there was a gap in the literature about the perceptions of middle school health/physical education teachers regarding the use of these technologies in educational settings to promote healthy eating habits and physical activity and to positively influence other obesity related factors that could help prevent and reduce the incidence of childhood overweight and obesity. Therefore, the purpose of this generic qualitative study was to fill the gap in the literature on that topic. However, this study also has practical implications for social change at the local level.

In the target district, the rate of childhood obesity concerned school district administrators who were aware of the literature showing the negative outcomes associated with childhood overweight and obesity. As stated in Chapter 1, "Children who are overweight or obese are at serious risk for being stigmatized, bullied, or marginalized, and they often are medically compromised" (Pizzi, 2016, p. 1). They also may suffer from low self-esteem, negative body image (IOM, 2012), and depression (Morrison et al., 2015). In addition to sleep apnea, hypertension, orthopedic problems (IOM, 2012), and less well-known kidney disorders, obesity can lead to Type 2 diabetes and fatty liver disease (NIDDKD, 2017) and have detrimental effects on the brain (Reinert et al., 2013). Obesity also may lead to cardiovascular diseases and cancer (WHO, 2017c). Ultimately, the presence of these comorbidities among children who are overweight or obese may contribute to obesity in adulthood (Mayo Clinic, 2016) and shortened life spans (IOM,

2012). In addition, historically, children who are overweight and obese have been found to be less successful academically when compared to their peers who are not overweight or obese (Howie & Pate, 2012; Taras & Potts-Datema, 2005). This condition may be due, in part, to the fact that children who are extremely obese (Rappaport et al., 2011), obese, or overweight have higher rates of absenteeism when compared to their peers who are not overweight or obese (Geier et al., 2007; Taras & Potts-Datema, 2005). By addressing childhood overweight and obesity in the school district, school district administrators can promote social change and improve physical, mental, and emotional outcomes for students in the district.

Because an important aspect of this study was childhood overweight and obesity, topics related to this concept are discussed in this chapter. Specifically, this chapter includes a discussion of the prevalence and factors that contribute to childhood overweight and obesity. Overweight and obesity awareness and prevention policies and overweight and obesity prevention initiatives and programs that can positively influence rates of childhood overweight and obesity also are identified. Suggestions for improving public health programs also are presented. Finally, the positive influence of interventions of physical activity, other healthy behaviors, and ultimately, overweight and obesity are discussed.

Because DHFTs and active video games were the focus of this study, a discussion of DHFTs and active video games and their potential for reducing rates of childhood obesity and related factors is included in this section. Although educational technology that promotes physical activity was limited at the time of this study, a brief discussion of

the available literature is presented. First however, the literature search strategy is explained, and the conceptual framework is discussed in detail.

Literature Search Strategy

To gather literature for this review, searches were conducted in databases available through Walden University. The multiple databases were organized by subject: behavioral science (*n* = 17), education (*n* = 31), health policy and science databases (*n* = 45), information and technology (*n* = 32), medical (*n* = 15), public health (*n* = 22), and social sciences (*n* = 19). However, the majority of sources used in this section came from nine databases: Academic Search Complete, EBSCOhost, Education Research Complete, Education Resource Information Center, JSTOR, ProQuest Central, PsychINFO, SAGE Journals Online, and ScienceDirect. The key search terms and phrases used to locate literature for this review were *(childhood) overweight, (childhood) obesity, rates/occurrence of (childhood) overweight/obesity, causes of (childhood) overweight/obesity, strategies for decreasing (childhood) overweight/obesity, schools and childhood overweight/obesity, digital health technologies, digital fitness technologies, physical activity and obesity,* and *active video games.*

All of the studies chosen for this review were published in peer-reviewed journals. Most of the studies were published between 2012 and 2017. When older studies were included, they were included because they (a) demonstrated a pattern over time, (b) were seminal works, or (c) were especially relevant to the discussion.

Theoretical Framework

The focus of this study was teachers' use of DHFTs and active video games to improve healthy eating habits and physical activity among students. Because teacher use of DHFTs and active video games can be described as a behavior, teachers' use of DHFTs and active video games to improve healthy eating habits and physical activity among students may be understood through concepts expressed in Ajzen and Fishbein's (1972) theory of planned behavior, a theory of behavioral intent. Although not intended to be a theory about behavior, because a person's behavior is predicated by that person's intent to behave in a particular way, understanding a person's behavioral intent can provide insight into that person's likely behavior (Ajzen, 2012). According to the theory, behavioral intent is the outcome of three factors: subjective norm, attitude toward the behavior, and perceived behavioral control (Ajzen, 2012; Ajzen & Fishbein, 1972). Behavior is the outcome of behavioral intent mediated by actual control over the behavior (Ajzen, 2012; Ajzen & Fishbein, 1972).

Respectively, normative beliefs, behavior beliefs, and control beliefs shape a person's subjective norm, attitude toward the behavior, and perceived behavioral control (Ajzen & Fishbein, 1972). A person's normative beliefs and subsequent subjective norm are related to that person's beliefs about how influential people in their lives expect them to behave (Ajzen, 2012). Ajzen and Fishbein used the term *important others* to refer to those who may influence a person's normative beliefs. A person's behavior beliefs and attitude toward a behavior are related to that person's perspective regarding the consequences of engaging in a particular behavior (Ajzen, 2012). A person's control

beliefs and perceived behavioral control are related to a person's beliefs about his or her ability to achieve a particular outcome as the result of engaging in a particular behavior (Ajzen, 2012). Additional mediating factors may influence the relationships among these factors as well as their influence on behavioral intent (Ajzen, 2012). In various capacities, motivation may influence these factors to impact behavior. The relationship among these concepts is presented in Figure 1.

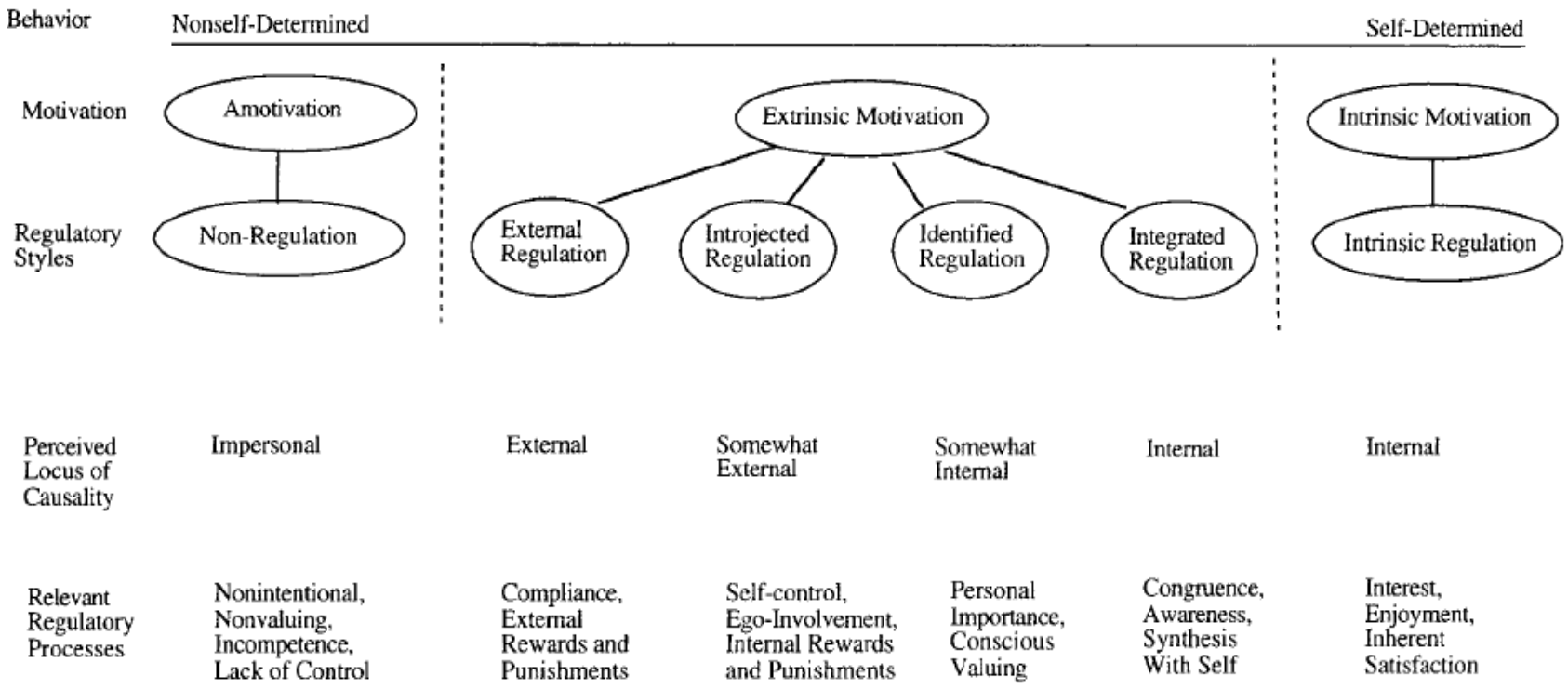
Perceived Behavioral Control

In Ajzen and Fishbein's (1972) theory of planned behavior, the concept of perceived behavioral control (a person's beliefs about his or her ability to achieve a particular outcome as the result of engaging in a particular behavior) is based on the concept of self-efficacy. According to Bandura (1977), self-efficacy refers to a person's perceptions about his or her capacity to accomplish a task. People will not engage in a behavior if they do not perceive they have the needed skills and capacity to accomplish the task for which the behavior is undertaken (Bandura, 1977). The impact of a person's perceived self-efficacy for accomplishing a specific task on that person's actual engagement in the behavior that will lead to the accomplishment of that task is mediated (a) by the way that person understands and processes information, and regulates emotions; (b) how motivated that person is to accomplish the identified task; and (c) by the extent to which that person can self-regulate his or her cognitive, emotional, and motivational processes (Bandura, 1994).

A person's perception of self-efficacy may be positively or negatively influenced by (a) that person's past personal experiences with the task, (b) that person's observations

Figure 1

The Self-Determination Continuum



Note. From "Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being," by R. M. Ryan and E. L. Deci, 2000, *American Psychologist, 55*(1), p. 72. Copyright 2000 by the American Psychological Association. Reprinted with permission.

of others' attempts to achieve the task, (c) the degree to which that person receives feedback about his or her behavior in relation to the task, and (d) that person's interpretation of his or her physiological and emotional responses to thoughts of engaging in the task-specific behavior or actual engagement in the task-specific behavior (Bandura, 1977, 1982). If a person (a) successfully engages in a task-specific behavior and accomplishes a specific task, (b) observes other people successfully engaging in that task-specific behavior and accomplishing that specific task, (c) receives positive feedback about his or her ability to engage in that task-specific behavior and accomplish that specific task, and (d) experiences positive physiological and emotional responses to thoughts of or actual engagement in that task-specific behavior, that person's self-efficacy for completing that task is likely to increase, thereby increasing the likelihood that person would attempt to complete that task or complete it again in the future (Bandura, 1977). On the other hand, if a person (a) fails to accomplish a specific task, (b) observes other people failing to accomplish that specific task, (c) receives negative feedback about his or her ability to accomplish that specific task, or (d) experiences negative physiological and emotional responses to thoughts of or actual engagement in that task-specific behavior, that person's self-efficacy for completing the task is likely to decrease, thereby decreasing the likelihood that person would attempt to complete the task or complete it again in the future (Bandura, 1977). The theoretical concept perceived behavioral control was the central concept of Research Question 1.

Attitude

A person's behavior beliefs and attitude toward a behavior are related to that person's perspective regarding the consequences of engaging in a particular behavior

(Ajzen, 2012). If a person does not believe a valuable consequence will result from engaging in a particular behavior, that person is not likely to engage in that behavior (Ajzen, 2012). Bandura (1977) referred to a person's perception of the impact of a behavior on a particular outcome as an outcome expectation. Bandura theorized that if a person does not perceive that a certain task-specific behavior will result in a particular outcome, that person will not engage in that task-specific behavior even if that person believes he or she has the skills and capacity to successfully engage in that task-specific behavior. The theoretical concept attitude was the central concept of Research Question 2.

Subjective Norm

A person's normative beliefs and subsequent subjective norm are related to that person's beliefs about how important others expect them to behave (Ajzen, 2012). According to Ajzen and Fishbein (1972), a person's belief's about the attitudes important others hold regarding the behavior in question may influence a person's normative beliefs (i.e., how that person perceives important others expect him or her to behave). If, for instance, an important other has a negative attitude toward a behavior, a person is likely to perceive that that important other does not expect that person to engage in that behavior (Ajzen, 2012). In this case, a person would be less likely to engage in a behavior. Conversely, if an important other has a positive attitude toward a behavior, a person is likely to perceive that that important other expects that person to engage in that behavior. In this case, a person would be more likely to engage in a behavior. However, a person's motivation to meet the expectations of others may mediate the relationship between a person's normative beliefs and that person's subjective norm (Ajzen, 2012).

For example, if a person is motivated to meet the expectations of others, that person is likely to develop a subjective norm representative of this normative beliefs and favoring his or her engagement in the behavior that person perceives others expect of him or her. On the other hand, if a person is not motivated to meet the expectations of others, that person is not likely to develop a subjective norm favoring his or her engagement in a particular behavior even if that person perceives others expect him or her to engage in that particular behavior. The theoretical concept subjective norm was the central concept of Research Question 3.

Mediators Between Behavioral Intent and Behavior

Perceived actual control refers to the extent to which a person believes he or she can overcome external barriers to performing a behavior (Ajzen, 2012). Perceived actual control can be a mediating factor between behavioral intent and actual behavior because if a person does not believe they have the capacity to overcome external barriers to a behavior, they will be unlikely to attempt to perform the behavior regardless of their perceived personal capacity for performing the behavior (Ajzen, 2012). In other words, self-doubt can hinder a person's engagement in an activity. When perceived actual control is high, as in the case of commonly performed behaviors, behavioral intent can be considered a sufficient predictor of behavior (Ajzen, 2012). However, when perceived actual control is low, as in the case with less-commonly performed or specific behaviors, behavioral intent is not sufficient to predict behavior and must be considered in conjunction with a person's actual control to perform a behavior (Ajzen, 2012). The theoretical concept perceived actual control was the central concept of Research Question 4.

Motivation may impact a person's behavior both indirectly and directly. As previously stated, the degree to which a person is motivated to accomplish a specific task may influence the impact of a person's self-efficacy on his or her actual engagement in the task-specific behavior required to accomplish the specific task (Bandura, 1977). In addition, a person's motivation to meet the expectations of others may mediate the relationship between a person's normative beliefs and that person's subjective norm (Ajzen, 2012). However, extrinsic and intrinsic motivators also may directly influence behavior (Deci & Ryan, 1985, 2000, 2008). Extrinsic motivators include rewards and punishments, feelings of self-worth, and the alignment between a person's values and his or her goals (Ryan & Deci, 2000). Intrinsic motivators include feelings of satisfaction and enjoyment (Ryan & Deci, 2000).

Prevalence and Factors of Childhood Overweight and Obesity

The prevalence of childhood overweight and obesity varies and is the outcome of many complex and interrelated factors (Ang et al., 2013). Some of these factors may be grouped conceptually into categories: personal and internal factors, and environmental and external factors. Personal and internal factors include race, gender, age, lack of physical exercise. Other personal factors that may impact obesity include chemical exposure *in utero* (La Merrill & Birnbaum, 2011); gestational diabetes (Zhao et al., 2016); genetics (Cheung & Mao, 2012). Furthermore, breastfeeding during early infancy has been found to be related to better appetite control during childhood, which could positively influence the incidence of childhood overweight and obesity (DiSantis et al., 2011). These medical related topics associated with obesity were beyond the scope of this

study and thus not discussed in detail here. Environmental and external factors include lack of access to free recreational areas and lack of access to affordable nutritious food.

Personal and Internal Factors

Children may or may not have control over personal and internal factors that contribute to obesity. Race, sex, age, and socioeconomic status are examples of personal characteristics over which children have no control. In certain circumstances, children may have control over the gender with which they identify if it is different from their biological sex. In the literature, engagement in physical activity is considered to be both in and out of a child's control.

Race

Rates of childhood obesity vary according to race (Ford et al., 2016; Ogden et al., 2015; Skinner et al., 2018). With few exceptions, between 1999-2000 and 2015-2016, rates of overweight and obesity for Black children have been higher than rates of overweight and obesity for White and Asian children; rates of obesity for Hispanic children have been higher than rates of overweight and obesity for Black, White, and Asian children (Day et al., 2014; Skinner et al., 2018). Rates of severe obesity are highest among both Black and Hispanic children (Ford et al., 2016; Skinner et al., 2018) although historically, the most severely obese children have been Black (Skinner et al., 2018). The differences in rates among Black and Hispanic children have not typically been significant (Ogden et al., 2015).

Using data from the Early Childhood Longitudinal Study, Cunningham et al. (2014) tracked children's rates of obesity through Grade 8. Results indicated that at all ages, Hispanic children were more likely to be obese when compared to non-Hispanic

White children (Cunningham et al., 2014). By Grade 3, however, non-Hispanic Black children also were found to have higher rates of obesity when compared to non-Hispanic White children (Cunningham et al., 2014). Between kindergarten and Grade 8, rates of obesity for (a) Asian, Pacific Islander, Native American, and multiracial children; (b) Hispanic children; (c) non-Hispanic White children; and (d) non-Hispanic Black children increased by 40%, 50%, 65%, and 120%, respectively (Cunningham et al., 2014). In a study specifically of American Indian and Alaska Native children ages 2 to 19 conducted using data from Indian Health Service National Data Warehouse, results showed that rates of overweight and obesity for this population were higher than the average overweight and obesity rates of children in the United States in general (Bullock et al., 2017). Disparity in obesity rates among minorities may be related to risk factors associated with pregnancy and child rearing practices during infancy (Dixon et al., 2012) as well as capacity to self-regulate food intake, which has been found to be lower among Black and Hispanic children when compared to children of European descent (Faith et al., 2012).

That obesity rates among Hispanic children in particular have been reported to be higher than obesity rates among other populations is not surprising. Data from two quantitative studies on content contained in advertising televised during children's programming showed that US television stations airing children's programs in Spanish televised more junk food commercials than television stations televising children's programs in English (Kunkel et al., 2013). Exposure to junk food advertising could contribute to higher rates of junk food consumption by Hispanic children and thus higher rates of childhood obesity among this population (Kunkel et al., 2013).

However, other research has shown that Latino youth with foreign-born parents are more physically active than youth born in the United States (Echeverría et al., 2015). In addition, Latino youth with foreign-born parents who have been in the United States for fewer than 10 years are more likely than their peers born in the United States to use an active form of transport, such as walking, to get to school (Echeverría et al., 2015). Because Latino youth are more active than their peers born in the United States, it would be logical to assume that this population would experience lower rates of obesity, although the literature had not shown this to be the case (Echeverría et al., 2015).

Gender

Data on the prevalence of overweight and obesity by gender show obvious trends (Skinner et al., 2018). For example, using the most recent available data from the NHNES, Skinner et al. (2018) found a positive trend of increasing overweight and obesity among adolescent females (ages 16-19) during 2015-2016. When considered along with race and age, Hispanic female children and adolescents of all ages have shown the greatest increases in overweight and obesity between 1999 and 2016 (Skinner et al., 2018). According to Day et al. (2014), among Asian/Pacific Islander, Hispanic, and White children, severe obesity is more prevalent among male children. When biologically implausible values (i.e., potential outliers) are included in the data analysis, severe obesity also is more prevalent among Black male children. However, these data represent only children in New York City public schools up to Grade 8 (Day et al., 2014).

Data on the relationship between gender and obesity varies widely with regard to the characteristics of the children studied and variables of interest. For example, among a group of students in Grade 6, involvement in vigorous exercise through sports was found

to lessen the potential for obesity among boys (Govindan et al., 2013). In comparison, milk consumption was found to lessen the potential for obesity among girls (Govindan et al., 2013).

Age

Rates of childhood obesity vary among age groups, with younger children having significantly lower rates of obesity than older children (Ford et al., 2016; Hoelscher et al., 2015; Ogden et al., 2015). Between 2011 and 2014, on average, rates of obesity for children ages 2-5 years and 6-11 years were 8.9% and 17.5%, respectively (Ogden et al., 2015). Rates of obesity for adolescents during these same years were 20.5% (Ogden et al., 2015). A variety of factors could explain these variations in incidents of obesity. For example, it is possible that adolescents' increased control over food choices contributed to the higher incidence of obesity among this age group.

Rates of childhood obesity among older children have been linked to rates of overweight and obesity among younger children (Cunningham et al., 2014). In Cunningham et al.'s (2014) study, 45.3% of children who were obese in Grade 8 were among the 14.9% of children who were overweight in kindergarten. Rates of annual incidence of childhood obesity also indicated that children who are overweight in kindergarten are 4 times more likely to become obese by the time they are in eighth grade when compared to children who are not overweight in kindergarten, 31.8% versus 7.9%, respectively (Cunningham et al., 2014).

Socioeconomic Status

Prevalence of childhood obesity has been found to differ among children from high, middle, and low socioeconomic backgrounds. For example, in Cunningham et al.'s

(2014) study of kindergarten children, the researcher found that overall, average rates of obesity for children in the highest of five socioeconomic groups (7.4%) was lower than those in the middle two (12.2% and 12.0%) and lowest two (16.5% and 13.8%) socioeconomic groups. Although rates of obesity among students from all five socioeconomic groups increased by Grade 8, rates of obesity for students in the highest socioeconomic groups (11.4%) was still lower than those in the middle two (20.5% and 24.2%) and lowest two (25.8% and 24.1%) socioeconomic groups (Cunningham et al., 2014).

Lack of Physical Activity

The CDC (2015b) has recommended that children and adolescents get 60 minutes of physical activity each day. Cardiovascular activity should make up the majority of time children spend engaged in physical activity; however, at least 3 times a week, children should engage in muscle and bone strengthening exercises (CDC, 2015b). However, not all children meet this goal. In combination with the consumption of foods high in calories and low in nutritional value, lack of physical activity can contribute to childhood overweight and obesity (CDC, 2015b). School personal also have perceived poor dietary choices and inactivity to be related to obesity among school children (Odum et al., 2013).

Not all researchers agree on the directionality of the relationship between lack of physical exercise and obesity. For example, McManus and Mellecker (2012) posited that childhood overweight and obesity may be the result of excess energy intake (McManus & Mellecker, 2012). As a result of metabolic changes in skeletal muscle due to the obesity, children are less able to be physically active (McManus & Mellecker, 2012). Ultimately,

obese children are less likely to engage in physical activity, although not necessarily to expend less energy during activity (McManus & Mellecker, 2012). Chen et al. (2014) also found that weight status had a small positive effect on the degree to which 9-11 year old children engaged in physical activity and that aerobic fitness had a strong positive effect on the degree to which they engaged in physical activity.

