The influence of instructional climates on motor skill competence, physical activity behaviors, and psychosocial variables of 2nd grade students

by

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Abstract

The purpose of this study was to determine the effect of two instructional climates (mastery, performance) on: a) motor skill competence, b) physical activity during physical education and after-school, and c) psychosocial variables (i.e., attitude toward and enjoyment of physical activity and physical education, perceived physical competence) in 2nd grade students. The Test of Gross Motor Development- 2 (Ulrich, 2000) assessed fundamental motor skills prior to, following (post-intervention), and 10-weeks after the intervention (retention). There was no significant main effect of climate ($F(1, 43) = .001$, $p = .98$, $\eta 2 < .001$) or interaction between climate and time ($F(1, 43) = 1.2$, $p = .29$, $\eta 2 = .03$). There was a main effect of time ($F(1, 43) = 153.6$, $p < .001$, $\eta 2 = .78$). Planned contrasts indicate that post-TGMD score was significantly higher than pre-TGMD score ($F(1, 43) = 171.5$, $p < .001$, $\eta 2 = .8$) and there was no significant difference between post- and retention TGMD score ($F(1, 43) = .34$, $p = .56$, $\eta 2 = .008$). In terms of direct observation, an independent samples Kruskal-Wallis test indicated a significant difference between climates on percent of class time students spent in moderate-to-vigorous physical activity (MVPA; $H(2) = 8.53$, $p = .014$). Pairwise comparisons indicate that students assigned to the mastery ($p = .011$) and the performance ($p = .023$) climates spent significantly more time in MVPA compared to typical physical education. There was no significant difference between mastery and performance climates ($p = .62$). A mixed between-within subjects ANOVA indicated no significant main effect of climate ($F(1, 22) = .94$, $p = .343$, $\eta 2 = .041$), time ($F(1, 22) = .34$, $p = .54$, $\eta 2 = .018$), or interaction between climates and time ($F(1, 22) = .99$, $p = .33$, $\eta 2 = .043$). There were no significant differences between or within climates for any of the psychosocial variables at any time point. The findings support the need for physical education reform in the elementary school setting as it relates to promoting motor skill competence and decreasing class time spent in management tasks.

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Chapter I

Introduction

The healthy development of children is dependent upon the maturation of five domains that are influenced, to varying degrees, by biological and environmental factors. The cognitive, social, emotional, physical, and motor domains are equally important and significant and develop in conjunction with each other, rather than independently. For example, research has suggested a relationship between early motor development to later cognitive functioning (Piek, Dawson, Smith, & Gasson, 2008), making the motor domain multifaceted and critical to the overall health and development of children.

One component of motor development is the learning of fundamental motor skills (i.e., gross motor skills). Fundamental motor skills are defined as “motor skills that involve the large, force-producing muscles of the trunk, arms, and legs” (Clark, 1994, p. 245). Fundamental motor skills are typically classified as object control and locomotor skills (Haywood & Getchell, 2009). Object control skills involve the transporting, intercepting, or projecting of objects such as throwing, catching, dribbling, kicking, underhand rolling, and striking. Locomotor skills include running, jumping, hopping, leaping, galloping, and sliding as different movements to transport the body from one location to another (Ulrich, 2000). The development of fundamental motor skills allows children to independently navigate their environment (Clark, 2007; Robinson & Goodway, 2009) and contributes to the overall health of children (Piek et al., 2008).

Fundamental motor skills are the building blocks of more complex movements (Clark & Metcalfe, 2002; Seefeldt, 1980) and the early childhood years are a critical time for their development (Clark, 1994). Fundamental motor skills enable children to apply basic motor skills to participate in sports and games that require more advanced movements during the school-age years and throughout the lifespan (Clark, 1994). For example, to participate in a game of baseball or softball, individuals need basic competence in running, catching, throwing, and striking. Evidence supports the association between fundamental motor skill competence and physical activity (Fisher et al., 2005; Houwen, Hartman, & Visscher, 2008; Morgan et al., 2008; Okely et al., 2001a; Robinson, Wadsworth, & Peoples, 2012; Williams et al., 2008). Emerging evidence also suggests that overweight or obese children tend to exhibit less competence in fundamental motor skills (Graf et al., 2004; Logan & Getchell, 2010; Logan, Scrabis-Fletcher, Modlesky, & Getchell, 2011; Williams et al., 2008) and are less physically active compared to typical weight peers (Bayer, Bolte, Morlock, Rückinger, & von Kries, 2008; Robinson, Wadsworth, & Peoples, 2012; Trost, Sirard, Dowda, Pfeiffer, & Pate, 2003). Thus, the development of fundamental motor skills in children could play a pivotal role in the prevention of childhood obesity.

Physical activity behaviors are established in childhood and remain relatively consistent through adolescence and into the adult years (Kelder, Perry, Klepp, & Lytle, 1994; Pate, Baranowski, Dowda, & Trost, 1996). National initiatives suggest that children should participate in at least 60 minutes of daily physical activity (National Association for Sport and Physical Education [NASPE], 2004). This guideline is also recommended by the Centers for Disease Control and Prevention (2010) in order for children to improve overall health, increase fitness, strengthen bones and muscles, maintain a healthy weight, and reduce the risk of chronic diseases. However, only 42% of elementary students meet the recommendation to engage in at least 60 minutes of daily physical activity (Troiano et al., 2008).

Physical education programs reach millions of children and are an ideal setting to implement school-based interventions that focus on physical activity and motor skill development. Interventions in physical education are effective in increasing physical activity during physical education class (Harrell, McMurray, Gansky, Bangdiwala, & Bradley, 1999; Luepker et al., 1996; Sallis et al., 1997; Simons-Morton, Parcel, Baranowski, Forthofer, & O'Hara, 1991). It is recommended that children receive a minimum of 30 minutes of daily physical education (NASPE, 2009a). Even if children are physically active for 100% of a 30 minute time period, they will not meet the daily recommendation of 60 minutes of physical activity exclusively through participation in physical education class. It is necessary for physical activity to occur outside of physical education. Yet, limited research has focused on the influence of interventions on physical activity outside of physical education. Evidence suggests limited to no effect of physical activity interventions in the physical education setting on out-of-school physical activity behavior of elementary (Sallis et al., 1997), middle (Wilson et al., 2011) and high school students (Dale, Corbin, & Cuddihy, 1998). Furthermore, physical activity interventions often ignore other goals of physical education (i.e. motor skill development).

With the national physical activity recommendations not being met, it is imperative to develop effective strategies that encourage children to establish and maintain healthy patterns of physical activity, while promoting motor skill competence in physical education environments. Furthermore, most interventions are curriculum-based and not grounded in theories of motivation that could ultimately influence individuals' desire to engage in physical activity. Therefore, it is essential to understand if school-based physical education interventions are effective in establishing positive physical activity behaviors outside of the intervention setting to truly determine its effectiveness. A potential strategy to increase physical activity outside of the physical education setting is by increasing intrinsic motivation of students through participation in a physical activity intervention that is grounded in motivation theory.

Achievement motivation is defined as “the energization and direction of competence-based affect, cognition, and behavior” (Elliot, 1999, p. 169). Thus, there is a dynamic relationship between thoughts, feelings, and behaviors that influence competence-seeking actions. Achievement goals are the purposes and reasons for task engagement (Elliot, 1999). The adoption of certain types of goals establishes “…a framework for how individuals interpret and experience achievement settings” (Elliot, 1999, p. 169). Early achievement goal theories emphasized two types of goals that guide behavior in achievement situations; mastery (i.e., learning) and performance goals (Ames & Archer, 1988; Elliott & Dweck, 1988). A mastery goal orientation emphasizes the learning process and encourages the belief that effort leads to competence. Also, performance is based on comparison to self-referenced standards (Ames, 1992a, b; Dweck & Leggett, 1988). If mastery goals are salient then children tend to use adaptive motivational strategies, seek out challenges, and display positive outcomes of cognition and affect such as enjoyment (Ames & Archer, 1988).

In contrast, a performance goal orientation is associated with the desire to demonstrate competence to others and views ability level as the contributing factor to the development of competence. Also, performance is based on comparison to normative standards (i.e., typical performance of peers; Ames & Archer, 1988). If performance goals are emphasized, individuals tend to exhibit maladaptive motivational strategies such as attributing failure to ability, negative affect, and a decrease in task persistence (Ames, 1992b; Ames & Archer, 1988; Elliott & Dweck, 1988). Achievement goal theory research has emphasized the person and the situation as two sources contributing to goal formation. Research in the classroom has emphasized the situational perspective and has provided evidence that the environment can be manipulated to emphasize a mastery or performance goal orientation (Ames 1992a, b; Ames & Archer, 1988).

