PHYSICAL LITERACY AND INTENTION TO PLAY INTERSCHOLASTIC SPORTS IN
SIXTH GRADE PHYSICAL EDUCATION STUDENTS

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Prevalence of physical inactivity in children and adolescents and the associated epidemic of obesity are increasing concerns. U.S. national health statistics indicate early adolescence (i.e., 10-14 years) appears to be a period of importance regarding physical activity, sedentary behavior, health-related physical fitness, and obesity trends. Considering a significant portion of their waking hours are spent in school, it is widely held that schools’ should play a significant role in increasing students’ physical activity and health-related physical fitness. To do this, physical education in schools focus on providing quality physical education programs that produce physically literate individuals who have the knowledge, skills, and confidence to enjoy a lifetime of health-producing physical activity. In effect, a call for developing a comprehensive and valid measure of physical literacy has been aptly expressed. Thus, the purpose of this dissertation was to test the psychometric properties of proposed models of physical literacy, examine correlates of the physical literacy factor, and investigate the significance of the relationship between physical literacy and interscholastic sport intention via structural equation modeling. Participants were 400 (231 female, 169 male) sixth-grade physical education students who completed three brief surveys assessing maturation, self-efficacy, self-esteem, knowledge and understanding, motivation, physical activity and sport participation, and interscholastic sport intention. In addition, students completed a sedentary behavior log, a health-related physical fitness assessment, and an overhand throwing skill assessment. Analyses offered overall support for the proposed physical literacy measurement models. Results also supported positive relationship Physical literacy was statistically significantly positively related physical activity
and sport team participation, and significantly negatively related and screen-time sedentary behavior. Results also supported a positive path between physical literacy and interscholastic sport intention. The implications of promoting physical literacy within physical education are discussed in light of the three higher-order underlying factors of physical literacy.
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By

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THE PERSPECTIVE ROLE OF PHYSICAL LITERACY IN OBESITY PREVENTION

Introduction

It is well established that regular physical activity—any bodily movement produced by skeletal muscles that expends energy (Caspersen, Powell, & Christenson, 1985)—has many physiological and psychological health benefits, which include enhanced cardiorespiratory and muscular health-related fitness (Warburton, Nicol, & Bredin, 2006), motor competence and improved functional ability (Logan, Kipling Webster, Getchell, Pfeiffer, & Robinson, 2015; Wrolniak, Epstein, Dorn, Jones, & Kondilis, 2006), increased exercise self-efficacy or self-confidence (Gao, Newton, & Carson, 2008; Sallis, Prochaska, & Taylor, 2000), higher self-esteem (Tremblay, Inman, & Willms, 2000), and decreased anxiety and depression (Sallis et al., 2000; Ströhle, 2009). As expected, these physiological and psychological changes are related to improvements in health-related quality of life—one’s perceived physical, mental, emotional, and social well-being over time (Centers for Disease Control and Prevention, 2016b)—as well as reduced rates in all-cause mortality, especially obesity-related mortality (Janssen & LeBlanc, 2010; Rejeski, Brawley, & Shumaker, 1996; Yeatts, Martin, & Petrie, 2017; Zhao et al., 2013).

Despite increased presence of obesity-prevention advertising across media (Kornfield, Szczypta, Powell, & Emery, 2014) and strong evidence laminating the positive lifelong impact of adopting regular physical activity, the prevalence of physical activity remains inadequate, while the prevalence of sedentary behavior is elevated (Caspersen, Pereira, & Curran, 2000; National Center for Health Statistics, 2016). Sedentary behavior is defined as any waking hours activity characterized by limited energy expenditure done in a sitting or reclining posture such as watching television and sitting at a desk (Sedentary Behaviour Research Network, 2012). While regular physical activity benefits health-related outcomes, sedentary behavior is negatively
related cardiorespiratory and muscular health-related physical fitness (Esmaeilzadeh & Kalantari, 2013), motor competence (Gu, 2016; Lopes, Santos, Pereira, & Lopes, 2012), exercise self-efficacy or self-confidence (Norman, Schmid, Sallis, Calfas, & Patrick, 2005), and psychological well-being (Ussher, Owen, Cook, & Whincup, 2007). As to be expected, sedentary behavior is positively related to obesity (Must & Tybor, 2005).

U.S. national health statistics clearly indicate that the prevalence of youth (2-19 years) obesity has more than tripled over the last four decades (Eisenmann, 2003; Fryar, Carroll, & Ogden, 2016). Obesity—abnormal or excessive adipose tissue that may impair health (World Health Organization, 2015)—is considered a complex health issue that stems from both behavioral (e.g., dietary patterns, physical activity, and inactivity) and genetic risk factors (Centers for Disease Control and Prevention, 2015c). As a result of obesity, many of today’s youth are facing poly-epidemic issues related to diabetes, elevated blood pressure and cholesterol, joint problems, gallbladder disease, asthma, depression, and anxiety (Ogden, Carroll, McDowell, Tabak, & Flegal, 2006; U.S. Department of Health and Human Services, 2001; Yang & Colditz, 2015). In addition, childhood obesity has been linked to poorer academic performance and a lower quality of life experienced by the child (Sahoo et al., 2015).

Although youth obesity rates are significantly higher than four decades ago, in the last 15 years youth obesity rates have remained rather stable (Fryar et al., 2016). However, when youth are fragmented into early childhood/toddlerhood (i.e., 2-5 years), late childhood/early adolescence (i.e., 6-11 years), and adolescence (i.e., 12-19 years), obesity rate pattern differences become evident. Specifically, in the last 15 years, the obesity rate in children aged 2-5 years has slightly decreased, the obesity rate in children aged 6-11 years has remained relatively the same, and the obesity rate in adolescents aged 12-19 years has slightly increased (Fryar et al., 2016).
These patterns might suggest that efforts to improve or foster health-enhancing behaviors and/or reduce obesity-related behaviors may need to be refocused or adjusted in order to encompass factors that emerge during late childhood/early adolescence and beyond. For example, with the loss of recess time, early adolescents experience a declined opportunity to be physical activity while in school (American Academy of Pediatrics, 2013). In addition, early adolescents experience a decrease in physical education requirements (Centers for Disease Control and Prevention, 2015e), an enhanced exposure to more receptive alternative motives (Eccles et al., 1989; Smith, 1999), a greater number of temporal conflicts (Tergerson & King, 2002), and an increase in the accuracy of their perceptive physical abilities (Beyer & Bowden, 1997).

While it is often purported, extant research does not clearly indicate that the decreased prevalence of regular physical activity sustained over the past few decades is the primary cause of the obesity crisis (Brownson, Boehmer, & Luke, 2005). There is a growing body of supportive evidence that suggests increased caloric and excessive sugar intake, rather than physical inactivity, is the primary contributor of childhood obesity (Sahoo et al., 2015). In fact, designating either as the primary contributor seems limiting in that it is widely-held that obesity has many determining factors and is generally multifactorial in youth (Karnik & Kanekar, 2012; Sahoo et al., 2015). On the other hand, it is universally accepted that prevention, especially in youth, is the best approach to reverse obesity trends (Han, Lawlor, & Kimm, 2010), and reversing youth obesity trends is considered chiefly imperative in that researchers consistently find that youth obesity most often leads to adult obesity (Biro & Wien, 2010; Dietz, 1998). Given its association with diabetes, stroke, cardiovascular disease, as well as many types of cancers (Biro & Wien, 2010; Sahoo et al., 2015), adult obesity is considered a major contributor of the rising projected healthcare costs (Thorpe, 2005). Thus, reducing the prevalence of youth
obesity, now, would undoubtedly produce a reduction in the prevalence of adult obesity in future years, which, in turn, should also decrease the prevalence of the health-consequences associated with adult obesity including shorter life-expectancies and rising healthcare costs (Spruijt-Metz, 2011; Thorpe, 2005).

Understanding that physical activity and sedentary behavior are both viewed as highly modifiable risk-factor behaviors (Barnes, 2013; Epstein & Roemmich, 2001), each are considered as key preventive measures (Han et al., 2010; Katzmarzyk, 2010). As noted, obesity has many determining factors; however, it is principally the result of an improper energy balance (i.e., energy intake [food] is greater than energy expenditure [physical activity]; Hill, Wyatt, & Peters, 2012). Thus, a change in prevalence of regular physical activity unquestionably would affect the prevalence of overweight and obesity. This fundamental position (i.e., increasing physical activity will decrease obesity rates) is why U.S. public health efforts, such as “Let’s Move!” and “NFL® PLAY 60,” have focused on increasing energy expenditure by monitoring and promoting physical activity in children (“Let’s move!,” 2011, “NFL® Play 60,” 2007). Further, this position, in part, is why health professionals developed programs such as the Youth Risk Behavior Surveillance System (YRBSS), the National Health and Nutrition Examination Survey (NHANES), and the National Youth Fitness Survey (NYFS). These programs allow governing bodies and health professionals to analytically monitor trends of priority health-risk behaviors, such as physical inactivity and sedentary behavior, as well as outcomes of these behaviors, such as health-related physical fitness. Health-related physical fitness, simply stated as physical fitness, is defined as a set of attributes (i.e., cardiorespiratory fitness, body composition, muscle strength and endurance, and flexibility) that persons have or achieve that relates to his or her ability to perform physical activity (Caspersen et al., 1985). Thus, achieving
enhanced levels of physical fitness is considered one of the main goals of physical activity (Centers for Disease Control and Prevention, 2015b, 2015f).

Activity trend research derived from the above public health programs consistently indicate that physical activity begins to decrease and sedentary behavior begins to increase during early adolescence (Belcher et al., 2010; Brownson et al., 2005; Caspersen et al., 2000; Nader, Bradley, Houts, Mcritchie, & Brien, 2008). Nader and his colleagues (2008), for instance, found that minutes of moderate-to-vigorous aerobic physical activity (MVPA) in children aged 9 years decreased, on average, by 38 minutes on weekdays and 41 minutes on weekends per additional year. As a result, by age 15, these youth were, on average, no longer meeting physical activity guidelines (i.e., ≥ 60 minutes of MVPA per day; USDHHS, 2008). Further, Belcher and her colleagues (2010) found that children aged 6-11 years spent, on average, 351 minutes per day sedentary, while adolescents aged 12-15 years spent, on average, 426 minutes per day sedentary, which was a significant age-related increase. In addition, data from the 2012 NYFS revealed that only about 27% of boys and 23% of girls aged 12-15 years were engaged in at least 60 minutes of MVPA daily (Fakhouri et al., 2014), and approximately 6% of boys and 9% of girls aged 12-15 years did not engage in at least 60 minutes of MVPA on any day of the week. The 2012 NYFS revealed also that only about 51% boys and 36% girls aged 12-13 years had adequate levels of cardiorespiratory fitness, and these percentages were even smaller in boys (49.1%) and girls (31.8%) just one to two years older (Gahche et al., 2014). Collectively, these national studies reveal that early adolescence (i.e., 10-14 years) appears to be a crucial time in which health-related behaviors experience a negative shift, which, as previously noted, coincides with an increase in overweight and obesity (Fryar et al., 2016).
Unfortunately, adult trend research indicates that these patterns continue through adulthood (Carlson, Fulton, Schoenborn, & Loustalot, 2010; Flegal, Carroll, Ogden, & Curtin, 2013; National Center for Health Statistics, 2016), which suggests that early adolescence is a period of particular importance for redirecting behaviors and reversing negative health trends in both youth and adults. Given that physical activity is a behavior that can vary from day-to-day and physical fitness attributes are achieved outcomes of physical activity (Ortega, Ruiz, Castillo, & Sjöström, 2008), physical fitness attributes are often considered more reliable, valid, and stronger predictors of all-cause mortality and morbidity than physical activity and sedentary behavior (Lee et al., 2011; Wei, Gibbons, Kampert, Nichaman, & Blair, 2000). As such, some researchers and health educators have suggested that improving physical fitness, instead of simply increasing physical activity, might be a better or more direct goal for which unfit, overweight, or obese individuals strive to achieve (Booth, Roberts, & Laye, 2012). For instance, overweight or obese individuals setting goals to improve their body composition directly targets changing the health-risk factor (i.e., weight); whereas, setting goals to increase their physical activity targets the vehicle by which the health-risk factor is impacted. In fact, Janz, Dawson, and Mahoney (2000) indicated that preventive efforts focusing on achieving or maintaining physical fitness during adolescence will have more favorable health benefits during adulthood.

In addition to the aforementioned consequences associated with overweight and obesity (i.e., diabetes, stroke, cardiovascular disease, cancer), research evidence also indicates that being overweight and obese during childhood and adolescence can profoundly negatively affect social and psychological well-being (Sahoo et al., 2015). Psychological well-being is often conceptualized as a combination of positive affective states (e.g., high self-esteem) and negative affective states (e.g., depression and anxiety) that affect daily functioning (Baccouche, Arous,
Though previous research indicated depression rates among adolescents (5.6%) have remained stable over previous decades (Costello, Erkanli, & Angold, 2006), recent research revealed a significant spike in the percentage of adolescents (12.5%) who have experienced a major depressive episode (HealthPeople.gov, 2017). Separately and in combination, obesity, physical activity, sedentary behavior, and physical fitness have been shown to be related to children’s and adolescents’ psychological well-being (Goldfield et al., 2007; Hills, King, & Armstrong, 2007; Ortega et al., 2008). As such, it is generally accepted that regular physical activity and enhanced physical fitness positively affect psychological well-being (Ortega et al., 2008; Ströhle, 2009). Knowing the current trend in obesity and the potentiality of its impact on society, it seems foundationally crucial to discover constructs that effectively produce favorable changes in modifiable behaviors (i.e., physical activity and sedentary behavior), which, in turn, enhance physical fitness and psychological well-being and reverse the obesity trends. That is, to help reverse obesity trends, health professionals need to gain an understanding of underlying factors and higher-order constructs that effectively produce individuals who enjoy healthful physical activity throughout their life. These individuals are more likely to have enhanced physical fitness, heightened psychological well-being, and favorable body composition (Barela, 2013; Robinson et al., 2015).

Underlying Factors Affecting Physical Activity

**Motor Skill Competency**

In the last couple of decades, research evidence demonstrating the importance of fundamental motor skill competency with respect to increasing physical activity and, thereby, enhancing health-related outcomes has begun to accumulate (Barnett, van Beurden, Morgan,
Brooks, & Beard, 2009; Robinson et al., 2015). Generally, fundamental motor skills consist of complex movements such as throwing, catching, jumping, striking, and running (Haywood & Getchell, 2014). Also referred to as movement skills, fundamental motor skills are considered to be foundational, crucial building blocks of future physical activity and sport participation (Clark, 2007). Stodden and colleagues (2008) “…contend that actual motor competence interacts with other variables, such as perceived competence, and is one of the most powerful underlying mechanisms influencing engagement and persistence in physical activity” (p. 292). To this end, becoming confident and competent in these foundational skills facilitates children’s development of complex sport-specific skills that allow them to more readily enjoy sport and physical activity, which, as expected, fosters their physical fitness and nurtures their psychological well-being (Barela, 2013; Fraser-Thomas & Côté, 2003; Stodden et al., 2008; Viholainen, Aro, Purtsi, Tolvanen, & Cantell, 2014).

Schüler, Sheldon, and Fröhlich (2010) denoted that perceived competence or achievement in skills associated with sport and physical activity demonstrate positive effects on subsequent flow state, intention to engage, and intrinsic motivation. In addition, they asserted that this relationship is not unique to sport and physical activities. For instance, Köller, Baumert, and Schnabel (2001) found that competence or achievement in math was statistically significantly related to current and subsequent interest in math. Moreover, this position that individuals are more likely to engage in activities where they deem themselves competent, thus more likely to succeed, is, in essence, supported by both the self-efficacy and self-determination theories (Bandura, 1977; Deci & Ryan, 1985; Rodgers, Markland, Selzler, Murray, & Wilson, 2014). Therefore, a substantial amount of research evidence has supported the positive relationship between engagement and competence.
Consistent with previously noted relationships, motor skill competence is bidirectionally related to physical activity, physical fitness, psychological well-being, and obesity, which indicates increasing the level in one is highly associated with increasing the level in the others (Bunker, 1991; Cattuzzo et al., 2016; D’Hondt, Deforche, De Bourdeaudhuij, & Lenoir, 2009; Loprinzi, Davis, & Fu, 2015). Accordingly, motor skill competence facilitates physical activity, which, in turn, further cultivates motor skill competence, physical fitness, and psychological well-being factors and reduces the likelihood of obesity, which, in turn, all facilitate physical activity. In fact, conceptual models introduced by Stodden and colleagues (2008) and Blair and colleagues (2001) effectively illustrate the facilitative and interrelated roles that underlying or developmental mechanisms (e.g., motor competence), physical activity behavior, and physical fitness have on health outcomes such as obesity.