Awareness

When a young person is overweight or obese, it is imperative that that young person take immediate action to lower his or her BMI to within recommended limits (United States Preventive Services Task Force [USPSTF], 2017). However, young people often do not receive the support they need to make the lifestyle changes necessary to reach a healthy body weight (USPSTF, 2017). In some cases, young people and/or their parents do not know how to access available resources (Ayala et al., 2015; USPSTF, 2017).

Environmental and External Factors

Poorly planned and implemented overweight and obesity intervention programs (Chuang et al., 2016) and lack of community support may negatively influence children's engagement in healthy lifestyles (Ayala et al., 2015). Many environmental and external factors in the community that impact childhood obesity belong to what is referred to in the literature as the *built environment* (CDC, 2011a). "The built environment includes all of the physical parts of where we live and work (homes, buildings, streets, open spaces, and infrastructure are such examples)" (CDC, 2011a, p. 1). The impact of the built environment on childhood obesity is sociological in nature and mediated by socioeconomic status.

Lack of Access to Parks and Recreational Areas

Lack of free access to parks and recreational areas may contribute to childhood obesity because it may impact children's ability to be physically active (Kurka, et al., 2015; Rahman et al., 2011; TFAH & RWJF, 2016; Wolch et al., 2011). Socioeconomic factors may mediate access to (Baran et al., 2013) and use of (Adlakha et al., 2014) parks and recreational areas. Low-income families may have less access to free recreational areas where children may engage in physical activity (Baran et al., 2013) because the neighborhoods in which these families can afford to live to do not support areas of this kind (TFAH & RWJF, 2016).

Sociodemographic factors also may mediate access to free recreational areas (Dahmann et al., 2010). Minority populations have been found to be similarly disadvantaged with regard to access to recreational provisions (Dahmann et al., 2010). Other researchers have suggested that neighborhood crime is a mediating factor of park use for families living in low-income areas (Reynolds et al., 2014). Although neighborhood residents may have access to free recreational and park areas, concern for safety may dissuade them from using those areas (Dahmann et al., 2010). From this perspective, high rates of obesity in cities may have more to do with high rates of crime rather than lack of access to free recreational areas. This condition appeared to be the case for the population included in this study; among those who lived within close proximity to a park or other free recreational areas, those who lived in areas with higher rates of crime had higher rates of obesity.

Land Planning

Another aspect of the built environment that may influence physical activity behavior is land planning. According to Kelly et al. (2014), people who live in areas with zoning policies and infrastructures that support pedestrians, such as crosswalks and sidewalks, are more active than people who live in areas without these supports. Similarly, people who live in areas with destinations within walking distance are more likely to be active when compared to people who live in areas without destinations within walking distance (Kelly et al., 2014). In addition, land areas with continuous sidewalks or walkways, pedestrian crossings, marked walking lanes, and public transportation support physical activity among residents who are more likely to walk to their destination or to public transportation if a designated path is provided (Kelly et al., 2014).

Poverty and Lack of Access to Fresh, Healthy, and Affordable Food

The relationship between poverty and lack of access to fresh, healthy, and affordable food is complicated. Similarly complicated are the relationships between both poverty and obesity, and lack of access to fresh, healthy, and affordable food and obesity. However, that lack of access to fresh, healthy, and affordable food has been linked to obesity in children should not be surprising (Howlett et al., 2016).

Lack of access to fresh, healthy, and affordable food may be attributed to low or lack of access to large grocery stores and supermarkets that sell fresh healthy foods at affordable prices (United States Department of Agriculture, Food and Nutrition Service [FNS], 2011). The term *food desert* often is used to refer to "locations without easy access to fresh, healthy, and affordable foods" (United States Department of Agriculture, National Institute of Food and Agriculture [NIFA], 2016b). The majority of the time,

food deserts are located in low-income areas (FNS, 2017). If people do not have access to fresh healthy foods either because they do not live in proximity to a large grocery store or supermarket where these foods are sold (Evans et al., 2015; Rahman et al., 2011; FNS, 2017) or because they cannot afford to purchase these foods (Evans et al., 2015; McGeeney & Mendes, 2013; Ver Ploeg et al., 2009), it is not likely that they will consume these foods. Rather, they will be likely to rely on convenience type stores that do not typically sell fresh healthy foods and therefore more likely to consume unhealthy foods (An & Sturm, 2012) that contribute to obesity.

Food deserts, marked by lack of access to fresh healthy food, appear to be linked to poverty (McGeeney & Mendes, 2013; FNS, 2017). However, poverty also has been linked to obesity (CDC, 2016; Eagle et al., 2012; Elbel et al., 2016; Jo, 2014). Overall, low income areas typically have higher rates of obesity when compared to higher income areas (FRAC, 2017b). This condition existed in the county in which the target school was located, where more children living in high poverty areas were obese when compared to children living in low poverty areas. In addition, of the 10 cities with the highest obesity rates in the county in which the target district was located, nine of those cities (a) had few large supermarkets but many convenience stores, (b) contained at least one food desert, and (c) were characterized as low-income neighborhoods. The city in which the target district was located also included food deserts; however, the city had an overall low rate of obesity when compared to other cities in the county.

Findings from research conducted by An and Sturm (2012) do not support the claim that access to fresh healthy food is linked to the consumption of healthy food among children. In other words, there may be a supply of healthy food but lack of

demand for it. Findings from research conducted by Drewnowski et al. (2012), and Wright et al. (2016) have not supported the claim that access to fresh healthy food is linked to the consumption of healthy food among children from low-income families. If parents do not value the consumption of healthy foods, they will not be inclined to instill these values in their children. Personal and household-level characteristics also may mediate the impact of access to fresh healthy food on obesity (Chen et al., 2016). Evidence also has shown that lack of access to fresh, healthy, and affordable food may be most closely related to access to a car (Ver Ploeg et al., 2009; Wright et al., 2016), although familiarity with food, convenience, and enjoyment also may be contributing factors that underscore the influence of conscious choice with regard to food consumption (Wright et al., 2016). In other cases, families may overindulge when they have access to food, a scenario that also could lead to the consumption of unhealthy foods, especially by children (TFAH & RWJF, 2016). Poor food choices (Ford et al., 2016), including the consumption of sugar-sweetened beverages (Hu, 2013; Malik et al., 2013), also can contribute to obesity.

Overweight and Obesity Awareness and Prevention Policies

Awareness of childhood overweight and obesity may be critical for reducing the incidents of these conditions (USPSTF, 2017). To help educate overweight and obese young people and their parents about the dangers of childhood overweight and obesity and guide them to available support services, the USPSTF (2017) has recommended that all children ages 6 and older be screened for obesity in clinical settings. Outside of clinical settings, a variety of policies, initiatives, and programs have been initiated to

prevent and reduce the incidence of childhood overweight and obesity and combat their negative effects on the health and welfare of children.

Similar to awareness, prevention policies targeting childhood overweight and obesity also may be critical for reducing the incidents of these conditions by preventing them in the first place (TFAH & RWJF, 2016). Schools, communities, and public health agencies are well-situated to implement policies to achieve these goals (TFAH & RWJF, 2016). However, despite the potential for polices to positively impact childhood and adolescent overweight and obesity, no policy will be effective if it is not implemented (TFAH & RWJF, 2016). According to Gollust et al. (2013), people are more likely to support the implementation of government sponsored childhood obesity prevention policies if they understand the health consequences associated with the condition. Understanding the health consequences may increase the perceived value of such a program.

Sanchez-Vaznaugh et al. (2012) found evidence in California public schools supporting the claim that lack of policy implementation can negatively impact the potential for those policies to prevent or reduce the incidence of childhood overweight and obesity. In California, schools are expected to comply with a national recommendation that children and adolescents engage in at least 1 hour of physical activity each day (Sanchez-Vaznaugh et al., 2012). Since 2002, monitoring of compliance with physical fitness policies by California schools has been mandated by law (i.e., California Education Code; Sanchez-Vaznaugh et al., 2012). However, in a study of 55 California school districts, Sanchez-Vaznaugh et al. (2012) found that almost 50% of school districts were not in compliance with the state's physical education mandates and

that the majority of students in the study (n = 74,813, 82%) attended those schools. In addition, when compared to students attending compliant schools, students attending noncompliant schools were more likely to be eligible for free or reduced-priced lunch (70.6% vs. 77.9%, respectively; Sanchez-Vaznaugh et al., 2012). Using Fitnessgram® scores to measure students' physical fitness, Sanchez-Vaznaugh determined that students in noncompliant schools were less physically fit when compared to students in compliant schools (57.1% vs. 60.9%, respectively). Noting that this seemingly small difference in percentages represented a concerning numbers of students, Sanchez-Vaznaugh et al. called for more attention to be paid to compliance of policies designed to promote student health and fitness. Thompson et al. (2015) found that compliance with school physical education policies could be improved through public disclosure of poor school adherence to those policies.

Overweight and Obesity Prevention Initiatives and Programs

Many overweight and obesity prevention programs exist throughout the United States. Many of those programs receive federal funding. In this section, key overweight and obesity prevention programs are discussed. Because the target school in this study was located in California, funding for California is discussed separately.

United States

Many overweight and obesity prevention programs in the United States receive federal funding from the United States Department of Agriculture, NIFA's (2018b) Agriculture and Food Research Initiative (AFRI), which identified childhood obesity prevention as a challenge area in response to increasing rates of childhood and adolescent obesity that have been prevent in the United States since the 1990s. In 2015, NIFA

(2015a) awarded 17 postsecondary institutions a total of $9 million to support childhood obesity prevention. Overweight and obesity prevention programs that are primarily focused on nutrition education but that also include a strong interest in physical activity and fitness receive federal funding from NIFA's (2018c) Expanded Food and Nutrition Education Program (EFNEP), which has been in place since 1969 and operates through AFRI to fund university programs in land-grant states. In 2014, grant recipients provided direct nutrition and physical health education to 392,563 children (NIFA, 2015b); in 2015, 75 land-grant universities received grants totaling $67.9 million and provided direct nutrition and physical health education to 377,702 children (NIFA, 2016a); in 2016, 76 land-grant universities received grants totaling $67.9 million and provided direct nutrition and physical health education to 365,369 children (NIFA, 2017a); and in 2017, those same 76 land-grant universities again received grants totaling $67.9 million and provided direct nutrition and physical health education to 366,327 children (NIFA, 2018a).

Nutrition education programs supported by EFNEP and childhood obesity prevention grants supported by AFRI vary widely. For example, in 2017, AFRI grant money was used to fund projects to study the influence of media exposure on young adults, specifically with regard to their diet and exercise, as well as projects to teach students how to grow and can vegetables (NIFA, 2017b). Educators who receive EFNEP grant money must follow a research-based learning model (NIFA, 2016a), ensure programs provide quality education and are implemented with fidelity (NIFA, 2017a), and measure behavior-change indicators using valid and reliable research methods (NIFA, 2018a).

In a similar effort to reduce the incidence of childhood overweight and obesity, the CDC funded three 4-year community-based projects in 2011 (Dooyema et al., 2013) using funds appropriated by the Patient Protection and Affordable Care Act in 2010 (National Collaborative on Childhood Obesity Research [NCCOR], 2016). The focus of the program, called the Childhood Obesity Research Demonstration (CORD), was on improving health behaviors and reducing obesity among underserved children ages 2 to 12 (NCCOR, 2016). A central element of CORD was the recruitment of parents, family members, and the community as part of an inclusive effort to help children successfully change their health behaviors (NCCOR, 2016). Community health workers filled an integral role as liaisons, connecting families with community resources that otherwise would have been challenging for the families to access (NCCOR, 2016). CORD was successfully implemented in Texas, Massachusetts, and California (NCCOR, 2016) using a team approach for administering and monitoring the program (Williams et al., 2015).

California

Federal and local funding has helped California cities and universities implement initiatives and programs to reduce rates of overweight and obesity for all citizens. Programs have been focused on encouraging healthy eating habits and physical activity. Federal funding also has been granted to universities to conduct obesity-related research. This section includes discussion about both city and university programs and research in California.

Cities

In 2010, a $16 million grant from Communities Putting Prevention to Work and a 5-year grant from the CDC National Public Health Improvement Initiative allowed the

city of San Diego to launch Live Well San Diego, a 10-year initiative focused on improving citizens' health, safety, and quality of life (TFAH, 2018). In 2011, the program also received a $15 million (5-year) Community Transformation Grant to further its efforts (TFAH, 2018). As part of its plan to build better health in San Diego, the Live Well San Diego initiative and its partners have taken steps to initiate and monitor obesity-reduction interventions in schools and in the county as a whole and to provide neighborhood-based incentives to help citizens become more physically active (Live Well San Diego, 2015). Healthy Works (2014), one Live Well San Diego program initiated by the County of San Diego Health and Human Services Agency, is dedicated to reducing poor nutrition and physical inactivity by promoting healthy eating and active living.

Other city-level programs focused on improving healthy eating habits and physical activity are funded locally. Two of the larger programs are identified here. The Los Angeles County Department of Public Health's (LACDPH, 2015) Early Childhood Obesity Prevention Initiative (ECOPI) is education focused and includes three campaigns: Choose Health LA Kids, Choose Health LA Moms, and Choose Health LA Child Care (LACDPH, 2015). Although Choose Health LA Moms does include an educational component to help mothers feed their babies and children nutritious foods, the Choose Health LA Kids and Choose Health LA Child Care campaigns are solely focused on education to improve children's eating habits and physical activity (LACDPH, 2015).

Although not promoted as a campaign specifically focused on reducing childhood overweight and obesity, the Healthy Eating Active Living Cities Campaign sponsored by

the League of California Cities and the Public Health Advocates (LCC & PHA, 2018) is entirely focused on improving nutrition and physical activity in California cities. The Healthy Eating Active Living Cities Campaign achieves outcomes through the initiation of city policies designed to improve park spaces, land use, access to healthy foods, and workplace wellness (LCC & PHA, 2018). Over 330 health and wellness policies have been implemented in 190 cities throughout California as the result of the Healthy Eating Active Living Cities Campaign (LCC & PHA, 2018).

Universities

California universities also have received federal funding for childhood overweight and obesity prevention and reduction. For example, of the $9 million dollars NIFA (2015b) awarded to postsecondary institutions in 2015, $149,890 was granted to California State University, $690,537 was granted to the University of California Davis, and $777,508 was granted to the University of California Berkeley. With additional funding from other partners, the universities used their funding to support existing programs and implement new programs focused on improving healthy eating habits and physical activity.

Between 2015 and 2017, California State University sponsored a mindful-eating intervention for third, fourth, and fifth grade Hispanic students in a northern California school (Pierson et al., 2016). The University of California Davis, Division of Agriculture and Natural Resources Center for Nutrition in School (2014) initiated a school-based intervention program called Shaping Healthy Choices Program focused on nutrition education and promotion in schools. Under the University of California, Division of Agriculture and Natural Resources (2018), the University of California Davis and the

University of California Berkeley initiated and continues to sponsor the Nutrition Policy Institute to conduct research that can be used to build evidence-based nutrition policy and programs.

As part of CORD, San Diego State University implemented a program, called Our Choice, in Imperial City, California, a predominantly Mexican community (Ayala et al., 2015). Based on the community involvement concept underlying all CORD funded projects, the Our Choice program recruited families (n = 1,200), early childhood care and education centers (n = 26), elementary school districts (n = 2), community recreation centers (n = 3), restaurants (n = 3), and a health center (Ayala et al., 2015). The 2-year intervention was intended to improve children's consumption of water, fruits, and vegetables; engagement in physical activity; and duration of quality sleep by initiating changes in the children's physical and social environments, and systems and policies that influence their behaviors (Ayala et al., 2015). In the healthcare setting, new obesity assessment policies were put in place and new healthcare delivery model was adopted; in the public health setting, early childhood care and education centers increased opportunities for children to engage in healthy eating and physical activity and to obtain quality sleep; and in community settings, fruit and vegetable gardens were built and restaurants promoted healthy children's menu options (Ayala et al., 2015).

Improving Public Health Programs

According to Ammerman et al. (2014), public health researchers and advocates have recognized the complexity of chronic disease prevention and offered suggestions to help program developers and practitioners achieve intended outcomes for the programs they design and implement. The suggestions vary in scope and focus. This section

includes discussions of models focused on program sustainability and support for (b) evidence-based models, (c) the dissemination of evidence, and (c) the use of DHFTs in classrooms.

Considering Sustainability

The Center for Public Health Systems Science (CPHSS) has suggested that program developers use a three-step planning process that begins by assessing a program using a program assessment tool (Calhoun et al., 2014). For the first step, program developers use a 40-question program sustainability assessment tool to measure the sustainability of their program based on eight domains: environmental support, funding stability, partnerships, organizational capacity, program evaluation, program adaptation, communications, and strategic planning (CPHSS, 2013). Responses range from 1 (*to little or no extent*) to 7 (*to a very great extent*); although a *not able to answer* response is offered, program developers are discouraged from using that response option (CPHSS, 2013). Overall domain scores are calculated by averaging the scores for each of the five questions in each domain; the average scores are then considered in relation to the scale (CPHSS, 2013). Programs with lower (closer to 1) overall domain scores are considered less sustainable than programs with higher (closer to 7) overall domain scores (CPHSS, 2013).

For the second step, program developers should develop an action plan in stages: (a) assemble a planning team; (b) review the program's mission and purpose; (c) consider the program sustainability assessment tool results; (d) determine which elements of the program need to be adapted, eliminated, or maintained; (e) prioritize program areas of sustainability that need attention; and (f) write an action plan (Calhoun et al., 2014). For

the final step, program developers should take action and implement the program plan (Calhoun et al., 2014). To ensure that the plan remains viable over time, the program developers should reassess the program's sustainability on an annual basis (Calhoun et al., 2014).

Considering Evidence

Results of a systematic review of the literature showed that although high school, middle school, and especially elementary school overweight and obesity interventions may have helped decrease rates of childhood overweight and obesity, the program designs often were not evidenced based and thus likely hindered the extent of positive influence the programs could have had on these health outcomes (Ickes et al., 2014). For example, many programs included in the systematic review had hands-on nutrition activities but did not combine them with a physical activity component even though the research has shown that programs are more effective when both of these program components are present (Ickes et al., 2014). Similarly, many programs in the systematic review did not include and environmental change or parent involvement even though the research has shown that programs are more effective when these program components are present (Ickes et al., 2014). Designing childhood overweight and obesity prevention interventions using evidence-based practices may be especially critical when implementing interventions designed to serve low-income populations (Ickes et al., 2014).

One way to ensure that programs are designed considering evidence is to include public health and clinical practitioners. In fact, Ammerman et al. (2014) claimed that it is essential to seek the input of both public health and clinical practitioners when

developing programs designed to decrease the incidents of chronic diseases, including obesity. Clinical health practitioners are essential for the development of successful disease prevention programs because they can provide public health practitioners with evidence-based tools and approaches they can use to generate practice-based evidence that can be applied in practice (Ammerman et al., 2014). Evidence-based interventions can be especially useful in situations in which practitioners are responsible for implementing public health programs, such as those for improving healthy eating habits and physical activity, but do not have the request skills or knowledge to do so (Leeman et al., 2014).

Disseminating Evidence

As Ickes et al. (2014) and Ammerman et al. (2014) stated, it is imperative that childhood overweight and obesity prevention programs are evidence based. However, in order for program developers to have access to evidence, that evidence must be disseminated to the public. Harris et al., (2014) found that Twitter users disseminate public health evidence using the social media app and suggested that more public health evidence could be disseminated to greater audiences and more readily translated into practice if more government agencies and education organizations increased their use of Twitter for that purpose.

Ammerman et al. (2014) also has stressed the importance of disseminating practice-based evidence once a program has been implemented and proven effective. By sharing practice-based evidence of program effectiveness, the program may be more broadly translated to other applications and expanded as needed (Ammerman et al.,

2014). In this way, an effective program may become relevant to practitioners in a wide range of settings and have the greatest positive influence (Ammerman et al., 2014).

Using Digital Health and Fitness Technologies in Classrooms

The need for preventing and reducing the incidence of childhood overweight and obesity among school-aged children has been well-established in the literature (Kihm et al., 2017). However, literature demonstrating strategies teachers can use to integrate DHFTs into their classrooms is scarce. This void is noteworthy considering teachers are well-situated to promote healthy eating, nutrition, and exercise habits in their classrooms. Recognizing this void, researchers at the Southeastern University in Hammond, Louisiana, developed a lab to simulate a classroom setting that could accommodate DHFTs and fitness equipment appropriate for elementary through high school students (Kihm et al., 2017). Equipment included direct-report equipment such as heart rate monitors as well as self-report instruments and video games (Kihm et al., 2017). The impetus behind the development of the lab, called the interactive physical activity lab, was that by providing a setting in which student teachers could learn to integrate DHFTs and fitness equipment into their daily teaching practices, the student teachers would gain real-world skills in these applications (Kihm et al., 2017). The assumption, then, is that if student teachers gain the knowledge and skills needed to effectively incorporate DHFTs into their teaching practices, they will be more likely to so when they are actively teaching (Kihm et al., 2017).

Positive Influence of Interventions on Childhood Obesity and Related Factors

Evidence in the literature demonstrates that interventions designed to decrease rates of childhood overweight and obesity can be effective. Evidence in the literature also

demonstrates that interventions designed to improve physical activity, healthy eating habits, and other obesity related factors also can be effective in achieving those outcomes. In this section, evidence from the literature just described is presented. When applicable, the discussions are divided according to whether they are general findings or findings specific to California.

Impact of Interventions on Physical Activity: General Findings

Interventions promoting physical activity have been shown to be effective. Annual impact reports from NIFA (2015a, 2016a, 2017a, 2018a) consistently show that young people have improved their levels of physical activity. NIFA data from 2014-2017 showing rates of annual improvement are presented in Table 3.

Table 3

Impact of EFNEP Sponsored Programs on Youth Knowledge of Physical Activity or Actual Physical Activity Practices (2014-2017)

Program year	Total youth participants (*N*)	Youth participants impacted by program (*n*)	Youth participants impacted by program (%)
2014	163,266	71,837	44
2015	133,904	61,596	46
2016	83,251	33,300	40
2017	208,824	85,618	41

Note. Data retrieved from 2014, 2015, 2016, and 2017 NIFA impact reports.

Like programs sponsored by NIFA, programs sponsored by the FNS's Supplemental Nutrition Assistance Program (SNAP), such as HealthMPowers (2017) and University of Florida, Family Nutrition Program (2017) have helped children improve

their engagement in physical activity after the implementation of interventions focused on improving this outcome. In Florida, children in Grades 3-5 increased their levels of physical activity by 50% after participating in the University of Florida, Family Nutrition Program (2017); students in Grades 6-12 increased their levels of physical activity by 40%. In Georgia, results of improvements in physical activity were reported with improvements in nutrition behavior; data showed that 95% of children who participated in the HealthMPowers (2017) program showed improvements in their physical activity or nutrition behavior. Playworks, a school-based physical activity program implemented in 29 schools in six cities across the United States, also has been found to improve rates of physical activity (Bleeker et al., 2015). In particular, girls who participated in the program increased the vigorousness of their physical activity and the length of time in which they engaged in physical activity (Bleeker et al., 2015).