Over the past two decades, motor behaviorists have successfully adapted the situational view of achievement goal theory to design and implement interventions in physical education settings. A mastery climate encourages the adoption of mastery goals and is theoretically grounded in achievement goal theory. In a mastery climate, children are provided opportunities to make choices, involve themselves in leadership roles, participate in a variety of learning experiences and peer interactions, and are allowed to self-select the difficulty and length of task engagement. Researchers suggest that a mastery climate increases intrinsic motivation (Ames, 1992a), that will increase interest and enjoyment which leads to more effort and persistence in an activity (Ames, 1992b; Deci & Ryan, 1985; Elliot & Dweck, 1988).

There are three important aspects of a mastery climate that may contribute to an increase in intrinsic motivation: promotion of perceived competence, support for autonomy, and an increase in enjoyment. A mastery climate increases perceived competence of children compared to other climates (Robinson, Rudisill, & Goodway, 2009; Valentini & Rudisill, 2004b). It is theorized that, as children become more proficient in performing a task they will experience higher self-perceptions that increases their motivation to learn how to move. Hauser-Cram (1998) suggested that a mastery approach increases motivation due to providing children with optimal control over the learning environment (i.e., support for autonomy). Research indicates better attitudes, higher enjoyment, and more positive affect after mastery experiences (Ames & Archer, 1988; Barron & Harackiewicz, 2001; Diener & Dweck, 1978; 1980; Elliot & Dweck, 1988). The physical activity literature indicates that higher perceived competence (Ferrer-Caja & Weiss, 2000; Sollerhed, Apitzsch, Råstam, & Ejlertsson, 2008), support for autonomy (Chatzisarantis & Hagger 2009; Wang, Chia, Quek, & Liu, 2006), and an enjoyment towards physical activity (DiLorenzo, Stucky-Ropp, Vander, & Gotham, 1998; Dishman et al., 2005) is associated with greater physical activity engagement. Thus, if an intervention is able to increase students' perceived competence and enjoyment of physical education and physical activity, then this may increase intrinsic motivation to participate in physical activity outside of the school setting (Wallhead & Buckworth, 2004).

Participation in mastery-oriented interventions is associated with an increase in gross motor skill competence, greater skill retention (Robinson & Goodway, 2009; Valentini & Rudisill, 2004b), and higher physical activity levels during intervention settings (Parrish, Rudisill, & St. Onge, 2007; Wadsworth et al., 2010). However, studies that examined the effect of instructional climates on motor skill competence have focused on preschool and kindergarten children. It is important to determine if findings can be replicated in older children. Evidence also indicates that children participating in a mastery climate demonstrate higher perceived competence at the conclusion of the intervention compared to other teaching styles (Robinson, Rudisill, & Goodway, 2009; Valentini & Rudisill 2004b).

A limitation of previous research is that mastery-based interventions have measured only one psychosocial variable, perceived competence. It is important to also measure enjoyment towards physical education and physical activity. Previous studies were not designed to change measures of affect. Rather, they were designed to capture a snapshot of students' physical activity behaviors and compare differences between two instructional climates during physical education. To expect change in enjoyment of physical education and physical activity, the intervention needs to be conducted every day to ensure that students do not experience a teaching climate that is not part of the assigned treatment or comparison condition. Due to the intensive nature of intervention studies, most occur on two to three days a week. Thus, it would be impossible to measure changes of affect and determine the cause. Wadsworth et al. (2010) conducted an intervention every day for 10 days and found that physical activity was higher for students participating in a mastery climate compared to a performance climate. However, due to the relatively short duration of the study, assessments of motor skill competence, after-school physical activity, and psychosocial variables were not completed.

It is unclear if the positive benefits of a mastery climate will translate to an increase of intrinsic motivation to participate in physical activity outside of the intervention setting. To date, no studies have examined this question. In addition, no research has examined the effect of participation in a mastery-oriented physical education intervention on students' attitude, enjoyment, and affect toward physical activity.

Statement of Purpose

The primary purpose of this dissertation was to determine the effect of two instructional climates (mastery, performance) on a) motor skill competence, b) physical activity behavior during physical education and after-school, and c) psychosocial variables (i.e., attitude toward and enjoyment of physical activity and physical education, perceived physical competence) of elementary school-aged children.

Research Questions and Hypotheses

Research Question #1: What was the effect of two instructional climates (mastery, performance) on motor skill competence at post-intervention and following a retention period?

Hypothesis #1: Students assigned to the mastery climate intervention will demonstrate significantly higher motor skill competence.

Research Question #2: What was the effect of instructional climate (typical physical education, mastery and performance climates) on students' physical activity behaviors during physical education?

Hypothesis #2: Students assigned to the mastery climate intervention will engage in significantly more physical activity during physical education.

Research Question #3: What was the effect of two instructional climates (mastery, performance) on students' after-school physical activity behaviors?

Hypothesis #3 Students assigned to the mastery climate intervention will engage in significantly more after-school physical activity.

Research Question #4: What was the effect of two instructional climates (mastery, performance) on students' attitude toward physical activity and physical education?

Hypothesis #4: Students assigned to the mastery climate will show significantly higher positive attitudes toward physical activity and physical education.

Research Question #5: What was the effect of two instructional climates (mastery, performance) on students' enjoyment of physical education and physical activity?

Hypothesis #5: Students assigned to the mastery climate will show significantly higher enjoyment of physical education and physical activity.

Research Question #6: What was the effect of two instructional climates (mastery, performance) on students' perceived physical competence?

Hypothesis #6: Students assigned to the mastery climate will show significantly higher perceived physical competence.

Definition of Terms

Achievement goal theory: Identifies the goals, purposes, and reasons that direct achievement-related behaviors (Maehr & Zusho, 2009).

Daily step counts: The average number of steps accumulated throughout the day (Beighle & Pangrazi, 2006).

Developmentally appropriate: Educational lessons provided to children should consider the environment, equipment, and constraints of the activities to ensure that all aspects are congruent with children's physical, social, and cognitive development (Gagen & Getchell, 2008).

Feedback: Verbal statements provided by teachers to students regarding their performance (Rink, 2010).

Fundamental motor skills (FMS): The term FMS is synonymous with gross motor skills. FMS require the activation of large muscle groups and are typically classified as object control and locomotor skills (Haywood & Getchell, 2009).

Locomotor skills: Movements that involve transporting the body from one location to another such as running, jumping, hopping, leaping, galloping, and sliding (Ulrich, 2000).

Mastery climate: A learning environment that allows individuals to make choices with regard to task engagement through the manipulation of the TARGET structure.

Mastery-goal orientation: Individuals who adopt this type of orientation desire to increase competence through learning for the purpose of mastering tasks and hold the view that effort and hard work lead to positive outcomes (Elliot & Dweck, 1988).

Metabolic equivalent (MET): A unit of measurement that describes the energy expenditure of different qualifications of physical activity. For example, one MET is the resting metabolic rate during which no activity is performed (Ainsworth et al., 2000).

Moderate-intensity physical activity: Bodily movement that results in energy expenditure of 3-6 METS (Haskell et al., 2007).

Motor development: The change in motor behavior across the lifespan and the processes that underlie the change (Clark, 1994).

Object control skills: Movements that involve transporting, intercepting, or projecting of objects such as throwing, catching, dribbling, kicking, underhand rolling, and striking (Ulrich, 2000).

Performance-goal orientation: Individuals who adopt this type of orientation desire to increase competence for the purpose of performing better than others. Ability is viewed as the cause of success and/or failure (Elliot & Dweck, 1988)

Performance-oriented climate: A learning environment that is teacher-centered and does not allow students to make decisions related to their engagement (Elliot & Dweck, 1988).

Physical Activity: Bodily movement produced by skeletal muscles that requires energy expenditure (World Health Organization, 2010).

TARGET structure: Task, authority, recognition, grouping, evaluation and time. Each of these structures can be manipulated to emphasize different types of learning environments (Epstein, 1988; 1989).

Vigorous-intensity physical activity: Bodily movement that results in energy expenditure of greater than 6 METS (Haskell et al., 2007).

Delimitations

The delimitations of this study were:

1. Participants of this study were elementary school-aged children enrolled in the 2nd grade of a public school located in a rural, southeast town in the United States. Students were primarily African-American.
2. An expert in motor development implemented the intervention, rather than a physical education teacher.

3. The type of climates implemented (mastery, performance). There are other types of instructional climates that could have been implemented.
4. Due to the school schedule, the motor skill intervention met for five days per week for five weeks.

Limitations

Limitations associated with this study included:

1. The experimental design of this study included a comparison group (performance climate) rather than a true control group (i.e., no treatment).
2. An intervention implemented for a shorter or longer period may have produced different results. The teacher to child ratio was approximately 25:1
3. Due to the physical education class schedule, each intervention session dedicated a relatively short amount of time to instruction (i.e., 20 minutes). This length of time is similar to other intervention studies found in the literature and the typical amount of physical education time allocated to skill instruction on a given day. However, a shorter or longer period dedicated to motor skill instruction may have produced different results.
4. The primary researcher was the lead teacher for the intervention. Experimenter effects were possible. However, measurement of climate fidelity and teacher feedback monitored these effects and none were detected.
5. Assessment of students' engagement in motor skill practice outside of the intervention setting was not possible.