Considering the bidirectional relationship between physical activity and motor skill competence, it should be noted that, like physical fitness, motor skill competence or motor skill ability is also considered an attribute or high-order factor of physical activity. Further, Wrolniak and colleagues (2006) indicated motor skill competency or “motor proficiency” was positively associated with more intense bouts of physical activity (e.g. MVPA), while other research evidence has indicated that motor skill competency was significantly related to participation in organized physical activity and skill-specific activity such as physical education and youth sports (Okely, Booth, & Patterson, 2001; Raudsepp & Päll, 2006; Ulrich, 1986). More importantly, research indicates mastery of fundamental motor skills during childhood and adolescence leads to a higher probability of engagement during adulthood (Loprinzi et al., 2015). Therefore, it appears motor skill competence is indeed an important underlying factor affecting both current and future physical activity behavior.
Physical Activity Motivation

Etymologically, Ryan and Deci (2017) define motivation as “…what ‘moves’ people to action” and more specifically “…what energizes and gives direction to behavior” (p. 13). Schunk and Mullen (2013) define motivation as the processes by which goal directed activities begin and then eventually are sustained. These positions are effectively modeled within the self-determination theory in that it holds motivation arises from gaining competence (i.e., effectance or mastery), autonomy (i.e., self-regulation), and relatedness (i.e., social connectivity; Deci & Ryan, 2000; Ryan & Deci, 2017). Further, the self-determination theory holds that possessing more autonomous motivation (i.e., intrinsically derived) will lead to experiencing more positive cognitive, affective, and behavioral consequences (Deci & Ryan, 1985; Ryan & Deci, 2007). As such, the more competence, autonomy, and relatedness gained the more autonomous one’s motivation becomes, which, in turn, is related to enhanced effort and enjoyment in physical activities and greater intention to participate in future physical activities (Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003; Ntoumanis, 2001, 2002; Shen, McCaughtry, & Martin, 2007; Standage, Duda, & Ntoumanis, 2003). In line with previous research evidence, enhancing motivation will lead to increased physical activity, which, as expected, further cultivates physical fitness, psychological well-being factors, motor skill competence, and a favorable body composition. In addition, the relationship between motivation and physical activity and, thereby, outcomes related to physical activity is also purported to be reciprocal. As a result, positive consequences of physical activity, such as enhanced physical fitness and greater perceived competence that likely results in greater enjoyment and sustained interest, thus, enhance autonomous motivation to continue participation (Fairclough, 2003; Gavin, Keough, Abravanel, Moudrakovski, & Mcbrearty, 2014). Furthermore, Teixeira, Silva, Matta, Palmeira, and
Markland, (2012) suggest that autonomously endorsing behavior goals lead to efforts that are more likely to result in long-lasting behavior change. Therefore, research also supports that motivation is an important underlying factor affecting both current and future physical activity behavior.

*Physical Activity Self-Efficacy*

Self-efficacy, which is defined as beliefs about one’s capability to achieve desired outcomes when performing a specific task (Bandura, 1977), is often considered to be the most central and studied individual-level underlying factor predicting physical activity behavior (Bandura, 1989; Kaczynski, Robertson-Wilson, & Decloe, 2012). In addition, research evidence indicates physical activity self-efficacy is significantly positively related physical activity and negatively sedentary behavior (Biddle, Whitehead, O’Donovan, & Nevill, 2005; Norman et al., 2005; van der Horst, Paw, Twisk, & van Mechelen, 2007), as well as positively related to both adherence and compliance to regular engagement (McAuley & Blissmer, 2000). Bandura (1977) describes self-efficacy as situationally specific self-confidence. Though Bandura (1986, 1990) distinctly noted self-confidence as the firmness or strength but not direction of the belief and self-efficacy as including a set direction or goal, when self-confidence is situationally specified (i.e., physical education self-confidence), these constructs are often considered interchangeable (National Research Council, 1994).

Similar to how motivation acts as an activity determinant, self-efficacy, being a product of a complex process of self-persuasion (Gao et al., 2008), regulates engagement by favoring activities that are more likely to be performed successfully, require effort deemed rewarding, or involve challenges viewed as fulfilling (Schwarzer & Fuchs, 2005). This capability evaluation
relies on information from previous performance accomplishments, vicarious experiences, external persuasion, and physiological states (Bandura, 1989). Like the previously discussed underlying factors, physical activity self-efficacy, as expected, is highly related to physical activity intention (Hagger, Chatzisarantis, & Biddle, 2003). While previous research indicated self-efficacy predicts motivation and performance similar to the motivational antecedent, perceived competence (Schunk, 1995), Rodgers and colleagues (2014) indicate self-efficacy and perceived competence are psychometrically distinct. Conceptually, Rodgers and colleagues (2014) distinguish perceived competence as perception of basic capability of carrying out a behavior, and self-efficacy as beyond basic capability in that it is the confidence to carry out a behavior under challenging circumstances. As such, it is evident that self-efficacy is also a significant underlying factor influencing current behavior and intentions to participate in future bouts of physical activity. Given that physical fitness, psychological well-being, motor skill competence, motivation, and self-efficacy are all considered to be strongly related to physical activity behavior, as well as being highly interrelated with each other, suggests a hierarchical structure or higher-order construct might exist. As such, similar to the position that improving physical fitness may be a better or more direct goal, improving this higher-order construct, which conceptually must involve enhancing its antecedents, might be a better or more direct goal for which unfit, overweight, or obese individuals strive to achieve. In addition, it may also be advantageous for physical educators, coaches, and health professionals to incorporate this higher-order construct in their goal.

Physical Literacy

Margaret Whitehead first proposed the construct of physical literacy in a paper presented
at the 1993 International Association of Physical Education and Sport for Girls and Women Congress in Melbourne, Australia (Whitehead, 2010). She defined physical literacy “…as the motivation, confidence, physical competence, knowledge and understanding to maintain physical activity throughout the lifecourse” (Whitehead, 2010, p. 12). In the last decade, this concept has gained increased esteem, especially in Great Britain, Australia, and Canada (Aspen Institute, 2015a; Corbin, 2016; Edwards, Bryant, Keegan, Morgan, & Jones, 2017; Hyndman & Pill, 2017; Mandigo, Francis, Lodewyk, & Lopez, 2012; Roetert & MacDonald, 2015; M. Whitehead, 2001, 2010). Though the physical literacy movement in the U.S. has been slower (Roetert & MacDonald, 2015), the latest national standards for physical education replaced the term physically educated person with physically literate individual (SHAPE America, 2013b). Overall, this prominence has brought forth a mass emergence of literature containing definitions that vary with respect to the concepts or factors that comprise physical literacy.

Edwards and colleagues (2016) state that many of these definitions mention lifelong participation in physical activity as an outcome related to physical literacy. For instance, Delaney, Donnelly, News, & Haughey (2008) define physical literacy as “the ability to use body management, locomotor and object control skills in a competent manner, with the capacity to apply them with confidence in settings which may lead to sustained involvement in sport and physical recreation” (p. 2). While the Aspen Institute (2015b) defines physical literacy as “…the ability, confidence, and desire to be physically active for life” (p. 9). In addition, SHAPE America (2015) defines it as “…the ability to move with competence and confidence in a wide variety of physical activities in multiple environments that benefit the healthy development of the whole person”. Though not directly mentioned in their definition, SHAPE America holds that the path to physical literacy functions as the means by which physical education students gain
the ability, confidence, and desire to be physically active for life (SHAPE America, 2013).
Lastly, the Long-Term Athlete Development model (LTAD; Balyi & Hamilton, 2004; Ford et al., 2011) holds that physical literacy is development and competence in fundamental movement/sport skills, permitting children or adults to move with confidence in a wide range of physical activities and sports. That is, the LTAD model holds that the path to physical literacy functions as the means by which children develop into elite athletes, which, thereby, supports lifelong physical activity engagement.

Other definitions or conceptualizations of physical literacy often place a stronger emphasis on certain underlying factors such as knowledge and understanding (Ennis, 2015; Lounsbery & McKenzie, 2015) or fundament motor skill development (Silverman & Mercier, 2015). Chen (2015) argues that motivation is the key underlying factor of physical literacy in that he denotes “…one determining characteristic of a physically literate person is a strong motivation for physical activity” (p. 130). Further supporting this position is that research consistently indicates that autonomous motivation is reliably related to both physical and psychological well-being (Deci & Ryan, 2008a), which, themselves, are both considered positive correlates of physical literacy (Giblin, Collins, & Button, 2014; Tokuda, Doba, Butler, & Paasche-Orlow, 2009). Holding that motivations to pursue and maintain physical activity throughout the lifecourse are fundamental for decreasing age-related trends in obesity and sedentary behavior (Hagger & Chatzisarantis, 2012), decreasing projected healthcare costs (Thorpe, 2005), suggests motivation is an integral component of physical literacy. On the other hand, when considering the aforementioned research evidence, physical fitness, psychological well-being, motor skill competence, and self-confidence may be equally integral. Considering the known positive interrelations among motivation, perceived confidence, psychological well-
being, and physical activity, some researchers have suggested that psychological well-being factors such as self-esteem would also likely be encompassed by the physical literacy construct (Edwards et al., 2017; Giblin et al., 2014; Hyndman & Pill, 2017; Whitehead, 2010).

In a special issue of the Bulletin of the International Council of Sport Sciences and Physical education, Whitehead (2013) aimed to clarify some of the misconceptions and misinterpretations regarding the physical literacy concept. In the report, she highlighted the importance of recognizing that physical literacy and physical activity are distinguishable. She detailed that while they are undeniably related, physical activity is likely not an attribute of physical literacy but rather a cause, correlate, and/or consequence of physical literacy (Whitehead, 2013). Supporting this position, Edwards and colleagues (2016) denotes that physical literacy is likely an antecedent of physical activity, while also being established and promoted through physical activity. That is, essentially, an increase in physical literacy provides more avenues in which to be physically active, which, in turn, will lead to an enhanced physical literacy. Therefore, physical activity (daily activity behavior) should likely not be a component of physical literacy, but rather, physical literacy should be conceptualized as a construct that is purported to influence daily activity behaviors (e.g., physical activity, sedentary behavior, and sport participation) and a generally active lifestyle. In their systematic literature review of physical literacy, Edwards and colleaguees (2016) concluded that “…physical literacy is conceptualized as the interactive and simultaneous consideration of competence in physical skills, confidence, motivation towards physical pursuits, and the valuing of physical movement and/or interacting with the physical world” (p. 9). They proposed that physical literacy is likely comprised of a wide array of affective (e.g., motivation and self-esteem), cognitive (e.g.,
knowledge and understanding), and physical capability factors (e.g., motor skill competence and movement capacities).

Concurrently, a principal assessment of SHAPE America’s National Physical Education Standards indicates that this three-prong conceptualization of physical literacy is, in fact, its underlying mission (SHAPE America, 2013b). That is, Standard 1 (i.e., the physically literate individual demonstrates competency in a variety of motor skills and movement patterns) and Standard 3 (i.e., the physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness) targets physical capability factors. Standard 2 (i.e., the physically literate individual applies knowledge of concepts, principles, strategies and tactics related to movement and performance) targets cognitive factors, and Standard 4 (i.e., the physically literate individual exhibits responsible personal and social behavior that respects self and others) and Standard 5 (i.e., the physically literate individual recognizes the value of physical activity for health, enjoyment, challenge, self-expression and/or social interaction) target affective factors (SHAPE America, 2013b).

Physical Literacy Vehicles

*Physical Education*

Over the past three decades, the public health role of school-based physical education has been scrutinized by numerous scientific, professional, and governmental organizations such as the Cooper Institute, Society of Health and Physical Education (SHAPE) America, and USDHHS, respectively. In general, this increase in research attention on school-based physical education has been a response to position statements held and promoted by the American College of Sports Medicine (ACSM) and CDC that call for increased bouts of health/fitness-
producing physical activity (i.e., MVPA) during school. The health-rationale for this position derives from research evidence that indicate frequent bouts of MVPA are strongly associated with enhanced levels of physical fitness and decreased prevalence of overweight and obesity (Blair et al., 2001; Kohl III & Cook, 2013; Sallis & McKenzie, 1991). Given that children and adolescents spend a significant amount of their waking hours in school, it is widely believed that schools should play a significant role in increasing youth’s MVPA levels by employing quality school-based physical education programs that provide enjoyable and developmentally appropriate physical activity (Le Masurier & Corbin, 2006; Sallis & McKenzie, 1991; SHAPE America, 2013b; Wechsler, McKenna, Lee, & Dietz, 2004).

School-based physical education programs are uniquely qualified in that they can offer physical activities within large group/class settings (Biddle, Cavill, & Sallis, 1998; Sallis & Owen, 1999). However, effectively providing physical activity to large groups of students, who likely have diverse interests and enjoyment determinants, can be quite challenging (Cole, 2008). It also may lead unintentionally to alienation due to extreme variations in skill level and maturation if a supportive environment is not present (Carlson, 1995; Standage, Duda, & Ntoumanis, 2003). Additionally, while it is well-established that regular physical activity is positively related to physical health and physical fitness (Garber et al., 2011), Ekkekakis and Lind (2006) found that individuals who perceived themselves as poor performers in physical activities and sport (those likely labeled as physically illiterate) tend to report less pleasure and more negative attitudes toward physical activity. In addition, Gately (2010) stated that overweight and obese children are often considered to have lower levels of physical literacy. This further supports the positive relationship between perceived competence and enjoyment (Carroll & Loumidis, 2001). Moreover, the strength of relationship between perceived
competence and enjoyment tends to intensify as children transition to adolescence (Ekkekakis, Lind, & Vazou, 2010; Whitehead & Biddle, 2008). This is due to the position that adolescents become more aware of skill level and physique differences between themselves and their peers (Bernstein, Phillips, & Silverman, 2011; Fry & Duda, 1997; Li & Rukavina, 2009). That is, through comparative or competitive evaluations, physical illiterate adolescents may feel alienated or experience low relatedness when they perceive their skill level as below average or “failing”; especially, if that perception is confirmed rather than redirected by the perceived climate (Spencer-Cavaliere & Rintoul, 2012; Teixeira, Carraça, Markland, Silva, & Ryan, 2012). Children and adolescents who view their skill level and/or performances in physical education activities as failing may perceive physical education as “not fun” (Portman, 1995), which, in turn, may lead them to labeling physical education as valueless in order to maintain a positive self-concept. Understanding values placed on a behavior or activity significantly affects one’s motives (Eccles, 1983; Ryan & Deci, 2000), indicates this valueless label will most likely increase amotivation to further participate in physical activities or sport, in and out of physical education (Carlson, 1995; Garn & Cothran, 2006; Portman, 1995; Standage et al., 2003).

If a goal of physical education is to increase MVPA, then physical educators should not just simply infuse aerobic activities, such as jogging/running into their current curricula models. Mainly, because these activities may not foster physical competences and, more importantly, may be deemed as boring, repetitive, and meritless (McConnell, 2015; Rikard & Banville, 2006). Research indicates activities that are deemed boring and/or not enjoyable are less effective at improving skill and physical fitness than variable activities that students find fun and enjoyable (Brewster & Fager, 2000; R. W. Wright & Karp, 2006). As such, increasing MVPA without simultaneously employing tactics that promote physical literacy may actually decrease support
for factors that improve or enhance physical literacy, such as motivation and physical competence. Therefore, while physical education programs should aim to increase MVPA, this should not be the primary focus. Activity should be employed through a combination of fun and enjoyable games and drills, which may be aerobically-centered but with the goals of cultivating fundamental motor skill acquisition and increasing awareness of physical fitness parameters (Kohl III & Cook, 2013). However, employing “fun” activities may be challenging given that Garn and Cothran (2006) revealed significant differences often exist in what is perceived as “fun” among students and between students and teachers. Tannehill and Lund (2015) suggested that physical education teachers should shift from teacher-centered to student-centered instruction and curricula. They define student-centeredness as providing a physical education setting where the students are more important than the content. Such programs are more likely to establish a climate that supports autonomy, competence, and relatedness satisfaction, which, in turn, reduces students’ amotivation toward physical education and facilitates their progress toward autonomous motivation (Ryan & Deci, 2000). Along with increased motivation, these programs should help students acquire knowledge and skills, which, collectively, should set them on a path to enjoy lifelong participation in physical activity (Kohl III & Cook, 2013).