Impact of Interventions on Physical Activity: Findings Specific to California

Interventions promoting physical activity in California in particular also have been shown to be effective. For example, as part of the Live Well San Diego initiative, the Healthy Works program helped an elementary school district in Chula Vista increase students' levels of physical activity through its Building Better Bodies project (Live Well San Diego, 2014). The project included policy changes that promoted activity breaks in classrooms throughout the day, added scheduled and structured physical education time to the common core curriculum, and provided guidance for encouraging active recess time (Live Well San Diego, 2014). The curriculum was designed for K-6th grade students and was aligned with California Physical Education Content Standards and Common Core State Standards (Chula Vista Elementary School District, 2018). Approximately 300

teachers helped more than 4,400 students be more active during their school day (Live Well San Diego, 2014).

In a study of courses (N = 7,045) offered by recreational programs in and around Los Angeles, Reynolds et al. (2014) found courses consistently provided participants with opportunities to engage in exercise of at least moderate intensity, which is considered to be exercise that requires an energy expenditure of 3.5 metabolic equivalent (MET) hours. The average MET-hour for all courses was 8.74, and the average MET-hour per session was greatest for courses advertised as appropriate for community members of all ages and courses advertised for community members between the ages of 6 and 18, when compared to courses advertised for children up to age 5 and for community members over age 50 (Reynolds et al., 2014). Courses requiring the highest degree of energy expenditure were those with the highest number of participants and the densest populations (Reynolds et al., 2014). These results suggest that recreation programs in the greater Los Angeles areas have the capacity to provide courses for the public that effectively help increase rates of physical activity.

Impact of Interventions on Nutrition Education: General Findings

Research has shown that healthy behavior interventions can help children improve their knowledge about nutrition. Among children in kindergarten, first, and second grade, a nutrition education program, called Growing Healthy Kids, helped students significantly improve their knowledge about nutrition (Vierregger et al., 2015). Teachers who implemented the program reported that they felt more confident teaching children about nutrition as a result of their participation in the program (Vierregger et al., 2015). It

is possible that teachers' increased confidence in teaching about nutrition influenced their teaching effectiveness and thus the effectiveness of the program.

Improvements in nutrition knowledge also have been found with programs targeting older children as well. Annual impact reports from NIFA (2015a, 2016a, 2017a, 2018a) consistently show that young people improved their knowledge or ability of how to make healthy food choices and improved their knowledge or ability of how to prepare low-cost and nutritious foods. Data showing improvements in knowledge or ability of how to make healthy food choices and how to prepare low-cost and nutritious foods for the years 2014-2017 are presented in Table 4.

Table 4

Impact of EFNEP Sponsored Programs on Youth Knowledge or Ability (2014-2017)

Program year	Total youth participants (*N*)	Youth participants impacted by program (*n*)	Youth participants impacted by program (%)
	How to make healthy food choices		
2014	164,353	141,343	86
2015	134,718	114,510	85
2016	167,723	135,856	81
2017	209,622	17,698	80
	How to prepare low-cost and nutritious foods		
2014	19,041	9,520	50
2015	24,914	11,959	48
2016	12,356	5,931	48
2017	28,273	13,288	47

Note. Data retrieved from 2014, 2015, 2016, and 2017 NIFA impact reports.

Using NIFA data from 2000-2006, Baral, Davis, Blake, et al. (2013) calculated the maximum average outcome costs of the EFNEP nationally and by state. Across the United States, the overall average cost per EFNEP participant, was $520; the standard deviation was $310 (Baral, Davis, Blake, et al., 2013). Excluding Nevada, for which no data were available, overall state costs per person ranged from $142 in Texas to $1,953 in Mississippi (Baral, Davis, Blake, et al., 2013). Overall EFNEP cost per person were calculated not only based on nutrition practices, including knowledge about or ability to choose healthy foods, and food resource management practices, including knowledge about or ability to prepare low-cost healthy meals, but also food safety, a concept not addressed in this study or literature review.

When average EFNEP cost per person was calculated specifically for improving nutrition practices, the average was $594 (Baral, Davis, Blake, et al., 2013). Excluding Nevada again, state costs per person for nutrition practices ranged from $156 in Texas to $2,286 in Mississippi (Baral, Davis, Blake, et al., 2013). When average EFNEP cost per person was calculated specifically for improving food resource management practices, the average was $634 (Baral, Davis, Blake, et al., 2013). Excluding Nevada again, state costs per person for nutrition practices ranged from $162 in Texas to $2,503 in Mississippi (Baral, Davis, Blake, et al., 2013).

Based on the cost-per-person state averages, Baral, Davis, Blake, et al. (2013) determined that the EFNEP most successfully improved program participants' nutrition practices followed by their food resource management practices. In addition, Baral, Davis, and You (2013) found a significant positive correlation between improvement in the nutrition practices index and rates of income 150% over the poverty line. In addition,

participants in nonfarming rural areas demonstrated greater improvement in nutrition practices and food resource management practices when compared to participants from central cities (Baral, Davis, & You, 2013).

Impact of Interventions on Nutrition Education: Findings Specific to California

In Baral, Davis, Blake et al.'s (2013) study of outcome costs for the EFNEP program by state, the author calculated outcomes for California. Based on NIFA data from 2000-2006, the cost in California was estimated to be $299 per person annually. This cost was below the $520 national average and well below the high end of the cost range, which was $1,953 in Mississippi (Baral, Davis, Blake, et al., 2013).

When average EFNEP cost per person was calculated specifically for improving nutrition practices, the cost in California was estimated to be $348 (Baral, Davis, Blake, et al., 2013). This cost was below the $594 national average and approximately one fourth of the high end of the cost range, which was $2,286 in Mississippi (Baral, Davis, Blake, et al., 2013). When average EFNEP cost per person was calculated specifically for improving food resource management practices, the cost in California was estimated to be $375 (Baral, Davis, Blake, et al., 2013). This cost was below the $634 national average and approximately one fourth of the high end of the cost range, which was $2,503 in Mississippi (Baral, Davis, Blake, et al., 2013).

Impact of Interventions on Healthy Eating Habits: General Findings

In another Growing Healthy Kids program, children from three North Carolina communities participated in a pilot program to evaluate the effectiveness of an obesity prevention program centered around community gardens (Castro et al., 2013). Children, ages 2-15, and their families (a) participated in a 7-week cooking and nutrition workshop

where they learned to prepare meals and make healthy food choices; (b) worked once a week for 8 months in a community garden where they learned gardening skills, including how to prepare soil, plant seedlings, weed, and tend to and harvest their crops; and (c) engaged in community social activities and events designed to promote and maintain interest in the garden program (Castro et al., 2013). Pre- and posttest results indicated that the community garden program helped increase household availability of fruits by 146% and vegetables by 123% and helped increased daily consumption of fruit by 28% and vegetables by 33% (Castro et al., 2013).

Improvements in health eating habits also have been found with programs targeting older children as well. Data for all *EFNEP* program participants for the years 2014-2017 show that adults and young people increased their dairy, vegetable, and fruit intake (NIFA, 2015a, 2016a, 2017a, 2018a). These data are presented in Table 5.

In all report years, results for the grain group were less favorable than the dairy, vegetable, and fruit groups (see NIFA, 2015a, 2016a, 2017a, 2018a). In 2014 and 2016, protein consumption remained the same, and in 2015 and 2017, protein consumption increased; however, in all years, protein consumption exceeded government recommendations for daily consumption.

Like NIFA, the FNS also found improvement in children's consumption of fruits and vegetables after the implementation of an intervention focused specifically on this outcome. The intervention, Building and Strengthening Iowa Community Support for Nutrition and Physical Activity (BASICS) program, was implemented by the Iowa Nutrition Network (INN) as part of an ongoing effort to help third grade children from

low income families enrolled in the FNS's SNAP increase their consumption of fruits and vegetables (Long et al., 2013a).

Table 5

Impact of EFNEP Sponsored Programs on Youth and Adult Food Consumption by Group (2014-2017)

Program year	Before program	After program	Increase
		Dairy consumption[a]	
2014	1.2	1.4	.2
2015	1.1	1.3	.2
2016	1.1	1.3	.2
2017	1.2	1.3	.1
		Vegetable consumption[b]	
2014	1.5	1.7	.2
2015	1.5	1.8	.3
2016	1.5	1.7	.2
2017	1.6	1.8	.2
		Fruit consumption[c]	
2014	1.0	1.3	.3
2015	.9	1.3	.4
2016	.9	1.3	.4
2017	.9	1.3	.4

Note. EFNEP program data retrieved from 2014, 2015, 2016, and 2017 NIFA impact reports. All data represent cups of food.

[a, b, c] According to the United States Department of Agriculture's MyPlate.gov healthy eating guidelines, females ages 19-30 should consume 3.0 cups of dairy, 2.4 cups of vegetables, and 2.0 cups of fruit per day.

Implementing the BASICS program was especially challenging for INN not only because the program's goal was to change children's eating habits but also to help parents promote those habits within a limited budget (Long et al., 2013b). The BASICS program

was implemented through schools over the course of 7 months and included eight in-school lessons that lasted approximately 30 minutes each, four in-school lessons that last approximately 50 minutes each, and take-home materials (Long et al., 2013b). In-class lessons included food tastings to complement the educational lessons, and take-home materials included messages encouraging parents to try new foods and buy healthy foods, recipe cards, and games focused on healthy eating (Long et al., 2013b). Evaluations conducted by both INN and FNS showed that after participating in the intervention, students ate more fruits and vegetables at home (Long et al., 2013b).

Another FNS sponsored program, University of Florida, Family Nutrition Program (2017), also showed positive behavior changes as the result of nutrition education. In Florida, the percentage of children in Grades 3-5 who eat more than one kind of vegetable increased by 35% after participating in the University of Florida, Family Nutrition Program; the percentage of children in Grades 6-12 who eat more than one kind of vegetable increased by 33%. In the same program, the percentage of children in Grades 3-5 who eat more than one kind of fruit increased by 44% after participating in the University of Florida, Family Nutrition Program; the percentage of children in Grades 6-12 who eat more than one kind of fruit increased by 38%.

As a member of the CORD program, the Massachusetts State Department of Public Health implemented a multisector intervention for low-income children ages 2 to 12 in two low-income communities to increase consumption of fruits and vegetables, decrease consumption of sugar-sweetened beverages, increase physical activity, decrease screen time, and increase duration of quality sleep (Franckle et al., 2017). The intervention included five components implemented in health centers, five components

implemented in schools, two components implemented in after-school programs, and one component implemented in the community (Franckle et al., 2017). Children in Grades 4 and 7 at both sites also showed increased consumption of water and decreased consumption of sugar-sweetened beverages; those same children also showed decreased screen time at Site 2 (Franckle et al., 2017).

Impact of Interventions on Healthy Eating Habits: Findings Specific to California

Interventions promoting healthier eating in California in particular also have been shown to be effective. For example, as part of Chula Vista elementary school district project Building Better Bodies, the school was able to implement improved food guidelines for the district (Live Well San Diego, 2014). The project also prompted changes in nutrition services at the schools; one major change was that allowable limits of fats and sugars in school-offered meals was decreased (Live Well San Diego, 2014).

Impact of Interventions on Overweight and Obesity: General Findings

The influence of childhood overweight and obesity prevention programs on childhood obesity are evident in a variety of settings and using different types of prevention formats (Wang et al., 2013). In a meta-analysis of obesity prevention programs designed for children ages 2 to 18 and implemented mostly in the United States, Wang et al. (2013) found study results that demonstrated the effectiveness of childhood obesity interventions in school-based programs focused on diet interventions, physical activity interventions, or both. Specifically, reductions in obesity among the participants were found in (a) school-home-based interventions focused on obesity reduction through diet modification (n = 1), increased physical activity (n = 3), and diet modification and increases physical activity combined (n = 21); (b) school-community-

based interventions focused on obesity reduction through diet modification (n = 1), and diet modification and increased physical activity combined (n = 1); and (c) school-home-community-based interventions focused on obesity reduction through diet modification (n = 1), and diet modification and increased physical activity combined (n = 1; Wang et al., 2013).

With regard to school-based interventions, Wang et al. (2013) concluded that the most effective interventions were those that were school-based and either physical activity interventions that included a family involvement or diet and physical activity interventions that included home and community involvement. Although the evidence showed that diet and physical activity interventions could influence the prevalence of childhood obesity, Wang et al. warned that evidence of the effectiveness of school-based overweight and obesity prevention interventions was only moderate and that the strength of the evidence was insufficient to claim that physical activity interventions are superior to diet interventions or vice versa.

Results of the multisector Massachusetts CORD program intervention also showed mixed results. Although overall, modest reductions in obesity were found for Grade 7 children at both intervention sites, results were significant only for children at Intervention Site 1 (Franckle et al., 2017). In school-based intervention components, outcomes may have been limited by high administrator attrition, teacher burnout, prioritizing of statewide testing (Blaine et al., 2017), poor communication with community partners, too little physical activity during the school day, and too few student choices for healthy snacks (Ganter et al., 2016). In the clinical sector of the Massachusetts CORD program in particular, the health center intervention was made up

of five components: staff training, decision-making support tools, clinic-based weight management programs, inclusion of clinical health workers at clinic sites, and modifications to health centers (Taveras et al., 2017). Children at the two intervention sites (Intervention Site 1, n = 111; Intervention Site 2, n = 1,368) and one control site (n = 2,286) were used to determine the effectiveness of the intervention (Taveras et al., 2017). After 2 years, participants' electronic health records showed no change at Intervention Site 1; however, a significant decrease in BMI scores for children was noted at Intervention Site 2 (Taveras et al., 2017).

Community-based childhood obesity preventions programs also may be effective. In the North Carolina Growing Healthy Kids Program, the garden-based community program was successful in reducing rates of childhood overweight and obesity (Castro et al., 2013). Of the 23 children who were obese at the beginning of the program, 13% had been reclassified as overweight; of the 13 children who were overweight at the beginning of the program, 23% had been reclassified as having normal weight (Castro et al., 2013). Despite such promising evidence from this and other programs, Bleich et al. (2013) suggested that community-based childhood obesity preventions programs may be more effective when they include a school component (Bleich et al., 2013). In addition, the effect of programs may be greater when the intervention includes both a physical activity and a diet component (Bleich et al., 2013).

Impact of Interventions on Overweight and Obesity: Findings Specific to California

Interventions targeting overweight and obesity specifically in California have been mixed. Some programs have been found to be effective. For example, programs implemented by Live Well San Diego (2017) partners decreased rates of childhood

obesity by 17% during the 2016-2017 program year. The Building Better Bodies program implemented in the Chula Vista elementary school district significantly reduce students' BMIs through policy changes regarding physical activity and healthier eating (Live Well San Diego, 2014). California schools that participated in the Shaping Healthy Choices Program also reported decreases in rates of childhood obesity (University of California, Davis Center for Nutrition in Schools, 2014). In 2014 when the program was implemented, rates of childhood obesity dropped from 56% to 38% (University of California, Davis Center for Nutrition in Schools, 2014).

On the other hand, when Madsen et al. (2015) explored the effect of the national-level Healthy Schools Program on the prevalence of overweight and obesity among 5th, 7th, and 9th grade students in California schools, they found no difference between students who participated in the program and students in the control group. However, the researchers noted that comparing schools that participated in the program was challenging because the implementation of the program varied greatly from school to school. In addition, Madsen et al. found that schools that had training and technical assistance on site or that were in contact with national program advisors showed greater decreases in the prevalence of overweight and obesity among its students. The researchers concluded that full implementation of the program and the use of provided program supports are critical to the success of the program.

In earlier research of the effect of obesity interventions in California schools, Aryana et al. (2012) found that overall fitness for 5th, 7th, and 9th grade students improved between 2003 and 2008. However, rates of obesity remained stable (Aryana et al., 2012). The researchers suggested that the program was not effective in decreasing the

rates of obesity because the students who entered the program in 5th grade were becoming increasingly obese each year. Therefore, although the program may have helped students decrease their degree of obesity, the incidence of obesity was not affected.

Digital Health and Fitness Technologies

DHFTs are digital devices or associated applications used to monitor body functions. However, the underlying purpose of many DHFTs is to promote physical activity (Middelweerd et al., 2014). The types and characteristics of DHFTs are discussed in this section. The influence of DHFTs on obesity and related factors also are discussed in this section. MHealth technologies, DHFTs used in medical settings, can be useful tools to help doctors monitor patients (Dobkin & Dorsch, 2011) and help patients self-monitor their own disease progression and health (Anderson et al., 2016). However, the medical applications of DHFTs are beyond the scope of this study and, therefore, not addressed here.

Types and Characteristics of DHFTs

DHFTs may be used to monitor activity, promote behavior change, or educate users. Although generally similar with regard to those purposes, DHFTs vary in type and characteristic. A brief discussion of the differences is provided here.

Activity

Some DHFTs are devices used to quantify physical activity (Schaefer et al., 2014). An example of a DHFT that is used to quantify activity is a pedometer (Schaefer et al., 2014), which is used to track the number of steps the wearer of the devices makes (Omron Healthcare, 2018). Some pedometers may also measure the distance a person

walks and the number of calories they burn while walking (Wise & Hongu, 2014). Devices such as pedometers are typically small and inexpensive to purchase (Schaefer et al., 2014). In a study of validity of physical activity trackers, Kooiman et al. (2015) found that most activity trackers accurately measured step counts and, therefore, were a good means of tracking physical activity.

Other DHFTs are devices used to both quantify and qualify physical activity (Schaefer et al., 2014) are called accelerometers, which are electromechanical devices capable of detecting changes in speed and direction of motion (Goodrich, 2013). Accelerometers typical measure movement laterally, longitudinally, and vertically (Wise & Hongu, 2014). Examples of accelerometers are the Philips Actical, the SenseWear Pro2, and the Polar Active (Schaefer et al., 2014).

DHFTs also may be considered downloadable apps. Apps may be designed to be used on computers or mobile devices (Baranowski & Frankel, 2012) or with fitness equipment. Dunton et al. (2014) suggested that the use of activity tracking apps on smartphones may be better alternatives to physical activity monitors such as pedometers and accelerometers because such devices are more susceptible to nonwear by users unlike mobile phones, which people less frequently forget to keep on their person. Arif et al. (2014) determined that smartphone features used to measure physical activity are 99% accurate. Some of the most popular apps for weight loss are CardioTrainer, MyFitnessPal, and CalorieCounter (García-Gómez et al., 2014). GoNoodle is a popular web-based resource designed especially school-aged children and is particularly well-suited for use in the classroom (Whitney, 2016). One example of a DHFT that can be used with cardio equipment is the BitGym (Active Theory, Inc., 2018).

Behavior Change

The most common feature of health and fitness apps is a behavior change function (Wearing et al., 2014; Wong et al., 2014); however, the fitness apps vary with respect to the types of behaviors they are designed to change or promote. In a study of 64 downloadable fitness apps, Middelweerd et al. (2014) found that on average, the apps focused on five behavior change techniques. The number of techniques included in each app ranged from two to eight; the most frequently included techniques were performance feedback (n = 64), self-monitoring of behavior (n = 62), goal setting (n = 40), social support (n = 37), and contingent rewards (n = 31). Among the 64 apps, Middelweerd et al. found that 17 of 23 possible behavior change techniques were found. The CardioTrainer app was included in the study and was found to include five behavior change techniques (Middelweerd et al., 2014). In their review of 62 health and fitness apps, Wearing et al. (2014) found the most common behavior change promoted was increased physical activity (53.25%) and increased consumption of fruits and vegetables (48.3%).

Although most health and fitness apps include a behavior change function, few apps include strategies for changing behavior (Wearing et al., 2014). In Wearing et al.'s review of health and fitness apps, the researchers found that only 20.9% of apps included a behavior strategy function. Those strategies were goal setting, positive reinforcement, self-monitoring, and cognitive restructuring (Wearing et al., 2014).

Fitness apps may be limited with respect to the degree that they promote expert-recommended behaviors and strategies for obesity prevention. In fact, Wong et al. (2014) found that that less than 20% of the 55 fitness applications they reviewed met at least four

of the eight recommendations for losing weight suggested by the American College of Sports Medicine. Wearing et al. (2014), who conducted a similar study with health and fitness apps specifically for children, found most of the 62 iPhone health and fitness apps they reviewed lacked adherence to expert recommendations for pediatric obesity prevention.

User Education

Typically, DHFTs used to educate users are focused on nutrition, and the education component is commonly structured as a game (see University of California, Santa Barbara, Center for Digital Games Research, 2018). Because most of the games do not require physical movement to play them, they would not be considered active video games. Examples of games for children related in some way to identifying healthy foods, making healthy food choices, or meal planning include (a) Aisha and Ronnie (British Nutrition Foundation, 2018); (b) Dining Decisions (CDC, 2017b) and (c) Food Group Frenzy, the Food Groups Game, and Food Detective, a matching game, from Sheppard Software (2018).

Because of the ubiquitous nature of mobile technologies, DHFT apps are not limited to development by Western cultures. This means that health and fitness apps may reflect unique aspects of a particular culture. For example, Damkliang et al. (2016) developed an app to promote nutritious eating for Thainese people based on traditional Thai foods and dishes.

Influence of Digital Health and Fitness Technologies on Obesity and Related Factors

For DHFTs to have the desired outcome of increased health and fitness, people must use the technology. People's interest in using DHFTs may be influenced by the

purpose for using the technology. In their study of 14 to 17 year old girls ($N = 8$), Depper and Howe (2017) found that girls perceived other girls only have the apps to uphold appearances. The girls who were interviewed felt other girls wanted to be perceived as being healthy and active but in fact did not actually use the apps. People's interest in using DHFTs also may be influenced by the structure and design of the technology. According to Schaefer et al. (2014), children are more likely to use DHFTs if they are "comfortable to wear, fit properly, have engaging features, and are waterproof" (p. 1). These study findings were based on a group of 7 to 10 year old children from California who tested three types of accelerator devices (Schaefer et al., 2014).

With regard to teacher use of DHFTs in educational settings, the same philosophy applies. Teachers who do not see the value of using DHFTs for themselves are unlikely to incorporate the use of DHFTs into their teaching strategies (Ertzberger & Martin, 2016). Even when teachers do see the value in using DHFTs to improve their heath and capacity to teach, they may be hesitant to incorporate them into their lessons because of their concern they will be a distraction to teaching or cause them to focus too much on fitness rather than the curriculum (Ertzberger & Martin, 2016).

If people are interested in using and do use DHFTs, positive outcomes may result. One positive outcome of using DHFTs is increased physical activity. Technology typically has been associated with sedentary behavior (Heyward & Gibson, 2014). However, advancing DHFTs, especially those that use GPS technology, often require people to be active in one or more ways (Heyward & Gibson, 2014).