Chapter II

Review of Literature

The primary purpose of this dissertation was to determine the effect of two instructional climates (mastery, performance) on a) motor skill competence, b) physical activity behavior during physical education and after-school, and c) psychosocial variables (i.e., attitude toward and enjoyment of physical activity and physical education, perceived physical competence) of elementary school-aged children. This section will provide a review of literature including the following topics: achievement goal theory, motor skill interventions, physical activity (currents rates of participation, methods of assessment, interventions, correlates of engagement including psychosocial variables).

Achievement goal theory

Background

White (1959) proposed the concept of effectance motivation that suggested individuals have an innate need to engage and acquire competence within the environment. The purpose of engagement is to develop competence which leads to feelings of efficacy, or self-worth. White (1959) suggested competence is obtained through exploratory behaviors that "…show direction, selectivity, and persistence in interacting with the environment" (p. 329). At the time of this publication, traditional drive theories dominated the literature in explaining human and animal motivation and behavior. This landmark study offered a new perspective of motivation that emphasized the internal desire for individuals to *master* the environment. Similar to effectance motivation, the drive towards competence is at the center of achievement goal theory.

It is important to provide operational definitions of constructs essential to achievement goal theory. Achievement motivation is defined as "the energization and direction of competence-based affect, cognition, and behavior" (Elliot, 1999, p. 169). A dynamic relationship exists between thoughts, feelings, and behaviors that influence competence-seeking actions. Achievement goals are the reasons for "…task engagement, and the specific type of goal adopted is posited to create a framework for how individuals interpret and experience achievement settings" (Elliot, 1999, p. 169). Furthermore, achievement goal theory identifies the "kinds of goals (purposes or reasons) that direct achievement related behaviors (Maehr & Zusho, 2009, p. 77). The adoption of certain achievement goals initiates and maintains behaviors in specific ways. Achievement goal theory primarily emerged from social-cognitive theory and attribution theory (Maehr & Zusho, 2009).

There are several assumptions of achievement goal theory (Maehr & Zushu, 2009). Motivation is a process. Specifically, the learning process is emphasized and the beliefs that lead to goal adoption and the subsequent behaviors that influence task engagement are all a part of this process. Also, both personal and situational influences continually shape the learning process. It is also assumed that competence is the goal of achievement-related behavior. This concept dates back to White (1959) and the emphasis placed on competence in effectance motivation. Recent research in achievement goal theory still emphasizes the central role of competence in the adoption of a goal orientation (Senko & Harackiewicz, 2005). Another assumption is that the preference for certain goals creates motivational systems (Maehr & Zushu, 2009). There are cognitions, behaviors, and states of affect that are associated with certain goal orientations. It is the dynamic interaction of these factors that guide, shape, and readjust the motivational system. Finally, goal orientations are connected with self-related processes such as self-awareness and the sense of self (Maehr & Zushu, 2009).

Two-goal and multiple goal perspective

Early achievement goal theories emphasized two types of goals that guide behavior in achievement situations; mastery (i.e. learning) and performance goals (Ames & Archer, 1988; Elliott & Dweck, 1988). A mastery goal orientation emphasizes the learning process and leads to beliefs that effort leads to competence. Also, performance is based on comparison to self-referenced standards (Ames, 1992a, b; Dweck & Leggett, 1988). If mastery goals are salient then children tend to use adaptive motivational strategies, seek out challenges, and display positive outcomes of cognition and affect such as enjoyment (Ames & Archer, 1988). These results were found for children regardless of perceived ability level.

In contrast, a performance goal orientation is associated with the desire to demonstrate competence to others and views ability level as the contributing factor to the development of competence. Also, performance is based on comparison to normative standards (i.e. others; Ames & Archer, 1988). If performance goals are emphasized, individuals tend to exhibit maladaptive motivational strategies such as attributing failure to ability, negative affect, and a decrease in task persistence (Ames, 1992b; Ames & Archer, 1988; Elliott & Dweck, 1988). In, Elliott & Dweck's (1988) definition of performance goals, individuals also tend to engage in behaviors that reaffirm competence (i.e. ability level) and avoid situations where failure is possible and/or likely. In contrast to the traditional two-goal approach of achievement goal theories, recent research has emphasized a multiple goals approach which separates mastery and performance goals into approach and avoidance goals within each construct.

Approach and avoidance behaviors are directed by a positive (desirable) or negative (undesirable) event or possibility, respectively (Maehr & Zusho, 2009). Traditional mastery and performance goals are driven by approach behaviors. However, Elliott & Dweck (1988) recognized the existence of an avoidance of failure component of performance goals. From a multiple goals perspective, mastery-avoidance and performance-avoidance goals were identified. Researchers initially extended the two-goal model to a three-goal model that included mastery, performance-approach, and performance-avoidance goals (Elliot & Church, 1997; Elliot & Harackiewicz, 1996). Performance-approach goals lead to behaviors that seek favorable judgments from others. Performance-avoidance goals initiate behaviors that avoid situations that may result in unfavorable judgments from others (Elliot & Church, 1997).

A further extension of the multiple goals perspective identified mastery-avoidance goals. Mastery-avoidance goals are emphasized by individuals who are still driven to learn for the purpose of mastery and performance is self-referenced, however, the focus is on avoiding negative outcomes (Elliot & McGregor, 2001). Individuals who adopt mastery-avoidance goals are often “perfectionists who strive to avoid making any mistakes or doing anything wrong or incorrectly” (Elliot & McGregor, 2001, p. 502). In a series of three studies, Elliot & McGregor (2001) provided empirical support for the four-goal perspective. Other research has supported the three- and four-goal approaches of achievement goal theory (Elliot, 1999; Elliot & McGregor, 2001).

Traditional views of achievement goal theory suggest that mastery and performance goals are adaptive and maladaptive, respectively. Pintrich (2002) provides evidence for the multiple goal perspective of achievement goal theory and that performance goals can be adaptive in certain situations. Children enrolled in the 8^{th} and 9^{th} grades (n = 150) completed the Motivated Strategies for Learning Questionnaire at the beginning and end of 8^{th} grade, and at the beginning of the 9^{th} grade. An additional questionnaire to measure goal orientation was also completed. Results indicated that children who adopted a high mastery/high performance goal orientation performed just as well, if not slightly better on outcomes compared to children who adopted a high mastery/low performance goal orientation. Thus, performance-approach goals did not reduce the positive outcomes typically demonstrated by those who adopt only a mastery-goal orientation. However, evidence was not provided that the adoption of both types of goals exceeded the benefits of children who adopt only mastery goals. Children that adopted low mastery and high performance goals exhibited maladaptive motivational patterns and experienced lower outcomes. This finding agrees with traditional goal orientation research. Finally, children who scored low on mastery and performance goal orientations also displayed maladaptive motivational patterns and experienced lower outcomes. Other recent research has continued to examine the potential benefits of performance goals (Barron & Harackiewicz, 2001; Harackiewicz, Barron, & Elliot, 1998) and is an interesting future direction of achievement goal theory research. The adoption of mastery and performance goals results in individuals exhibiting positive and negative, respectively, motivational strategies to engage in a learning environment.

Sources of Goals: Person and the Situation

Achievement goal theories have emphasized two different perspectives of where goal formulation resides; the person or the situation. Although goal theories tend to emphasize one source of goals more than the other, most researchers acknowledge that it is an interaction between the two sources that shape goal-directed behavior (Maehr & Zusho, 2009). Initial research that emphasized the person as the source of goals found that when confronted with failure, children exhibited either a helpless or mastery-oriented response (Diener & Deck, 1978; 1980). The helpless response leads to attributions of failure due to ability level and lower expectations of future outcomes (Diener & Dweck, 1978; 1980). The mastery-oriented response generally did not include attributions for failure. Rather, these children focused on effort, engaged in solution-directed behavior, and focused on strategies to improve performance (Diener & Dweck, 1978).

Elliott and Dweck (1988) conducted a study that included fifth-grade children (n = 101) and experimentally manipulated the salience of goal orientations to further understand the findings of Diener & Dweck (1978; 1980). The salience of mastery and performance goals and the perceived ability of participants were manipulated (Elliott & Dweck, 1988). There were four conditions: mastery/high ability, mastery/low ability, performance/high ability, and performance/low ability. Children's perceived ability level was manipulated through feedback during a pattern recognition task. To emphasize mastery or performance goals, children were presented with two boxes to choose from (although each held an identical item-discrimination task). The contents of one box were described to emphasize performance goals. Children were told that learning was not likely and that their performance would be filmed and evaluated by experts. Furthermore, children were told that their performance would be compared to others. The other box was described to emphasize mastery goals. Children were told that they would learn new things, regardless if any mistakes were made. Also, children were told that learning this task may lead to improvement in school. There was no mention of filming or comparing their performance to others.