With the purpose of producing higher quality physical education programs that (a) promote students’ enjoyment of and motivation toward physical education, (b) cultivate students’ skill acquisition, and (c) enhance students’ health-related fitness, physical education professionals revisited and altered the physical education standards and established the 2013 National Physical Education Standards (SHAPE America, 2013b). As previously mentioned, these standards, collectively, aim to develop physically literate individuals; that is, individuals who have the knowledge, skills, and confidence to enjoy a lifetime of healthful physical activity.
(SHAPE America, 2013a, 2013b). While it is important to provide students with opportunities to be physically active, with the adoption of the physical literacy concept, these newly constructed standards seem to shift from directly aiming to change current behavior (i.e., physical activity) to aiming to a change determinants of habitual behavior with the adapting of physical literacy concept. That is, given that enhanced physical literacy purportedly leads to maintaining physical activity throughout the lifecourse, the revised standards are targeting a lasting or habitual change in physical activity behavior. Considering childhood and adulthood obesity trends, this mission appears to be rightly focused.

However, since the passage of the No Child Left Behind Act in 2001, nearly half of schools report they have actually decreased students’ exposure to physical education (Kohl III & Cook, 2013). For example, data from the 2014 School Health Policies and Practices Study (SHPPS) indicated that not all middle schools (78.8%) required students to take physical education for graduation or promotion to the next grade level or school, and very few middle schools (3.4%) required students to take physical education daily or for the entire school year (CDC, 2015d). In addition, the SHPPS indicated that by grade level the percentage of schools that require physical education continues to drop from grade to grade with significant drops occurring after the fifth (45.1% to 34.3%) and sixth grade (34.3% to 29.4%), ending with only 8.7% of schools requiring physical education in the twelfth grade. As such, the probability and possibility of many school-based physical education programs to transition physically illiterate individuals to physically literate individuals diminishes with each additional year. Therefore, even though the above standards and their predecessors have been heavily promoted during the last two decades, this decreased exposure to physical education inevitably hinders schools’ capability of playing this integral role of improving health outcomes. That is, given the amount
of time that children and adolescents spend in school, this decreased exposure to physical education inevitably decreases students’ opportunities to develop motor competences and to be physically active, thereby hindering their chances of improving competences and/or meeting current physical activity recommendations (i.e., ≥ 60 minutes of MVPA). To avoid this deficiency, some schools have started to employ physical education programs, such as the Comprehensive School Physical Activity Program (CSPAP), that foster high levels of MVPA both in and out of physical education (Kohl III & Cook, 2013). On the other hand, in the U.S., especially, the decline of physical education after the sixth grade has alternative explanation, in that interscholastic sports commence.

**Interscholastic Sports**

Understanding that a substantial component of physical education is active play (i.e., sports, games, and other physical activities), youth sport participation including school-sponsored sports such as interscholastic sports is another vehicle that cannot only actively promote students’ regular physical activity in the school setting but also improve affective, physical, and cognitive physical literacy factors such as self-esteem and motor competences (Carlson, 1995; Mohr, Townsend, & Pritchard, 2006; Penney & Jess, 2004). Unfortunately, similar to the trend in physical education, Petlichkoff (1996) found that sport dropout rates also increased substantially during adolescence. Like physical education, common reasons for sport dropout or disengagement are negative experiences, including a lack of fun, a lack of playing time, less individualized attention, and conflicts with coaches (Fraser-Thomas, Côté, & Deakin, 2008; Weiss & Williamson, 2004). This drop in youth sport participation is, however, not entirely clear in that increased participation in one sport may lead the discontinuance of another
That is, sport specialization—year-round training in a single sport with the exclusion of other sports—is common during adolescence (Jayanthi, Pinkham, Dugas, Patrick, & LaBella, 2013). Therefore, this drop-out rate may reflect that adolescents are ceasing participation in one or more sports, but continuing participation in another sport.

As mentioned earlier, while the commencement of interscholastic sports seemingly provides another avenue in which adolescents can increase their physical activity and enhance their physical literacy, it is also a determining factor for the decrease of physical education requirement after the sixth grade. That is, in most schools in the U.S. the commencement of interscholastic sport programs (e.g., school-sponsored football, basketball, volleyball, and track), typically the seventh grade (12-13 years-old), coincides with a significant decrease or even cease of physical education requirements (Kohl III & Cook, 2013; McEwin & Swaim, 2007a). Understanding both physical education and interscholastic sports consume resources and students who enjoy physical activity and/or are athletically talented are likely to play interscholastic sports (Kohl III & Cook, 2013), providing physical education after the sixth-grade may appear to some as an unneeded commodity. This is especially true given that many believe these resources should be spent on other (academic) subjects (Yin & Moore, 2004). Further giving weight to this position (schools need not offer both physical education and interscholastic sports) is that approximately two-thirds of schools support intramural or club sports programs, which are often externally funded and fulfill the school’s physical education requirements (Grossman, Walker, & Raley, 2001; McEwin & Swaim, 2007a; SHAPE America, 2013c). Additionally, 33 states allow students to be exempt from physical education requirements if they participate in an equivalent activity outside of school such as martial arts (Kohl III & Cook, 2013; SHAPE America, 2016). Therefore, even if schools have the foundational offerings to
employ a quality physical education program, it is highly likely that policies and alternative offerings will hinder its efficacy to develop physically literate individuals.

In general, compared to physical education participation, trends in school sport participation are encouraging in that since 1991 interscholastic sport participation has remained relatively steady (Child Trends Databank, 2015). Specifically, approximately 53% to 62% of high school students and 62% to 70% of middle school students participated in interscholastic sports, which is far above percentages regarding physical education participation (Centers for Disease Control and Prevention, 2015e). Though interscholastic sports tend to cater to the best athletes or the most physically literate students (Kanters, Bocarro, Casper, & Forrester, 2008), interscholastic sport participation rates suggest that adolescents of varying levels of physical literacy enroll in athletics (i.e., a class that centers around one or more interscholastic sports).

Understanding commencement of interscholastic sports coincides with fading physical education requirements suggests school sports essentially replace physical education for the physically literate students. However, considering that approximately 46% of middle school and 65% of high school sport programs practice cut policies (McEwin & Swaim, 2007b), it also suggests that the physical education of students who do not choose to participate in school sports or get cut from their interscholastic sports team has principally ceased. Thus, these possibly physically illiterate students may never again receive instruction designed to enhance their physical literacy, which, in turn, likely thwarts their ability to enjoy a lifetime of healthful physical activity. Essentially, this uncompromising situation is inevitability creating a competency paradox. That is, given that the choice or motivation to participate in physical activity is often directly related to one’s confidence or perceived competency in pertinent skills (Cairney et al., 2012), physically illiterate students may forego enrolling in athletics out of fear
of being cut or rejected for lack of skill. Further, these students may forgo enrolling in physical education in that it is simply not required and/or because they have labeled it valueless to preserve self-concept (Carlson, 1995; Standage et al., 2003). Considering that the majority of middle school students are enrolling in athletics, a choice to not enroll in athletics, but instead enroll in the less socially accepted alternative (i.e., school-based physical education) may be viewed as against the norm.

Overall, this situation is especially paradoxical when considering that physical education curricula grade-level outcomes for middle schools primarily consist of competencies related to sports play (SHAPE America, 2013a). That is, a below average-skilled student may forego trying out or be cut from a school sports team for not possessing skills that may be future grade-level outcomes. So, unless students possess the determination to enroll in either athletics or physical education, with neither possibly being required, they may never become physically literate individuals, which, as mentioned earlier, likely sets them down a path of physical inactivity and unfavorable health outcomes. Moreover, McEwin and Swaim (2007a) state that cutting is often based on factors that are beyond the individual’s control (e.g., maturational differences). So, even if a player desires to participate in school sports, they may still face obstacles that thwart their physical activity engagement, thereby, their opportunity to learn new skills, build confidence in their abilities, improve motor competences, and experience positive interactions with their peers (McEwin & Swaim, 2007a; Merkel, 2013). Thus, yet again, possibly setting them down a path that greatly thwarts their chances of enjoying a lifetime of healthy physical activity.

Nevertheless, despite these obstacles, school sports participation affords adolescents with many physical and psychological health benefits (Merkel, 2013). Like effective school-based
physical education, sport participation has been linked to positive mental and physical health outcomes such as an increase in sociability and decrease prevalence of childhood obesity (Kohl III & Cook, 2013; Moore & Werch, 2005; WHO, 1998). For instance, Taliaferro and colleagues (2008) found that school sport participation was significantly associated with possessing confidence and feeling socially accepted; thus, an enhanced affective well-being. Katzmarzyk and Malina (1998) found that sport participation was an effective channel for increasing physical activity and energy expenditure, while also decreasing leisure-time sedentary behaviors such as watching television in youths aged 12-14 years.

Participation in school sports provides many physical and psychosocial benefits for early adolescents, but research also indicates that participation in school sports may increase injury-risks, produce unwanted psychological stress, and lead to students dropping out of sports completely and permanently (Coakley, 1987; Engh, 2002; Merkel, 2013; Swaim & McEwin, 2005). However, these consequences are often the result of overuse and early specialization rather than participation itself (Fraser-Thomas et al., 2008; National Association for Sport and Physical Education, 2010). Further, school sports offered, especially at the middle school level, tend to be team sports (e.g., basketball and volleyball) rather than individual sports (e.g., swimming and tennis), which may be problematic in that individual sports more often than team sports become lifelong activities and support autonomy (Lee, Burgeson, Fulton, & Spain, 2007; van de Pol, Kavussanu, & Kompier, 2015). Nonetheless, given that physical education requirements substantially decrease after the sixth grade, choosing to participate in school sports may significantly impact students’ lifelong physical activity behaviors in that behaviors practiced during adolescence often become lifelong habits (Todd, Street, Ziviani, Byrne, & Hills, 2015).
As noted earlier, this potentially problematic situation (i.e., whether to enroll in athletics or not) is especially concerning during middle school ages (i.e., 11-14 years). These students are likely experiencing their peak growth velocities (i.e., peak height and weight velocities during puberty) within varying stages and are developing profoundly their self-concept (Sebastian, Burnett, & Blakemore, 2008). Consequently, if students lack motivation to participate in physical education, then they may forgo future involvement in physical education including interscholastic sports. This may yield decreased physical activity, physical fitness, and self-worth and increased sedentary behavior, obesity risk, and depressive symptoms (Kohl III & Cook, 2013).

Conclusion

The previous research findings suggest promoting physical literacy in school-aged children will likely lead them to adopting a physically activity lifestyle, which would help reverse the trends in both childhood and adulthood obesity. On the other hand, if children’s motivation, confidence, physical competence, and knowledge and understanding are not supported, then their physical literacy may not be sufficient enough for them to maintain physical activity throughout the lifecourse. The conclusion presented above demonstrates that early adolescence appears to be a crucial developmental period for physical literacy. The longevity of the motivation, confidence, experience, skill, and knowledge established during these periods persist into adulthood (Barnett, Morgan, van Beurden, & Beard, 2008; Corder et al., 2013; Loprinzi et al., 2015; Reinboth & Duda, 2006), which, in turn, results in higher levels in physical activity and decreased levels of overweight and obesity (Hasselstrøm, Hansen, Froberg, & Andersen, 2002).
All in all, obesity has become a major public health concern in both childhood and adulthood. Though it is well-established that obesity has many underlying factors, promoting and maintaining a physically active lifestyle is considered a critical component in that it directly and indirectly influences body composition (Gately, 2010). Moreover, based on extant literature, improving physical literacy during youth should produce individuals who possess the motivation, confidence, physical competence, and knowledge and understanding to enjoy lifelong participation in physical activity.

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MEASURING PHYSICAL LITERACY AND INTERSCHOLASTIC SPORTS INTENTION IN SIXTH-GRADE PHYSICAL EDUCATION USING STRUCTURAL EQUATION MODELING

Introduction

The term *literacy* is sometimes synonymously used with education in that it is commonly defined as competence or knowledge in a specific area or the ability to engage in or negotiate challenging situations (Cunningham, Many, Carver, Gunderson, & Mosenthal, 2000). While first conceptualized by Margret Whitehead in 1993, in recent years, *physical literacy* has gained increased esteem among educational organizations and researchers, especially in Great Britain, Australia, and Canada (Aspen Institute, 2015a; Corbin, 2016; Edwards et al., 2017; Hyndman & Pill, 2017; Mandigo et al., 2012; Roetert & MacDonald, 2015; Whitehead, 2001, 2010). Though the physical literacy movement in the U.S. has been more gradual (Roetert & MacDonald, 2015), the latest national standards for physical education offered by the Society of Health and Physical Educators (SHAPE America) replaced the term *physically educated person* with *physically literate individual* (SHAPE America, 2013b). This essentially indicated that physical literacy was incorporated in the goal of U.S. physical education (Mandigo et al., 2012). Overall, this prominence has brought forth a mass emergence of literature, however, the definitions adopted vary with respect to the underlying factors to measure physical literacy.

In their systematic literature review of the definitions, foundations, and associations of physical literacy, Edwards and colleagues (2017) indicated that most of these definitions contain a theme that projects lifelong participation in physical activity as the outcome or endgame to physical literacy. For instance, Delaney, Donnelly, News, & Haughey (2008) defined physical literacy as “the ability to use body management, locomotor and object control skills in a
competent manner, with the capacity to apply them with confidence in settings which may lead to sustained involvement in sport and physical recreation” (p. 2), and the Aspen Institute (2015b) defined physical literacy as “…the ability, confidence, and desire to be physically active for life” (p. 9). Whitehead (2010) offered “As appropriate to each individual’s endowment, physical literacy can be described as the motivation, confidence, physical competence, knowledge and understanding to maintain physical activity throughout the lifecourse” (p. 11-12).

Further, definitions or conceptualizations of physical literacy often place a stronger emphasis on differing underlying factors as well as forego mentioning the lifelong objective. For instance, Ennis (2015) and Lounsbery and McKenzie (2015) emphasized the importance of knowledge and understanding rather than just doing (being physically active), and Silverman and Mercier (2015) accentuate the primary importance of fundamental motor skill development in attaining physical literacy. Whereas, Chen (2015) argues that motivation is the key underlying factor of physical literacy in that he denotes “…one determining characteristic of a physically literate person is a strong motivation for physical activity” (p. 130). Supporting Chen’s position is that research consistently indicates that autonomous motivation is reliably related to both physical and psychological well-being (Deci & Ryan, 2008a), which, themselves, are both considered positive correlates of physical activity and physical literacy (Giblin et al., 2014; Tokuda et al., 2009). The definition that SHAPE America adopts is as “…the ability to move with competence and confidence in a wide variety of physical activities in multiple environments that benefit the healthy development of the whole person” (Mandigo et al., 2012). Though not explicitly stated within their adopted definition, SHAPE America’s National Standards for K-12 Physical Education do project that the path to physical literacy functions as the means by which physical education students gain the ability, confidence, and desire to be physically active for life
Lastly, physical literacy, within the Long-Term Athlete Development model (LTAD; Balyi & Hamilton, 2004; Ford et al., 2011), is defined as the development and the competence in fundamental motor/sport skills that permit children or adults to confidently move in a wide range of physical activity, rhythmic, and sport situations. Again, though not explicitly stated, the LTAD model holds that the path to physical literacy functions as the means by which children develop into elite athletes (Ford et al., 2011). Therefore, given that research indicates elite athletes have a greater propensity for enhanced physical health, positive psychosocial development, and lifelong recreational or sport participation (Fraser-Thomas & Côté, 2003), lifelong engagement in physical activity is also supported in the LTAD model.

Edwards and colleagues (2017) declare that these alternative conceptualizations lead researchers, educational organizations, and governments to interpret findings and promote interventions differently, which has undermined physical literacy measurement and hindered the generalizability of research evidence (Edwards et al., 2017). Understanding the breadth of the potential significant health-benefits that regular physical activity affords (Centers for Disease Control and Prevention, 2015d), properly defining and promoting a concept that purportedly leads to lifelong participation is crucially important.