Another positive outcome of using DHFTs is weight loss. This outcome was found by Pourzanjani et al. (2016) in their study of almost 15,000 people using online

activity tracking apps in which they logged more than 2 million activities. People who logged activities lost weight; however, people who more often logged their food habits and body weight lost greater percentages of weight, 0.63% and 0.40%, respectively, when compared to people who logged their food habits and weight less frequently (Pourzanjani et al., 2016). People who frequently logged physical activities also lost greater percentages (0.38%) of body weight when compared to people who logged their physical activity less frequently (Pourzanjani et al., 2016).

In a review of the literature, Thomas and Bond (2014) determined that the most effective DHFTs are those that include a function for self-monitoring weight-control behaviors. However, not all research supports the benefits of using DHFTs for weight loss or control. In their randomized controlled study of usage of two mobile weight loss apps by 18 to 35 years olds, Svetkey et al. (2015) did not find a connection between usage of the app and weight loss. The researcher did acknowledge that mediating factors may have been involved with the unexpected and negative outcomes of the study.

Active Video Games

Active video games are video games that require some type of physical activity for use (Baranowski & Frankel, 2012). In this section, the types and characteristics of active video games are introduced. In addition, the influence of active video games on childhood obesity and related factors is discussed.

Types and Characteristics of Active Video Games

Active video games may be designed to be played indoors or outdoors (Boulos & Yang, 2013). Examples of active video games designed to be played indoors typically require the use of a platform such as the Nintendo Wii™ (Nintendo, 2018), Microsoft

Xbox Kinect (Meyler et al., 2014), or *Dance Dance Revolution* (Gao, Podlog, & Huang, 2013). Games that may be played on the consoles include Helix (Ghostfire Games, 2012), Nintendo Wii Fit+™, Nintendo Wii™ Sports, Walk It Out!, We Cheer, and We Cheer 2 (Nintendo, 2018). Examples of active video games intended to be played outdoors include (a) Dokobots, (b) Epic/Mix ski, (c) Microsoft HealthVault (Boulos & Yang, 2013), (d) Zombies, Run!, (e) GameFit Racing (Wise & Hongu, 2014). Although not marketed as a health app, Pokémon Go can be considered an active video game because it requires extensive walking (McCartney, 2016). Outdoor-based active video games typically include functions that rely on GPS to determine the player's location and interact with other players (Boulos & Yang, 2013).

Influence of Active Video Games on Childhood Obesity and Obesity Related Factors

The research has shown that playing active video games has a number of positive outcomes. However, based on a systematic review of the literature, Mack et al. (2017) suggested that positive outcomes associated with playing active video games may be most likely to be realized when the game-playing activity is part of an organized treatment program or intervention. In addition, Bernstein et al. (2015) suggested that children's skill level with active video games may influence the degree to which they play the games, especially in competitive situations. This finding underscores the importance of skills coaching in addition to access to active video games to recognize positive outcomes of playing such games (Bernstein et al., 2015). Similar research outcomes across varied racial backgrounds demonstrates that the influence of active video games on childhood obesity and obesity related factors is not race specific and can benefit all children.

Influence on Obesity

The use of active video games has been found to decrease obesity. For example, in a study of overweight and obese children ages 8 to 12, Trost et al. (2014) found that when children played active video games as part of a structured pediatric weight management program, BMI *z* scores and rates of overweight were reduced significantly.

Influence on Physical Activity

A variety of studies have shown that playing active video games increases levels of physical activity (Merino-Campos & del Castillo Fernández, 2016; Peng et al., 2012). For example, Gao et al. (2012) found that when compared to children in Grade 5 who did not play the active video game Dance Dance Revolution 3 times per week for 9 months, children in Grade 4 who did play Dance Dance Revolution had significantly increased levels of physical activity per week (Gao et al., 2012). Children who participated in Gao et al.'s (2012) study were Latino (71%), White (12%), Black (9%), and Asian (8%).

In a similar study examining the relationship between playing Dance Dance Revolution and children's levels of physical activity, Maloney et al. (2012) also found that playing the game increased levels of physical activity among children. However, those results were based on self-reported data from the students and were not confirmed with inferential analyses (Maloney et al., 2012). The children in Maloney et al.'s study were between the ages of 9 and 17, and participated in the game playing treatment for 12 weeks; races of the participants were not identified. In a separate but similar study, Errickson et al. (2012) found that playing Dance Dance Revolution significantly increased children's levels of physical activity over a 10-week period. Children in the study were ages 7 and 8, and identified as White (66.7%) and non-White (33.3%;

Errickson et al., 2012). Errickson et al. suggested that the positive findings were mediated by coaching the children received on how to navigate the game menu and physically engage in the dance steps.

In Trost et al.'s (2014) study, children who played active video games as part of a structured pediatric weight management program had significantly greater increases in rates of moderate to vigorous exercise when compared to a control group who participated in the same weight management program but who did play active video games. Children who participated in Trost et al.'s study were White (45%), Hispanic (27%), and Black (23%).

Although study findings demonstrate that engagement in active video games is an effective means for increasing levels of physical activity in children, Sun (2013) questioned the sustainability of the outcome. According to Sun, after two semesters of playing one or more of eight total exergames, the fifth grade students in the study began to lose interest in playing the games; however, the intensity of their physical activity increased over time. Students were identified as Black (60.7%), Latino (20.3%), White (9.5%), Asian (2.7%), Native Indian (1.4%), and multi-racial (5.4%; Sun, 2013).

Influence of Physical Fitness

In addition to improving levels of engagement in physical activity, playing active video games has been shown to improve levels of physical fitness. In a study of Latino children ages 10-12 (fourth grade), Gao, Hannan et al. (2013) found that children who played Dance Dance Revolution for 30 minutes a day 3 times a week had better levels of physical fitness when compared to children who did not play the game. Increase in physical fitness was calculated using time to complete a 1-mile run (Gao, Hannan, et al.,

2013). Children who played Dance Dance Revolution for 9 months decreased their 1-mile run completions time by 8.2% (Gao, Hannan, et al., 2013). During the second year, children played the game, children improved their 1-mile run completion times by 7.8% (Gao, Hannan, et al., 2013).

That playing active video games improves levels of physical activity is not surprising given that unlike traditional video games that encourage sedentary behavior, active video games include activity as an essential component of engagement (Heyward & Gibson, 2014). However, Gao, Podlog, and Huang (2013) suggested that intrinsic motivation may be a mediating factor in the relationship between active video games and increased physical activity, at least regarding the active video game *Dance Dance Revolution*. The degree to which active video games promote physical activity also varies depending on the type of game being played (Biddiss & Irwin, 2010). Active video games that require more use of the upper body require significantly lower levels of energy expenditure when compared to active video games that require more use of the lower body (Biddiss & Irwin, 2010).

Influence on Energy Expenditure

Playing active video games has been found to increase energy expenditure. However, O'Donovan and Hussey (2012) found that energy expenditure, measured by heart rate and metabolic equivalents, is lower for active video games requiring more upper body movement in comparison to active video games requiring more lower body movement. When playing the Wii Fit Free Jogging game, 18-29 year old participants had a mean heart rate of 71%, compared to 58% for participants playing Wii Sports Boxing, 42% for participants playing Wii Sports Basketball, and 42% for participants playing Wii

Sports Tennis (O'Donovan & Hussey, 2012). Energy expenditure also has been found to be higher when people played active video games using the multi-player option (O'Donovan et al., 2012).

Influence of Self-Efficacy

The use of active video games also has been found to improve self-efficacy. In Gao et al.'s (2012) study, children in Grade 4 who played *Dance Dance Revolution* had higher levels of self-efficacy for physical activity when compared to the control group of children who did not play the game. Self-efficacy for physical activity was measured using the physical activity confidence scale, a six-item, Likert-type instrument (Gao et al., 2012). The scale items were related to general physical activity self-efficacy, not restricted to self-efficacy specifically for playing Dance Dance Revolution game (Gao et al., 2012).

Influence on Motor Skills

The use of active video games also has been found to improve motor skills (Merino-Campos & del Castillo Fernández, 2016). For example, in study of third grade students, Sheehan and Katz (2012) found that active video game play improved students' balance to a degree similar to engagement in traditional training activities such as gymnastics and dance. Because balance is a fundamental movement skill associated with and essential for all physical activity, Sheehan and Katz concluded that encouraging children to play active video games could be a practical means of improving children's engagement in physical activities. Sheehan and Katz did not identify the races of the students who participated in their study.

Influence on Academic Performance

The use of active video games also has been found to improve academic performance (Merino-Campos & del Castillo Fernández, 2016). For example, in Gao et al.'s (2012) study of fourth grade Latino students, the researchers found improvements in students' math scores after playing Dance Dance Revolution 30 minutes a day 3 times a week for 9 months. Math scores increased during the second year of the study as well, although no change was indicated in students' reading scores for either year (Gao, Hannan, et al., 2013). Gao, Hannan, et al. (2013) posited that no improvements were found in students' reading scores because the timing and pattern-reading skills children developed playing Dance Dance Revolution were more specifically applicable to mathematical operations.

Educational Technology that Promotes Physical Activity

DHFTs and active video games may be used in educational settings to promote physical activity. However, it is also possible that educational technology designed primarily for instructional purposes may promote physical activity. One such educational tool is the Jump In! mat designed by Graham et al. (2014) to test the compatibility of physical activity and academic learning in educational settings. The mats, which measured 2 feet by 2 feet, were divided into four equally sized but different colored squares; each square contains a different letter, A through D (Graham et al., 2014). To promote activity during second grade math lessons, teachers using the mats asked students to *jump in* with their answers rather than raising their hands; children could jump in in a number of ways (Graham et al., 2014). If a multiple choice question was posed to the students, the students could jump in on the letter box associated with the correct

multiple choice answer; if teachers asked for the solution to a math problem, the children could jump up and down on the mat a number of times equivalent to the correct answer; or students simply could jump in on the mat to indicate they knew the correct answer (Graham et al., 2014). The mats could be used in their original form or incorporated with clickers if that technology were available to teachers using the mats (Graham et al., 2014). Results of the study indicated that use of the Jump In! mat helped students better focus on their work and do not distract from their academic performance in any way (Graham et al., 2014). This study demonstrates the potential for incorporating physical activity into learning in educational settings.

Summary and Conclusions

Three patterns are apparent in the literature regarding childhood overweight and obesity. The first pattern is that childhood overweight and obesity are prevalent throughout the United States (CDC, 2017c; Skinner et al., 2018). Research from Wolstein et al. (2015) supports other researchers' findings that childhood overweight and obesity are prevalent in California, the state in which this study will be conducted. The second pattern is that concern for preventing childhood overweight and obesity is evident at the national (Dooyema et al., 2013; NCCOR, 2016; NIFA, 2015a, 2015b, 2016a, 2017a, 2018b, 2018c; Williams et al., 2015), state (Bleeker et al., 2015; HealthMPowers, 2017; Live Well San Diego, 2014; Reynolds et al., 2014; University of Florida, Family Nutrition Program, 2017), and institutional (Chula Vista Elementary School District, 2018; University of California, Agriculture and Natural Resources Nutrition Policy Institute, 2018; University of California Davis, Division of Agriculture and Natural Resources Center for Nutrition in School, 2014; University of California, Santa Barbara

Center for Digital Games Research, 2018; Vierregger et al., 2015) levels. The third pattern is that efforts to prevent childhood overweight and obesity have been focused on improving public health programs (Ammerman et al., 2014; Calhoun et al., 2014; CPHSS, 2013; Harris et al., 2014; Ickes et al., 2014; Kihm et al., 2017; Leeman et al., 2014).

The literature included in this chapter demonstrated that much is known about childhood overweight and obesity. For example, various factors contribute to childhood overweight and obesity (Ang et al., 2013); those factors may be personal and internal (Bullock et al., 2017; Cheung & Mao, 2012; Cunningham et al., 2014; Day et al., 2014; Dixon et al., 2012; Faith et al., 2012; Ford et al., 2016; Hoelscher et al., 2015; La Merrill & Birnbaum, 2011; Ogden et al., 2015; Skinner et al., 2018; Zhao et al., 2016) or environmental and external (Adlakha et al., 2014; Ayala et al., 2015; Baran et al., 2013; CDC, 2011a, 2016; Chuang et al., 2016; Dahmann et al., 2010; Eagle et al., 2012; Elbel et al., 2016; FSN, 2011; Howlett et al., 2016; Jo, 2014; Kelly et al., 2014; Kurka, et al., 2015; NIFA, 2016b; Rahman et al., 2011; Reynolds et al., 2014; TFAH & RWJF, 2016; Wolch et al., 2011). Many overweight and obesity awareness and prevention programs are in place throughout the United States (Dooyema et al., 2013; NCCOR, 2016; NIFA, 2015a, 2015b, 2016a, 2017a, 2018b, 2018c; Williams et al., 2015), including California (Healthy Works, 2014; Live Well San Diego, 2015; LACDPH, 2015; LCC & PHA, 2018; Pierson et al., 2016; TFAH, 2018; University of California, Davis Center for Nutrition in Schools, 2014; University of California, Division of Agriculture and Natural Resources, 2018). Suggestions for improving public health programs include considering sustainability (Calhoun et al., 2014; CPHSS, 2013), considering evidence (Ammerman et

al., 2014; Ickes et al., 2014; Leeman et al., 2014), disseminating evidence (Ammerman et al., 2014; Harris et al., 2014Ickes et al., 2014), and using DHFTs in classrooms (Kihm et al., 2017). Childhood overweight and obesity interventions have been found to have positive outcomes on physical activity (Bleeker et al., 2015; Chula Vista Elementary School District, 2018; HealthMPowers, 2017; Live Well San Diego, 2014; NIFA, 2015a, 2016a, 2017a, 2018a; University of Florida, Family Nutrition Program, 2017), nutrition education (Baral, Davis, Blake, et al., 2013; NIFA, 2015a, 2016a, 2017a, 2018a; Vierregger et al., 2015), healthy eating habits (Castro et al., 2013; Franckle et al., 2017; Live Well San Diego, 2014; Long et al., 2013a; NIFA, 2015a, 2016a, 2017a, 2018a; University of Florida, Family Nutrition Program, 2017), and overweight and obesity (Blaine et al., 2017; Bleich et al., 2013; Castro et al., 2013; Franckle et al., 2017; Ganter et al., 2016; Live Well San Diego, 2014; Taveras et al., 2017; University of California Davis Center for Nutrition in Schools, 2014; Wang et al., 2013).

There are a variety of DHFTs, many of which have been found to promote behavior change (Middelweerd et al., 2014; Wearing et al., 2014; Wong et al., 2014), knowledge about nutrition (British Nutrition Foundation, 2018; CDC, 2017a; Damkliang et al., 2016), physical activity (Heyward & Gibson, 2014), and weight loss (Pourzanjani et al., 2016; Thomas & Bond, 2014). There are a variety of active video games (Boulos & Yang, 2013; McCartney, 2016; Wise & Hongu, 2014), many of which have been found to increase physical activity (Errickson et al., 2012; Gao et al., 2012; Maloney et al., 2012; Merino-Campos & del Castillo Fernández, 2016; Peng et al., 2012; Sun, 2013), energy expenditure (O'Donovan & Hussey, 2012; O'Donovan et al., 2012), and physical fitness (Biddiss & Irwin, 2010; Gao, Hannan, et al., 2013; Gao, Podlog, & Huang, 2013;

Heyward & Gibson, 2014), and to promote weight loss (Trost et al., 2014). Active video games also have been found to improve self-efficacy (Gao et al., 2012), motor skills (Merino-Campos & del Castillo Fernández, 2016; Sheehan & Katz, 2012), and academic performance (Gao et al., 2012; Gao, Hannan, et al., 2013; Merino-Campos & del Castillo Fernández, 2016).

Despite the evidence that much is known about the prevalence and contributing factors of childhood overweight and obesity, more research is needed. For example, Cunningham et al. (2014) identified a lack of knowledge about the factors that contribute to childhood overweight specifically among children prior to kindergarten age. More research also is needed about methods for preventing childhood overweight and obesity. For example, Blaine et al. (2017) indicated a need for further research on the effectiveness of obesity prevention programs in schools, and Bernstein et al. (2015) stressed the need for ongoing research to understand students' perceptions about using active gaming in physical education settings as a motivator of physical activity and engagement so that teachers could ensure they provide students with effective learning experiences. Anderson et al. (2016) suggested that further research be conducted to determine how specific health problems could be improved or managed using downloaded apps on mobile devices, Wearing et al. (2014), suggested that future researchers should focus on the efficacy of downloadable health and fitness apps, and Schaefer et al. (2014) suggested future research be focused on the impact of digital feedback from health and fitness apps on user health and fitness behavior.

The results of this study provided increased understanding of the opportunities that existed in the target district for promoting healthy eating habits and physical activity

among students. This information extended the knowledge in the discipline about the use of technology for promoting healthy eating habits and physical activity among students, knowledge, that as Bernstein et al. (2015) indicated, has been lacking.

Results of this study also filled a gap in the literature with regard to the need for further research on the effectiveness of obesity prevention programs in schools as indicated by Blaine et al. (2017). Before implementing an obesity prevention program in a school, it would be sensible to understand the conditions surrounding its effective implementation. For example, it would be logical to understand the potential for success of a DHFT-based childhood overweight and obesity prevention program at the target school before actually implementing it so that time in addition to fiscal and human resources are not wasted on a program that would not likely be effective. This study was a first step in that process.

This study provided insight into why middle school health/physical education teachers may or may not use technology in health education classrooms and physical education settings to promote healthy eating habits and physical activity and to positively influence other obesity related factors, insight administrators at the target school could use to make educated decisions about the best strategies to implement a DHFT-based childhood overweight and obesity prevention program at their school. With such insight, administrators at the school could better understand how they may encourage teachers to use technology for that purpose. In these ways, this study filled a gap in the literature with regard to the effectiveness of obesity prevention programs in schools.

At the time of this study, there was a gap in the literature regarding why middle school health/physical education teachers may or may not use technology in health

education classrooms and physical education settings to promote healthy eating habits and physical activity and to positively influence other obesity related factors. To collect data to fill the gap in the literature about this topic, it was critical to understand teachers' perceptions about using technology in those settings and for those purposes.

More details about the study's methodology are presented in Chapter 3. The chosen methodology, as explained in Chapter 3, supported the collection of data that lessened the gap in the literature pertaining to the use of technology to promote healthy eating habits and physical activity and to positively influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity. These data were unique because most of the literature on this topic available at the time of this study was quantitative in nature. The study methodology presented in Chapter 3 includes discussions of the research design and rationale, role of the researcher, issues of trustworthiness, and ethical procedures.

Chapter 3: Research Method

The purpose of this generic qualitative study was to fill a gap in the literature on the perceptions of middle school health/physical education teachers regarding using technology in educational settings to help improve physical activity and influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity. One-on-one interviews were used to collect data from the middle school health/physical education teachers. I analzyed the collected data using initial and pattern coding. The details of the data collection and analyses processes are discussed in this section along with other pertinent aspects of the study methodology, such as the participant selection and instrumentation. Issues of trustworthiness and ethical considerations are also addressed. This section begins with an overview of the study's research design and rationale.

Research Design and Rationale

The central phenomenon in this study was the use of technology in educational settings to promote healthy eating habits and physical activity and to positively influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity. Four research questions were developed to support the exploration of that phenomenon for those purposes:

RQ1. What are middle school health/physical education teachers' perceptions regarding their capacity (perceived behavioral control) to use technology to prevent and reduce the incidence of childhood overweight and obesity?

RQ2. What are middle school health/physical education teachers' perceptions regarding the value (attitude toward the behavior) of using technology to prevent and reduce the incidence of childhood overweight and obesity?

RQ3. What are middle school health/physical education teachers' perceptions regarding the influence of others (subjective norm) on their use of technology to prevent and reduce the incidence of childhood overweight and obesity?

RQ4. What are middle school health/physical education teachers' perceptions regarding the actual control they have over their use of technology to prevent and reduce the incidence of childhood overweight and obesity?

Researchers conducting qualitative research may choose from a variety of research designs. Traditionally, narrative, ethnographic, phenomenological, case study, and grounded theory designs have been considered appropriate for qualitative research (Merriam & Tisdell, 2016; Mertler, 2016). According to Mertler (2016), with the exception of the case study, the definitions of and uses for these research designs have remained generally static over the years.

Researchers may choose to use a narrative research design when they want to conduct in-depth explorations of a person's life experiences and the meaning those people attach to those experiences (Mertler, 2016). Narrative research typically is conducted with one or two participants, and the results are expressed in the form of a story (Mertler, 2016). Although the focus of this study was the perceptions of teachers, I did not want to present those perceptions in narrative form; therefore, a narrative research design was not appropriate for this study.

Another design option researchers may choose is the ethnographic research design. This design is fitting when they want to conduct an in-depth exploration of a particular population (Mertler, 2016). Researchers conducting ethnographic research immerse themselves into the population under study so that they may gain a clear understanding of the population's culture and social phenomena (Mertler, 2016). Because the interest in this study was not cultural or social in nature and because I did not immerse myself in each teacher's educational setting, an ethnographic research design was not appropriate for this study.

A phenomenological research design is appropriate when a reseracher wants to conduct an in-depth exploration of people's perceptions regarding a particular and shared experience (Mertler, 2016). Typically, researchers conducting phenomenological research study no less than five and no more than 25 participants (Mertler, 2016). This research design was not appropriate for this study because it could not be known whether the teachers who agreed to participate in this study would be teachers who use technology in an educational setting to help improve physical activity and influence other obesity related factors. For this reason, it could not be assumed that the population under study would share a particular experience, a condition that essentially characterizes phenomenological research.

Researchers may choose to use a grounded theory research design when they want to conduct research for the purpose of generating a theory (Mertler, 2016). Data are collected and inductively analyzed over time so that the resulting theory emerges from the data and evolves with each new set of data and analyses (Mertler, 2016). Because

findings from this study were not used to generate theory, a grounded theory approach was not appropriate for this study.

Unlike the definitions of these other research designs, the definition of the case study and its status in research has changed over time (Caelli et al., 2003; Gay et al., 2011; Merriam & Tisdell, 2016; Mertler, 2016; Percy et al., 2015; VanWynsberghe & Khan, 2007). When the concept of qualitative research first began gaining momentum in the 1960s and 1970s, terminology for the research design and associated processes was lacking (Merriam & Tisdell, 2016). This lack in terminology led to the use of the term *case study* to represent any descriptive study that was not experimental in nature (Merriam & Tisdell, 2016). By the 1980s, the case study, although often not recognized in the scientific community, was beginning to be considered an acceptable research method among qualitative researchers (Merriam & Tisdell, 2016). Eventually, the term case study began to be used to describe any qualitative research that could not be characterized as narrative, ethnographic, phenomenological, or grounded theory research (Merriam & Tisdell, 2016).