Children chose a box and completed the item-discrimination task. Children in the performance/low ability condition responded with maladaptive learning strategies, failure attribution, and negative affect (Elliott & Dweck, 1988). This response is similar to children who displayed the learned helpless response in the Diener & Dweck (1978; 1980) studies. Children in the performance/high ability condition responded similar to the mastery-oriented response. However, these children were not interested in learning new skills and avoided public failure. When the mastery goal orientation was emphasized, regardless of perceived ability level, children exhibited typical mastery-oriented responses. Researchers concluded that achievement goals are influential determinants of children's behavior patterns (Elliott & Dweck, 1988). Other researchers have emphasized the importance of the person in adopting either mastery or performance-oriented goals (Dweck & Leggett, 1988; Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002).

Research in the classroom has emphasized the situational perspective and has provided evidence that the environment can be manipulated to emphasize a mastery or performance goal orientation (Ames 1992a, b; Ames & Archer, 1988). Mastery motivation is emphasized when "…value is placed on the process of learning through the emphasis on meaningful learning, self-referenced standards, and opportunities for self-directed learning" (Ames, 1992b, p. 266). Ames & Archer (1988) administered a questionnaire to determine eighth- through eleventh-grade children's perceptions of the classroom goal orientation (*n* = 176). The questionnaire also determined children's use of effective learning strategies, task choices, attitude, and causal attributions of outcomes. Children who perceived the classroom setting as encouraging a mastery goal orientation "…were more likely to report using effective learning strategies, prefer tasks that offer challenge, like their class more, and believe that effort and success covary" (Ames & Archer, 1988, p. 264). These results were found regardless of perceived ability level. As expected, children who perceived the classroom setting as encouraging a performance goal orientation attributed failures to ability level. This study provided evidence that the environment influences the adoption of goal orientations.

TARGET structure

Furthermore, Epstein (1988, 1989) and Ames (1992b) identified six dimensions of the learning environment that could be manipulated to emphasize mastery motivation. The six dimensions are known as the TARGET structure and include *task, authority, recognition, grouping, evaluation,* and *time*. See Table 1 for detailed information of each aspect of TARGET.

Table 1. The TARGET structure is described and a theoretical description of how a mastery climate emphasizes each is provided.

Aspect of TARGET	Description	Mastery Climate
Task	Task refers to the design and presentation of the learning activities and environment (Ames 1992a, b).	Activities should include a variety of tasks that differ in difficulty to provide an opportunity for learners of all skill and ability levels to be successful (Epstein, 1989). The learner should find the tasks challenging, interesting, and be able to make his/her own decisions as it relates to task engagement.
Authority	Authority relates to the interaction of the child and teacher in the decision-making process within the learning environment (Epstein, 1989).	Learners are provided decision-making opportunities with regard to engagement. This shifts responsibility for learning from an adult to the child and supports autonomy.
Recognition	Recognition focuses on informal and formal rewards, incentives, and praise that are used and distributed by teachers to facilitate motivation (Ames 1992a, b).	Effort, progress, and achievement are recognized privately to each and every learner, and not to the group as a whole. When *recognition* is private, the learner's sense of pride and satisfaction is derived from doing his/her best and not from outperforming others.
Grouping	The classroom environment is an extension of society where individual differences in ability, experience, gender, and background are often used to structure grouping patterns.	The formation of groups is determined by the learners. Groups are created and disbanded using a flexible and dynamic process. This will allow the formation of heterogeneous cooperative groups that foster peer interaction and use individual and group activity to encourage learners to work effectively with others (Epstein, 1989).
Evaluation	This structure focuses on methods that are used to assess, monitor, judge, and measure the learners' behavior and progress.	Evaluation is based on improvement, personal progress, participation, effort, and mastery of learning (Ames 1992a, b). Evaluation should focus on the process of acquiring knowledge (i.e. learning) and developing skills.
Time	This structure embodies the appropriateness of the workload, the pace of instruction, and time allotment for learners to complete activities and assignments (Epstein,	Learning experiences are tailored to the needs of individuals. Learners are allowed to self-direct their own pace and are not determined by the teacher or the progress of other students (Epstein, 1989). There is no set time allocated to a specific skill, rather, each child spends different amounts of time engaged in

	1989).	skills based on his/her individual needs and preferences.

In practice, all of the structures are intertwined and for any given task, certain structures may be emphasized more than others. For example, for some tasks, children must work alone and the grouping structure is not a factor. However, children could still be provided authority in the *task* and *time* aspects of the lesson. The TARGET structure provides guidelines to facilitate a child-centered learning approach and encourages the adoption of a mastery goal orientation. This approach recognizes that many individual differences exist in any group of children and provides a learning environment that offers opportunities for learning and success for all individuals.

Mastery-goal orientation and motor skill interventions

Over the past two decades, motor behaviorists have adapted the situational view of achievement goal theory to design and implement motor skill interventions. The purpose of motor skill interventions is to increase competence in gross motor skills such as running, jumping, throwing, and catching. Mastery or performance goals have been emphasized in the intervention setting by manipulating the learning climate based on the TARGET structure. A performance climate is teacher-centered and children are not provided opportunities to contribute to the decision-making process regarding engagement. Children are instructed to engage in specific tasks for a predetermined amount of time. Children are only provided only one level of difficulty for tasks. Also, children are not permitted to choose who to engage with during the intervention. Performance is recognized publicly and evaluation is based on comparison to normative standards. A mastery climate is a child-centered learning experience and encourages children to independently navigate the environment by choosing the task, level of task difficulty, the amount of time to spend engaged in each task, and which peers to engage with during an intervention. Also, performance is recognized privately and evaluation is based on self-referenced standards. Each type of climate is designed based on the TARGET structure to emphasize either mastery or performance goals.

This is a description of a motor skill intervention session that promotes a mastery climate: *After the opening group activity, the teacher introduces the activities and their objectives to the entire class. The teacher provides a demonstration (both child and teacher), identifies the critical elements and cues of the skills, and checks for student understanding. The children are then released to choose their own pathway from the stations and activities that are available. For example, Michelle decided to spend 6 minutes at the kicking station at a low level of difficulty. She then moved to the dribbling station where she practiced for about 4 minutes at a moderate level of difficulty. Michelle experienced a great deal of success at kicking and decided to float back to the station. She now spent 5 more minutes practicing kicking at a higher degree of difficulty (e.g., the size of the ball is smaller) and did not experience a high degree of success. The low degree of success, prompted Michelle to move back to the dribbling station for 4 minutes but she was not challenged by the task. Michelle then returned to the higher degree of difficulty for kicking for the remaining 5 minutes in the motor skill session. At the end of the session, Michelle spent a total of 24 minutes practicing different motor skills but the time she spent on each skill varied based on the her individual decisions (e.g., kicking, 16 minutes and dribbling, 8 minutes) and the level of difficulty at each station (easy to hard).*

Summary

Participation in mastery-oriented interventions is associated with an increase in skill competence (Robinson & Goodway, 2009; Valentini & Rudisill, 2004a, b), physical activity (Wadsworth et al., 2010), perceived competence, and greater motor skill retention (Robinson, Rudisill, & Goodway, 2009; Valentini & Rudisill 2004b) compared to performance-oriented interventions. Despite these studies there are a few potential directions of future research. First, it is unknown whether physical activity engagement is influenced outside of the intervention setting. Second, no research has examined the effect of participation in a mastery-oriented motor skill intervention on children's attitude, enjoyment, and affect. Previous research in education indicates better attitudes, higher enjoyment, and more positive affect after mastery experiences (Ames & Archer, 1988; Barron & Harackiewicz, 2001; Diener & Dweck, 1978; 1980; Elliot & Dweck, 1988). It is important to determine if these findings can be replicated in the motor domain.

It is important to develop research-based strategies to increase physical activity. Research suggests mastery environments increase intrinsic motivation which leads to greater effort and task persistence (Ames, 1992b; Elliot & Dweck, 1988). It is hypothesized that participation in a mastery-oriented motor skill intervention also increases physical activity outside of the intervention setting. However, no studies have examined this hypothesis.