Physical Literacy Measurement

The Canadian Assessment of Physical Literacy (CAPL; Healthy Active Living and Obesity Research Group, 2013) assesses physical literacy by weighing the comprised scores of four higher-order factors. That is, both physical competence, comprised of physical fitness and physical capability measures, and daily activity behavior, comprised of physical activity and sedentary behavior measures, are each 32% of the overall physical literacy score. While,
knowledge and understanding, a 10-item assessment, and motivation and confidence, comprised of self-efficacy, motivation, and self-esteem measures, are each 18%. Lloyd, Colley, and Tremblay (2010) also offer a four factor/domain physical literacy measurement model, which includes fundamental motor skills, physical fitness (referred to as movement capacities), physical activity behavior, and knowledge and understanding. In comparison, this measurement model separated physical competence into two distinct factors (i.e., fundamental motor skills and movement capacities), included activity behavior as a factor, but excluded affective factors (e.g., confidence, motivation, and self-esteem). Considering that the positive underlying relationships between affective factors and physical activity are well-established, excluding affective factors from a physical literacy measurement would be conceptually deficient (Edwards et al., 2017; Giblin et al., 2014; Hyndman & Pill, 2017; Whitehead, 2010).

The International Physical Literacy Association’s (IPLA) theoretical assessment emphasizes knowledge and understanding, physical competence (e.g., motor skill and physical fitness), motivation and confidence, and daily activity behavior as higher-order factors of physical literacy (Longmuir et al., 2015). Notably, these assessments all include daily activity behavior as a factor of physical literacy. In a special issue of the Bulletin of the International Council of Sport Sciences and Physical education, Whitehead (2013) aimed to clarify some of the misconceptions and misinterpretations regarding the physical literacy concept. In the report, she highlighted the importance of recognizing that physical literacy and physical activity are distinguishable. She detailed that while they are undeniably related, physical activity is likely not simply an attribute of physical literacy but rather a cause, correlate, and/or consequence of physical literacy (Whitehead, 2013). Seemingly supporting this position, Edwards and colleagues (2017) assert that physical literacy is likely an antecedent of current physical activity, while also
being established and promoted through past physical activity. Thus, in theory, an increase in physical literacy would provide more avenues by which to be physically active, which, in turn, would enhance physical literacy. As such, physical literacy is conceptualized as a construct that is purported to influence or predict future daily activity behaviors (e.g., physical activity, sedentary behavior, and sport participation) or an active lifestyle. Furthermore, unlike the other underlying factors, which are fairly stable or achieved outcomes with slow degradation, physical activity behavior can vary from day-to-day or week-to-week (Atkin, Sharp, Harrison, Brage, & van Sluijs, 2016; Pereira et al., 2015), especially among individuals with lower motivation, confidence, physical fitness, motor skill competence, and knowledge (Ridgers et al., 2017). In fact, McKenzie (2002) states that multiple observations sessions are needed to adequately estimate physical activities. Therefore, including a cross-sectional sample of physical activity behavior as a factor of a physical literacy measure could decrease the reliability and validity of the measure and, moreover, is conceptually unnecessary given that measuring factors such as physical fitness, motivation, and self-efficacy will likely provide a more accurate depiction of habitual physical activity behavior than a single sample of physical activity would.

In their review, Edwards and colleagues (2017) concluded that “…physical literacy is conceptualized as the interactive and simultaneous consideration of competence in physical skills, confidence, motivation towards physical pursuits, and the valuing of physical movement and/or interacting with the physical world” (p. 9). Further, they purported that physical literacy is likely comprised of a wide array of affective factors (e.g., motivation and self-esteem), physical capability factors (e.g., motor skill competence and movement capacities), and a cognitive factors (e.g., knowledge and understanding). In addition, this arrived conceptualization adequately encompasses the key components of Whitehead’s definition of physical literacy (i.e.,
“...as the motivation, confidence, physical competence, knowledge and understanding to maintain physical activity throughout the lifecourse” [Whitehead, 2010, p. 12]). Moreover, this three-factor model appears to effectively represent the three domains of learning (i.e. affective, psychomotor, and cognitive), providing theoretical support for physical literacy as an educational paradigm. In fact, Bailey and colleagues (2009) posited that physical education and interscholastic sports offer affective, physical, and social/cognitive benefits to students, and, deductively, these benefits can also be viewed as individual learning domains. Thus, with physical literacy as the objective, both physical education and interscholastic sports produce learning (i.e., a relative permanent change behavior; Huit & Hummel, [2006]) in each of these domains, resulting in holistic development and behavior permanence.

With these aforementioned assertions in mind, a principal assessment of SHAPE America’s National Physical Education Standards might suggest that this three-domain/factor conceptualization of physical literacy is, in fact, its underlying mission (SHAPE America, 2013b). That is, Standard 1 (i.e., the physically literate individual demonstrates competency in a variety of motor skills and movement patterns) and Standard 3 (i.e., the physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness) target physical capability factors, as well as cognitive factors. Standard 2 (i.e., the physically literate individual applies knowledge of concepts, principles, strategies and tactics related to movement and performance) targets cognitive factors, and Standard 4 (i.e., the physically literate individual exhibits responsible personal and social behavior that respects self and others) and Standard 5 (i.e., the physically literate individual recognizes the value of physical activity for health, enjoyment, challenge, self-expression and/or social interaction) target affective factors (SHAPE America, 2013b).
However, for physical education to effectively utilize physical literacy as the goal or standard, as previously mentioned, a valid assessment of physical literacy is needed. In effect, calls for developing a comprehensive and valid measure of physical literacy has been aptly expressed (Aspen Institute, 2015b; Edwards et al., 2017; Lundvall, 2015; Tremblay & Lloyd, 2010). For instance, Edwards and colleagues (2017) concluded “there is an emerging need to both test which variables contribute to the development of physical literacy and test those that are enhanced by the development of physical literacy” (p. 123). While the CAPL is a viable option, fixed-weights given to the underlying factors conceptually limits the individual uniqueness that physical literacy theoretically portrays (Whitehead, 2010). Additionally, CAPL includes daily activity behavior, which as previously noted is likely conceptually unwarranted. Moreover, given that by definition physically literate individuals meet the aforementioned national standards and are committed to actively seeking purposeful physical pursuits, these individuals may be highly inclined to continue their physical education by participating in interscholastic sports. However, the relationship between physical literacy and interscholastic sports participation has not yet been examined.

Therefore, the purpose of the current study was to, first, analyze and evaluate the perspective affective (i.e., physical self-efficacy, motivation, and self-esteem), physical (i.e., physical fitness and motor skill competence), and cognitive (i.e., knowledge and understanding) factors of physical literacy. Second, to test the model fit of underlying factor models and of proposed physical literacy measurement models, as well as to explore measurement invariance with respect to sex in these models. Byrne (1989) explains that measurement invariance refers to the degree to which a measure, model, or construct/factor maintains its meaning across groups. Significant departure from measurement invariance indicates that the proposed model is not
consistent across groups, revealing that meaningful group comparisons cannot be conducted using the model (Hoyle & Smith, 1994). Third, to examine the relationships between the physical literacy construct and reciprocal correlates (Edwards et al., 2017). While researchers have tested these variables (i.e., activity behaviors) as probable attributes of physical literacy (Healthy Active Living and Obesity Research Group, 2013; Hyndman & Pill, 2017; Longmuir et al., 2015), the current study took the primary position that these desirable outcomes were reciprocal correlates of physical literacy (Edwards et al., 2017). Fourth, to investigate proposed physical literacy models’ relationship with sixth grade students’ intention to participate in interscholastic sports. That is, based on the findings of Edwards et al. (2017), this study aimed to: (a) test fit of the underlying factor models, as well as the proposed first-order (see Figure 1) and second-order (see Figure 2) measurement models of physical literacy; (b) explore the measurement invariance of the proposed models between sexes; (c) examine models’ relationship with physical activity, sport participation, and screen-time sedentary behavior; and (d) investigate the significance of the physical literacy construct in predicting sixth grade physical education students’ intention to participate in interscholastic sports in the seventh grade.

To extend on literature reviewed, it was, first, hypothesized that physical literacy would significantly explain the variance of the affective, physical, and cognitive factors (Edwards et al., 2017; Hyndman & Pill, 2017). Given that sex/gender differences in physical literacy have yet to be fully explored (Longmuir & Tremblay, 2016), measurement variance regarding physical literacy between sex is unidentified. However, given that Whitehead (2010, 2013c) holds that each individual’s physical literacy journey is appropriately unique and sex/gender differences in many of the underlying factors of physical literacy have been measured including physical competence, motivation, and activity engagement (Deaner, Balish, & Lombardo, 2016; Lirgg,
1991; Longmuir et al., 2015; Lorson, Stodden, Langendorfer, & Goodway, 2013; Ortega et al., 2008), it was hypothesized, second, that the proposed models would demonstrate variance across sex. Third, it was hypothesized that physical activity and sport participation would be significantly positively related and screen-time sedentary behavior would be significantly negatively related to the physical literacy construct (Edwards et al., 2017; Giblin et al., 2014; Longmuir et al., 2015; Tokuda et al., 2009). Lastly, it was hypothesized that higher levels of the affective, physical, and cognitive factors, specifically, physical self-efficacy (Ibrahim, Jaafar, Kassim, & Isa, 2016), motivation (Erdvik, Øverby, & Haugen, 2014; Standage et al., 2003), self-esteem (Boyer & Petrie, 2007; Taliaferro et al., 2008), physical fitness (Armstrong, Tomkinson, & Ekelund, 2011), motor skill competence (Okely et al., 2001; Ulrich, 1986), knowledge and understanding (Whitehead, 2010), and, thereby, higher levels of physical literacy would be significantly positively related to intention to participate in interscholastic sports (Ford et al., 2011; Kirk, 2013).

Methods

Procedure

After approval for this study was granted by the researchers’ Institution Review Board and the two schools’ district administrative offices, principals, and physical education teachers, an agreed upon data collection schedule was set (see Table 1). The current study used a cross-sectional research design to collect data from October of 2016 to January 2017. Researchers recruited participants face-to-face using a recruitment script (Appendix A) that was read as a class announcement and included the purpose statement and a brief description of study. During the announcement a research assistant disseminated the parent/guardian informed consent forms.
Figure 1. Hypothesized first-order physical literacy measurement model illustrating its relationship with interscholastic sport intention. Right of the dotted vertical line represents the measurement models of the underlying factors of physical literacy, while right of the solid vertical line represents the first-order physical literacy measurement model. Left of the solid vertical line represents the intention measurement model.
Figure 2. Hypothesized second-order physical literacy measurement model illustrating its relationship with interscholastic sport intention. Right of the dotted vertical line represents the measurement models of the affective, physical, and cognitive factors of physical literacy, while right of the solid vertical line represents the second-order physical literacy measurement model. Left of the solid vertical line represents the intention measurement model.

After students returned their signed parent/guardian informed consents, students were then asked to sign a Student Assent Form (see Appendix B) before data collection commenced. Data collection spanned 13 weeks and consisted of the motor skill assessment, three brief surveys, physical fitness assessment, and a sedentary behavior log. All data was collected during
participants’ regularly scheduled physical education class. Motor skill assessment was completed within one week per school. Survey 1 contained three brief questionnaires (20 items) that assessed basic demographics (4 items; age, date of birth, sex, and ethnicity), pubertal development (6 items), and knowledge and understanding (10 items). Survey 2 contained three brief questionnaires (14 items) that assessed physical activity and sport team participation (2 items), global self-esteem (6 items), and confidence (6 items). Survey 3 contained two brief questionnaires (8 items) that assessed intrinsic motivation (4 items) and intention to participate in athletics (4 items). The sedentary behavior log was completed within one week per school. The physical fitness assessment was also completed within one week per school and recorded on a designated fitness data record sheet. As compensation for participation, all participants received a water bottle. In addition, participants who completed the study were entered into a lottery to win an iPad Mini.

Participants

Participants were 419 sixth grade physical education students (244 female, 175 male; \(M_{age} = 11.51 \text{ years}, \ SD = 0.5, \ \text{range} = 11-12 \text{ years}\)) from two public middle schools (School A = 276, School B = 143) located in the Southwest U.S. Participants were predominately white (74.5%), followed by 15.0% multi-racial/other, 6.2% Hispanic/Latin, 2.9% Black/African-American, and 1.4% Asian. Schools were located in middle-class to upper-middle-class suburban neighborhoods. In School A, participants were recruited from ten physical education classes taught by five physical education instructors. In School B, participants were recruited from four physical education classes taught by two physical education instructors (two classes per instructor for both schools).
Measures

_Maturational Level_

The 6-item Pubertal Development Scale (PDS; Petersen, Crockett, Richards, & Boxer, 1988) was used to assess self-reported maturation of the participants. Specifically, all participants were asked to respond to three items regarding overall maturation level and three sex respective items. For all items, participants were asked to indicate, on 4-point scale ranging from _has not yet begun_ (0) to _growth or development is complete_ (3), the status of their pubertal development regarding relative attributes such as body hair growth and growth spurt. Example items are: “Would you say your growth in height” (both sexes), “Have you noticed a deepening of your voice” (males only), and “Have your breast begun to grow” (females only). Mean scores for the six item were calculated to determine pubertal categories (i.e., prepubertal, \( M = 1 \); early pubertal, \( M > 1 < 2 \); midpubertal, \( M \geq 2 < 3 \); late pubertal, \( M \geq 3 < 4 \); and postpubertal, \( M = 4 \)). The PDS scores have shown good concurrent and convergent validity (Carskadon & Acebo, 1993; Robertson et al., 1992) in sixth grade boys and girls. PDS scores in the current study demonstrated good internal consistency for females (\( \alpha = .82 \)) and males (\( \alpha = .88 \)).

_Affective Factors of Physical Literacy_

_Physical education self-efficacy_. To assess participants’ physical education self-efficacy, a six-item questionnaire was used (Gao, Lodewyk, & Zhang, 2009; Gao et al., 2008). All items contained the stem, “With regard to the activities in my P.E. class, I have confidence in:” Example item for confidence scale was “My ability to do well in most activities”. Participants were asked to indicate how strongly they agree or disagree with each item on a 7-point scale, ranging from _strongly disagree_ (1) to _strongly agree_ (7), regarding their confidence in physical
education activities. Previous research has indicated the scores of these six items had acceptable validity and internal consistency (Gao, Lee, Xiang, & Kosma, 2011). Confidence scores in the current study demonstrated high internal consistency ($\alpha = .93$).

**Intrinsic motivation.** Participants’ intrinsic motivation toward physical education was assessed using the 4-item intrinsic motivation subscale of the 20-item Perceived Locus of Causality scale (Deci & Ryan, 2000; Goudas, Biddle, & Fox, 1994; Ryan & Connell, 1989). All items contained the stem, “I take part in this PE class…” Example item was “because PE is fun”. Participants were asked to indicate, on a 7-point scale ranging from *strongly disagree* (1) to *strongly agree* (7), the extent to which they agreed or disagreed with each item. This subscale has been validated in an adolescent physical education setting (Standage, Duda, & Ntoumanis, 2005). Consistent with previous research (Standage et al., 2005), scale scores demonstrated good internal consistency ($\alpha = .87$).

**Global self-esteem.** Global self-esteem was assessed using the 6-item Global Self-esteem Scale (GSES) of the Self-perceptions Profile for Children questionnaire (Harter, 2012). Participants were asked to indicate how true each structured alternative format item was, on a $2 \times 2$-point scale ranging from *really true for me* (1) to *sort of true for me* (2) in format 1 (low self-esteem) to *really true for me* (3) to *sort of true for me* (4) in format 2 (high self-esteem). Previous research has shown scores of the GSES had good reliability and validity (Robins, Hendin, & Trzesniewski, 2001). In the current study, scores for the global self-esteem had good internal consistency ($\alpha = .83$).

**Physical Factors of Physical Literacy**

**Physical fitness.** FITNESSGRAM® test items (Cooper Institute, 2013) and the NHANES
(2012) plank test were used to assess participants’ physical fitness. Specifically, body composition and aerobic capacity/fitness were assessed using the body mass index (BMI) measure and the Progressive Aerobic Cardiovascular Endurance Run (PACER) from the FITNESSGRAM®, and the NHANES (2012) plank test was used to assess muscular fitness. BMI, PACER, and the plank test are utilized in the Canadian Assessment of Physical Literacy (CAPL; Healthy Active Living and Obesity Research Group, 2013; Longmuir et al., 2015) to measure physical factors of physical literacy.