Case study research typically is conducted when a researcher wants to gain in-depth insight into a particular case because that case itself is of specific interest to the researcher (Leedy & Ormrod, 2016). In particular, case studies often are used when a researcher wants to find out what happened with regard to a particular case of interest or find out why or how something happened with regard that case of interest (Gay et al., 2011). Thus, case studies are well-suited for answering descriptive and explanatory research questions and for conducting formative and summative evaluations of programs and other interventions (Gay et al., 2011).

One commonality among case studies is that they typically involve observation of or interaction with the case being studied over time so that analysis of the case is comprehensive (Hancock & Algozzine, 2017). Cases selected for study in case study research should share characteristics of the theoretical or conceptual framework chosen to support the study or be representative of the issues identified in those theoretical or conceptual frameworks (Yin, 1994). The units of analyses (Fraenkel et al., 2012) that make up the cases themselves may be diverse, but they are almost always "a noun, a thing, an entity; it [the case] is seldom a verb, a participle, a functioning" (Stake, 2006, p. 1). In addition, the unit of analysis exists within a bounded system with clearly identifiable boundaries (Gay et al., 2011). Examples of bounded systems related to education include a student, classroom, school, program, or community (Mertler, 2016), although some researchers may conduct studies using multiple cases (Gay et al., 2011).

In lieu of other available options for qualitative research that cannot be characterized as narrative, ethnographic, phenomenological, or grounded theory research, the use of the case study appears logical (Merriam & Tisdell, 2016). However, not all qualitative research that cannot be characterized as narrative, ethnographic, phenomenological, or grounded theory research can inherently be categorized as case study research (Merriam & Tisdell, 2016). Such was the case with this study. First, this study did not include observation over time, a characteristic of case studies described by Hancock and Algozzine (2017). Second, this study was not explanatory in nature nor conducted as part of a formative or summative evaluation of a program or intervention as Gay et al. (2011) explained was characteristic of case study research. Third, although it was valuable to gain in-depth insight into the perceptions of middle school

health/physical education teachers, the focus of this study was not on any particular middle school health/physical education teachers in the school as specific cases of interest in and of themselves as described by Leedy and Ormrod (2016) and Yin (1994). Fourth, the essential focus of this study was not the teachers themselves but rather the teachers' perceptions and how those perceptions may impact teachers' decision making processes and ultimately teachers' behavior with regard to using technology. In that sense, the focus of this study was an action, which, as described by Stake (2006), is seldom a unit of analysis for a case. Further, because most education research is focused on concepts and activities rather than on exclusive units of analyses (as is the case with case study research), education research may be better characterized as basic qualitative research (Merriam & Tisdell, 2016) or generic research (Kahlke, 2014).

The concept of generic qualitative research is not new. Since the late 1990s, researchers including Brink and Wood (2001), Merriam (1998), Sandelowski (2000), and Thorne et al. (1997) have discussed alternative study designs for basic qualitative studies that are descriptive in nature. In 2003, the use of generic qualitative research was described by Caelli et al. (2003) as "quite common" (p. 2), and since that time, the generic qualitative research approach "has gained fairly wide acceptance" (Lichtman, 2013, p. 114).

Generic qualitative research is research that is descriptive and based on qualitative methods of interpreting data (Merriam & Tisdell, 2016). Researchers may use generic qualitative research when they want to better understand a situation or specific topic (Kahlke, 2014; Merriam & Tisdell, 2016) or illustrate characteristics of a particular population but do not intend to generalize their findings to other populations (Hancock &

Algozzine, 2017). In addition, generic qualitative research is ideal when a researcher wants to explore participants' perceptions (i.e., opinions, beliefs, attitudes) about practical issues but does not want to conduct phenomenological research focusing on participants' experiences or conduct a case study with a specific unit of analysis.

This study was considered a generic qualitative study. A generic qualitative study design was appropriate for this study because the central interest was in conducting an exploratory study for the purpose of better understanding a particular situation. Illustrating the characteristics of a particular population, specifically with regard to middle school health/education teachers' perceptions about using technology in educational settings to promote healthy eating habits and physical activity and to positively influence other obesity related factors, was of interest in this study.

Role of the Researcher

In qualitative studies, researchers often collect data using interviews, a process that requires direct interaction with participants (Merriam & Tisdell, 2016; Pezalla et al., 2012). As a result of this process, the researcher becomes a data collection instrument (Merriam & Tisdell, 2016; Pezalla et al., 2012; Stake, 2010) as well as an interview respondent (Pezalla et al., 2012). In these capacities, researchers are well-situated to establish rapport with study participants by demonstrating good listening skills such as patience and attentiveness, asking nonassumptive questions, remaining objective and reserving judgement about participants' responses, and ensuring the interview discussion remains relevant to the study (Gay et al., 2011). When researchers establish rapport with participants, participants are likely to feel safe (Fraenkel et al., 2012) and be willing to speak openly (Gay et al., 2011). In this way, researchers, as instruments of data collection

and respondents in the interview process, can help ensure conditions that will promote the collection of rich data sufficient to answer the study's research questions.

In this study, I was responsible for data collection, data analysis, and the presentation of findings based on those analysis. As the collector of data, I served both as a data collection instrument and a respondent in the interview process (see Merriam & Tisdell, 2016; Pezalla et al., 2012). In these capacities, I worked to establish rapport with study participants by asking non-assumptive questions, remaining objective and reserving judgement about participants' responses, and ensuring the interview discussions remained relevant to the study. I also practiced good listening skills by waiting patiently for participants to respond to questions so they had time for reflection, and I listened attentively to participants and demonstrated my attentiveness by nodding, maintaining eye contact, and providing verbal encouragement.

As an educator in a public school, I observed the negative impact of childhood overweight and obesity on a regular basis. As an individual, I had a personal interest in technology and its applications for improving health. These conditions predisposed me to bias toward using technology in educational settings to help improve physical activity and influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity. However, in this study, I took proactive measures to ensure that bias did not influence the data collection process, the data analysis process, or the presentation of findings in this study.

One way that researchers can avoid bias is to use objective thinking, which can help the researcher collect data that is free of evaluation and judgement (Mertler, 2016). An essential step to engaging in objective thinking is to identify biases prior to beginning

data collection so that with the awareness of potential biases, the researcher may actively search for evidence of bias in his or her work and subsequently and actively avoid it (Gagnon, 2010; Kahlke, 2014; Leedy & Ormrod, 2016). The use of member checking and a second coder to validate findings also may help a researcher avoid introducing bias into his or her study (Gagnon, 2010). In addition, peer debriefers and external auditors can provide useful feedback regarding evidence of bias in a researcher's work (Mertler, 2016).

Through this current discussion, I acknowledged the potential for bias in this study and considered ways to avoid that bias essentially taking the first step toward avoiding bias in this study. I continued to search for evidence of bias throughout the data collection and analysis processes as well as during the presentation of findings. In addition, I used a second coder to confirm the accuracy of initial interpretations of data and member checking to validate the completed analyses. The second coder holds a PhD in clinical psychology and regularly codes study data for doctoral students. In these varied ways, I worked to eliminate all potential researcher bias from this study.

Methodology

In this section, the details for the specific methodology for this study are presented. First, the processes for selecting and recruiting participants are explained. Then, the data collection process and the instrument that were used to collect data are discussed. Finally, the data analysis process is explained.

Participant Selection Logic

The purpose of this generic qualitative study was to fill the gap in the literature by exploring middle school health/physical education teachers' perceptions about the use of

technology in educational settings to promote healthy eating habits and physical activity, and to positively influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity.

When researchers collect data from a specific group of participants because those participants are most likely to be the richest sources of data for a particular study focus, that sample is considered a purposive sample (Gall et al., 2007). In this study, middle school health/physical education teachers were selected as participants because I deemed them to be the most logical sources of data about middle school health/physical education teachers' perceptions. Therefore, the sample in this study was considered a purposive sample. However, because the teachers who were invited to participate in this study were employed in the school district in which I worked, the sample also was considered one of convenience.

Participant Eligibility

All middle school health/education teachers ($N = 16$) in the target district were invited to participate in the study by being interviewed. No teachers were excluded from the study based on their age, gender, ethnicity, years of teaching experience, education level, or other demographic characteristics. Differences in teacher characteristics helped ensure a diverse sample, which contributed to the richness of the data collected.

Inviting Teachers to Participate in the Study

Teachers were invited to participate in the study via email and reminded about the opportunity in a second email message. To be considerate of teachers' time and to encourage the potential participants to read the entire email invitation, both the original invitation and the reminder emails were brief and included only the essential information

about the nature of the study. If the potential participants' interest was piqued, they could open the attached informed consent, where they could read about the study in detail, including the procedures for participation in the study. The body of the email included my contact information so that potential participants could reach me with questions about the study or to arrange for participation in the one-on-one interviews.

When middle school health/physical education teachers contacted me regarding participation in the one-on-one interviews, I confirmed their eligibility by asking them to identify the subjects and grade levels they teach in the target district. Teachers who meet the eligibility requirements were formally invited to participate in the study. When the invitation was accepted, an interview was scheduled at a mutually convenient time within the data collection window.

Because teacher email addresses were not freely accessible on their respective school websites or on the target district website, help from an administrative assistant from the superintendent's office was required to distribute the email invitations. Because a reminder letter was sent to participants to promote teacher participation, I needed help twice. When I sought permission to conduct this study from the superintendent of the target district, I included a request for this specific administrative assistance.

Sample Size

No one standard process for determining sample size in qualitative research exists, and as a result, determining sample size can be difficult (Marshall et al., 2013). One reason for the lack of standards for sample sizes is that the number of participants needed to generate sufficient data to answer the research questions posed for a study may be influenced by the characteristics of the study and the study methodology (Merriam &

Tisdell, 2016). In addition, resource limitations (Merriam & Tisdell, 2016) such as lack of funding, insufficient time to collect or analyze data, and lack of access to participants also may influence the number of participants a researcher includes in a study (Gay et al., 2011).

Because of the varied determinants of sample size, suggestions for appropriate sample sizes in qualitative research are diverse. Creswell (2014), who identified appropriate sample sizes by study type, stated that typically, case studies have four or five participants, narrative studies have one or two, phenomenological studies have three to 10, grounded theory studies have 20 to 30. Ethnographic studies focus on one culture (Creswell, 2014), and the need to have a specific number of individual participants is essentially not applicable. Although there may be up to 60 or 70 participants in a qualitative study (Gay et al., 2011), among researchers who speak generally about qualitative research, most agree that qualitative researchers include 20 or fewer participants in their studies (Fraenkel et al., 2012; Gay et al., 2011; Marshall, et al., 2013). Guest et al. (2006) and Onwuegbuzie and Leech (2007) have claimed that 12 participants are sufficient when researchers are collecting data in a qualitative study using one-on-one interviews. However, in discussions in the literature dating back more than 3 decades, researchers, for example, Lincoln and Guba (1985), have discussed sample size in terms of *data redundancy.* More commonly, data redundancy is referred to as *data saturation* (Merriam & Tisdell, 2016).

Data saturation refers to a point in the data collection process where no new data are uncovered or in other words, when the data become saturated (Merriam & Tisdell, 2016). Researchers can help ensure the accuracy of study findings by ensuring the data

truly are saturated (Gall et al., 2007). Collecting data from one participant past the point of perceived data saturation is a good way to accomplish that goal (Lincoln & Guba, 1985). The underlying concept of data saturation is that researchers collect sufficient amounts of data to answer the research questions they posed in their studies (Merriam & Tisdell, 2016).

Because data saturation can only be determined during the data collection process (Merriam & Tisdell, 2016), researchers are only able to estimate needed sample sizes before they begin to collect data. Therefore, data saturation also must be determined during the data collection process and an anticipated sample size must be estimated before data can be collected. Researchers, for example Guest et al. (2006) and Onwuegbuzie and Leech (2007), have stated that 12 participants are sufficient when a researcher is collecting data in a qualitative study using one-on-one interviews. However, there were only 16 middle school health/physical education teachers in the target district, and it was unrealistic to expect that a 60% participation rate would be achieved. Therefore, the interview recruitment goal was lowered to 10 to 12 middle school health/physical education teachers for this study. I acknowledged the potential that data saturation might result in fewer participants or that lack of data saturation might warrant the addition of participants. By being cognizant of data saturation, teachers' time was respected but a situation also was created in which it was likely that data sufficiently rich to answer my research questions could be collected. Unfortunately, the population from which participants was recruited was small, and there was no way to control who participated. Regardless, all of the data collected contributed to the value of this study because new information about teachers' perceptions was collected.

Data Collection

Data for this study were collected using one-on-one interviews. The interviews were conducted at a time and in a place most convenient for the participants. I considered any private area on or off the school campus acceptable although I expected that teachers were likely to feel most comfortable being interviewed in their own rooms. I also conducted interviews over the phone as necessary. No interviews were scheduled during the teachers' regular work day so that their teacher preparation time and other duties would not be impacted by their participation in this study.

Prior to beginning the interviews, the terms of participation in the study were reviewed and any questions the participants had were answered. Each participant was asked to agree to the terms of the informed consent before they were allowed to participate in the interview. Participants who were interviewed in person physically signed a consent form. Participants who were interviewed over the phone agreed to the terms verbally. Because this study was voluntary, participants were free to exit the study at any time before or during the data collection process simply by expressing their interest in discontinuing their participation.

Interviews were expected to last approximately 1 hour. During the interviews, the interview protocol was used for recording initial interpretations of the data and additional questions that came to mind while the participants are speaking. However, continuous note taking could have been distracting for both the participants and myself and therefore was not used as a data collection method. Rather, so that participants' full responses could be captured for in-depth analysis, the interviews were digitally recorded with the permission of the participants using the Otter and Dictate transcription service app on my

iPhone. To ensure participant confidentiality, all participants were referred to by an arbitrarily assigned participant number during the interviews. I planned to collect data over the course of 3 weeks and follow up with participants approximately 2-4 weeks later to ask them to review the preliminary findings and provide feedback for additional consideration for analysis.

Instrumentation

An interview protocol was used to collect data from middle school health/physical education teachers regarding their perceptions about using technology in educational settings to help improve physical activity and influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity. Data collected using interviews were used to answer Research Questions 1-3. I developed the instrument myself.

Interview Protocol

The interview protocol used for data collection contained an introductory dialog, six background items, 9 topic-specific items, and a closing dialog (see Appendix A). The introductory dialog was used to welcome the participants to the interview, confirm their agreement with the terms of participation in the study, and direct the collection of the informed consent. The background items were used to collect demographic data about the participants. No descriptive data were used in the discussion of the results when they may have inadvertently allowed readers to discern the identity of a participant. The topic-specific items were used to collect data directly pertaining to teachers' perceptions regarding using technology in educational settings to help improve physical activity and influence other obesity related factors associated with the prevention and reduction of the

incidence of childhood overweight and obesity. The closing dialog was used to announce the end of the interview, thank participants for their time, and remind them about the follow-up e-mail they will receive requesting their feedback on the initial study findings (i.e., member checking).

Instrument Validity

When researchers develop instruments, they must consider whether they are valid means of measuring the construct the researcher intends to measure (Trochim & Donnelly, 2008). In quantitative studies, researchers may determine predictive validity, concurrent validity (distinguishing between groups), convergent validity (similarity between groups), and discriminant validity (differences between groups) in order to establish the overall validity of an instrument for measuring a particular construct (Trochim & Donnelly, 2008). However, these types of validity are not applicable for qualitative research because they require inferential analyses, which are not appropriate for qualitative studies.

Two other ways to determine whether an instrument is valid is to examine its face validity and its content validity (Trochim & Donnelly, 2008). These methods may be used to establish the validity of instruments in qualitative research because they do not rely on inferential analyses. Face validity refers to the review of an instrument to determine if the instrument appears to be a good measure of the construct of interest (Trochim & Donnelly, 2008). Although this process is not without value, it is the weakest method for determining the validity of an instrument because it is entirely subjective (Trochim & Donnelly, 2008).

Content validity refers to the extent that the content of the instrument matches the information that is known about the construct, or the criteria of the *content domain* (Trochim & Donnelly, 2008, Content validity section). However, establishing the criteria for the content domain may be challenging when the constructs are not well-established or are highly conceptual as is the case with self-efficacy and perception, for example (Trochim & Donnelly, 2008). Establishing the criteria for the content domain also may be challenging when no sufficient description of the content domain of interest is available (Trochim & Donnelly, 2008).

In this study, the data collection instrument was used to collect data for descriptive purposes. The data collected using interviews were analyzed in the sense that they were interpreted. Because the data collected in this study were not analyzed using inferential statistics, content validity was not a concern with respect to the data analysis process itself. However, if the instruments used to collect data in this study were not developed so that the instrument items adequately reflected the construct under study, the data that were collected would not have been reflective of the construct under study and as a result not useful for answering the research questions. Therefore, the validity of the instruments developed for this study needed to be established.

The interview protocol I developed to collect data was reviewed by three highly qualified university advisors as part of the development of this dissertation. Adjustments were made accordingly. Through this process, face validity of the data collection instrument was established. To establish content validity for the interview items, the sources of literature from which the concepts for the content of the interview items were drawn have been identified, as suggested by Anfara et al. (2002). A table showing the

conceptual bases and supporting literature for the topic-specific interview items is presented in Appendix B. Additionally, to ensure the clarity of the interview items, I pilot tested the interview protocol in the field with two colleagues from my school. One teacher was female. The other was male. The female teacher had a bachelor's degree. The male teacher had a master's degree. Both teachers were credentialed in the state, in their mid-thirties, and had more than 5 years but less than 10 years of teaching experience in the school district. Neither of the teachers appeared confused by any of the interview items. Both teachers stated that they clearly understood the intent of the interview items. The outcome of the instrument pilot testing indicated the interview items were not ambiguous and that they would generate the type of data needed to answer the research questions posed for this study.

Data Analysis Plan

The interview protocol was used to collect data from middle school health/physical education teachers regarding their perceptions about using technology in educational settings to promote healthy eating and physical activity and to positively influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity. These data were analyzed and used to answer Research Questions 1-3. All data collected for this study were analyzed, including discrepant cases which were presented in the discussion of the results in Chapter 4 as applicable.

There are a variety of qualitative data analysis methods from which a researcher can choose (Merriam & Tisdell, 2016; Saldaña, 2009). Researchers may choose the data analysis methods they use based on the type of study they conduct (Creswell, 2014);

however, most qualitative data analysis methods are inductive in nature (Mertler, 2016) and include the coding of data. The inductive coding process is a means of breaking down large amounts of raw data (Richards, 2015) into smaller units that researchers can interpret more easily (Creswell, 2014). In this study, inductive coding was used following the processes described here.

The coding process can be best understood as a series of steps that begins with the initial labeling of units of data (Merriam & Tisdell, 2016; Saldaña, 2009). Those units of data may be individual words or phrases (Mertler, 2016) or entire sentences or paragraphs (Fraenkel et al., 2012). The labels given to the identified data are referred to as codes (Saldaña, 2009) and the organizational pattern of the codes is referred to as a *coding scheme* (Mertler, 2016). The codes are intended to represent fundamental characteristics and essential meaning inherent in the labeled data (Saldaña, 2009). This initial coding process also may be referred to as *open coding* (Fraenkel et al., 2012).

After the data have been reviewed multiple times and a researcher has completed the initial coding phase by developing an appropriate and sufficient coding scheme, the researcher then searches for patterns in the data (Percy et al., 2015). Those patterns are then organized into categories (Merriam & Tisdell, 2016). Sometimes individual codes may be strong enough on their own to represent a category (Leedy & Ormrod, 2016). The categories that are developed should be unique and relevant to answering the research questions and for addressing the problem posed in the study (Merriam & Tisdell, 2016). The process of identifying patterns among the initial data codes is referred to as pattern coding (Percy et al., 2015).

In some cases, these first two steps are sufficient for data analysis and allow researchers to fully interpret the raw data and draw accurate conclusions (Mertler, 2016). In other cases, additional conceptualization of the categories is needed. During this final conceptualization step, researchers may organize the categories into more broadly structured themes (Lichtman, 2013; Merriam & Tisdell, 2016; Saldaña, 2009). As is the case for the previous step, the themes should be unique and relevant to answering the research questions and for addressing the problem posed in the study (Creswell, 2014).

Issues of Trustworthiness

For almost 6 decades, researchers have debated what constitutes rigor in qualitative research (Denzin & Lincoln, 2018; Merriam & Tisdell, 2016; Mertler, 2016; Morse, 2018). Although the debate continues, researchers do agree that when compared to researchers who conduct quantitative research, researchers who conduct qualitative research must consider different parameters when establishing rigor in their work (Denzin & Lincoln, 2018). Many researchers refer to the term *trustworthiness* when referring to rigor in qualitative studies (Denzin & Lincoln, 2018). Establishing trustworthiness in a study helps promote reader confidence in one's research findings (Connelly, 2016). Guba (1981) explained that trustworthiness in qualitative studies is best demonstrated through evidence of the study's credibility, transferability, dependability, and confirmability.

Credibility

The equivalent of internal validity in quantitative studies, credibility in qualitative studies refers to the believability of the study findings (Mertler, 2016; Trochim & Donnelly, 2008). The presentation of accurate data can help ensure that data are

believable and contribute to a study's credibility (Mertler, 2016). In this study, the credibility of the findings was developed by establishing the face validity and content validity of the data collection instrument as described previously. Credibility of the findings also was developed by validating the completed analyses using member checking.

Transferability

The equivalent of external validity in quantitative studies, transferability in qualitative studies refers to the generalizability of a study's findings (Trochim & Donnelly, 2008). Although generalizability of findings in qualitative studies typically is not a concern for researchers, readers in other settings may determine relevance in those findings in their own settings (Percy et al., 2015; Trochim & Donnelly, 2008). A researcher can help those in other settings determine relevance of his or her findings by clearly and thoroughly explaining the research methods used to complete the study (Leedy & Ormrod, 2016), presenting findings with rich (Merriam & Tisdell, 2016) thick descriptions (Miles et al., 2014), and fully explaining any personal or professional biases the researcher may have regarding the study topic or participants (Fraenkel et al., 2012). In this study, the research methods that were used to complete this study and my potential biases as a researcher have been clearly and thoroughly explained. Additionally, I provided rich, thick descriptions in the study findings. In these ways, the transferability of this study's potential findings has been established.

Dependability

The equivalent of reliability in quantitative studies, dependability in qualitative studies (Guba, 1981) refers to how stable one can consider the data used to generate

conclusions in a study (Mertler, 2016). The focus of dependability "is not whether findings will be found again but whether the results are consistent with the data collected" (Merriam & Tisdell, 2016, p. 251). To establish dependability in a study, a researcher must record and report any changes in conditions that could impact the outcomes a study (Hancock & Algozzine, 2017; Mertler, 2016; Trochim & Donnelly, 2008). Triangulating data also may help negate the negative impact of changing study conditions on study findings (Gay et al., 2011; Merriam & Tisdell, 2016). Finally, researchers may help establish dependability in a study by identifying researcher biases (Merriam & Tisdell, 2016). As suggested in the literature just presented, to establish dependability in this study, researcher biases have been identified and discussed and any changes in conditions that could impact the outcomes were reported.