Motor skill interventions

Background

Motor competence describes an overall level of functioning or skillfulness in a variety of aspects of the motor domain. At a specific level, the motor domain can be separated into motor abilities and gross/fine motor skills. Burton and Miller (1998) define motor abilities as "…general traits or capacities of an individual that underlie the performance of a variety of movement skills" (p. 43). Examples of motor abilities include control precision, multilimb coordination, manual dexterity, and aiming (Fleishman & Quaintance, 1984). Motor abilities are considered the building blocks required for more complex movements such as those involving the whole body. Fine motor skills involve movements that use small muscle groups or muscles (Payne & Isaacs, 2008). Gross motor skills (i.e., fundamental motor skills [FMS]) are defined as movements "…that involve the large, force-producing muscles of the trunk, arms, and legs" (Clark, 1994, p. 245).

One component of physical development is the learning of FMS. FMS are typically classified as object control and locomotor skills (Haywood & Getchell, 2009). Object control skills involve the transporting, intercepting, or projecting of objects as in throwing, catching, dribbling, kicking, underhand rolling, and striking. Locomotor skills include running, jumping, hopping, leaping, galloping, and sliding as different movements to transport the body from one location to another (Ulrich, 2000). The development of FMS allows children to independently navigate the environment (Clark, 2007; Robinson & Goodway, 2009). Competence in FMS is associated with positive, health-related outcomes (D'Hondt et al., 2009; Hands, 2008; Lopes, Rodrigues, Maia, & Malina, 2011; Lubans et al., 2010; Piek et al., 2008).

The early childhood years are a critical time for the development of FMS (Clark, 1994). FMS enable children to apply basic motor skills to participate in sports and games that require more complex movements during the school-age years and throughout the lifespan (Clark, 1994; Clark & Metcalfe, 2002; Seefeldt, 1980). For example, to participate in a game of baseball or softball, individuals need basic competence in running, catching, throwing, and striking. Evidence supports the association between FMS competence and physical activity (Fisher et al., 2005; Houwen, Hartman, & Visscher, 2008; Morgan et al., 2008; Okely et al., 2001a; Robinson, Wadsworth, & Peoples, 2011; Williams et al., 2008). Emerging evidence also suggests that overweight or obese children are less competent in FMS (Graf et al., 2004; Logan & Getchell, 2010; Logan, Scrabis-Fletcher et al., 2011; Williams et al., 2008) and are less physically active (Bayer et al., 2008; Robinson, Wadsworth, & Peoples, 2012; Trost et al., 2003). The development of FMS in children could play a pivotal role in the prevention of childhood obesity and the establishment of sufficient physical activity behaviors.

Often, free play is the only opportunity for children to engage in movement activities and while this may encourage some physical activity, it does not promote the learning of FMS (Gagen & Getchell, 2006). Although the term development may imply that FMS competence is acquired "naturally" through maturational processes, this is not the case (Clark, 2005). These skills need to be learned, practiced, and reinforced (Goodway & Branta, 2003; Robinson & Goodway, 2009; Valentini & Rudisill, 2004a). Motor skill interventions consist of developmentally and instructionally appropriate planned movement activities that includes high-quality instruction from trained movement specialists.

Characteristics of motor skill interventions

Characteristics of motor skill interventions include the intervention approach, provider, duration, sample type (size and age), and the motor assessment used to evaluate pre- to post-improvement. Research design characteristics include if a control or comparison group was established and if participants were randomly assigned to conditions. Based on an extensive literature search, 22 studies were identified that met the following inclusion criteria: 1) published in a peer-review journal, 2) implemented any type of motor skill intervention, and 3) pre- and post- process-oriented assessment of FMS competence. Detailed information is provided in Tables 2 and 3 for the 22 studies that were identified. Studies that reported means and standard deviations for pre- and post- FMS performance are included in Table 2. For these studies, Cohen's d effect sizes were calculated to determine the effectiveness (as measured by FMS improvement) of the interventions. Studies that did not report the necessary data to calculate effect sizes of pre- to post-intervention changes in FMS performance are reported in Table 3.

Motor skill interventions included in Tables 2 and 3 lasted between 6 and 15 weeks and 320 to 11,550 minutes of total intervention time. There were many different approaches used by researchers to design and implement the interventions. Nine studies used a mastery or child-centered approach and five studies used a direct instruction approach as the treatment group. Other approaches included music-based (Chatzipaneli et al., 2007), fitness infusion (Ignico, Corson, & Vidoni, 2006), an occupational therapy program (Rimmer & Kelly, 1989), or an approach that could not be classified. Typically, regularly scheduled free play was considered as a form of control group. Twenty-one of 22 studies reported the intervention provider: 11 were implemented by researchers, four by physical education and classroom teachers, two by undergraduate students, and one was implemented by each of the following: an occupational therapist, parents, coaches, staff of a community-based program, and an entire support-system (included the school principal, preservice teachers, classroom and physical education teachers, parents and students). Sample size of included studies ranged from 13 to 1,045 participants. Sample type included typically developing participants (nine studies), participants diagnosed or at-risk of developmental delay (11 studies) or a learning disability (one study), classified as overweight and obese (one study), and one study did not report the sample type. Participants' mean age ranged from 4 to 10.4 years old. Of the 22 studies included, 17 administered the first or second version of the Test of Gross Motor Development to measure motor skill competence (Ulrich, 1985; 2000), two studies administered the Get Skilled: Get Active motor skill assessment, and one study administered the following: I CAN program, OSU Sigma, and an unnamed assessment.

Table 2. Descriptions provided for each study included in necessary data to calculate effect sizes to determine improvement of pre- to post-intervention FMS competence.

Study	Intervention Approach	Intervention Provider	Intervention Duration	Sample Type	Sample Size	Mean Age (Yrs)	Motor Assessment	Score Type	Effect Size	Significant improvement (Y/N)	Random Assignment
Apache (2005)	Child-facilitated	Researchers	15 weeks 1,350 min.	DD or at-risk of DD	28	4.2	TGMD	Raw			Class Level
							Locomotor		.24	Y	
							Object Control		.49	Y	
	Direct Instruction	Researchers	15 weeks 1,350 min.	DD or at-risk of DD	28	4.2	Locomotor		.18	N	
							Object Control		.05	N	
	No control group										
Cliff, Wilson, Okely, Mickle, & Steele (2007)	Mastery	Community-based. No further details provided	10 weeks 1,200 min.	Overweight/ Obese Children	13	10.4	TGMD-2	Standard	.63	N	No
							GMQ			Y	
	No control group										
Goodway & Branta (2003)	Direct Instruction	Researchers	12 Weeks 1,080 min.	DD or at-risk of DD	31	4.7	TGMD	Raw			Class level
							Locomotor		.73	Y	
							Object Control		.72	Y	
	Control		Regularly scheduled free play	DD or at-risk of DD	28	4.7	Locomotor		.17	Y	
							Object Control		.33	Y	
Goodway, Crowe & Ward (2003)	Direct Instruction	Researchers	9 Weeks 630 min.	DD or at-risk of DD	33	4.9	TGMD	Raw			Class level
							Locomotor		.45	Y	
							Object Control		.42	Y	
	Control		Regularly scheduled free play	DD or at-risk of DD	30	5.0	Locomotor		.01	N	
							Object Control		.04	N	
Hamilton, Goodway, Haubenstricker (1999)	Direct Instruction	Parents	8 Weeks 720 min.	at-risk of DD	15	3.9	TGMD	Raw			Class Level
							Object Control		.33	Y	
	Control		Regularly scheduled free play	at-risk of DD	12	4.0	Object Control		-.01	N	

Ignico (1991)	Direct Instruction	Undergraduate Students	10 Weeks 480 min.	Typically Developing	15	4.9	TGMD GMDQ	Standard	.33	Y	Class level
	Control	Regularly scheduled free play			15	5.0	GMDQ		-.03	N	
Martin, Rudisill, & Hastie (2009)	Mastery	Researchers	6 weeks 900 min	at-risk of DD	42	5.7	TGMD Locomotor Object Control	Raw	.54 .23	Y Y	Class Level
	Direct Instruction	Researchers	6 weeks 900 min	at-risk of DD	22	5.4	TGMD-2 Locomotor Object Control		.01 .12	Y Y	
	No Control Group										
Rintala, Pienimäki, Ahonen, Cantell, &	Psychomotor training program	Trained Physical Education and classroom teachers	10 weeks 1,350 min.	Developmental language disorders	38	8.1	TGMD GMDQ	Standard	.08	N Y	No
Kooistra (1998)	Physical Education	Regular Physical education	10 weeks 1,350 min.	Developmental language disorders	16	8.3	TGMD GMDQ		.07	Y	
	No Control Group										
Robinson & Goodway (2009)	Mastery	Researchers	9 weeks 540 min.	at-risk of DD	39	4.0	TGMD-2 Object Control	Raw	.65	Y	Class/ Individual Level
	Direct Instruction	Researchers	9 weeks 540 min.	at-risk of DD	38	3.9	Object Control		.52	Y	
	Control	Regularly scheduled free play		at-risk of DD	40	4.0	Object Control		.01	N	
Valentini & (2004a)	Mastery	Researchers	12 Weeks 1440 min.	With and Without Disabilities	19 31	8.1 7.5	TGMD Locomotor Object Control	Standard	.5 .53	Y Y	Individual Level
	Control		Regularly scheduled free play	With and Without Disabilities	17 37	8.0 7.4	Locomotor Object Control			N N	
Valentini & Rusidill (2004b)	Mastery	Researchers	12 weeks 840 min.	DD	19	5.5	TGMD Locomotor Object Control	Standard	1.5 .71	Y Y	Individual Level

Direct Instruction	Researchers	12 weeks 840 min.	DD	20	5.4	TGMD Locomotor Object Control	 .87 .73	 Y Y
No control group								

NOTE: DD = Developmentally delayed in the motor domain; GMDQ = Gross Motor Development Quotient; GMQ = Gross Motor Quotient; (these are standard scores that represents performance on all skills).