A Health-o-meter® 500KL digital physician height/weight scale (Pelstar, LLC, St. McCook, IL) was used to measure participants’ height and weight to compute BMI using the following formula:

\[
\text{BMI} = \frac{\text{weight [kg]}}{\text{height}^2 [\text{m}]}
\]

As a measure of body composition, BMI is an indication of the healthy weight to height ratio in that a high BMI can indicate high body fatness, while a low BMI can indicate low body fatness (Centers for Disease Control and Prevention, 2015a). To gain more precise measurements, participants were asked to remove their shoes when measuring height and weight, which were measured to the nearest quarter inch and tenth pound, respectively.

As noted earlier, the FITNESSGRAM® PACER was used to assess aerobic fitness. The objective of the PACER is to run 20-meter laps as long as possible at a specified pace that has a progressive intensity (Cooper Institute, 2013). That is, the PACER is designed to be easier at the beginning of the test with each minute getting progressively more difficult. Thus, the more laps completed constituted a higher level of aerobic fitness. Like the other FITNESSGRAM® tests, the specified pace was designated in a track on the CD in FITNESSGRAM® software packet. The track contains brief instructions and is set to music that includes beeps at certain intervals.
signifying when to start a new lap, which simultaneously indicates the completion of the previous lap. Thus, participants were to begin each 20-meter lap at the sound of beep and reach the opposite side of the 20-meter space prior to the sound of beep signifying the start of the next lap. Participants were told to avoid common errors such as not completing a lap within the given time, beginning a lap before the signifying beep, and continuously running so that a narrow oval was run rather than direct lines to avoid starting and stopping. These common errors were demonstrated by the researchers to improve the participants’ understanding of the errors. The participants’ PACER was completed when they could no longer continue or after they committed their second error. The total number of correctly completed laps was the participants’ performance score. Participants’ PACER performance scores were then used to compute an estimate of their aerobic capacity (i.e., VO2max) using the following formula developed on a validated sample by Mahar, Guerieri, Hanna, and Kemble (2011) with sex = 0 for female, 1 for male:

\[ VO2_{\text{max}} = 41.77 + .49 \times \text{laps} - 0.0029 \times (\text{laps})^2 - 0.62 \times \text{BMI} + 0.35 \times (\text{sex} \times \text{age}) \]

Boiarskaia, Boscolo, Zhu, and Mahar (2011) compared seven different methods to estimate VO2max in middle school aged youth and found that the estimated VO2max derived from the above quadratic formula had the highest correlation coefficient with the measured VO2max for both females and males.

The plank test (NHANES, 2012), which measured the number of seconds participants could hold themselves in the plank position, aimed to measure core muscular strength. The plank is an isometric exercise that works the core muscles of the trunk and pelvis. The objective of the plank test was to hold the plank position for as long as possible with a maximum of 300 seconds. An audio track containing a second count-off was used to signify the number of seconds held in
the plank position. Participants started the plank test by lying down in a prone position on top of
a mat with leg slightly apart and toes pointed down tucked under their legs. Participants were
then be asked to raise their body and legs off the ground so that each elbow remained on the
ground approximately shoulder width apart as the second count-off began, toes were on the
ground, and the back and legs remained in a straight line. Participants were asked to avoid
common errors that included a dip in the back and legs and the butt being extended higher in the
air. Again, examples of these errors were demonstrated by the researchers so that participants
understood what form errors to avoid. Participants’ plank test was completed when they could no
longer continue or after a researcher signaled that they committed a second form error. The
number of seconds plank position was held was the participants’ performance score.

Motor skill competence. Participants’ motor skill competence, specifically, overhand
throwing competence was assessed using the fifth grade physical education metrics (PE
Metrics®) rubric (SHAPE America, 2010). Overhand throwing competence (OTC) was chosen as
the measure of motor skill competence because previous research suggested it was the most
difficult motor skill and proficiency in object control skills like throwing significantly predicts
physical activity in future years (Barnett et al., 2009; Castelli & Valley, 2007). Further, like most
fundamental motor skills, overhand throwing gradually improves throughout childhood and
adolescence (Halverson, Roberton, & Langendorder, 1982); however, it is distinct in that
proficiency is not always researched due to its complexity (Halverson et al., 1982; Langendorfer
& Roberton, 2002). The PE Metrics® overhand throwing rubric consists of assessing
participants’ performance level in both form and accuracy of throwing to a target using a 0–4
rating scale on three attempts. Criteria for competence (9 or mean rating of 3 on the 3 attempts)
in throwing form is: “throws with selected essential elements: (a) throwing elbow shoulder-high,
hand back and side orientation in preparation for the throw, (b) trunk rotation, with elbow lagging behind hip, (c) weight transfer to non-throwing forward foot.” Criteria for competence (9 or mean rating of 3 on the 3 attempts) in throwing accuracy is: “hits target area on wall” (National Association for Sport and Physical Education, 2010, p. 105). Therefore, criteria for overall competence (form and accuracy) was 18.

Two trained field staff (i.e., researcher and a research assistant) scored each component (i.e., form and accuracy) simultaneously using a copy of the assessment score sheet provided with the PE Metrics® rubric (SHAPE America, 2010). In a pilot test, field staff reached an interrater agreement of greater than 90%. Reliability and validity of scores for this assessment have been previously established (SHAPE America, 2010; Zhu et al., 2011). In the current study, interrater reliability for form and accuracy (ICC = .93, CI = .92, .94; ICC = .97, CI = .96, .97, respectively) and for total OTC scores were high (ICC = .96; CI = .94, .96). In addition to the PE Metrics® assessment, throwing speeds for the three throws were also assessed using a Bushnell® Velocity Speed gun (Bushnell Outdoor Products, Overland Park, KS). Average speeds (Speed) for the three throws were computed per participant. Previous research indicates that ball speed was significantly correlated to developmental level and measure of performance (Roberton & Konczak, 2001; Stodden, Langendorfer, Fleisig, & Andrews, 2006a, 2006b). Speed scores demonstrated high internal consistency (α = .92).

**Cognitive Factors of Physical Literacy**

*Knowledge and understanding.* Participants’ knowledge and understanding of concepts related to physical education and physical activity was assessed using the 10-item measure of the CAPL questionnaire, which developed to reflect curricula of physical education in grades 4, 5, and 6 (Healthy Active Living and Obesity Research Group, 2013; Longmuir, 2013; Longmuir et
al., 2015). Specifically, items assessed: (a) participants’ understanding of minimal physical activity and maximum sedentary behavior guidelines; (b) awareness of fitness, activity, and motor skill parameters, as well as proper methods of improving activity and fitness levels and motor skill competence; (c) perceptions of health; and (d) proper use of safety equipment commonly used when performing physical activities (Longmuir et al., 2015). Example items are: “Muscular strength or muscular endurance means…” and “Shade-in the circle of all the words you think describe what ‘Healthy’ means”. Per the CAPL scoring guidelines, seven items were dichotomously scored, incorrect (0) and correct (1); two items were scored on 6-point scale ranging from zero correct responses (0) to all correct responses (5); and one item was scored based on the percentage of the 11 safety scenarios that were correctly assessed ranging from zero percent (0) to 100 percent (1). Thus, total scores based on the sum of scores from the 10 knowledge and understanding items could range from 0 to 18. Previous research indicated that scores were independent of participants’ sex and were directly related to participants’ age (Longmuir et al., 2015).

Correlates of Physical Literacy

Physical activity and sport team history. Physical activity and sport team participation history was assessed using items from the Middle School Youth Risk Behavior Surveillance Survey (MSYRBS; CDC, 2016). Zullig and colleagues (2006) found that the MSYRBS demonstrated high reliability in their assessment of self-reported physical activity instruments. Biddle and colleagues (2011) hold that the five activity behavior items of the MSYRBS received support from the majority of the experts. Specifically, MSYRBS contains one item that assesses physical activity (i.e., indicate how many days of the last seven day were they physically active
for a total of at least 60 minutes per day), two items that assess sedentary behavior (i.e., indicate how many hours per day do you watch television, and how many hours per day do you play video games), one item that assesses physical education frequency (i.e., indicate how many days in an average week you attend physical education), and one item that assesses sport team participation (i.e., indicate on how many sports teams did you play during the past 12 months). As such, the single item assessing physical activity was used as the measure of physical activity (Days60), and the single item assessing sport team participation was used as the measure of sport team participation (STP).

**Sedentary behavior.** The Adolescent Sedentary Activity Questionnaire (ASAQ; Hardy, Booth, & Okely, 2007) was modified in that students were asked to log their sedentary activities daily, instead of asking them to recall information from the previous seven days. That is, on a specified Monday, students were asked to log their sedentary activities for the previous Friday-Sunday. Then, on Tuesday, students were asked to log their sedentary activities for the previous Monday, and then the same pattern was followed for the remaining weekdays in that specified week. An example of sedentary behavior activities logged were “Watching TV or Videos” and “Doing homework not on a computer”. Hardy and colleagues (2007) indicated ASAQ displayed good to excellent reliability, and Strath et al. (2013) found that logs provided better subjective assessment of activity behaviors in that they were not subjective to memory or recall errors. For analyses, sedentary activities was separated into screen-time sedentary behavior (STSB) and other sedentary behavior or non-screen-time sedentary behavior (NSTSB) and then totals for each calculated.

**Interscholastic Sport Intention**

In line with previous validated activity intention scales (Alvarez, Balaguer, Castillo, &
Duda, 2012; Chatzisarantis, Biddle, & Meek, 1997; Standage et al., 2003), four items were created to assess students’ intention to enroll in athletics (i.e., play interscholastic or school sports) in the seventh grade. Specifically, students were asked to respond to “I plan to enroll in athletics (play school sports) next school year,” “I intend to play school sports next year,” “I am determined to play school sports next year,” and “I am looking forward to playing school sports next year,” on a 5-point scale ranging from strongly disagree (1) to strongly agree (5), the extent to which they agreed or disagreed with each item. Previous work found scores of activity intention scales demonstrated acceptable internal consistency with similarly-aged physical education students (Alvarez et al., 2012; Chatzisarantis et al., 1997). In the current study, scores for the interscholastic sport intention items demonstrated high internal consistency (α = .97).

Data Analyses

Statistical analyses were conducted using SPSS® 22.0 (IBM Corporation, Armonk, NY, USA) for Windows®/Apple Mac®, Version 7.3 of Mplus (Muthén & Muthén, 2015), and statistical significance was set at α < .05. G*Power Version 3.1.9.2 (Faul, Erdfelder, Buchner, & Lang, 2009) was used to perform an a priori power analyses. After data collection concluded and before model fits were assessed and hypotheses were tested, missing values, univariate outliers, univariate normality, and multivariate outliers were explored. For the most part, missing data analysis revealed no data were missing. However, 161 participants did not complete the PDS. Reasons given varied from “I don’t know” to “I don’t feel comfortable responding to these questions.” Similar to previous research (Shirtcliff, Dahl, & Pollack, 2009), more male than female participants did not complete the PDS. Attrition analysis revealed mean values for the knowledge and understanding, affective, and physical factors scores for those who did not
complete the PDS ($n = 161$) were not statistically significantly different from those who did complete the PDS ($n = 258$). Though Little’s MCAR test, $\chi^2(108) = 179.32, p < .01$, revealed, as expected data were not missing completely at random, these participants were not excluded from the study in that this variable was their only missing data.

Six participants were discovered to have univariate outliers (Hoaglin, Iglewicz, & Tukey, 1986), and all variables were deemed normally distributed except BMI, with skewness of 1.64 ($SE = .12$) and a kurtosis of 3.49 ($SE = .24$). Previous research indicates BMI tends to be positively skewed in the tested age group (Fredriks, van Buuren, Wit, & Verloove-Vanhorick, 2000; Rothman, 2008). Based on Mahalanobis, Cook’s, and leverage distances, 13 unique participants were discovered to have multivariate outliers (Henson, 1999; Kannan & Manoj, 2015). Once outliers ($n = 19$) were excluded (Osborne & Overbay, 2004), score reliabilities and descriptive statistics were assessed, and the interobserver agreement was calculated according to van der Mars (1989) for the OTC scores. In addition, independent-samples $t$-tests and chi-squared tests were conducted to examine mean differences and associations between variables with respect to school and sex.

After these preliminary analyses, to test the hypotheses, structural equation modeling (SEM) analyses were used to test model fit of the measurement models, explore measurement invariance (Byrne, 2012; Milfont & Fischer, 2010), examine relationships using the physical literacy factor scores, and test model fit of the proposed structural model investigating the directional relationship between physical literacy and interscholastic sports intention. Regarding invariance testing, models were tested for equality of constraints across groups (i.e., females and males) using multi-sample invariance analyses prescribed by Byrne (2012). These analyses involved establishing baseline models for the groups through combined sample analyses, which
established base model fit statistics to which subsequent models’ fit were compared (Marsh, 1993). Invariance testing was conducted by comparing the structural statistics, path coefficients (factor loadings), variances/covariances residuals, and intercepts of the baseline model to that of the groups. Specifically, invariance among configural models (structure invariance), metric models (path coefficient invariance), and scalar models (intercept invariance) were examined using chi-square difference testing for each measurement model and the structural model (Byrne, 2012; Kline, 2016; Milfont & Fischer, 2010). Statistically significant differences would indicate significant measurement model variance.

Confirmatory factor analyses, known within SEM as measurement models, were used to assess factor correlations, statistical significance of path coefficients, and the model fit of each measurement model within the structural model in order to examine their ability to accurately represent (i.e., model fit) the observed data (Brown, 2015; Tabachnick & Fidell, 2013). Measurement models tested were: (a) self-efficacy; (b) intrinsic motivation; (c) self-esteem; (d) affective factor; (e) physical fitness (i.e., BMI, VO₂max, and plank); (f) motor skill competence (i.e., OTC and Speed); (g) physical factor; (h) interscholastic sport intention; and (i) first- and second-order physical literacy factor (see Figure 1 and 2, respectively). After measurement model fits were tested, bivariate relationships between the saved physical literacy factor scores and Days60, STP, STSB, and NSTSB were examined, and SEM analyses were conducted to investigate the significance of the relationship between physical literacy and sixth grade physical education students’ intention to participate in interscholastic sports in the seventh grade (see Figure 1 and 2).

Given that this study analyzed multiple groups (i.e., females and males), units for common factors (e.g., self-efficacy, intrinsic motivation, self-esteem, physical fitness, motor skill
competence, and interscholastic sport intention) were designated using the marker variable technique (Lindell & Whitney, 2001; Williams, Hartman, & Cavazotte, 2010), which consists of fixing the path coefficients of the marker variables to a nonzero value. In the present study, the self-efficacy factor and affective factor were assigned as the marker variable for the first- and second-order physical literacy measurement models, respectively. In that, Edwards and colleagues (2017) denoted confidence and affective factors, in general, were the more common measurements or attributes of physical literacy in extant literature. Marker variables for the factors where either the first item (observed variable) of the measure or the variable most strongly associated to the factor (e.g., VO2max on Fitness). Factors represented by a single item (i.e., knowledge and understanding), as well as motor skill competence variables (i.e., OTC and Speed) and physical fitness variables (i.e., BMI, VO2max, and plank) were standardized (Z-score), so that all variables were on a similar metric, facilitating maximum likelihood estimates (Brown, 2015). In addition, factors represented by a single item had their path coefficient fixed to a nonzero value (1) and their residual variance fixed to zero (Byrne, 2012; Hayduk & Littvay, 2012; Sagan & Pawelek, 2014).

The most common statistical method used to test significance within confirmatory factor and SEM analyses is maximum likelihood estimation (Fabrigar, Wegener, MacCallum, & Strahan, 1999). While the chi-square statistic ($\chi^2$) is the most common model fit statistic, it is important to know it can be problematic due to its sensitivity to sample size, the number of indicators, and the number factors in the model (Anderson & Gerbing, 1984). Therefore, to avoid misfit diagnoses this study judged model fit ability using multiple fit indices (i.e., root mean square error of approximation [RMSEA], standardized root mean square [SRMR], comparative fit index [CFI], Tucker-Lewis index [TLI], Bayesian information criterion [BIC], and sample-
size adjusted BIC [SABIC]) that measured absolute fit, incremental/relative fit, and comparative fit (Heene, Hilbert, Draxler, Ziegler, & Bühner, 2011; Hu & Bentler, 1999; Kline, 2016).