Confirmability

The equivalent of objectivity in quantitative studies, confirmability in qualitative studies (Guba, 1981) refers to the capacity for others to verify others' study findings (Trochim & Donnelly, 2008). Researchers can establish confirmability by soliciting feedback from peers during the data analysis process (Merriam & Tisdell, 2016). Researchers also can establish confirmability by demonstrating intercoder reliability, a measure of "the extent to which two or more independent coders agree on the coding of the content of interest with an application of the same coding scheme" (Cho, 2008, p. 345). Intercoder reliability is achieved when the researcher and a second coder each code a small portion of the data and reach consistent findings (Richards, 2015). Researchers often consider 80% agreement to be acceptable (Creswell, 2014). A researcher's presentation of neutral data can increase the chances that peers will interpret the data in

the same way the researcher does (Gay et al., 2011). In this study, confirmability of my findings was demonstrated by using a second coder to establish intercoder reliability. Based on the literature, I considered 80% agreement demonstrative of intercoder reliability in this study.

Of the 105 pages of collected data, I selected 14 pages to share with the second coder for analysis. After conferring with the second coder about her findings, I determined the intercoder reliability of this study was close to 90% and thus acceptable. In general, most of the differences in analyses were related to word choice. In some instances where the second coder and I disagreed, however, our differences were conceptual in nature. In most of those cases, the second coder and I agreed that the data were applicable to both of the categories to which we each had assigned them. In those cases, I simply included the data in both categories. In instances where our differences were conceptual but not simply addressed by using the data in two categories, the second coder and I, after presenting our rational for our choices, were able to agree on the best application of the data. When appropriate, I adjusted my analyses accordingly.

Ethical Procedures

To ensure the protection of study participants, ethical procedures for conducting research were followed. Ethical considerations were made in five ways:

- Data were not collected from any participants until approval was received from Walden University's Institutional Review Board (IRB; #11-25-19-0161928) and the superintendent of the target district.
- Participation in this study was voluntary. Although I was an employee in the target district, I did not hold a position of authority or power over any potential participants

in this study; therefore, no participants in this study should have felt obligated or pressured to participate. In addition, participants were free to end participation in the study at any time prior to the completion of the final study report.

- I made arrangements for a counselor from the school district—who signed a confidentiality agreement—to be available for participants should any have become upset as the result of their participation in this study and wished to speak to a trained professional. No participants became upset during the course of the interviews.
- Teachers were not allowed to participate in the study until they had been provided with informed consent and had agreed to the conditions of study participation. In the informed consent, I introduced myself and provided a brief statement of the purpose of the study and a description of the procedures for participation in the study. In addition, participation in the study was identified as voluntary, and the risks and benefits of participation were described. Participants were informed that they would not receive compensation for participating in the study and that their privacy would be maintained throughout and following the completion of the study. Finally, contact information for both myself and the Walden University representative was provided.
- All data from teachers who agreed to participate in the individual interviews were deidentified. Participants were referred to by participant number. Although it was necessary to keep a master list of participants and their participant numbers to allow for the member checking phase of the data analysis process, the master list was destroyed immediately after member checking was complete.

- All digital and hard copy data associated with this study was safeguarded. Hard copy files were stored in a locked filing cabinet, and digital files were stored on a password protected computer. Both the filing cabinet and the computer were kept in my home office. According to Walden University policy, all hard copy and digital raw data files will be destroyed after 5 years.

Summary

The purpose of this generic qualitative study was to fill the gap in the literature regarding middle school health/physical education teachers' perceptions about the use of technology in educational settings to promote healthy eating habits and physical activity, and to positively influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity. Data for this study were collected using one-on-one interviews. Data were analyzed using initial and pattern coding and then used to answer Research Questions 1-3.

Trustworthiness of the study was demonstrated by ensuring the study findings are credible, transferable, dependable, and confirmable. Establishing the face validity and content validity of the data collection instruments, thoroughly explaining the research methods and potential researcher biases, reporting deviance from the planned methodology, conducting member checking, and establishing intercoder reliability helped demonstrate the study findings are trustworthy. During all phases of the research process, ethical procedures were followed to ensure the protection of participants.

Chapter 4: Results

The purpose of this generic qualitative study was to fill the gap in the literature regarding middle school health/physical education teachers' perceptions about the use of technology in educational settings to promote healthy eating habits and physical activity, and to positively influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity. The four research questions in this study were developed to generate data about middle school health/physical education teachers' perceptions about using technology to prevent and reduce the incidence of childhood overweight and obesity:

RQ1. What are middle school health/physical education teachers' perceptions regarding their capacity (perceived behavioral control) to use technology to prevent and reduce the incidence of childhood overweight and obesity?

RQ2. What are middle school health/physical education teachers' perceptions regarding the value (attitude toward the behavior) of using technology to prevent and reduce the incidence of childhood overweight and obesity?

RQ3. What are middle school health/physical education teachers' perceptions regarding the influence of others (subjective norm) on their use of technology to prevent and reduce the incidence of childhood overweight and obesity?

RQ4. What are middle school health/physical education teachers' perceptions regarding the actual control they have over their use of technology to prevent and reduce the incidence of childhood overweight and obesity?

The purpose of this chapter is to present the results of this study. However, before presenting the results of the thematic analysis, the study setting and participant

demographics are discussed along with the data collection and analyses processes. Concepts of trustworthiness also are addressed.

Setting

The site for this study was a medium-sized K-8 school district located in a rural city in California. Around mid-March of 2020, toward the end of the data collection process, California schools closed amid the COVID-19 pandemic. That situation directly influenced participants and their experiences at time of study and had the potential to influence interpretation of the study results. Details about this situation are referred to briefly in the subsequent Data Collection section and more thoroughly in the Limitations section in Chapter 5.

Demographics

Participant demographics are shown in Table 6. The data show an equally gender-diverse study sample of various ages with a range of teaching experience at different grade levels. To be eligible to teach in California, teachers must at least have a bachelor's degree; therefore, it was not surprising to find that that was the lowest level of education participants reported.

Data Collection

Qualitative data were collected from 10 participants (P1 – P10) over the course of 4 months at the beginning of 2020. All data were digitally recorded using the Otter and Dictate transcription service app on an iPhone as planned. A few notes were taken by hand to capture initial overall thoughts on the data I was collecting.

Table 6

Select Participant Demographics

Demographics	Frequency (*n*)
Grade Level	
6th	1
6th-7th	2
7th	2
7th-8th	1
8th	3
6th-7th-8th	1
Total years of teaching experience	
< 1	1
1 < 5	1
5 < 10	1
10 < 15	3
15 < 20	3
20 <	1
Years of teaching experience in the district[a]	
< 1	1
1 < 5	2
5 < 10	1
10 < 15	1
15 < 20	3
20 <	1
Gender	
Male	5
Female	5
Age	
25 < 35	2
35 < 45	3
45 < 55	4
55 < 65	1
Academic background	
Bachelor's degree	3
Bachelor's plus additional credits	1
Master's degree[b]	6

[a]One participant did not teach in the school district. [b]One participant had an advanced master's degree, which includes doctoral level courses.

Initially, the plan was to collect data over the course of 3 weeks. However, final IRB approval was not obtained until near the end of the first school trimester. At that time, teachers were overwhelmed with completion of end-of-trimester report cards as well as other end-of-trimester responsibilities before the winter break. Consequently, scheduling the interviews became challenging. During the winter break, many teachers were traveling or otherwise occupied with personal activities. When school resumed, teachers again found themselves engrossed in professional responsibilities. Three face-to-face interviews were conducted in January, two interviews were conducted in February, and another two interviews were conducted in March. Two of these seven interviews took place in self-contained classrooms. The other five took place in the coaches' offices. These areas were quiet, away from distractions, and all took place after school. The interviews lasted approximately 45 minutes. Each participant signed a consent form before the interview began. At this point, seven interviews had been completed.

One of the original 10 teachers who agreed to participate in the study stopped responding to my emails. Out of respect, I discontinued contact with him and sought out one more participant. After 3 weeks, I deemed it necessary to expand my search for participants outside of the school district. I asked a colleague from my school for a reference. She gave me the contact information for a teacher in a neighboring school district. I contacted him, and he agreed to participate in the study although at that time, he was unable to confirm a time to be interviewed.

Later in March, while teachers were on break during the initial stages of the COVID-19 school closures, two interviews were conducted by phone. Because I was a researcher with current IRB approval to collect data, I was automatically approved to

conduct my remaining data collection via email, phone, video conferencing, or any other online format of my choosing. Before the two phone interviews began, I reviewed the consent form in its entirety with each of the participants. Each participant verbally agreed to all aspects of the study delineated on the consent form.

At this point, having collected data from nine participants, I felt confident that the data had become saturated. However, for good measure, as suggested by Lincoln and Guba (1985), I moved forward and scheduled the final interview in April. Again, before the phone interview began, I reviewed the consent form in its entirety with the participant who verbally agreed to all aspects of the study delineated on the consent form.

Although the pandemic conditions hindered the data collection process, they also posed a unique opportunity. During the final interview, Participant 10 made reference to the necessary changes in teaching strategies driven by the COVID-19 pandemic and subsequent shift to online learning environments. Because the focus of the study was the use of technology to prevent and reduce the incidence of childhood overweight and obesity, I took the opportunity to reach out to the study participants to ask nine short follow up questions related to their experiences during the pandemic (see Appendix C). Of the 10 participants I emailed to ask the follow-up questions, three participants responded (P1, P3, P8).

Data Analysis

To analyze the data, I inductively coded them using the process described in Chapter 3. Although some researchers code individual words or phrases (Mertler, 2016), I coded entire sentences and in some cases complete paragraphs as suggested by Fraenkel et al., 2012). Because the codes were broad in scope, many subsequently served as

indicators of patterns. Those patterns were then grouped into categories and then the categories were grouped into themes. All discrepant cases were addressed in the analysis.

Three themes emerged from the data that pertained to teaching in general (Themes 1-3). Three main themes associated with the research questions emerged from the data (Themes 4-6). The themes are presented in Table 7. The three main themes are discussed here individually in detail and are supported by appropriate quotes from the participant transcripts.

Table 7

Themes Identified in the Data

Theme number	Theme description
1	Teachers have control over what and how they teach
2	Challenges to educating students about and promoting physical education concepts
3	Using technology in general
4	Teacher use of technology in physical and health education classes
5	Challenges to using technology in health/physical education classrooms
6	Responses to COVID-19 pandemic

Summary of General Themes Related to Teaching

Theme 1: Teachers Have Control over What and How They Teach

Teachers talked about teaching motor skills and educating students about and engaging students in physical activity, topics well-aligned with physical education teachers' areas of expertise. Ultimately, teachers just "want kids to move" (P1, P2), but it also should build student confidence (P10) and be enjoyable (P1, P6, P10). For example,

P1 said, “My personal focus is to just keep it fresh and new and keep them having fun,” and P10 said, “I think that’s a critical piece. We need to teach kids is how to how to enjoy activities.” P9 specifically recognized the value of physical activity in the prevention of obesity.

Some teachers also taught students about health and nutrition (P4, P7, P9, P10), and overweight and obesity (P5, P9, P10). It is possible that teachers taught about health and nutrition because they were health conscious themselves (P4, P10), recognized the benefits of teaching children about healthy eating habits and nutrition (P2, P3, P6, P10), and had control over what they taught in the classroom (P6, P10). Teachers supported those concepts with lessons on setting goals for physical activity (P6, P10) and about healthy eating habits in part through awareness (P7, P10) about making healthier food choices (P10).

Teachers also reported having control over how they teach, for example the use of technology (P4, P5, P6, P10). Teachers who reported they did not teach their students about health and nutrition indicated that not teaching about health and nutrition had nothing to do with technology. Rather, they cited (a) lack of thought (P1), required standards (P4), available curriculum (P1), and time (P1); (b) student interest in physical activity versus knowledge about health and nutrition (P1, P5); and (c) the need to attend to more important social and educational concerns (P1). Examples of participat responses that exemplify some of these concepts are, “I never really thought about teaching the nutrition part of it. I guess I’m a bad teacher for not doing that” (P1); “The standards called for writing a 2 week fitness plan, and so we focus mostly on the components of fitness and we didn’t go deeply into nutrition” (P4); and “Anytime I take them in the

classroom, or I'm sitting outside and teaching them even a five-minute lesson. It's, I feel like they're getting, you know, maybe 30% of what I'm saying" (P5).

Theme 2: There are Challenges to Educating Students about and Promoting Physical Education Concepts

Although teachers indicated there was value in teaching students about healthy eating habits (P2, P7), teachers also suggested it was challenging to do so because of limited control over supporting student choices outside the classroom, including in the school cafeteria (P2) and at home (P2, P6, P7, P8, P10). For example, P2 said, "Some of it too, is the guidelines. Like even here, the school lunches truthfully, they're not that healthy," and P6 said, "Eating the proper things, it's, it's a team effort. It's, it's the people at home, making good choices for them, offering good choices as far as the intake that they're putting in their body."

Limited control over supporting student choices outside the classroom also emerged as a challenge to consistently engaging student in physical activity (P6, P8, P10). For example, P8 said, "I think that we can teach them what we can in the school but I think it all goes back to what's happening at home," and P10 said, "First it [physical activity] needs to be something that is prioritized as a value. It has to be valued either in the home or the school. Both is ideal."

Teachers reported that lack of administrator interest in supporting overweight and obesity education (P7) and the sensitive nature of overweight and obesity (P6, P7, P10) make it difficult for teachers to educate students about overweight and obesity. About lack of focus on overweight, P7 said,

> Let's say from different departments, administrators, I came across, you know, different administrators I worked at a school here that was very very low income and the focus was definitely not on whether or not a child was overweight. You know, a lot of schools focus a lot on academics.

About the sensitive nature of overweight and obesity, P7 said, "You know, people don't want to be told that they're overweight," and P6 said, "You know, people don't want to be told that they're overweight."

Theme 3: Use of Technology in General

Almost half of the teachers acknowledged that technology could be a good resource in general for gathering and sharing information (P3, P5), giving tests (P1, P9), generating and maintaining student interest (P3, P9), and promoting social interaction (P10). Others admitted that they did not use technology for teaching at all because they are not tech savvy (P1, P3). P1 described himself as "old school," and P3 said, "I'm not much of a technology person," and "I personally don't like technology." However, in contradictory statements P3 also said "I'm a tech person." Still others shared that they did not use technology with their students over concern of teachers' inability to properly monitor student of the technology (P1, P2, P3, P9). Both P1 and P2 referred to students' potential incorrect use of using technology as "dangerous."

Theme 4: Teacher Use of Technology in Physical and Health Education Classes

Four categories of data were evident for this theme: teachers use technology in health/physical education classes, teachers do not use or rarely use technology in health/physical education classes, technology can be used to teach health/physical

education classes, and teachers are willing to try to use technology to teach in health/physical education classes. These categories are discussed in detail in this section.

Teachers Use Technology in Health/Physical Education Classes

The data showed that some teachers use technology to teach students in health/physical education classes. When teachers spoke about using technology to teach students in their health/physical education classes, they often spoke generally in terms of administrative functions such as providing resources (P10), sharing assignments (P5), and giving presentations (P9) or in terms of digital technologies as feedback tools or record keeping devices (P1, P7, P9, P10).

However, teachers also reported specifically using technology (a) to educate students about healthy eating habits and nutrition (P5, P9, P10), physical activity (P4, P5, P8, P9, P10), and overweight and obesity (P1, P2, P3, P4, P9, P10); (b) to demonstrate motor skills (P7, P8, P9), and (c) to promote physical activity (P1, P2, P3, P4, P9, P10). Some teachers also knew or had heard of other teachers who used technology to educate their students about overweight and obesity (P8, P10), demonstrate motor skills (P1, P4, P5, P7, P9), and promote physical activity (P1, P3, P4, P7).

In some cases, teachers used existing Google slides, Google Classroom (P9), You Tube (P3, P9) or other videos (P10), or PowerPoint presentations (P7). In other cases, for example as with P8, teachers may record students engaged in an activity and then use the video to help the students improve in that activity. Teachers gave examples of using slides and videos (a) “for showing students how to correctly perform a skill” (P7), such as “how to pass” a ball (P4); (b) to demonstrate “correct technique for a push up or curl” (P5); or to “explain a sport” such as hockey (P5). Teachers also indicated that they use

technology to engage students in physical activities such as running (P1) and other aerobic exercise (P3).

When teachers spoke about the value of using technology to promote physical activity, they did so in terms of student interest (P1, P2, P3, P8, P10). For example, P3 said, "kids love technology," so when they get to use it, "they get excited" and "get a kick out of it." P1 said that his students are "like yeah, I get to use my phone in class!" P8, an adaptive physical education instructor with a master's in special education, said that she "used technology as a reward with some of my more severe autistic kids. Like if they did A, B, and C, then they could have 1 minute on a game." P5 and P9 specifically referred to technology with regard to student motivation.

Teachers Do Not Use or Rarely Use Technology in Health/Physical Education Classes

Although some teachers reported using technology to teach students in health/physical education classes, the data showed that most teachers do not use or rarely use technology to teach motor skills (P7), promote physical activity (P3, P4, P8, P10), promote healthy eating habits (P1, P2, P4, P5, P6, P7, P8, P9), or educate students about overweight and obesity (P2, P4, P8, P10). Some teachers (P4, P6, P8) also explicitly stated that they were not aware of other teachers using technology for these purposes. According to P9, "good administrators . . . would like all middle school teachers in physical education to use the technology if it was available." P6, who disagreed, suggested that some of the reasons teachers are not using technology for these purposes may be the lack of "any expectation" for them to do so.

Technology Can Be Used to Teach Health/Physical Education Classes

Regardless of whether teachers used or did not use technology to teach students in their health/physical education classes, most teachers acknowledged that technology can be used to promote healthy eating habits (P1, P2, P4, P5, P6, P7, P8, P9, P10) and lifestyles (P5, P6, P7, P10), to promote energy expenditure (P3, P6, P9) or physical activity (P2, P4, P5, P7, P8, P9, P10), to teach motor skills (P3, P4, P6, P7, P8, P9, P10), and to educate students about physical activity (P4, P6, P7, P8, P9, P10), overweight, and obesity (P3, P4, P5, P7, P9). As P6 indicted, "Every unit of study for PE can incorporate technology. There's no doubt about it."

Many of the teachers' comments about using technology to educate students about healthy eating habits and lifestyles, motor skills, physical activity, and overweight and obesity was associated with access to and the transfer of information. For example, P7 referred generally to using "technology to instill knowledge;" P8 said technology "could be used for a demonstration, like showing a video on the proper way to swing and throw a baseball or swing a bat;" and P9 suggested that technology could be used to '"give knowledge on how much, exactly, or how often they [i.e., students] are supposed to learn and do an activity." Regarding overweight and obesity in particular, teachers made comments referring to using presentations (P7) and videos (P5) to teach students because, according to P5, students "learn better from that [i.e., a video] than [from] me standing in front of them teaching a lesson about obesity."

When teachers talked about using technology to promote energy expenditure and physical activity or teaching about physical fitness, they typically talked about apps and online programs. P9 referred to "using apps and programs that make content more

accessible for the students." P7 said there are "lots of different music apps—you can go on YouTube and download workout music to try to help motivate you to want to get through a workout or workout for longer." P4 said "having apps as a teacher, I think definitely is important" because the apps can be used to "teach them [i.e., students] knowledge about physical activity."

Four teachers (P6, P7, P8, P10) also referred to the value of digital technologies as feedback and tracking tools. Some teachers associated their value with the ability to log physical activity (P6, P7, P8, P10). Others found value in biofeedback mechanisms, such as the capacity to record heart rate, pulse (P6), and weight (P8). P7 spoke directly to the value of such feedback, which can both create awareness and motivate students; she said, feedback can help them

> become so much more self-aware about: Are they making healthy choices? Are they not? Are they exercising enough? Are they exercising at a high enough heart rate? Are they are they only doing it once a week? Yeah, and then, you know, meeting their goals. And I think that those things . . . can really help motivate students to work a little bit harder to maybe try to hit that ideal weight goal.

According to P8, digital technologies with the capacity to provide feedback can be especially useful for students with disabilities such as autism.

Teachers are Willing to Try to Use Technology to Teach in Health/Physical Education Classes

Not only did teachers acknowledge that technology can be used to promote healthy eating habits and lifestyles, promote energy expenditure or physical activity,

teach motor skills, and educate students about physical activity, and overweight and obesity, teachers also indicated that they would be willing to try to use technology to teach in health/physical education classes (P3, P7, P9, P10). Teachers who expressed willingness to use technology to teach their students referred to the value of doing so in terms of student interest (P1, P6, P8), enjoyment (P9), and its capacity for allowing student independence (P10). Two teachers specifically said they would be willing to use technology to teach their students in a health/physical education setting because learning with technology in this setting would be novel for students and thus likely to promote participation (P6) and because students already are tech savvy and engaged with social media (P1). As P1 said, "I'm probably thinking half of them already have phones," "half of them are on social media in sixth grade," and "kids connect with technology better than they do with a live teacher sometimes."

Teachers specifically referred to using technology to impart knowledge about physical activity (P8), and overweight and obesity (P1, P2, P3, P4, P9, P10), and to promote healthy eating habits (P1, P2, P6, P7, P9) and physical activity (P8, P9, P10), although P2 and P10 did clarify that using technology to promote physical fitness should be supplemental to actual physical activity.

Teachers who expressed willingness to use technology to teach their students referred to needing (a) support from colleagues and administration (P2); (b) availability of "some sort of program" (P1), "programs" (P7), "app" (P4), "curriculum" or "lesson plans" (P1); and (c) access to technology (P9) as a requirement for them doing so. P9 indicated that the use of technology to teach nutrition is "actually part of our . . . [state] model content standards for 6th and 7th grade so it's actually a really big thing." He went

on to say that the standards make reference to "students being able to log in for nutrition."

Theme 5: Challenges to Using Technology in Health/Physical Education Classrooms

As demonstrated in Theme 4, teachers not only suggested that technology could be used in a variety of capacities to teach students in health/physical education classes, teachers reported that they do use technology in a variety of capacities to teach students in their health/physical education classes. Despite acknowledging the value of using technology in health/physical education classrooms, teachers expressed concern that using technology to teach their students takes up time they could be spending outside of the classroom engaged in some sort of physical activity. Teachers also recognized logistical challenges to using technology in health/physical education classes and noted the lack of expectation for teachers to do so as challenges to their implementation of technology in their health/physical education classes.