Table 3. Descriptions provided for each study that did not include necessary data to calculate effect sizes for pre- to post-changes in FMS competence.

Study	Intervention Approach	Intervention Provider	Intervention Duration	Sample Type	Sample Size	Mean Age (Yrs)	Motor Assessment	Score Type	Significant Improvement (Y/N)	Random Assignment	Reason(s) not included
van Beurden et al. (2003)	9 intervention schools	Whole school approach included: Principal, teachers, preservice teachers, parents, and students.	N/A	Typically developing	1,045	7-10	Get skilled: get active	N/A	Y	School Level	Only the mean % of improvement in near mastery or mastery for treatment.
	9 control schools								N/A		
Chatzipanteli, Pollatou, Diggelidis, & Kourtesis (2007)	Music-based	N/A	8 weeks N/A mins.	N/A	40	6.3	TGMD-2 Object Control	N/A	N/A	Not Indicated	The full article is only available in the original language of publication (Greek).
	Movement program- No music				35	6.3			N/A		
	No Control Group										An English abstract is available and was used to provide information.
Deli, Bakle, & Zachopoulou (2006)	Movement Program	Physical Educator	10 weeks 700 mins	Typically developing	28	5.4	TGMD Locomotor	Raw	Y 5 of 6 skills	Not indicated	Means reported for individual skills
	Movement Program- With music				28	5.5			Y 5 of 6 skills		Standard deviations not reported.
	Control Group	Regularly scheduled free play			27	5.4			N		
Deri, Tsapakidou , Zachopoulou, & Kiomourtzoglou (2001)	Music-based	Researchers	10 weeks 800 min.	Typically developing	35	5.4	TGMD Locomotor	Raw	Y	Individual level	Means and standard deviations reported for individual skills only
	Control	Regularly Scheduled Free play		Typically developing	33	5.4	Locomotor		Y		
Foweather	Activity Based	Coaches	9 Weeks	Typically	19	9.2	Get skilled:		Y	School/Class	Only the mean % of

(2008)	After-school setting		1080 min.	developing			get active	N/A	2 of 7 skills	Level	participants at pre- and post- that demonstrated near mastery or mastery of each individual skill was provided.
	Control	Regularly scheduled free play			15	9.1					
Goodway & Amui (2007)	Mastery	Researchers	9 weeks 540 min.	Disadvantaged	24	Preschool	TGMD-2 Object Control	Raw	Y	Individual	Conference Abstract
	Direct Instruction				27				Y		
	Control				26				N		
Ignico, Corson, & Vidoni (2006)	Fitness Infusion	Physical Education Teacher	24 weeks 1,440 mins.	Typically developing	68	5th grade	tennis, gymnastics, hockey, basketball, and softball skills	Raw	Y 5 of 6 skills	N	Means reported for individual skills only Standard deviations not
	Typical Physical Education				18				Y 5 of 6 skills		
Logan, Webster, Lucas & Robinson (March, 2011)	Child-facilitated No control group	Undergraduate Students	12 weeks 720 min.	Typically developing	14	4.6	TGMD-2 Locomotor Object Control	%	Y N	N	Conference Abstract
van der Mars & Butterfield (1987)	Modified Direct Instruction	Preservice Teachers	8 weeks 320 min.	Typically developing	15	4.6	OSU SIGMA	Raw	Y 5 of 10 skills	N	Conference paper. Means reported for individual skills only Standard deviations not reported.
	Control				9	5.5			N		
Rimmer & Kelly (1989)	Occupational Therapy Program	Occupational Therapist	35 weeks 8,925 - 11,550 min.	Children with Learning Disabilities	8	4.5	I CAN program	N/A	N	N	Means and standard deviations reported for individual skills only.
	Adapted Physical Education Program	Adapted Physical Education Teacher	35 weeks 3,960 min.	Children with Learning Disabilities	11	4.9			Y 4 of 5 skills		

	Control	Special Education Teachers	Regularly scheduled free play	Children with Learning Disabilities	10	5.0			N		
Rudisill et al. (2003).	Mastery	Researchers	12 weeks 840 min.	at-risk of DD	13	4.0	TGMD Locomotor	Raw	Y	N	Conference Abstract
	No control group										

NOTE: van Beurden et al. (2003) included balance, vertical jump, sprint run, kick, catch, throw, hop, and side gallop. Foweather (2008) included balance, leap, vertical jump, sprint run, kick, catch, and throw. OSU SIGMA = Ohio State University Scale of Intra Gross Motor Assessment (skills include: walking, stair and ladder climbing, running, throwing, catching, kicking, jumping, hopping, skipping, and striking. Get skilled: get active includes a variety of skills. I CAN program includes qualitative assessment of the catch, throw, kick, bounce, and jump.

Effectiveness of motor skill interventions

Researchers use a variety of motor assessments when measuring pre- to post-intervention changes in FMS competence. Assessments use either a product- or process-oriented approach to measure movement performance. A product-oriented assessment evaluates movement based on the outcome. This type of assessment provides little information with regard to *how* the movement was performed. In contrast, a process-oriented assessment evaluates movement based on the demonstration of behavioral criteria which provides information of how the movement was performed. This information allows teachers to identify specific aspects of movement for each child that need to be improved upon. Recently, researchers have questioned the generalizability of results across studies that use different types of motor assessments (Stodden et al., 2008). In addition, there is confusion in the literature regarding the operational definition of FMS. While some researchers use this term to describe general motor competence (Fisher et al., 2005; Ziviani, Poulsen, & Hansen, 2009), others reserve this term for the specific use of describing *skills* which directly apply to participation in physical activity (Clark & Metcalfe, 2002; Haywood & Getchell, 2009).

A meta-analysis by Logan, Robinson, Lucas, & Wilson (2011) found a significant and positive effect of motor skill interventions on the improvement of FMS in children. The overall effect was considered moderate based on standard effect size interpretation of meta-analysis results. Furthermore, results indicated that object control and locomotor skills improved similarly due to participation in a motor skill intervention. This is important because this suggests that interventions are effective in increasing competence in a variety of gross motor skills. Another important finding is the lack of improvement of FMS of children who were assigned to a control group and did not receive motor skill instruction. These children engaged in typical free play opportunities provided by the early childhood center or school. This finding provides direct evidence that children do not “naturally” gain competence in gross motor skills. These skills need to be taught, practiced, and reinforced.

Logan, Robinson et al. (2011) provide support for the effectiveness of motor skill interventions to improve FMS in children. Research suggests that FMS competence during childhood tracks, at least somewhat, to adolescence (Branta et al., 1984; McKenzie et al., 2002). FMS development has also been associated with health-related outcomes such as higher participation in physical activity (Okely et al., 2001a; Robinson, Wadsworth, & Peoples, 2012), higher cardiorespiratory fitness (Okely et al., 2001b), and a healthy body weight (Graf et al., 2004; Logan & Getchell, 2010). Given the benefits of the development of FMS, early childhood education settings and elementary physical education programs are ideal for the implementation of motor skill interventions.

There are many obstacles that early childhood and physical education teachers may encounter even if a priority is placed on the development of FMS. First, children need equipment that is developmentally appropriate for their age and body size. Due to budget constraints, physical education programs are often not able to purchase new equipment on a regular basis. Over time, this may result in a lack of appropriate equipment for children across several grades. The equipment needs of kindergarteners are very different from those of fifth grade students. Second, a sufficient play space or gymnasium is required for movement activities. Elementary physical education programs often serve several classes during the same class period. Thus, insufficient space and a large number of children may inhibit the ability of physical education teachers to implement high-quality lesson plans.

Summary

There are many aspects of the motor domain. One aspect includes the development of fundamental motor skills such as object control and locomotor skills. These skills are important because they contribute to an individual becoming a skilled and active mover within the environment. Researchers have designed and implemented motor skill interventions with the specific goal of promoting skill improvement (Robinson & Goodway, 2009; Valentini & Rudisill, 2004a, b). Logan, Robinson et al. (2011) determined that interventions are effective in improving skill competence of children and that skill development does not occur naturally over time. This provides direct evidence of the importance of children receiving high-quality instruction and opportunities to engage in skill practice.