Specifically, absolute fit indices (e.g., RMSEA and SRMR) measure average misfit size between residuals of the observed covariance matrix and the hypothesized model, and values less than or equal to .05 indicate excellent fit and values between .06 and .10 respectively indicate good to mediocre fit (Hooper, Coughlan, & Mullen, 2008). On the other hand, Kenny, Kaniskan, and McCoach (2015) declare that RMSEA often falsely indicates poor fitting models with respect to models with small degree of freedom (\(df\)) and sample size. Incremental/relative fit indices (e.g., CFI and TLI) compare the observed covariance matrix with the null model’s covariance matrix while taking sample size into account (Bentler, 1990; McDonald & Ho, 2002); thus, they generally perform well with a small sample size (Tabachnick & Fidell, 2013). For incremental/relative fit indices, Hooper and colleagues (2008) claim that values greater than or equal to .96 indicate excellent fit and values between .95 to .90 indicate good to mediocre fit, respectively. Comparative fit indices (e.g., BIC and SABIC) are used when two different models are estimated, where the lower value indicates a better model fit (Kline, 2016; Raftery, 1996).

In addition, while Kline (2016) recommends that each factor (\(f\)) tested has at least three indicators (\(p\)) and that the sample size should exceed 150, Gagné and Hancock (2006) explain that the validity of these guidelines are interdependent in that sample size and construct reliability both affect model convergence and parameter estimations. The average variance extracted by each factor was computed according to the procedures outlined by Fornell and Larcker (1981), and construct reliabilities, which are measures of measurement model quality derived from the \(p/f\) ratio and the magnitudes of the factor loadings (Gagné & Hancock, 2006), were computed based on the omega (\(\Omega\)) formula suggested by Bacon, Sauer, and Young (1995).
Results

Descriptive Statistics

After outliers were excluded, 240 participants of the 400 remaining participants completed the PDS (female = 159, male = 81). Of those, six were categorized as prepubertal (2.5%), 93 were categorized as early pubertal (38.8%), 121 were midpubertal (50.4%), and 20 were categorized as late pubertal (8.3%). Mean scores were 2.17 ($SD = .58$) for females and 1.98 ($SD = .37$) for males. No participants were categorized as postpubertal. Descriptive statistics for fitness variables revealed mean performances for both sexes were considered healthy or favorable. Based on the FITNESSGRAM® Performance Standards (Cooper Institute, 2013), 80.5% of females and 71.0% of males had a BMI in the healthy fitness zone (HFZ) or the very lean zone, and 59.3% of females and 74.6% of males had a VO$_2$max estimation score in the HFZ. According to the CAPL scoring guidelines (Healthy Active Living and Obesity Research Group, 2013), 56.7% of females and 74.5% of males had a plank time that was categorized as achieving or excelling.

Regarding motor skill assessment, mean OTC score for females was 16.37 ($SD = 1.26$) with only 8.7% categorized as competent; whereas, mean OTC score for males was 18.63 ($SD = 1.22$) with 78.7% categorized as competent. Mean Speed was 22.50 mph ($SD = 2.81$) for females and 30.77 mph ($SD = 3.36$) for males. Descriptive statistics for the knowledge and understanding measure indicated that the majority of participants (87.9% of females and 91.1% of males) were categorized as progressing or achieving (Healthy Active Living and Obesity Research Group, 2013). Lastly, descriptive statistics for the proposed correlates of physical literacy indicated that, in females, only 32.5% engaged in at least 60 minutes of MVPA on five or more days each week (Days60); whereas, 55.6% of males engaged in at least 60 minutes of MVPA on five or more
days each week. Further, 73.2% of females and 71.6% of males reported that they had participated in at least one sport team in the last 12 months (STP), and, on average, females logged 163.27 minutes ($SD = 55.86$) and males logged 153.70 minutes ($SD = 64.69$) of STSB per day.

Preliminary Analyses

Independent-samples $t$-tests indicated VO$_{2max}$ ($t = -5.13, p < .01$), OTC ($t = -17.98, p < .01$), and Speed ($t = -26.72, p < .01$) means scores were statistically significantly different between sexes. All other single-item factors were not statistically significantly different between sexes. Controlling for sex, independent-samples $t$-tests indicated that, among females only Sport ($t = -3.76, p < .01$) mean scores were statistically significantly different between schools, while, among males only OTC ($t = -2.42, p < .05$) mean scores were statistically significantly different between schools. A two (school) by two (sex) chi-square test indicated a significant association between students’ school and sex, $\chi^2 (1) = 35.47, p < .01$, $\phi = -.30$, and a two (school) by five (race) chi-square test indicated a nonsignificant association between students’ school and race, $\chi^2 (4) = 2.90, p = .58$, $\phi = .09$.

Invariance Analyses

Results of the measurement and structure models invariance tests are displayed in Table 2. By conducting multi-group (i.e., female and male) invariance analyses, equivalence of the structural statistics, path coefficients, variance/covariance residuals, and intercepts were tested to determine to what extent the model representing each group were identical. Though most measurement models were found to be invariant, the physical fitness model, motor skill
The psychological competences, physical model, and interscholastic sport intention model, and thus, the physical literacy measurement model were found to be variant. That is, the intercepts (expected value of the items when the latent variable is equal to zero) were variant between sexes in the physical fitness model, the factor loadings (path coefficients) and the intercepts were variant between sexes in the motor skill competence model, and the intercepts were variant between sexes in the interscholastic sport intention model. In addition, both the factor loadings and the intercepts were variant between sexes in the physical literacy measurement models, which also included a variant confidence factor structure path coefficient. Based on these findings, subsequent model fit was tested female and male data independently.

Confirmatory Factor Analyses

Results of the tested models by sex are presented in Table 3. Slight modifications of the tested models were performed to improve model fit (Jackson, Gillaspy, & Purc-Stephenson, 2009; Raubenheimer, 2004). Specifically, item five of the self-efficacy scale (i.e., my success in most activities if I exert enough effort) and item five of the self-esteem scale (i.e., some kids are very happy being the way they are BUT other kids wish they were different) were removed from the models representing females and males. Modification indices suggested their removal would improve model fit (Brown, 2015). For justification for their removal, the ambiguity of the word “success” may explain the poor performance of the removed confidence item (Nicholls, 1989; Treasure & Roberts, 1994). The poor performance of the removed self-esteem item was likely due to multicollinearity (Grewal, Cote, & Baumgartner, 2004). Further, based on the recommendations of Muthén & Muthén (www.statmodel.com), items or factors with non-statistically significant negative residual variances had their residual variances fixed to zero in
order to avoid a not positive definite residual covariance matrix. Finally, modification indices suggested the residual variances for BMI and plank variables be correlated to improve model fit. Because one would expect the unexplained variance in BMI and plank is related since both are affected by muscle mass, this covariance path was estimated (Hasan, Kamal, & Hussein, 2016; Rothman, 2008; Strand, Hjelm, Shoepe, & Fajardo, 2014).

Based on model selection guidelines established by Raftery (1996), the first-order physical literacy model (see Figure 1) demonstrated evidence (≈ 75% probability) for the better fitting model in females (ΔBIC = 3.37). Whereas, the second-order physical literacy model (see Figure 2) demonstrated evidence (≈ 99% probability) for the better fitting model in males (ΔBIC = 13.75). Because the absolute and incremental/relative fit indices indicated both the proposed first- and second-order physical literacy models had good model fit for both sexes (Hooper et al., 2008; Hu & Bentler, 1999) and selection results only providing weak evidence supporting the first-order model for female data, both models where further tested. However, according to the parsimony principle the simplest model is preferred (Posada & Buckley, 2004).

Table 4 presents the factor loadings (path coefficients), variance explained ($R^2$), average variance explained (AVE), and the alpha ($\alpha$) and construct ($\Omega$) reliabilities of the first- and second-order physical literacy models. An examination of the factor loadings and $R^2$ values revealed all loadings were statistically significant and all factors were able to significantly reproduce the variances of the indicator variables and the lower-order factors, with exception of the first-order physical literacy factor significantly reproducing the variance of the motivation factor in females ($p = .06$). Based on the .50 standard (Fornell & Larcker, 1981), the average variance extracted for each factor for both groups was considered acceptable. However, while the average variance extracted for each factor was greater than .50, both female and male models
contained indicators with $R^2$ values below .50. The alpha ($\alpha$) reliability coefficients (Cronbach, 1951) for the underlying factors (i.e., self-efficacy, intrinsic motivation, self-esteem, physical fitness, and motor skill competence) suggested that the indicator variables designated to each factor adequately represented a unidimensional subconstruct. Based on the .70 standard, the construct reliabilities ($\Omega$) for all factors were also considered acceptable, with exception of the second-order affective factor for both females and males (Bacon et al., 1995; Fornell & Larcker, 1981). Collectively, the results of the confirmatory factor analyses indicated the first- and second-order physical literacy model fit the data well and demonstrated good reliability and construct.

Correlates of Physical Literacy

The estimated correlation matrix of the first- and second-order physical literacy models and the measured correlates by sex is presented in Table 5. Among both female and male participants, the bivariate relationship values between the physical literacy factors and measured proposed correlates (i.e., Days60, STP, STSB, and NSTSB) revealed the physical literacy factors were statistically significantly related to Days60, STP, and STSB. Specifically, the correlation analyses indicated that among females physical literacy, on average, had approximately 35-36% shared variance with Days60, 18% shared variance with STP, and 4-5% shared variance with STSB. Among males, physical literacy, on average, had approximately 37-45% shared variance with Days60, 24-30% shared variance with STP, and 4-5% shard variance with STSB. As hypothesized earlier, NSTSB was not statistically significantly related to the physical literacy factor, which was consistent with previous research (Fletcher et al., 2015). Post hoc Fisher’s $r$-to-$z'$ test (http://vassarstats.net/rdiff.html) indicated that the bivariate relationships between the
second-order physical literacy factor and its measured correlates were not statistically significantly different between sexes.

Interscholastic Sport Intention and Physical Literacy

The goodness-of-fit indices for the proposed four-factor interscholastic sports intention model derived from the confirmatory factor analysis using female data were: $\chi^2 (2) = 1.00, p = .61; \text{RMSEA} = .00 (\text{CI} = .00 – .11); \text{SRMR} = .00; \text{CFI} = 1.00; \text{and TLI} = 1.00$. The average variance explained was .99 and the construct reliability was .97. An examination of the factor loadings and $R^2$ values revealed all loadings were statistically significant and the interscholastic sports intention factor significantly reproduced the variances of the indicator variables. In contrast, the goodness-of-fit indices for the proposed four-factor interscholastic sports intention model derived from the confirmatory factor analysis using male data were: $\chi^2 (2) = 3.93, p = .14; \text{RMSEA} = .08 (\text{CI} = .00 – .18); \text{SRMR} = .00; \text{CFI} = 1.00; \text{and TLI} = .99$. Again, the average variance explained was .99 and the construct reliability was .97. Factor loadings and $R^2$ values revealed all loadings were statistically significant and the interscholastic sports intention factor significantly reproduced the variances of the indicator variables. Collectively, these results indicated that the proposed interscholastic sports intention measurement model demonstrated good model fit for both sexes (Bacon et al., 1995; Fornell & Larcker, 1981; Hooper et al., 2008; Hu & Bentler, 1999).

Results of the SEM analyses investigating the relationship between the physical literacy construct and interscholastic sport intention by sex are presented in Table 6. Based on model selection guidelines established by (Raftery, 1996), the SEM analyses indicated the second-order physical literacy model demonstrated positive evidence for the better fitting structural model in
females ($\Delta$BIC = 3.42) and in males ($\Delta$BIC = 54.57). As shown in Table 6, the goodness-of-fit indices for the second-order physical literacy structural model predicting interscholastic sport intention demonstrated the implied covariance matrix adequately represented the observed covariance matrix in both female and male sixth-grade physical education. An examination of the path coefficients and $R^2$ values revealed that in both models (female and male) all paths were statistically significant and all factors were, again, able to significantly reproduce the variances of the observed variables. Graphic illustrations of the second-order physical literacy structural model predicting interscholastic sport intention, including standardized path coefficients are presented in Figure 3 (female) and Figure 4 (male), respectively. For the structural model representing female data, the second-order physical literacy factor was statistically significantly associated to the interscholastic sport intention factor. Specifically, the standardized path coefficient between these factors was .84 ($p < .001$), which indicated that, on average, physical literacy explained approximately 70% of the variance in interscholastic sport intention. Further, for the structural model representing male data, the physical literacy factor, again, was statistically significantly associated to the interscholastic sport intention factor. The standardized path coefficient between these factors was .89 ($p < .001$), which indicated that, on average, physical literacy explained approximately 80% of the variance in interscholastic sport intention.
Figure 3. The female structural model illustrating the relationship between physical literacy and interscholastic sport intention with the standardize estimates for factor structure path coefficients and the factor and observed variable residual variances labeled.
Figure 4. The male structural model illustrating the relationship between physical literacy and interscholastic sport intention with the standardize estimates for factor structure path coefficients and the factor and observed variable residual variances labeled.

Discussion

The proposed measurement models of physical literacy tested in the present study were developed based on the conceptualizations provided by extant literature; specifically, the Aspen Institute (2015b), Edwards and colleagues (2017), and Whitehead (2010). These conceptualizations hold physical literacy to be a multidimensional higher-order factor that is purported to be directly related to maintaining an appropriate level of physical activity throughout the lifecourse. The present study was designed to test the psychometric properties of proposed models of physical literacy, examine correlates of the physical literacy factor, and
investigate the significance of the relationship between physical literacy and interscholastic sport intention in the context of sixth-grade physical education.

Descriptive statistics were deemed congruent with previous research evidence. Specifically, pubertal development scores were statistically similar to values found in previous research with this age group (Carskadon & Acebo, 1993). Even though, BMI, VO₂max estimate, and plank scores were more favorable in this sample than previous research (Fryar et al., 2016; Gahche et al., 2014; Longmuir et al., 2015), when considering this sample was from schools located in middle-class to upper-middle-class suburban neighborhoods, this finding may, in fact, be explained by the know positive relationship between socioeconomic status and physical fitness (Bohr, Brown, Laurson, Smith, & Bass, 2013).

While the prevalence of overall competence in overhand throwing (both form and accuracy) in males matched previous research findings (Hushman, Hushman, & Carbonneau, 2015), females overall competence was lower (Barnett, van Beurden, Morgan, Brooks, & Beard, 2010; Hushman et al., 2015). However, when form and accuracy competences were separately examined females’ accuracy competence was actually higher than previous research, suggesting this sample may have prioritized accuracy over form. Regarding Speed, throwing performances for both sexes were slightly elevated compared to previous research (Lorson et al., 2013), but given that mean score differences between sexes were congruent and the present sample was a year older, this elevated performance may simply reflect maturational changes. Participants’ knowledge and understanding scores and Days60, STP, and STSB data were consistent with previous research findings (Eime, Charity, Harvey, & Payne, 2015; Fakhouri et al., 2014; Longmuir et al., 2015; Nelson, Neumark-Sztainer, Hannan, Sirard, & Story, 2006). As expected, preliminary analyses revealed male participants, on average, had statistically significantly greater
cardiorespiratory fitness, were more competent in overhand throwing, and could throw faster than female participants (Barnett et al., 2010; Gahche et al., 2014; Lorson et al., 2013).

Confirmatory factor analyses provided validation evidence that indicated the psychometric properties of the underlying factor models and the proposed physical literacy models were sustained in the sample of sixth-grade physical education students. These results supported the first hypothesis in that the physical literacy factor significantly explained the variance of the affective, physical, and cognitive factors, and those underlying factors significantly explained observed variables measured. In addition, these analyses provided further construct validation of the underlying factor models (Alvarez et al., 2012; Gao et al., 2009; Harter, 2012b; Longmuir et al., 2015; Standage et al., 2005; Stodden & Goodway, 2007), while also providing initial construct validity for the proposed higher-order physical literacy models. Further, similar to previous research assessing higher-order factors of physical literacy (Longmuir et al., 2015), the largest path coefficient (or explained variance) of the factor represented by the physical factor was physical fitness, and the largest path coefficient of the factor represented by the affective factor was self-efficacy.