Shifts Focus away from Physical Activity

Teachers consistently perceived movement to be the goal of health/physical education classes (P1, P5, P6, P8, P10). It is "the most important thing" (P6). With regard to using technology for classroom instruction, the question, it seemed, was not whether technology could be used in health/physical education classrooms, but rather "how much time you want to spend [using it]" (P6) and "how much time students are sitting" (P7). P5 described it as "a real balance for teachers to try to use . . . technology [for instruction in the classroom] and still keep kids moving during PE class." As P6 explained, "it's hard to spend too much time on that [i.e., instructional technology] . . . In a short amount of time, you're supposed to get a lot done and then still move expectations of minutes per day per

week." P7's concern with taking time away from physical activity was specifically connected to state standards. She said, "If we spent that time showing all these wonderful PowerPoints and all these great videos and things, we wouldn't be achieving a lot of the other standards . . . because you're sitting in a room watching a screen." She added, "that means maybe there's one less day a week that they [i.e., students] could have put their heart rate up and actually benefited physically from it, rather than just learning about it."

P5, who expressed her personal concern for wanting to get "kids to move during PE," also expressed concern about how the students would feel about being in the classroom and subsequently whether the administration would approve. She stated that administration

> wouldn't want to see one class teacher . . . being in the classroom all the time where others are out doing things because I think it would create a problem where some kids would be like, "Hey, they're out there playing that, and we're sitting in here."

Regardless of administrative concerns and how students may react to spending time in the classroom, P5 suggested that concern for spending too much time in the classroom was not a universal concern among teachers. She said, "I think some PE teachers . . . are not as worried about going to the classroom more often . . . as I am."

Concern that using technology would take away from physical activity was not limited to use of technology in the classroom. Teachers (P1, P3, P6, P7) also expressed concern that using technology to promote physical activity could take time away from actual physical activity because class periods were short and some of the time was allotted for students to change in and out of their physical education clothes. As P1

explained, “It’s 10 minutes to change your clothes at each end of the period. 30 minutes in the middle for some physical activity . . . If you’re stopping all the time to use this technology, they’re not moving.” P6 made a similar comment. He said, “It’s difficult. Get them organized. Get them set up. Whatever the activity is, you’re not going to maximize your physical . . . output that day [if you are focused on technology].”

Logistical Concerns in General

From a logistical perspective, teachers reported that using technology in health/physical education classes can be problematic. In this regard, teachers cited lack of knowledge, lack of access, issues of student engagement, and inconvenience.

Knowledge. A seemingly obvious challenge to using technology in health/physical education classes was teachers’ lack of knowledge using technology. For example, speaking generally about technology, P3 said, “Technology is hard to work with.” P5 described other teachers as being “more technology savvy” and suggested she was not “very good at adapting my lessons to technology. I kind of go with what I know.” P1, questioning his capacity to use technology to teach his students, said, “Maybe I’m just old school.” P4 specifically expressed concern about her lack of knowledge of available technological resources.

P8 suggested that teachers’ lack of use of technology was related to their age. Although P2 did say, “technology wasn’t used that much when I was a kid” and admitted his age likely had something to do with why he was not “digital tech savvy,” the connection between age and use of technology in this study could not otherwise be confirmed using the data available. Despite not being comfortable using technology, P2 did state that he is “constantly learning” and expressed willingness to continue to learn

and to try to implement technology with students. He did admit, however, that he "would probably need . . . some guidance," "help," and "assistance" to so effectively. P4 said that she could get information about "what other teachers are doing" by networking on her own and searching online.

Access. Teachers reported lack of access to technology was a challenge (P1, P3, P5, P6, P7, P8, P9, P10) in part because it was out of their control (P10) and limited their ability to integrate digital technologies into their classes (P2, P3). Cost of technology was cited as a reason that teachers do not have access to class sets of digital technologies (P1, P3, P10). As P7 suggested, health/physical education classes are not provided full access to technology because "a lot of times PE, unfortunately, is seen as kind of an extra, not as a necessity." Subsequently, health/physical education teachers do not have full sets of Chromebooks (P7, P8) or desktop computers to accommodate all the students in their classes (P3). Teachers explained that "every teacher on this campus has a Chrome cart for their classroom, and we're five teachers without one [complete set]" (P6). "Sometimes we have to go to the library and get another set [of Chrome books] to cover our biggest classes" (P5). "We don't have pedometers. We don't have heart rate monitors. . . . We are limited on stop watches" (P7).

Although many students have access to their own digital technologies, not all students do (P2, P3, P9). This lack of access can be challenging for teachers who, for example, subsequently cannot digitally distribute information about healthy eating or provide digital resources for students to access on their own (P9). When P3 wants students to track their heart rate and pulse, students who do not have access to their own

digital technologies either have to rotate using the equipment that is available to the class or do so using manual methods.

Student engagement. Teachers expressed concern over student engagement when introducing technology to students in their health/physical education classes. For example, P4 was concerned about how "to get them to connect with it [technology] in a personal way" (P4). P10 expressed a similar concern that technology alone is not enough to promote student engagement and spoke about how teaching values can do more to promote "an important mindset" for "prioritizing your habits." Speaking about a particular student, P10 said,

> He is a basketball player, and there's tons of good workout videos online . . . He is a pretty motivated athlete, [but] getting him to go out and do 30 minutes to an hour working on his basketball skills is less motivating than playing NBA2K for 30 minutes to an hour.

In addition to how to engage students using technology, teachers shared that they lacked control over students' use and storage of the resulting personal data students' generated using technologies (P7) and were concerned about students' accessing inaccurate information (P7), information with which they did not agree (P4), and inappropriate websites (P1, P2, P9).

P1 and P2 also expressed their concern that student use of their mobile phones during the day is against school policy. Even though some teachers may ask students "to get out their phones and look stuff up . . . , the school district policy is to have them off while at school" (P1). Additionally, there are legal considerations associated with

videotaping students (P7) and concern for being able to adequately monitor students' proper use of videos used in health/physical education classes (P7).

Inconvenience. Using technology with student in health/physical education classes is challenging because it is inconvenient in a variety of ways. First, technology is time consuming for teachers who must develop their own "curriculum or lesson plans" (P1), "set it up" (P7), and "hook it up to the Internet" (P1). With regard to workload in particular, P1 explained, "I'm just trying to get through the day too, you know?" Second, using technology requires that teachers "be monitoring them [i.e., students] all the time" to audit what they are accessing online (P9). "These are goofballs, you know? They're . . . middle school kids" (P1) who need supervision. Third, technology also is highly inconvenient to use when "out in the field" (P7) where the sun shining on the Chromebook screen makes it hard to see (P8) and where equipment damage becomes a concern (P7, P8). Even "having a kid carry around a Chromebook all day tracking their food might be hard" (P8). Finally, P7 said that technology can be inconvenient sometimes because it is not dependable.

Lack of Expectations

More than half of the teachers (P1, P2, P3, P4, P7, P8) made reference to the lack of expectations for health/physical education teachers to incorporate technology into their classes for the purpose of decreasing rates of student overweight and obesity. According to P4, "the only thing that they've [i.e., administrators] mentioned is using technology in general, using Google Classroom more to connect with the kids, but not specifically related to decreasing obesity." P7 made a similar comment. She said,

> I would say the expectation of using technology is not that high. Otherwise we'd probably have more people trying to ask us to . . . promote the use of, you know, let's say, Fitbit, and watches, and heart rate monitors, and they'll be more of a push for that kind of thing and there's none. There's really none at all.

Of the school administration's interest in teachers using technology to decrease rates of student overweight and obesity, P1 said, "I don't think it's even on the radar. . . . the leaders that I work with [are] . . . under an avalanche . . . They're in a shit storm." P3 suggested that administrators are not likely to have such expectations for teachers "because it's not in our standards."

Theme 6: Responses to the COVID-19 Pandemic

Because of the pandemic, schools at which the teachers in this study taught were closed, and instruction moved to online learning platforms where the use of digital technology was necessitated. To teach in this new learning format, teachers reported using a variety of learning platforms: Google meetings/classrooms (P1, P3, P7, P8, P10), Zoom (P10), YouTube (P1, P7), and email (P3, P8). P10 also recognized that Skype and Facetime could be useful resources for connecting live with students.

When asked what expectations the school district had for teachers transitioning to instruction in online learning environments, P3 and P8 spoke in general terms. P3 said, "We were expected to continue educating our students in the best way possible," and P8 said, "To provide enrichment opportunities." P1 and P7 were more specific. P1 said, "Not many. We do have to post lessons each day we are out of school." P7 said, "The expectations were not very high since everyone was navigating the situation."

As well as having few expectations for student instruction, teachers also received little training or guidance. According to P7, “the support was minimal.” P1 received “a few PD [i.e., professional development] sessions offered by the district administration over the computer,” and P8 said, “There was one training that I attended for Google classroom.” P3 cited her colleagues as her greatest resource.

When teachers talked about physical activities they included or intended to include in their lesson plans, they talked about games students could play with their siblings, the use of equipment to which students had access (P10), and workout videos (P1, P3, P7, P8). P8 used videos she downloaded from YouTube. P3 and P7 used a combination of videos they had made and ones they downloaded from YouTube. P1 explained that originally he had been making his own videos but that after 3 weeks of minimal student participation he began downloading videos that were available on the Internet. In addition to assignments for physical activities, P8 also provided students with documents and slide slows pertaining to the activities she was providing and “created a Bitmoji [i.e., cartoon avatar] classroom that the students could explore and click on items that would link them to a video or activity.” P7 also provided students “quizzes for students to track their fitness, a nutrition and fitness module, an ongoing fitness log and reflection, a week on sportsmanship, as well as topics on motivation, inspiration, and what makes you successful.”

Most teachers agreed that “most students are not engaging at all” (P1). P1 explained, “I started out with 35 kids out of 220 students viewing the workouts on YouTube. By the time 3 weeks went by, I was down to 8 views on my you tube channel.” P3 “had an average of 38% participation rate through distant learning in PE.” P8, who

reported that a few of her "students that participated seemed to enjoy it [online learning]," said she "had about 10-15 participate a week" out of about 50 students. Although P7 said that "students were generally engaged in the lessons, and found exercises challenging," she did acknowledge that some students "found it less motivating to exercise at home without their peers/friends" and that "a few students found the online system frustrating and needed additional to help to complete assignments."

Teachers suggested a number of reasons for students' lack of participation. According to P1, "there is no grading or attendance taken. Grades can go up with extra credit if students do some work but not down." So "if a student has an A or B and it [i.e., the grade] can't go down, then why engage?" As a result, there is a "lack of accountability" (P1), and students are unmotivated (P1, P3). P7 made a similar statement about the negative effect of not having grades attached to lessons. Despite teachers' best efforts to engage students and increase participation by, for example, "reaching out to parents and trying to make . . . assignments fun" (P3), student participation did not increase (P1, P3, P8).

Teachers perceptions of the online format overall were not favorable. Some teachers made reference to the inability to engage students in "group related activities," to the lack of "human contact" (P10), and to "the benefits of being present in the classroom" (P3). P8, an adaptive physical education instructor, stated in general that she did "not feel it was the right format for most of my students." P1, who said "the new format sucks," suggested that "distance learning can work for college students but for grade school it is a disaster for learning." P3 suggested that "physical education from a distance would have been more successful" if was mandatory. Similarly, P7, who did suggest that that the "system was

fairly successful," also acknowledged that face-to-face interaction is more ideal and that the online program would be better if students were required to provide evidence of their activity as opposed to just written documentation.

Evidence of Trustworthiness

As described in Chapter 3, the credibility of the findings was developed by establishing the face validity and content validity of the data collection instrument. Credibility of the findings also was developed by validating the completed analyses using member checking. Transferability of the study findings was established by clearly and thoroughly explaining the study's research methods and my potential biases as a researcher. Additionally, I provided rich, thick descriptions in the study findings. To establish dependability, I discussed changes in conditions that could have influenced study outcomes. My acknowledgement of potential biases as a researcher also helped establish dependability of the study. Confirmability of my findings was demonstrated by using a second coder to establish intercoder reliability. No adjustments were made to my initial plans for establishing the rigor, and thus trustworthiness, of my study findings.

Results

This section is a discussion of the data that pertain specifically to the research questions, all of which were related to the use of technology to prevent and reduce the incidence of childhood overweight and obesity. Overall, teachers' responses about their capacity to use technology (RQ1), the value of using technology (RQ2), the influence of others on their use of technology (RQ3), and the actual control they have over their use of technology (RQ4) to prevent and reduce the incidence of childhood overweight and obesity were limited. It is possible that teachers responses pertaining to technology use

and the reduction of childhood overweight and obesity were limited because some teachers (P1, P3) were not technologically savvy and some teachers (P1, P2, P4, P7, P9) expressed concern in general about students' access to technology (see Theme 5).

Research Question 1

RQ1 was, "What are middle school health/physical education teachers' perceptions regarding their capacity (perceived behavioral control) to use technology to prevent and reduce the incidence of childhood overweight and obesity?" Teachers' responses about their capacity for using technology specifically to prevent and reduce the incidence of childhood overweight and obesity were limited. Although P3, P4, P5, P7, P8, and P9 made statements suggesting that technology could be used to prevent and reduce the incidence of childhood overweight and obesity, of the eight teachers who expressed they were comfortable using technology in general, only P9 and P10 talked about their actual use of technology in that regard. P10 said, "The main way we use online resources for . . . weight management or anything managing weight is that we do communicate about obesity." P9 said, "I typically only use it [i.e., technology] for students that are overweight and obese." P9 also said he personally is "very motivated to use different types of technology in order to keep up or decrease children being overweight or obese." Additionally, P9 made a direct connection between obesity and physical fitness. He said he holds students "accountable for getting a little bit more physically fit which inadvertently helps them to lose weight and fight childhood obesity."

Research Question 2

RQ2 was, "What are middle school health/physical education teachers' perceptions regarding the value (attitude toward the behavior) of using technology to

prevent and reduce the incidence of childhood overweight and obesity?" None of the teachers made direct statements about the value of using technology to prevent and reduce the incidence of childhood overweight and obesity. However, P9 and P10 stated that they did use technology to prevent and reduce the incidence of childhood overweight and obesity, and P1, P2, P3, P4, P9, and P10 made statements suggesting they were willing to use technology for those purposes. P9 specifically stated that he uses technology with "students that are overweight and obese . . . to motivate them."

Because it is unlikely that P9 and P10 would purposely use technology to prevent and reduce the incidence of childhood overweight and obesity and that P1, P2, P3, and P4 would be willing to use technology for those purposes if they did value the process, one could infer that the majority of teachers in this study valued the use technology to prevent and reduce the incidence of childhood overweight and obesity. It also is possible that so few teachers in this study expressed they valued the use of technology to prevent and reduce the incidence of childhood overweight and obesity because, according to P6, there is no expectation from administration for them to do so.

Research Question 3

RQ3 was, "What are middle school health/physical education teachers' perceptions regarding the influence of others (subjective norm) on their use of technology to prevent and reduce the incidence of childhood overweight and obesity?" Teachers made few comments with regard to the influence of others on their use of technology to prevent and reduce the incidence of childhood overweight and obesity. P9, who did report using technology to prevent and reduce the incidence of childhood overweight and obesity also said, "I do believe that others in my school expect me to utilize that to help

decrease rates of childhood obesity," although it is unclear as to whether those expectations had any bearing on his use of technology in that regard. More than half of the teachers (P1, P2, P3, P4, P7, P8) made reference to the lack of expectations for health/physical education teachers to incorporate technology into their classes for the purpose of decreasing rates of student overweight and obesity. Participants also talked about how teachers are beginning to use technology (P8), could use technology (P3), or likely would be willing to use technology (P2) to prevent and reduce the incidence of childhood overweight and obesity. However, the idea that other teachers were, could, or would be willing to use technology to prevent and reduce the incidence of childhood overweight and obesity did not appear to have any influence on study participants' intentions of using technology for those purposes.

Research Question 4

RQ4 was, "What are middle school health/physical education teachers' perceptions regarding the actual control they have over their use of technology to prevent and reduce the incidence of childhood overweight and obesity?" Teachers' perceptions about control varied. Although some teachers talked generally about having control over what they teach (P6, P10) and having control over how they teach (P4, P10), other teachers indicated that they generally lacked control over using technology. Teachers explained that students lack their own digital technologies (P7, P9) and teachers lack access to specific or full class sets of digital technologies (P5, P6, P7, P9, P10). Teachers also cited the inconvenience of using technology in the field (P7, P8) and the inability to control for equipment failure (P7), equipment safety (P7), student safety (P1, P2, P7, P9), and student privacy (P7) as reasons for their lack of control using technology with their

students overall. With regard to using technology specifically to prevent and reduce the incidence of childhood overweight and obesity, teachers cited students' lack of digital technologies (P2), teachers' lack of full class sets of digital technologies, and student and parent sensitivity to class focus on obesity (P7).

Summary

The four research questions in this study were developed to generate data about middle school health/physical education teachers' perceptions about using technology to prevent and reduce the incidence of childhood overweight and obesity. Of particular interest were teachers' perceptions about their capacity to use technology (RQ1), the value of using technology (RQ2), the influence of others on their use of technology (RQ3), and the actual control they have over their use of technology (RQ4) for that reason.

Data showed that although most teachers perceived that technology could be used to prevent and reduce the incidence of childhood overweight and obesity, of the eight teachers who were comfortable using technology in general, only two teachers used technology for those purposes. However, more than half of the teachers were willing to use technology to prevent and reduce the incidence of childhood overweight and obesity even though they also perceived they had little control over doing so. Additionally, more than half of the teachers indicated there was little or no expectation on the part of others for them to use technology to prevent and reduce the incidence of childhood overweight and obesity. An interpretation of these findings in relation to the literature and theoretical framework is presented in Chapter 5.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this generic qualitative study was to fill the gap in the literature regarding middle school health/physical education teachers' perceptions about the use of technology in educational settings to promote healthy eating habits and physical activity, and to positively influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity. This study was conducted to generate insight into health/physical education teachers' perceived value of using technology in educational settings to promote healthy eating habits and physical activity and to positively influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity.

The two key findings in this study are reflective of conditions prior to and after the onset of the COVID-19 pandemic. The first key finding was that teachers' use of technology in health/physical education classes to promote healthy eating habits and physical activity and to positively influence other obesity related factors varies. The second key finding was that the COVID-19 pandemic has influenced teachers' use of technology in their health/physical education courses.

Three types of literature were used in two ways to interpret the study findings. First, to establish credibility of the findings in this study, the findings are compared to current research studies; both similarities and differences, when applicable, are presented. Because research on the use of technology in physical education classrooms is limited (Hill & Valdez-Garcia, 2020), studies from outside the United States and studies conducted with teachers at various levels have been included in this discussion.

Second, literature related to the study's theoretical framework and laws related to childhood obesity and the use of technology in classrooms to prevent childhood obesity are included because they contribute to the discussion about potential reasons underlying the findings in this study. The majority of this literature is not current because the sources are either seminal theoretical works or previously established laws that are still in place; however, those historical sources are essential for interpreting the study findings and add critical value to the discussion. The study limitations, recommendations, implications, and recommendations for practice also are discussed in this section.

Teachers' Use of Technology in Health/physical Education Classes to Promote Healthy Eating Habits and Physical Activity and to Positively Influence other Obesity Related Factors Varies

Teachers Used Technology

Some teachers in this study used technology in their health/physical education classes to promote healthy eating habits and physical activity and to positively influence other obesity related factors or were willing to do so. These findings are supported in the literature. Both Lambert (2016) and Whitney (2016) suggested that health/physical education teachers have supported using technology to promote physical education. Additionally, Browne (2015) found that student teachers successfully used digital tablet apps during their in-class practicums, and, because they found the applications valuable, were likely to use the apps in the future in their own classrooms.

One reason teachers in this study gave for using technology in their health/physical education classes was that they have access to technology and established programs and tools that support those outcomes. This scenario is reflective of the general

educational landscape where legislative and organizational support of schools exists and federal funding of programs for schools promote healthy children and the prevention of obesity. Examples of legislative level support for promoting healthy children in schools include (a) NASBE's call for increased attention to the role of schools in children's health (Bogden, 2000); (b) the implementation of the Healthy, Hunger-Free Kids Act of 2010 to promote child nutrition and access to school meal programs (FRAC, 2017a); and (c) the enacting of the Every Student Succeeds Act (2015) to improve students' eating, nutrition, and physical fitness habits and to provide federal funding for communities experiencing childhood obesity. Examples of organizational support are evident in the development of school-based childhood obesity prevention programs such as Growing Health Kids (Vierregger et al., 2015), the Healthy Schools Program (Alliance for a Healthier Generation, 2017), and NFL Play 60 FitnessGram® (Cooper Institute, 2014b). Additionally, the CDC (2017c), the Harvard School of Public Health (2017), the IOM (2012), and the United States Department of Agriculture, Food and Nutrition Service (2017) have continuously identified the role of schools as critical to supporting good health and physical fitness for children and adolescents. The CDC (2011b) also has specifically encouraged the use of technology in health education classrooms and physical education settings.

Teachers in this study specifically mentioned having the capacity to show Power Point presentations and You Tube videos, which suggests they at least had access to a computer. Hill and Valdez-Garcia (2020) also found that teachers have access to various technologies and digital tools in their physical education classrooms. Specifically, 86.6%

had access to a personal laptop computer, 84.6% had access to a digital projector, and 55.2% had access to a document camera.

Teachers in this study reported using technology to demonstrate physical techniques and skills. Similarly, Kretschmann (2015) found that teachers used video feedback to help 5th grade students in a swimming class improve their front crawl techniques. Students in the experimental group who were provided with video feedback for 7 weeks significantly improved their 25 meter crawl racing speed by 2.2 seconds, more than double the improved demonstrated by students who received only traditional verbal feedback from their teachers.

Teachers Did Not Use or Rarely Used Technology

Although some teachers in this study did indicate using technology in their health/physical education classes to promote healthy eating habits and physical activity and to positively influence other obesity related factors, other teachers did not use technology in their classrooms for those purposes. This finding is supported in the literature. In a study of 57 high school level in-service physical education teachers, Kretschmann (2015) found that with the exception of stereo systems and images, few teachers used technology in their classes. The barriers teachers in this study cited for not using technology are (a) teachers' perceived and actual control over what they teach, (b) teachers' perceived and actual control over how they teach, (c) lack of technology acceptance, and (d) lack of support from administration.

Teachers' Perceived and Actual Control Over What and How They Teach

Teachers' perceived control over what they teach emerged as a reason that teachers either use or do not use technology in health/physical education classes to

promote healthy eating habits and physical activity and to positively influence other obesity related factors. The influence of perceived control over behavior is supported by the literature pertaining to the study's theoretical framework. According to Ajzen and Fishbein (1972), people's intents to engage in behaviors are influenced by their perceived control over those behaviors. This means that if people perceive they have control over a behavior, they will be more likely to intend to engage in a behavior (Ajzen & Fishbein, 1972). Additionally, the transition from intent to engage in a behavior to actual engagement in a behavior is mediated by the actual control people have over the behavior This means that if people do not have actual control over a behavior, their level of perceived control is irrelevant (Ajzen & Fishbein, 1972). Similarly, Ertmer et al. (2012) suggested that barriers to using technology negatively impact the degree to which teachers use technology. However, Ertmer et al. also suggested that this relationship occurs regardless of the level of acceptance teachers have for technology and their motivation for using it.