Of the 22 studies identified that implemented a motor skill intervention, only six focused on school-age children. Most focused on a special population (Cliff et al., 2007; Rintala et al., 1998; Valentini & Rudisill, 2004a) or were implemented after-school (Cliff et al., 2007; Foweather, 2008). Another limitation of previous research is that only two studies included an assessment of skill competence following a retention period (Robinson & Goodway, 2009; Valentini & Rudisill, 2004b). It is important to determine if the improvements displayed immediately following participation in a motor skill intervention are retained after a period of time when limited to no instruction was received. There is a need for research to implement motor skill interventions in physical education settings. This will allow a determination of the most effective characteristics of interventions that may shape policy and physical education curriculum recommendations.

Physical activity

Background

Childhood obesity is an epidemic in the United States. Current statistics reveal that 35.5% of children between the ages of 6 – 11 years are overweight, while 19.6% are obese (Ogden et al., 2010). Overweight and obese children are at a greater risk for maintaining an unhealthy weight status throughout the life span (Nader et al., 2006). This increase in weight has serious health consequences in pediatric populations, such as high blood pressure, type 2 diabetes, and sleep disturbances (Daniels, 2006). Evidence consistently demonstrates that greater participation in physical activity is associated with a healthy body weight in preschool (Trost et al., 2003) and school-age children (Cleland et al., 2008; Hands & Parker, 2008).

Physical activity behaviors are established in childhood and remain relatively consistent through adolescence and into adulthood (Kelder et al., 1994; Pate et al., 1996). It is imperative that research focus on effective strategies to encourage children to establish and maintain healthy patterns of physical activity. National initiatives suggest that children should participate in at least 60 minutes of physical activity every day (NASPE, 2004). However, a majority of elementary students are not meeting this recommendation (Troiano et al., 2008).

Current rates of physical activity

Due to the increase of overweight and obesity around the world, physical activity has received empirical attention in many countries. Beets, Bornstein, Beighle, Cardinal,

& Morgan (2010) reviewed 43 studies from 13 countries. Results indicated that children of Australia and New Zealand are the most active followed by several European countries (Belgium, Czech Republic, France, Greece, Sweden, Switzerland, and the United Kingdom). Their analysis revealed that children of the United States take significantly less steps per day than children of other countries.

Recent research in the United States has focused on physical activity prevalence rates for elementary students. The National Health and Nutritional Examination Survey (NHANES) is one of the largest efforts in the United States to collect a variety of health-related information. Using data from NHANES (2003-2004), Troiano et al. (2008) described the physical activity levels of 597 children between the ages of 6 to 11 years old. Boys and girls spent approximately 95.4 and 75.2 minutes, respectively, in moderate-to-vigorous physical activity (MVPA) on a daily basis. This suggests that 42% of children in this age range meet the daily physical activity recommendation of 60 minutes (48% of boys and 35% of girls). Data from NHANES (2005-2006) examined total steps per day to measure physical activity levels. Boys and girls aged 6-11 years (n = 915) accumulated approximately 13,000 and 12,000 steps per day, respectively (Tudor-Locke, Johnson, & Katzmarzyk, 2010). Similar total steps per day are reported by Beighle & Pangrazi (2006) for 1st through 6th grade children (boys: 13,348, girls: 11,702), 1st through 3rd grade children (Le Masurier et al., 2005; boys: 13,110, girls: 11,120), 4th through 6th grade children (Le Masurier et al., 2005; boys: 13,631, girls: 11,125), and 10-11 year olds (Johnson, Brusseau, Graser, Darst, & Kulinna, 2010; boys: 12,853, girls: 10,409). Researchers have begun to examine physical activity levels during different parts of the day in an effort to better understand physical activity engagement.

Elementary schools often provide physical education (PE) class and unstructured free play time (i.e., recess) to children. Besides promoting motor skill development, a goal of PE and recess is to promote engagement in physical activity. In a multicenter study, McKenzie et al. (1995) examined physical activity levels of third grade children during PE. A typical PE lesson lasted approximately 29.5 minutes and children engaged in 5.2 vigorous and 10.6 moderate-to-vigorous minutes of physical activity per lesson. Scruggs (2007) reported that 5th grade boys and girls accumulated 2,517 (78 steps/min) and 1,816 (58 steps/min) steps, respectively, per 30 minute PE class. Ridgers, Stratton, and Fairclough (2006) conducted a review of studies that examined recess physical activity levels of 4-12 year old children. The range of minutes children engaged in MVPA was 2.8 to 24 minutes for boys and 2.7 to 18.4 minutes for girls. This suggests that for boys and girls, approximately 4.5% to 40% of physical activity during recess contributed to the recommended 60 minutes of physical activity per day.

In another study, Beighle, Morgan, Le Masurier, & Pangrazi (2006) examined physical activity engagement during recess and outside of the school setting in 270 children enrolled in the third, fourth, and fifth grades. During a 15 minute recess, boys spent 11.7 minutes (78%) and girls spent 9.4 minutes (63%) of time engaged in physical activity. In addition, boys spent 25% and girls spent 20% of out-of-school time in physical activity. Out-of-school time was limited to a 30 minute period before school began and after school until the average time of sunset for the period of data collection.

Brusseau et al. (2011) described physical activity levels of 829 fourth and fifth grade students during the total day, out-of-school, in-school, and during lunch, recess, and physical education. For the entire sample, children engaged in approximately 12,027 steps per day. This is similar to steps reported from NHANES data (Tudor-Locke, Johnson, & Katzmarzyk, 2010). Children engaged in 63.3% of daily steps outside of school, 37.9% at school, 12.6% at lunch, 8.9% at recess, and 13.5% during physical education. Boys accumulated more steps than girls during every segment of the day (see Brusseau et al., 2011 for details). This approach has also been used in 6th grade students (Tudor-Locke, Lee, Morgan, Beighle, & Pangrazi, 2006). In a review of 31 studies, physical activity levels of the separated school day were described for children between the ages of 6 to 18 (Tudor-Locke, McClain, Hart, Sisson, & Washington, 2009). However, data was not separated by age group thus results are not discussed. Although previous research has focused on students enrolled in grades three, four, and five, there is a lack of studies that focus on students enrolled in the first and second grade.

Methods of physical activity assessment

Three methods are commonly used to measure physical activity in elementary students and include direct observation, pedometers, and accelerometers. Direct observation requires researchers to observe and record information about physical activity engagement. This method can be conducted in a live setting or through video analyses. The System for Observing Fitness Instruction Time (SOFIT; McKenzie, Sallis, & Nader, 1991) is a popular assessment that has been validated for use during elementary physical education classes (Rowe, Schuldheisz, & van der Mars, 1997). SOFIT follows a time-interval sampling technique to describe the duration and intensity of physical activity. SOFIT is used to describe physical activity engagement at the group level. The protocol includes a 10-second observe and 10-second record interval. Physical activity is coded at five different levels of intensity: lying down, sitting, standing, walking, and vigorous. Lying down, sitting, and standing categories represent sedentary behaviors. Walking and vigorous categories represent MVPA. There are other coding categories to describe the context of the physical education class and teacher behaviors. Other direct observation instruments are used to measure physical activity, eating behavior, and related environmental events (BEACHES, McKenzie et al., 1991), physical activity in the home (McIver, Brown, Pfeiffer, Dowda, & Pate, 2009), and physical activity during play time in a specified area (SOPLAY, McKenzie, Sallis, & Nader, 1991). Advantages of direct observation include accuracy and the frequency, duration, and intensity of physical activity can be described. Disadvantages include only a group level of analysis is possible, the time requirement for coding is extensive and expensive, and is not feasible for large populations.

Pedometers are used to objectively measure physical activity. The typical output of pedometers is total steps accumulated per day to measure physical activity. This value may be converted to a steps per minute value to describe physical activity during specific time periods. A commonly used pedometer is the Omron HJ-720ITC (Omron Healthcare, Inc; Bannockburn, IL). This pedometer features dual piezoelectric sensors that allow steps to be accumulated in a vertical and horizontal plane and has been validated in prescribed and self-paced conditions and demonstrates an absolute error of <3.0% (Holbrook, Barreira, & Kang, 2009). The accurate assessment of acceleration is most associated with the center of mass of an individual (Trost, McIver, & Pate, 2005). Research indicates that hip placement of pedometers are most effective in accurately measuring steps accumulated (Graser, Pangrazi, & Vincent, 2007). Research in adults suggests that three (Tudor-Locke et al., 2005) to five days (Gretebeck & Montoye, 1992;

Kang, Bassett et al., 2009) of pedometer monitoring of physical activity will provide a reliable and valid estimate. In children, five (Strycker et al., 2007) to six (Rowe, Mahar, Raedeke, & Lore, 2004) days are recommended. However, Kang, Bassett et al. (2009) suggest that 3-7 days is appropriate. Advantages include the low-cost, small size, and ease of use with large populations. Other advantages of the Omron pedometer includes the 7-day recall on the display, 41-day data storage of daily step counts, records step accumulation by time, resets automatically at midnight, and cannot be reset manually. Disadvantages include the lack of a water-resistant model and the frequency, duration, and intensity of physical activity cannot be described. Due to this last limitation, researchers have recommended daily step count levels to meet national physical activity guidelines.