An exploration of variance between sexes of the proposed measurement models supported the second hypothesis. That is, measurement variance between sexes was discovered in both the physical fitness and motor skill competence measurement model, which, thereby, lead to measurement variance between sex in the physical factor measurement model and the higher-order physical literacy measurement models. Remembering the results of the preliminary analyses, these findings were expected and consistent with previous research (Longmuir et al., 2015; Lorson et al., 2013; Thomas, Nelson, & Church, 1991). Given the PDS data, this sample, like most early adolescents, have started experiencing physiological changes that may also, in
part, explain this between group variance (Ortega et al., 2008). Additional, subjection to sex-related social and cultural constraints regarding activity engagement (Wright, MacDonald, & Groom, 2003) may further explain this variance. Furthermore, variance between sexes supported the position that the physical literacy journey is unique to each individual's socioecology (Taplin, 2011; Whitehead, 2007, 2013). Lastly, consistent with previous research (Chen, Dai, & Gao, 2017; Harter, 2012; Standage et al., 2005), affective factors demonstrated measurement invariance between sexes.

While sex differences regarding better fitting models was demonstrated using BIC comparisons (Raftery, 1996), as noted earlier, other fit indices demonstrated both the proposed first- and second-order physical literacy models provided good model fit to the data. Regarding first-order physical literacy models, factor structure path coefficients indicated physical fitness had the highest value in both female and male models. This finding is supported by previous research (Blair et al., 1989; Ortega et al., 2008), which indicated physical fitness was often the strongest correlate of physical activity and its underlying factors (e.g., motivation and self-efficacy). In addition, it was effectively supported by the CAPL scoring protocol (Healthy Active Living and Obesity Research Group, 2013), in that CAPL designates that approximately a third of a physical literacy composite to the physical competence domain, which is primarily composed of physical fitness factors (Longmuir et al., 2015). The factor structure path coefficients also revealed intrinsic motivation had the lowest value in both female and male models. Considering the position taken in Chen (2015), along with the vast amount of research focusing on enhancing motivation as a primary vehicle for increasing physical activity, this finding appears conflicting. However, it may simply be the consequence of not including additional motivational regulations in the measure. That is, people can be both intrinsically and
extrinsically motivated to participate in physical activity (Chen, 2015). Thus, future researchers are encouraged to test models that include additional motivational regulations.

The factor structure path coefficients in the second-order physical literacy model indicated the physical factor had the highest value for females, and the second-order affective factor had the highest value for males. These results suggest that in this sample physical factors may carry greater weight in determining physical literacy in females; whereas, affective factors may carry greater weight in determining physical literacy in males. This difference may reflect social and cultural constraints (Lenhart et al., 2012; Weiss, 2000). That is, variance in the physical factors may better represent physical literacy in females because these factors are often not socially or culturally supported or valued. Therefore, variance in this factor accurately reflects “purposeful physical pursuits/activities”, which Whitehead (2013a) holds as a key vehicle and goal of physical literacy (p. 29). However, further research is needed to determine whether this result is generalizable or particular to this sample. Although Longmuir and colleagues (2015) found gender/sex was not related to the cognitive factor, the present study indicated the cognitive factor had a significantly larger factor structure path coefficient in males than in females. On the other hand, given that the present study was the first to test the cognitive factor as an underlying factor within a higher-order physical literacy model, this result needs to be further tested in alternate samples.

The examination of the relationships between the measured physical literacy construct and the proposed theoretically relevant variables (i.e., Days60, STP, and STSB) provided further evidence of construct validity, which supported the third hypothesis. This evidence supports Edwards and colleagues' (2017) assertion that physical literacy significantly related to behaviors such as physical activity, sport participation, and health risk-factors (e.g., screen-time sedentary
behavior). It also supports Almond's (2013) notion that physical literacy is bi-directionally related to regular engagement in purposeful physical pursuits such as physical activity and sport participation. Overall, the validity analyses revealed that, in this sample of early adolescents, enhanced physical literacy was associated with a greater number of days per week with at least 60 minutes of physical activity, a greater number sport teams in which participated, and fewer minutes of screen-time sedentary behavior.

The SEM analyses in the current study provided additional validation evidence to support the proposed models of physical literacy in the context of sixth-grade physical education. As hypothesized, participants’ physical literacy was statistically significantly related to their intention to participate in interscholastic sports, which further supported the position that physical literacy is highly related to future purposeful pursuits in physical activity/sports (Almond, 2013; Edwards et al., 2017; Whitehead, 2010). When comparing factor structure path coefficients in the structural model with the factor structure path coefficients in second-order physical literacy measurement model, a few interesting differences were revealed. Specifically, in both models (female and male), the path coefficient between the physical literacy higher-order factor and the physical factor decreased, while the path coefficients between the physical literacy higher-order factor and the affective factor increased. As expected, the path coefficients between the affective factor and the motivation and self-efficacy underlying factors also increased. These findings indicate that freely estimating these paths resulted in the make-up of the physical literacy factor changing in order to improve fit in the structural model (i.e., maximizing the amount of shared variance between the physical literacy factor and the interscholastic sports intention factor, while simultaneously minimizing the effect these changes have on the model fit of the measurement models).
When considering that participating in interscholastic sports is optional and that the interscholastic sports intention factor measures planned future behavior, this change in the make-up of physical literacy was expected. That is, according to previous research, higher levels of confidence/self-efficacy (Foley et al., 2008) and intrinsic motivation (Chatzisarantis et al., 1997; Rhodes, Blanchard, Matheson, & Coble, 2006) would be significantly related to a stronger intention to participate in interscholastic sports. These findings also suggest that the significance of the underlying factors of physical literacy may depend greatly on what the specific goal is and, maybe more importantly, when it is. Because of the nature of their causal relationship, physical factors such as aerobic capacity may better predict current activity behavior; whereas, affect factors such as intrinsic motivation may better predict future activity behavior or future activity behavior adherence. In addition, the goal of developing children into elite athletes, as in the LTAD model (Balyi & Hamilton, 2004; Ford et al., 2011), may be more prone to target physical factors such as motor skill competence; whereas, the goal of developing children into individuals who enjoy a lifetime of healthful physical activity (SHAPE America, 2013a, 2013b) may be more prone to target affective factors. Future research is encouraged to examine the significance of relationships between varying factors of physical literacy and proposed outcomes, such as the relations between affective and cognitive factors and academic performance or the relations between physical factors and intramural sport participation and all-cause mortality and morbidity risk factors. Further, future research is encouraged to examine the effects that physical education curriculums, such as Sport Education, Adventure Education, and Fitness and Wellness Education (Lund & Tannehill, 2015) have on the physical literacy and its underlying factors.
Limitations and Strengths

Overall, the findings of the present study confirmed the research hypotheses; however, the current study had limitations to consider when interpreting results. First, all affective, cognitive, activity, and behavior intention data were collected via self-report; thus, they are subject to social desirability biases (van de Mortel, 2008). For example, if participants wanted to not have low self-esteem, did not want others to know they had low self-esteem, or felt the researchers wanted them to not have low self-esteem, then they may have responded accordingly rather than truthfully. Though measures were taken to reduce this limitation such as making sure participants did not group together while responding to the questionnaires and reiterating that all responses would remain confidential, it still remains a limitation to the current study. In addition, this study holds the assumption that participants fully understood each self-reported item and that they were able to accurately recall past activity behavior. If participants responded to an item without truly understanding its objective or without being able to accurately recall particulars of past behavior, then their scores would be subject to measurement error (Schwarz, Knäuper, Oyserman, & Stich, 2008). While researchers and their assistants were present and actively volunteered to answer clarifying questions, this limitation was still present. Second, to obtain participants’ best physical performance score, physical fitness and motor skill assessments required participants to give maximal effort during testing. Thus, even though researchers encouraged participants to give best effort, validity of participants’ performance scores may have suffered if they did not or could not give best effort. Third, given that participants were from schools located in middle-class to upper middle-class neighborhoods and research has consistently indicates persons from lower-socioeconomic areas may demonstrate different variable relationships (Eime, Casey, et al., 2015), the generalizability of these findings may be
limited to similar samples. Future research should test the fit of proposed models and its associations in alternative samples with lower socioeconomic status. Fourth, the cross-sectional research design employed did not allow for causal conclusions to be made; thus, result interpretations were limited to a relational nature. Future research examining the significance of physical literacy on future engagement in physical activities should employ longitudinal research design or experimental research design so that the real effect of physical literacy on future engagement can be determined. Lastly, approximately 40% of participants did not complete the PDS. As a result, maturation was not entered in the analyses as a control variable. Even though previous research indicates pubertal development relates to physical fitness, motor skill competence, psychological well-being, and purposeful pursuits in physical activity (Davies & Rose, 2000; Davison, Werder, Trost, Baker, & Birch, 2007; Patton & Viner, 2007), the current study was unable to determine whether or not including maturation level in the model would have altered the findings.

Despite the noted limitations, the present study had several significant strengths worth stating. To our knowledge the present study was the first to test the psychometric properties of a comprehensive or multidimensional model of physical literacy. Considering physical literacy is still considered a relatively new paradigm in physical education, it “…provides a fresh springboard from which a renewed emphasis on physical education can emerge” (Tremblay & Lloyd, 2010, p. 26). However, for physical education professionals to effectively utilize this renewed interest, a better understanding of this complex and promising vehicle is needed in order to produce affective, physical, and cognitive changes in individuals that increase the students’ likelihood of enjoying a lifetime of healthful physical activity. Because of this, the call for
developing a comprehensive and valid measure of physical literacy has been aptly expressed (Aspen Institute, 2015b; Edwards et al., 2017; Lundvall, 2015; Tremblay & Lloyd, 2010). As such, the primary strength of the present study was that it provided validation for an initial multidimensional measurement model for assessing physical literacy. Future research is encouraged to further validate and/or make suggested and practical adjustments to this model to improve its validity. Second, knowing the principal objective of producing physically literate individuals is to enhance factors that not only foster present physical activity engagement but, more importantly, establishes a strong desire to continue to seek purposeful physical pursuits throughout the lifecourse, the present study provided evidence that physical literacy was indeed strongly related to intention to pursue future physical activity/sport engagement. Third, given every individuals’ physical literacy journal is unique in that it reflects “…their own capabilities, social and geographical context, and life experiences” (Edwards et al., 2017, p. 118), this exploratory study can be used as a framework for future research conducted in other contexts. That is, it can be easily expanded to include additional motivational regulations, motor skills, physical fitness components, and/or health-related knowledge concepts, or it can be reformed to include alternate motor skills, physical fitness components, and/or health-related knowledge concepts that may better reflect physical literacy in the tested context. Lastly, utilizing SEM analyses allowed for conducting and combining statistical methods into order to examine latent variables and their relationships, while simultaneously affording the opportunity to analyze the dependencies of these factors without measurement errors (Nachtigall, Kroehne, Funke, & Steyer, 2003). Thus, the use of this advanced statistical analysis allowed the current study to examine the relationships between latent factors of physical literacy, physical literacy, and interscholastic sports intention without their residual variance.
Conclusions

As noted, physical literacy is a unique journey that begins at birth and continues throughout the lifespan. However, given that many of the affective, physical, and cognitive factors of physical literacy are generally established during youth by physical education or sport participation, the window in which to increase physical literacy is relatively short. Therefore, understanding physical literacy is purported to determine lifelong physical activity and sport participation, obtaining an accurate and complete assessment of physical literacy during these formative years seems crucial. The present study provides initial validation for a multidimensional measurement model of physical literacy in the context of sixth grade physical education with recommendations on how to further expand on or emphasize relative factors.
Table 1

Data Collection Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>School A (n = 276)</th>
<th>School B (n = 143)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Recruit, pass-out &amp; pick-up Informed Consents</td>
<td>Recruit, pass-out &amp; pick-up Informed Consents</td>
</tr>
<tr>
<td>2</td>
<td>Recruit, pass-out &amp; pick-up Informed Consents</td>
<td>Recruit, pass-out &amp; pick-up Informed Consents</td>
</tr>
<tr>
<td>3</td>
<td>Motor skill assessment</td>
<td>Motor skill assessment</td>
</tr>
<tr>
<td>4</td>
<td>Survey 1</td>
<td>Survey 1</td>
</tr>
<tr>
<td>5</td>
<td>Survey 2</td>
<td>Survey 2</td>
</tr>
<tr>
<td>8</td>
<td>Survey 2</td>
<td>Survey 2</td>
</tr>
<tr>
<td>10</td>
<td>FITNESSGRAM and Plank Test</td>
<td>FITNESSGRAM and Plank Test</td>
</tr>
<tr>
<td>12</td>
<td>Survey 3 and Sedentary Behavior Log</td>
<td>Survey 3 and Sedentary Behavior Log</td>
</tr>
</tbody>
</table>

Note. Survey 1 = assessed basic demographics, pubertal development, and knowledge and understanding; Survey 2 = assessed global self-esteem and physical education self-confidence; Survey 3 = assessed intrinsic motivation and intention to participate in athletics.
Table 2

Summary of the Invariance Tests of the Measurement Models with Respect to Sex

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$</th>
<th>$df$</th>
<th>$\Delta\chi^2$</th>
<th>$\Delta df$</th>
<th>CFI</th>
<th>SRMR</th>
<th>RMSEA (90% CI)</th>
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</thead>
<tbody>
<tr>
<td>Self-efficacy MM</td>
<td>33.80*</td>
<td>5</td>
<td>—</td>
<td>—</td>
<td>.98</td>
<td>.02</td>
<td>.12 (.08 -.16)</td>
</tr>
<tr>
<td>Self-efficacy MM (Configural)</td>
<td>38.16*</td>
<td>10</td>
<td>4.36</td>
<td>5</td>
<td>.98</td>
<td>.02</td>
<td>.12 (.08 -.16)</td>
</tr>
<tr>
<td>Self-efficacy MM (Metric)</td>
<td>39.84*</td>
<td>14</td>
<td>1.68</td>
<td>4</td>
<td>.98</td>
<td>.04</td>
<td>.10 (.06 -.13)</td>
</tr>
<tr>
<td>Self-efficacy MM (Scalar)</td>
<td>41.80*</td>
<td>19</td>
<td>1.96</td>
<td>5</td>
<td>.99</td>
<td>.04</td>
<td>.07 (.05 -.11)</td>
</tr>
<tr>
<td>Intrinsic Motivation MM</td>
<td>3.34</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td>1.00</td>
<td>.00</td>
<td>.04 (.00 -.12)</td>
</tr>
<tr>
<td>Intrinsic Motivation MM (Configural)</td>
<td>3.96</td>
<td>4</td>
<td>0.62</td>
<td>2</td>
<td>1.00</td>
<td>.01</td>
<td>.00 (.00 -.11)</td>
</tr>
<tr>
<td>Intrinsic Motivation MM (Metric)</td>
<td>5.49</td>
<td>7</td>
<td>1.53</td>
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<td>1.00</td>
<td>.03</td>
<td>.00 (.00 -.08)</td>
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<td>Intrinsic Motivation MM (Scalar)</td>
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<td>1.79</td>
<td>4</td>
<td>1.00</td>
<td>.03</td>
<td>.00 (.00 -.05)</td>
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<td>Self-esteem MM</td>
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<td>5</td>
<td>—</td>
<td>—</td>
<td>1.00</td>
<td>.02</td>
<td>.03 (.00 -.08)</td>
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<tr>
<td>Self-esteem MM (Configural)</td>
<td>9.92</td>
<td>10</td>
<td>2.79</td>
<td>5</td>
<td>1.00</td>
<td>.02</td>
<td>.00 (.00 -.08)</td>
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<tr>
<td>Self-esteem MM (Metric)</td>
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<td>14</td>
<td>4.65</td>
<td>4</td>
<td>1.00</td>
<td>.05</td>
<td>.01 (.00 -.07)</td>
</tr>
<tr>
<td>Self-esteem MM (Scalar)</td>
<td>19.37</td>
<td>19</td>
<td>4.80</td>
<td>5</td>
<td>1.00</td>
<td>.06</td>
<td>.01 (.00 -.06)</td>
</tr>
<tr>
<td>Affective Factor MM</td>
<td>119.39</td>
<td>74</td>
<td>—</td>
<td>—</td>
<td>.98</td>
<td>.04</td>
<td>.04 (.03 -.05)</td>
</tr>
<tr>
<td>Factor</td>
<td>MM (Configural)</td>
<td>MM (Metric)</td>
<td>MM (Scalar)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>-------------</td>
<td>-------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Affective Factor</td>
<td>194.13*</td>
<td>202.40*</td>
<td>211.44*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fitness</td>
<td>18.17*</td>
<td>30.22*</td>
<td>34.92*</td>
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*Denotes significance at the .05 level.
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<th>Ref</th>
<th>Estimate</th>
<th>SE</th>
<th>Ref</th>
<th>Estimate</th>
<th>SE</th>
<th>Ref</th>
<th>Estimate</th>
<th>SE</th>
<th>Ref</th>
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<td>Cognitive Factor MM (Metric)</td>
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<td></td>
<td>0.00</td>
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<td>0.00</td>
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<td></td>
<td>0.00 (.00 - .00)</td>
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<td>.05</td>
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<td>Physical Literacy MM (Configural)</td>
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<td>11</td>
<td>12.91*</td>
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<td>0.09 (.07 - .11)</td>
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</tbody>
</table>