When teachers in this study referred to lack of actual control over using technology in their classrooms, they referred to (a) lack of resources in the forms of access to DHFTs and time in their classes to be able to make use of those technologies, (b) lack of control over the environment, and (c) lack of control over what students are accessing online. These findings were supported in the literature. According to Hall and Valdez-Garcia (2020), 57.4% of the physical education teachers in their study lacked access to applicable technology, and 57.1% lacked in-class time to use the technology. Kretschmann (2017) acknowledged the challenge of using technology in "unfriendly" environments (i.e., those outside the classroom and gymnasium), and Hill and Valdez-

Garcia (2020) found that teachers have concerns about the information students access online.

Lack of Technology Acceptance

Some teachers who were not using technology in their health/physical education classes reported that they struggled to use technology in general. Other teachers who were not using technology in their health/physical education classes valued the use of technology only for administrative purposes (e.g., giving tests, sharing information) and perceived that using technology in physical education classes kept students from actually engaging in physical activity.

These findings are supported in the literature that suggests teachers (a) do not know how to use technology (Hill & Valdez-Garcia, 2020; Kretschmann, 2015), (b) do not know how to integrate technology into their teaching content, (c) may not accept using technology for educational purposes in general (Ertmer et al., 2012; Hill & Valdez-Garcia, 2020) or specifically in health/physical education settings (Lambert, 2016), and (d) may not use DHFTs in their classes because they view them as distractions to teaching (Ertzberger & Martin, 2016). Additionally, Zhu and Dragon (2016) found that the use of mobile technologies in physical education classes significantly decreased the amount time students spent engaged in physical activities and the interest they expressed in the activities.

From a theoretical perspective, people who have negative attitudes toward a behavior are less likely to intend to engage in a behavior and ultimately engage in that behavior (Ajzen & Fishbein, 1972). Applying this theoretical lens the participants in this study helps to explain why teachers who had negative attitudes toward using technology

in their health/physical education classrooms were not motivated to do so. Additionally, people's past experiences with particular behaviors contribute to their perceived self-efficacy for those behaviors (Bandura, 1977, 1994), which further contributes to their perceived behavioral control (Ajzen, 1985, 2012; Ajzen & Fishbein, 1972). This means that teachers who have had past negative experiences using technology for any reason would be less likely to use technology in their health/physical education classes to promote healthy eating habits and physical activity and to positively influence other obesity related factors.

Lack of Support

Some teachers in this study cited lack of support as a reason for not using technology in their health/physical education classes. Teachers specifically mentioned that administrators did not have any expectation for teachers to use technology in their health/physical education classes. These findings are supported in the literature.

The CDC (2011b), which does recommend that teachers integrate computer-based instruction into their health education lessons, does not include specific strategies for incorporating that technology into those lessons and thus does not put forth expectations in this regard. From a theoretical perspective, Ajzen and Fishbein (1972) suggested that subjective norms (i.e., important others' expectations about a person's behavior) influence people's intent to engage in and actual engagement in a particular behavior. It is possible then that teachers in this study, whose administrators did not expect them to use technology in their health/physical education classes, lacked the influence of that subject norm and thus were less likely to intent to or actually use technology in their classes. Additionally, according to Deci and Ryan (1985, 2000, 2008), external

motivators mediate the transition of behavioral intent into actual behavior. From this perspective, lack of administrators' expectations for teachers' use of technology in their health/physical education classes could be perceived as a lack of external motivation to use technology for that purpose. This scenario helps explain why teachers who reported not having administrative support did not use or rarely used DHFTs in their classes.

COVID-19 Pandemic has Influenced Teachers' Use of Technology in Their Health/Physical Education Courses

Prior to the COVID-19 pandemic, teachers' use of technology in their health/physical education classes to promote healthy eating habits and physical activity and to positively influence other obesity related factors was voluntary. However, because of the pandemic, schools at which the teachers in this study taught were closed and instruction moved to online learning platforms where the use of technology was necessitated. Teachers received little instruction, direction, or support to transition to the online environment.

Within the online environment, teachers used a variety of communication platforms to connect with students and both created and accessed available digital resources to provide optional enrichment activities for students. Because student participation was not required, few students engaged in the activities. When teachers began to notice dwindling participation rates among their students, they no longer perceived the extra work needed to create their own material was a good investment of their time and turned to established and freely available online content. Most of the resources teachers used were workout videos, although some activities were related to nutrition and fitness tracking. Overall, teachers' perceptions of the online teaching format

were not favorable, and teachers questioned the quality of education students were receiving.

These findings are supported in the literature. For example, Kaden (2020) and Merrill (2020) have found that teaching in an online format increases teacher workload and that providing meaningful learning experiences in online environments is challenging for teachers. Because I work in the same school district as nine of the participants, I personally can confirm that the state and school district provided teachers little guidance for transitioning to the online learning environment and that students were not held accountable for completing any of the provided activities or assignments.

Additionally, despite teachers' best efforts to engage students in meaningful learning, without the incentive of grades, students are not motivated to engage in online learning activities (DeWitt, 2020). Lack of student engagement in physical activity is especially likely to occur in online environments necessitated by the COVID-19 pandemic (Rundle et al., 2020). These conditions mirror typical summer breaks (Rundle et al., 2020) during which children are more likely to gain weight (Franckle et al., 2014; von Hippel & Workman, 2016). This scenario is exacerbated among populations of students who are socioeconomically disadvantaged (Franckle et al., 2014; Wang et al., 2015) and susceptible to food insecurity (Rundle et al., 2020) and those who are obese or overweight (Franckle et al., 2014).

Limitations of the Study

Study limitations and plans for mitigating the influence of those limitations on study outcomes were introduced in Chapter 1. No changes to those limitations occurred. Solutions for mitigating the influence of those limitations on study outcomes stand as

noted. In Chapter 3, specific issues of trustworthiness were introduced and plans for addressing those issues were suggested. Those concepts were reviewed in Chapter 4, and changes in the study setting due to the COVID-19 pandemic, which could have influenced the interpretation of the study data, were addressed.

In this section, the previously discussed study limitations and issues of trustworthiness determined before the study started are reviewed. Additionally, one limitation to the study's trustworthiness that arose from execution of this study is identified.

Limitations and Issues of Trustworthiness Identified Before the Study Started

The collection of qualitative data from only a small group of 10 middle school teachers limited the amount of data able to be collected for analysis and, subsequently, findings from this study are not generalizable to larger populations. However, I was able to determine that the study sample was not unnaturally homogenous, and because new information about teachers' perceptions were generated, the collected data are considered valuable.

This study was limited by the use of a generic qualitative design, which limited the types and sources of data that could be collected. However, I ensured rigor by (a) providing a clear discussion of the theoretical framework, (b) aligning all aspects of the study with the theoretical framework, (c) aligning the study methods and methodology, (d) acknowledging and explaining my personal bias for the use of technology in educational settings to promote healthy eating habits and physical activity as a means of preventing and reducting the incidence of childhood overweight and obesity, (e)

remaining cognizant about my personal bias during the interview process, (f) conducting member checking, and (g) using a second coder to confirm the study findings.

Limitation to the Study's Trustworthiness that Arose from Execution of the Study

With regard to study dependability, a researcher must record and report any changes in conditions that could impact the outcomes a study (Hancock & Algozzine, 2017; Mertler, 2016; Trochim & Donnelly, 2008). As indicated in the Setting section of Chapter 4, the COVID-19 pandemic necessitated the closing of schools toward the end of the data collection process for this study. Because of this change, the last three participants interviewed were operating in atypical circumstances. The first two essentially were on school break and not teaching during the time they were interviewed. Therefore, the pandemic conditions did not have any direct influence on their teaching habits. However, by the time the last participant was interviewed, the school district had moved to an online teaching format. As such, the teaching habits used by and strategies employed by the final participant inherently were influenced by the pandemic. Although that participant did directly make distinctions between how he had used technology before as compared to during the pandemic, I remained cognizant about these two distinct periods when I analyzed and interpreted the data. Therefore, the COVID-19 pandemic was not considered an undue influence on the interpretation of the study results.

Recommendations for Research

Typically, study recommendations are based on the strengths and limitations of the study in conjunction with concepts of interest in the literature. However, the onset of the COVID-19 pandemic and resulting school closings changed the dynamic of the teaching process. Therefore, recommendations that would have been logical based on the

data collected prior to the onset of the COVID-19 pandemic are not applicable to the current educational landscape. For example, how teachers might use technology, including DHFTs, in their health/physical education classes is a moot point because they are not in the school where they potentially would have access (albeit often inadequate) to those technologies. Additionally, because not all students have access to DHFTs, exploring how teachers might implement these particular technologies in an online learning environment is not practically relevant.

What is more urgent and does make sense, however, is the exploration of health/physical education teachers' experiences transitioning to the online learning environment, how they have adapted their instructional strategies to the new platform, and the support they need to help them be successful in engaging students in activities that increase physical activity and health knowledge, both of which can subsequently have a positive impact to reduce overweight and obesity. Both qualitative and quantitative research would be viable options for collecting data relevant to these areas of interest. Because teachers at all levels have become distance educators, it is recommended that research include elementary, middle, and high school teachers.

Additionally, teachers in this study indicated that they struggled to support healthy eating habits because they did not have control over their students' home environments and that students were not engaging in the physical activity lessons teachers were assigning. Because at the time of this study students were learning remotely and all of their time was being spent at home, it is recommended that research be conducted on how school districts can help educate parents about the risk factors for

and negative outcomes of overweight and obesity and to encourage their involvement in their children's health and physical activity expenditures.

It is also recommended that case study research be conducted to explore how physical education departments in varied school districts in the state service students in the distance learning environment and successfully meet state standards. Findings from this type of research could be used to develop programs that would be applicable in all educational settings within the state. In a similar fashion, grounded research could be conducted to develop models that clarify roles for both health/physical education teachers, and parents. The construction of such models should include research-based strategies that will help families in distance learning environments stay physically fit.

Implications

The intention for conducting this study was to share the findings with stakeholders as a first step to taking action to reduce the incidence of childhood overweight and obesity. In children, overweight and obesity can have detrimental effects on the brain (Reinert et al., 2013) and lead to a variety of negative physical conditions including sleep apnea, hypertension, orthopedic problems (IOM, 2012), kidney disorders, Type 2 diabetes, and fatty liver disease (National Institute of Diabetes and Digestive and Kidney Diseases, 2017). Obesity also may lead to cardiovascular diseases and cancer (WHO, 2017c). The combination of such comorbidities may contribute to obesity in adulthood (Mayo Clinic, 2016) and shortened life spans (IOM, 2012).

Children who are overweight and obese also are likely to suffer emotionally from low self-esteem, negative body image (IOM, 2012), and depression (Morrison et al., 2015) and are at risk for being bullied and otherwise stigmatized (Pizzi, 2016). It is

possible that these conditions contribute to the high rates of absenteeism among children who are extremely obese (Rappaport et al., 2011), obese, or overweight (Geier et al., 2007; Taras & Potts-Datema, 2005) and that the high rates of absenteeism hinder academic success among students who are overweight or obese (Howie & Pate, 2012; Taras & Potts-Datema, 2005). It is in the potential to decrease rates of childhood obesity and thereby improve children's physical, mental, and emotional health states that this study has the potential for positive social change.

However, in light of the shift from in-school to online learning as a result of the COVID-19 pandemic, additional barriers to using technology to instruct students in health/physical education exist and must be overcome before being able to have a positive influence on rates of childhood overweight and obesity. Two recommendations for practice to accomplish that goal are presented in the next section.

Recommendations for Practice

The first recommendation for practice is to provide teachers with training. Beyond helping teachers navigate the online learning platform they are required to use by the school district, training should include opportunities to practice using and experimenting with DHFTs, including computer programs, websites for fitness and nutrition, phone apps, watch apps, fitness tracker watches, and pedometers. The more opportunities teachers are given to experiment with DHFTs, the more familiar teachers will become with them, the more confident they will become in their ability to explain to students how to use them, and the more likely they will be to incorporate them into their lessons. Kihm et al. (2017) suggested incorporating such training in teacher preparation programs so

that educators enter the workforce prepared to use DHFTs with their students, particularly those who have weight management challenges.

Training also should include resources for ongoing support. For example, teachers could be introduced to and encouraged to join online professional learning communities and support forums where teachers can collaborate with other teachers and share ideas and experiences. It is likely that if teachers have access to ongoing support such as this, their perceived value of using DHFTs will improve and they will be motivated to find new and innovative ways to use them with their students.

However, training should be designed to directly encourage teachers to use technology creatively to make physical education relevant, valuable, and motivating for students. Allowing students to generate their own health and fitness goals could be one way to make online health/physical education content relevant and valuable. Teachers could motivate students using tracking and point systems built into the DHFTs or generate their own systems of rewards.

The second recommendation for practice is to provide students with DHFTs they can use at home to better engage in health/physical education learning activities. Most students in the school district in this study had access to the Internet at home. Those students who did not were provided Chromebooks shortly after school closures in April 2020. However, ensuring that all students have access to the infrastructure necessary to participate in online learning is not enough. Students need access to DHFTs that can provide feedback on their effort, including evidence of health and fitness progress, and motivate them to be health conscious and physically active despite the limitation of

having to participate in their health/physical education classes in online learning environments physically isolated from their classmates.

Conclusion

Engaging in healthy eating habits and physical activity are sustainable means of maintaining a healthy body weight (CDC, 2017a). The CDC (2015b) recommends that children and adolescents get 60 minutes of physical activity each day. By maintaining a healthy body weight, children and adolescents can avoid the many negative mental, physical and emotional conditions associated with overweight and obesity (see Geier et al., 2007; Howie & Pate, 2012; IOM, 2012; Mayo Clinic, 2016; Morrison et al., 2015; NIDDKD, 2017; Pizzi, 2016; Rappaport et al., 2011; Reinert et al., 2013; Taras & Potts-Datema, 2005; WHO, 2017c). Schools are in a unique position to impact the incidence of obesity by promoting healthy nutrition and physical activity (CDC, 2017c) in part through the use of DHFTs.

Middle school health/physical education teachers in this study demonstrated they valued using and were willing to use technology to promote healthy eating habits and physical activity, and to positively influence other obesity related factors associated with the prevention and reduction of the incidence of childhood overweight and obesity. However, they faced challenges to using technology in their classes, including lack of access to various technologies; lack of resources, including time; and lack of knowledge needed to integrate technology into their lesson plans. Additionally, at the time of this study, public, and most private, schools remain closed as a preventative measure against the spread of the COVID-19 virus. As a result, student instruction is taking place in online learning environments, a scenario poised to exacerbate the negative mental,

physical, and emotional risks of the childhood obesity epidemic in the United States as children lose supportive structures provided by schools, and in particular, health/physical education teachers (Rundle et al., 2020).

When providing instruction using distance education platforms, health/physical education teachers are challenged by (a) the limitations of the online learning platforms, (b) the limited influence of YouTube workout videos and exercise logs on student motivation, (c) the lack of physical proximity with students, (e) the lack of control over students' home environments, and (e) students' lack of access to classmates that allow for group activities and otherwise promote physical activity. These challenges, in conjunction with teachers' lack of efficacy using technology during instruction, are likely to hinder teachers' use of DHFTs on the online learning environments in which they are currently instructing students.

To be effective, online education needs to be well-designed and considerate of potential social inequalities (Kaden, 2020). Although schools can and should provide teachers with training, resources, and ongoing support, additional research should be conducted to better understand how health/physical education teachers in particular can best engage their students in healthy eating habits and physical activity using technology, in particular DHFTs. Attention to the childhood overweight and obesity epidemic cannot be put on hold by the COVID-19 pandemic. It is as crucial now to diminish the incidence of childhood overweight and obesity and subsequently improve children's mental, physical, and emotional health and overall quality of life as it was before the COVID-19 virus took the spotlight.

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Appendix A: Interview Protocol for Middle School Health/Physical Education Teachers

Interview Protocol for Middle School Health Education Teachers

Date: _____ Participant #: _____Start Time: _____ End Time: _____

Dialogue: Thank you for agreeing to participate in this study and to be interviewed today. I appreciate your time and value your feedback. Information you share with me today will provide insight that may be used by administrators in the target district to make informed decisions about how to best promote teachers' use of technology not only as a means of reducing the incidence of childhood overweight and obesity but as a proactive measure for preventing it as well.

When I invited you to participate in this study, I provided you with informed consent in which I explained the details of this study and what would be expected of you as a participant. If you have any questions about the study or your participation in it, including what will happen in this interview, I will answer them now. (If the participant has questions, answer them. If the participant wishes to exit the study, thank the participant for meeting with you today, and excuse him or her. If the participant does not have any questions, continue reading the dialog.) Ok, then let's begin with the 6 background items. The first item is:

1. What grade level do you teach?

6th	7th	8th

2. In total, how many full years of teaching experience do you have?

< 1	1 < 5	5 < 10	10 < 15	15 < 20	20 <

3. How many years of teaching experience do you have in the Xxxxxxx School District?

< 1	1 < 5	5 < 10	10 < 15	15 < 20	20 <

4. How would you describe your gender?

Male	Female	Other

5. What is your age?

< 25	25 < 35	35 < 45	45 < 55	55 < 65	65 <

6. What is your academic background?

Bachelor's degree	Bachelor's degree plus additional master's level credits	Master's degree	Master's degree plus additional doctoral level credits	Doctorate degree	Other or additional degrees or certificates

Dialogue: Thank you. Those are all of the background questions. There are 7 technology use items. Please keep in mind that any reference to technology is not limited to digital health and fitness technology. You may consider digital health and fitness technology such as (a) pedometers and accelerometers; (b) health and fitness apps such as CardioTrainer, MyFitnessPal, and CalorieCounter; and (c) educational games such as Food Group Frenzy, the Food Groups Game, and Food Detective. You also may consider active video games such as Nintendo Wii™, Microsoft Xbox Kinect, or *Dance Dance Revolution*. You may also consider desktop computers, laptops, iPads, Chromebooks, and mobile phones.

7a. To what extent, if at all, do you believe that technology *can be used* with middle school children in health/physical education settings to promote healthy eating habits?

7b. How about to promote physical activity and energy expenditure?

7c. How about knowledge about physical activity?

7d. How about motor skills associated with physical activities?

8. How often do your lessons and/or prepared activities for students (in or out of the classroom) include using students' assigned Ipads (K) or Chromebooks (Grades 1-8) specifically **to promote healthy eating habits**?

☐ Most lessons and activities include the use of an Ipad or Chromebook
☐ More than one lesson or activity per day
☐ At least once per day
☐ At least once per week

- ☐ More than one time per week
- ☐ At least once every 2 weeks
- ☐ At least once every 3 weeks
- ☐ At least once per month
- ☐ Rarely
- ☐ Never

8a. To what extent, if at all, do you believe that promoting healthy eating habits can decrease rates of childhood overweight and obesity among middle school children?

8b. How about promoting physical activity and energy expenditure?

8c. How about promoting knowledge about physical activity?

8d. How about promoting motor skills associated with physical activities?

9a. Please describe the extent of control, if any, you personally have over using technology with your students to promote healthy eating habits.

9b. How about to promote physical activity and energy expenditure?

9c. How about to promote knowledge about physical activity?

9d. How about to promote motor skills associated with physical activities?

10. Please describe the extent of control, if any, you have over influencing student overweight and obesity by using technology.

11. How do you think other middle school teachers and school administrators feel about the value of using technology with students in educational settings to decrease rates of childhood overweight and obesity among middle school children?

12. What do you believe others expect of you regarding the use of technology with your students to decrease rates of childhood overweight and obesity among middle school children?

13. In what ways are you motivated to use technology with your students to decrease rates of childhood overweight and obesity among middle school children?

14a. What barriers, if any, do you perceive exist to using technology with students to promote healthy eating habits?

14b. What about barriers to using technology to promote physical activity and energy expenditure?

14c. What about barriers to using technology promote knowledge about physical activity?

14d. What about barriers to using technology to promote motor skills associated with physical activities?

15. Is there anything else of relevance you'd like to share before we end the interview?

Dialogue: Those are all the questions I have for you today. The interview is now over. Thank you again for your time.

Appendix B: Table of Interview Items and Conceptual Framework Concepts for Research Questions 1-3

Interview Item	Conceptual framework concept
7. To what extent, if at all, do you believe that technology can be used with middle school children in health/physical education settings to promote healthy eating habits, physical activity, knowledge about physical activity, energy expenditure, and/or motor skills associated with physical activities?	• Persuasive technology • Behavior beliefs • Attitude toward the behavior
8. To what extent, if at all, do you believe that promoting healthy eating habits, physical activity, knowledge about physical activity, energy expenditure, and/or motor skills associated with physical activities can help prevent and reduce the incidence of childhood overweight and obesity among middle school children?	• Persuasive technology • Behavior beliefs • Attitude toward the behavior
9. Please describe the extent of control, if any, you personally have over using technology with your students to promote healthy eating habits, physical activity, knowledge about physical activity, energy expenditure, and/or motor skills associated with physical activities.	• Persuasive technology • Control beliefs • Perceived behavioral control
10. Please describe the extent of control, if any, you have over impacting student overweight and obesity by using technology.	• Persuasive technology • Control beliefs • Perceived behavioral control
11. How do you think other middle school teachers and school administrators feel about the value of using technology with students in educational settings to prevent and reduce the incidence of childhood overweight and obesity among middle school children?	• Persuasive technology • Beliefs about others' attitude toward the act
12. What do you believe others expect of you regarding the use of technology with your students to prevent and reduce the incidence of childhood overweight and obesity among middle school children?	• Persuasive technology • Normative beliefs • Subjective norm
13. In what ways are you motived to use technology with your students to prevent and reduce the incidence of childhood overweight and obesity	• Persuasive technology

among middle school children?	• Motivation to meet expectations of others
14. What specific barriers, if any, do you perceive exist with regard to using technology with students in educational settings to promote healthy eating habits, physical activity, and knowledge about physical activity, energy expenditure, and/or motor skills associated with physical activities to help prevent and reduce the incidence of childhood overweight and obesity among middle school children?	• Control beliefs • Perceived behavioral control
15. Is there anything else of relevance you'd like to share before we end the interview?	• Not applicable

Appendix C: COVID-19-Related Follow-Up Questions for Teachers

1. What platform(s) are you using to connect with students?

2. What expectations for teaching students at a distance does your district have of you?

3. What training or support have you received to help you transition to and succeed in this new learning platform?

4. What do your lesson plans look like? (Including the types of resources you are using.)

5. How are the students reacting and engaging?

6. What is your perception about the level of success you and the students are achieving in this new format?

7. What barriers to success are you and your students encountering?

8. How are you overcoming those barriers?

9. Anything else you'd like to share about your experiences teaching health and/or physical education from a distance?