*Note. N = 400. df = degrees of freedom; CFI = comparative fit index; SRMR = standardized root mean square; RMSEA = root mean square error of approximation; CI = confidence interval; MM = measurement model; Configural = structure invariance; Metric = path coefficient invariance; Scalar = intercept invariance. *p < .05.
Table 3

Results of the Confirmatory Factor Analyses (Measurement Models) by Sex

<table>
<thead>
<tr>
<th></th>
<th>$\chi^2$</th>
<th>df</th>
<th>$p$-value</th>
<th>CFI</th>
<th>TLI</th>
<th>SRMR</th>
<th>RMSEA (90% CI)</th>
<th>BIC</th>
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<tr>
<td>Physical Self-efficacy</td>
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<td>5</td>
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<td>.98</td>
<td>.96</td>
<td>.03</td>
<td>.13 (.08 - .19)</td>
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<td>.22</td>
<td>1.00</td>
<td>.99</td>
<td>.01</td>
<td>.05 (.00 - .15)</td>
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<td>1.01</td>
<td>.02</td>
<td>.00 (.00 - .08)</td>
<td>2578.44</td>
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<td>.98</td>
<td>.98</td>
<td>.04</td>
<td>.04 (.02 - .06)</td>
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<td>.00 (.00 - .00)</td>
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<td>.00 (.00 - .08)</td>
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<td>1.00</td>
<td>1.00</td>
<td>.00</td>
<td>.00 (.00 - .00)</td>
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<tr>
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<td>164</td>
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<td>.97</td>
<td>.97</td>
<td>.06</td>
<td>.04 (.03 - .05)</td>
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<td>SO Physical Literacy</td>
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<td>.97</td>
<td>.06</td>
<td>.04 (.03 - .05)</td>
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<td>RMSEA</td>
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<td>SO Physical Literacy</td>
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Note. Females ($n = 231$), Males ($n = 169$). $df$ = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis index; BIC = Bayesian information criterion; SRMR = standardized root mean square; RMSEA = root mean square error of approximation; CI = confidence interval; FO = first-order; SO = second-order.

*Just-identified models.
Table 4

Path Coefficients, Variance Explained ($R^2$), Average Variance Explained (AVE), and Alpha ($\alpha$) and Construct ($\Omega$) Reliabilities of the Physical Literacy Models by Sex

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<th>Factors and Items</th>
<th>Path Coefficients</th>
<th>$R^2$</th>
<th>$p$-value</th>
<th>AVE</th>
<th>$\alpha$</th>
<th>$\Omega$</th>
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<td>SO</td>
<td>FO</td>
<td>SO</td>
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<tr>
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<tr>
<td>SO Physical Literacy</td>
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<td>1.00</td>
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<td>.00</td>
</tr>
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</tr>
<tr>
<td>SO Physical Literacy</td>
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<td>.63*</td>
<td>.27</td>
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<td>.00</td>
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<td>.67**</td>
<td>.27</td>
<td>.45</td>
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<td>Affective Factor</td>
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<td>1.00**</td>
<td>—</td>
<td>1.00</td>
<td>.00</td>
<td>.00</td>
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<tr>
<td>Physical Factor</td>
<td>—</td>
<td>.73**</td>
<td>—</td>
<td>.53</td>
<td>.00</td>
<td>.00</td>
</tr>
</tbody>
</table>

Note. FO = first-order; SO = second-order.

*p < .05, **p < .01 (statistically significant variance between sexes).
Table 5

Estimated Correlation Matrix for the Physical Literacy Models and the Measured Correlates by Sex

<table>
<thead>
<tr>
<th>Latent Variables</th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
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</thead>
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<td>.61**</td>
<td>.49**</td>
<td>-.19*</td>
<td>-.09</td>
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<tr>
<td>2. SO Physical Literacy Factor</td>
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<td>—</td>
<td>.67**</td>
<td>.55**</td>
<td>-.22**</td>
<td>-.03</td>
</tr>
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<td>3. Physical Activity (Days60)</td>
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<td>.59**</td>
<td>—</td>
<td>.42**</td>
<td>-.36**</td>
<td>-.05</td>
</tr>
<tr>
<td>4. Sport Team Participation (STP)</td>
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<td>.42**</td>
<td>.37</td>
<td>—</td>
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<td>-.02</td>
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<tr>
<td>5. STSB</td>
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<td>-.21**</td>
<td>-.24</td>
<td>.08</td>
<td>—</td>
<td>.76**</td>
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<tr>
<td>6. NSTSB</td>
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<td>.04</td>
<td>-.02</td>
<td>.06</td>
<td>.73**</td>
<td>—</td>
</tr>
</tbody>
</table>

Note. Lower diagonal represents female data (n = 231), and upper diagonal represents male data (n = 169). FO = first-order; SO = second-order; STSB = screen-time sedentary behavior; NSTSB = non-screen-time sedentary behavior. *p < .05, **p < .01.

Table 6

Results of the SEM Investigating the Relationship between Physical Literacy and Interscholastic Sport Intention by Sex

<table>
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<tr>
<th></th>
<th>χ²</th>
<th>df</th>
<th>p-value</th>
<th>CFI</th>
<th>TLI</th>
<th>SRMR</th>
<th>RMSEA (90% CI)</th>
<th>BIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females (n = 231)</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>Intention on Physical Literacy Factors</td>
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<td>232</td>
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<td>.99</td>
<td>.98</td>
<td>.05</td>
<td>.03 (.01 - .04)</td>
<td>14100.55</td>
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<tr>
<td>Intention on FO Physical Literacy</td>
<td>335.34</td>
<td>245</td>
<td>.00</td>
<td>.98</td>
<td>.97</td>
<td>.06</td>
<td>.04 (.03 - .05)</td>
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<tr>
<td>Intention on SO Physical Literacy</td>
<td>326.48</td>
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<td>.98</td>
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<td>.04 (.03 - .05)</td>
<td>14080.27</td>
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<td>Males (n = 169)</td>
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<td>.97</td>
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<td>.95</td>
<td>.06</td>
<td>.06 (.05 - .07)</td>
<td>10378.39</td>
</tr>
<tr>
<td>Intention on SO Physical Literacy</td>
<td>328.29</td>
<td>246</td>
<td>.00</td>
<td>.97</td>
<td>.97</td>
<td>.06</td>
<td>.04 (.03 - .06)</td>
<td>10323.82</td>
</tr>
</tbody>
</table>

Note. FO = first-order; SO = second-order.
References


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APPENDIX A

RECRUITMENT SCRIPTS
Recruitment Script

Hello class my name is, ______________________________. I am a researcher from the University of North Texas, and I am here today to ask you to participate in a study that will examine the relations among overhand throwing competence, average time spent physically active and time you spent sitting per day, body composition, cardiorespiratory fitness, muscular strength and endurance, flexibility, physical education (PE) motivation, self-esteem, depression, and anxiety, and how these factors may directly and indirectly influence your decision or desire to participate in interscholastic sports and PE next year. Participation will require you to complete four brief surveys (Hold up an example of one the surveys), complete a physical activity and sedentary behavior log (Hold up an example of log), complete an overhand throwing assessment that requires to throw a tennis ball three times, and complete the FITNESSGRAM assessment. My assistant, __________________________, is passing out what is called an informed consent form that I would like you to give to your parents for them to read and sign if they are willing to let you participate in this study. If they are, then I would like you to return this signed form to your PE teacher before the end of the week. Do you have any questions? (Answer any questions asked or direct them to the personnel that can answer their questions.)
Hello class, my name is Gene L. Farren. I am a PhD student at the University of North Texas, and I am writing this to ask you to allow your child to participate in a study that will examine the relations among overhand throwing competence, average time spent physically active and time spent sitting per day, health-related physical fitness (i.e., body composition, cardiorespiratory fitness, muscular strength and endurance, and flexibility), and psychosocial factors (i.e., physical education motivation, self-esteem, depression, and anxiety), and how these factors may directly and indirectly influence your child’s decision to participant in interscholastic sports and physical education next year. Participation will require your child to complete three to four brief surveys, a physical activity and sedentary behavior log, an overhand throwing assessment that requires to throw a tennis ball three times, and complete the FITNESSGRAM health-related fitness assessment. Attached is the informed consent form that I would like you to read and sign if you are willing to let your child participate in this study. For participating your child will receive a UNT water bottle and/or backpack, and they will be entered into a drawing to win a 16GB Wi-Fi iPad Mini 2 and a $50.00 gift card that will be awarded at the completion of this study, which will likely be in March or April of 2017. If you have any questions the best way to contact me is via email at gene.farren@unt.edu. Thank you for your time.
APPENDIX B

INFORMED CONSENT FORMS AND STUDENT ASSENT FORM
Title of Study: Factors related to future participation in interscholastic sports and physical education in sixth grade students: A mixed-methods approach.

Investigator: Gene L. Farren, M.S., University of North Texas (UNT) Department of Kinesiology, Health Promotion, and Recreation. Supervising Investigator: Dr. Tao Zhang.

Purpose of the Study: You are being asked to allow your child to participate in a research study which involves examining the relations among overhand throwing competence, physical activity (i.e., time spent active), sedentary behavior (i.e., time spent sitting), health-related physical fitness (i.e., body composition, cardiorespiratory fitness, muscle strength and endurance, and flexibility), and psychosocial factors (i.e., motivation, self-esteem, self-worth, anxiety, and depression), and how these factors may influence your child’s decision or desire to participate in interscholastic sports and physical education (PE) in the future. Specific research questions are: 1) How does motivation to participate in PE activities relate to physical activity, sedentary behavior, body composition, cardiorespiratory fitness, self-worth, and depression?; 2) How do overhand throwing competence, physical activity, sedentary behavior, health-related physical fitness, and psychosocial factors relate to intention to participate in interscholastic sports?; and 3) How do these relations vary with respect to maturation, gender, and sport history?

Study Procedures: During your child’s regular PE class, he or she will be asked to complete four brief surveys assessing his or her sport history, exercise preference, intention to participate in interscholastic sports, motivation, self-worth, self-esteem, anxiety and depression levels, and maturational development such as growth of body hair and other puberty-related development. Occurring about one month apart, each survey will take your child about 20-30 minutes to complete. Your child will also be asked to complete a physical activity and sedentary behavior habits log. Lastly, as part of their PE class, your child will be asked to complete an overhand throwing assessment and health-related fitness assessments (e.g., FITNESSGRAM).

Foreseeable Risks: Overall, the potential risks associated with participation in this study are unlikely and of low risk. While risks associated with the physical portion of this study do not go beyond the risks associated with normal PE participation, some topics covered in the surveys (e.g., depression and anxiety) may be sensitive for some children/adolescents. However, every effort will be made to minimize all of these risks by evaluation of preliminary information relating to participants health and fitness and by careful observations during assessment. Emergency equipment and trained personnel are available to deal with unusual situations that may arise. Specifically, Gene L. Farren is First Aid/CPR/AED certified and researcher assistants (i.e., Alan Chu and Joon Lee) are trained in basic counseling. In addition, your child’s school
Benefits to the Subjects or Others: We expect this project to benefit your child by encouraging him or her to be physically active while at school and at home. Information gained from the study may provide beneficial information to you about your child’s motor skill competence, physical activity, sedentary behaviors, physical fitness, and psychosocial status. Further, the results of this study may provide valuable insights for practitioners (e.g., how to increase sport and/or physical education participation among children/adolescents), and results could facilitate the development of effective interventions aimed to increase participation in sports and physical activity by uncovering barriers and their possible solutions.

Compensation for Participants: In order to show appreciation for your child’s participation, your child will receive a UNT labeled water bottle and/or backpack that will be presented after data collection has concluded (March 2017). In addition, your child will be entered into a lottery to win a 16GB Wi-Fi iPad Mini and a $50.00 gift card. Drawings will be performed approximately one month after data collection has concluded.

Procedures for Maintaining Confidentiality of Research Records: The confidentiality of your child’s individual information will be maintained in any publications or presentations regarding this study. The data may be inspected by the Institutional Review Board (IRB) Offices at UNT and regulatory agencies as required by law. However, your child's individual responses including responses to surveys and logs will NOT be shared with school personnel or anyone other than our research team. To ensure that all information remains anonymous, stored data will NOT contain any identifiable information (e.g., child’s name) in that all data collection forms including surveys, activity monitor logs, and physical fitness records will be coded and all identifiable information will be removed. Paper data will be stored in a locked office/lab on UNT campus. Electronic data will be stored on the investigator's password-protected computer for three years. Only members of the research team will have access to the confidential data. The results of this study may be published, but these results will NOT include your child's name or any other information that would in any way personally identify your child.

Questions about the Study: If you have any questions about the study, you may contact Gene L. Farren at (940) 565-3218 or via email at gene.farren@unt.edu or you may contact Dr. Tao Zhang at (940) 565-3415 or via email at tao.zhang@unt.edu.

Review for the Protection of Participants: This research study has been reviewed and approved by the UNT Institutional Review Board (IRB). The UNT IRB can be contacted at (940) 565-4643 with any questions regarding the rights of research subjects.

Research Participants’ Rights: Your signature below indicates that you have read or have had read to you all of the above and that you confirm all of the following:

- You have read and understand the above information and Gene L. Farren has answered all of your questions, and you have been told the possible benefits and the potential risks and/or discomforts of the study.
• You understand that you do not have to allow your child to take part in this study, and your refusal to allow your child to participate or your decision to withdraw him/her from the study will involve no penalty or loss of rights or benefits. The study personnel may choose to stop your child’s participation at any time.
• You understand why the study is being conducted and how it will be performed.
• You understand your rights as the parent/guardian of a research participant and you voluntarily consent to your child’s participation in this study, and you have been told you will receive a copy of this form.

Printed Name of Child

Printed Name of Parent or Guardian

Signature of Parent or Guardian Date

For the Student Investigator or Designee: I certify that I have reviewed the contents of this form with the parent or guardian signing above. I have explained the possible benefits and the potential risks and/or discomforts of the study. It is my opinion that the parent or guardian understood the explanation.

Signature of Student Investigator Date
Child Assent Form

You are being asked to be part of a research project being done by the University of North Texas Department of Kinesiology, Health Promotion, and Recreation.

This study involves examining the relations among overhand throwing competence, physical activity, sedentary behavior (i.e., time spent sitting), health-related physical fitness (i.e., cardiorespiratory fitness, body composition, muscle strength, endurance, and flexibility), and psychosocial factors (i.e., motivation, self-esteem, self-worth, anxiety, and depression), and how these factors may influence your decision or desire to participate in interscholastic sports and physical education in the future.

You will be asked to complete four brief surveys assessing your sport history, exercise preference, intention to participate in interscholastic sports, motivation, self-worth, self-esteem, anxiety and depression levels, and maturational development such as growth of body hair and other puberty-related development. Occurring about one month apart, each survey will take you about 20-30 minutes to complete. In addition, you will be asked to complete a physical activity and sedentary behavior habits log. Lastly, as part of their PE class, you will be asked to complete an overhand throwing assessment and health-related fitness assessments (e.g., FITNESSGRAM).

If you decide to be part of this study, please remember you can stop participating any time you want to.

If you would like to be part of this study, please sign your name below.

______________________________________________  
Printed Name of Child

______________________________________________  
Signature of Child  Date

______________________________________________  
Signature of Student Investigator  Date


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https://www.amle.org/BrowsebyTopic/WhatsNew/WNDet/TabId/270/ArtMID/888/ArticleID/324/Middle-Level-Interscholastic-Sports-Programs-.aspx


Chatzisarantis (Eds.), *Intrinsic motivation and self-determination in exercise and sport* (pp. 1–19). Champaign, IL: Human Kinetics.


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