Tudor-Locke et al. (2004) recommends that elementary school-aged boys and girls accumulate 15,000 and 12,000 steps per day, respectively. In physical education class, Scruggs (2007) recommends that children engage in 58 to 63 steps per min (1,740 to 1,890 steps per class) to reach a minimum level of recommended physical activity guidelines during PE. More research is needed to determine the threshold of steps per minutes that correspond to MVPA as measured by accelerometers.

Accelerometers are small, light-weight instruments that feature piezoelectric sensors to measure acceleration in one to three planes to estimate physical activity engagement. Many different body segments have received attention for placement of accelerometers including the lower back, ankle, upper leg, wrist, and upper arm (Bouten et al., 1997). The most common accelerometer placement on an individual is the hip (Trost, McIver, & Pate, 2005). However, hip placement is not always possible due to the practicality and feasibility of a research study and the burden placed on the participant to comply with the study protocol. There are many different accelerometers available to researchers including the ActiGraph, ActiWatch, and ActiCal and are validated for use in children (Chia et al., 2009; see Trost, McIver, and Pate, 2005 for a review). Cliff, Reilly, & Okely (2009) provide an excellent review of guidelines for accelerometer use in children. Advantages include the small size, ease of use with large populations, energy expenditure is estimated based on age and gender specific algorithms, and the frequency, duration, and intensity of physical activity is measured. Disadvantages include the lack of water-resistant models, high cost ($200-$400 per unit), and the complexity of downloading data. Another disadvantage is the lack of an external display which prevents researchers from determining if the device is properly functioning on a daily basis. Accelerometer research suggests that 3-5 days of monitoring is sufficient for adults and 4-9 days is sufficient for children (Trost, McIver, & Pate, 2005). See McClain & Tudor-Locke (2009) for a recent opinion article regarding the advantages and disadvantages of pedometers and accelerometers.

Correlates of physical activity

A correlate is a factor that has a reciprocal relationship with an outcome measure. Internal correlates are within person characteristics and are either physical (i.e., sex, age, weight, body mass index, race/ethnicity, motor skill competence) or psychosocial (i.e., perceived competence, enjoyment, support for autonomy). External correlates are outside of the person such as socioeconomic status, parental influence, and environmental conditions (such as access to playgrounds and the temperature). The preschool population has received most of the attention (see Hinkley, Crawford, Salmon, Okely & Hesketh, 2008 for a review). Due to the specific aims of this dissertation, the following internal correlates will be emphasized for review: sex, body composition, motor skill competence, perceived competence, enjoyment, and attitude.

One of the most consistent findings of physical activity research is that boys are more active than girls. For the total day, boys accumulate 1,000-2,506 more steps per day compared to girls (Beighle & Pangrazi 2006; Johnson et al., 2010; Le Masurier et al., 2005; Tudor-Locke, Johnson, & Katzmarzyk, 2010). This sex difference is also found during physical education (Beighle et al., 2006), out-of-school, in-school, and during lunch and recess (Brusseau et al., 2011). Researchers suggest that a partial explanation of sex differences of physical activity participation may be the playground environment and its alignment with activity preferences of each sex (Beighle et al., 2006). Informal observations suggest that boys typically used the field to participate in sports and games that result in MVPA while girls tend to use the periphery of the field and engage in less active games.

The relationship between physical activity and body composition has received empirical attention due to the growing concern of childhood obesity. In elementary students, overweight and obese children are less active than their normal weight peers (Rowlands, Eston, & Ingledew, 1999); however, mixed findings suggest this relationship exists in boys but not girls (Hussey, Bell, Bennett, O'Dwyer, & Gormley, 2007; Purslow, Hill, Saxton, Corder, & Wardle, 2008), or in girls but not boys (Hands & Parker, 2008). This finding may be more consistent in boys since they tend to be more active. Perhaps overweight girls' physical activity levels do not decline as much because girls' overall activity levels are lower in general.

One of the basic assumptions of motor development is that a relationship exists between FMS competence and participation in physical activity. Evidence suggests low to moderate significant correlations between FMS competence and participation in physical activity in elementary students (Houwen, Hartman, & Visscher, 2008; Morgan, Okely, Cliff, Jones & Baur, 2008; Raudsepp & Päll, 2006; Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006). Evidence suggests that object control skills contribute more to physical activity compared to locomotor skills (Houwen, Hartman, & Visscher, 2008; Hume et al., 2008; Morgan et al., 2008; Raudsepp & Päll, 2006) during the elementary school years. Elementary school physical education programs start to shift from providing general movement activities to participation in more advanced games and sports such as modified versions of kickball, baseball, basketball, and soccer. These sports require the application of several object control skills such as kicking, throwing, striking, catching, and dribbling. It is possible that the focus of sports and games during this time results in a greater relationship between competence in object control skills and physical activity. Further research is needed to clarify the relationship between FMS and physical activity.

Psychosocial Variables

Psychosocial correlates to elementary students' physical activity include perceived competence and enjoyment of physical education and physical activity. Researchers suggest that enjoyment is increased through demonstrating competence (Wallhead & Buckworth, 2004) and evidence supports this claim in elementary school-age children (Baron & Downey, 2007). Furthermore, children diagnosed with Developmental Coordination Disorder enjoy physical education less and have lower perceived competence compared to typically developing peers (Cairney et al., 2007). Thus, it is important to determine how perceived competence and enjoyment of physical education and physical activity contributes to participation in physical activity.

Children self-evaluate their performance level in a variety of domains. This self-evaluation process forms the construct of perceived competence and is not necessarily related to actual competence (Harter, 1982). It is theorized that, as children become more proficient in performing a task they will experience higher perceived competence that increases their motivation to learn how to move. Theoretically, this increase in motivation should manifest as higher levels of physical activity. Research indicates that perceived competence is associated with increased physical activity for elementary school-age (Crimi, Hensley, & Finn, 2009; Sallis, Prochaska, & Taylor, 2000; Sollerhed et al., 2008; Welk & Schaben, 2004) and adolescent children (Ferrer-Caja & Weiss, 2000; Hagger, Chatzisarantis, & Biddle; 2001; Ntoumanis, 2001).

Another psychosocial variable often examined in relationship to physical activity is enjoyment of and attitude towards physical activity and physical education. Children's motivation to engage in physical activity is influenced by enjoyment of the activity. Enjoyment is positively related to a desire to continue participation in physical activity for elementary school-age children (Crimi, Hensley, & Finn, 2009; Hagger, Cale, & Almond, 1997; Sallis, Prochaska, & Taylor, 2000; Trost et al., 1997). DiLorenzo and colleagues (1998) found that enjoyment was the most important predictor of physical activity in fifth and sixth grade children. Enjoyment of physical education and physical activity is also associated with increased physical activity levels of adolescent children (Bengoechea, Sabiston, Ahmed, & Farnoush, 2010; Dishman et al., 2005).

Wallhead and Buckworth (2004) state that "…if physical educators are able to increase students' perceived competence and subsequent enjoyment of their experiences in physical education, these affective outcomes of physical education will transfer into motivation to adopt a physically active lifestyle outside of school" (p. 286). Very limited research has empirically examined the association of perceived competence and enjoyment of physical education to out-of-school physical activity. Carroll and Loumidis (2001) measured perceived competence in physical education and physical activity, enjoyment of physical education, and participation in physical activity through self-report measures in 10-11 year old children (n = 922). Perceived competence and enjoyment in physical education were significantly correlated (r = .39). Children with high perceived competence participated in more physical activity and at a higher intensity than others. Enjoyment in physical education was not associated to participation in out-of-school physical activity. Carroll and Loumidis (2001) suggest that perhaps physical education lessons and out-of-school physical activity are two distinct entities. There may be other factors that affect out-of-school physical activity such as peer and family influences and opportunities to engage in activity.

Summary

Previous research has focused extensively on describing physical activity behaviors of elementary school-aged children during the total day and different time periods, including physical education class. In addition, researchers have implemented large-scale physical activity interventions within physical education and found an increase in physical activity (Harrell et al., 1999; Luepker et al., 1996; Sallis et al., 1997; Simons-Morton et al., 1991). However, these interventions did not target or measure psychosocial variables or competence in fundamental motor skills. Furthermore, only Sallis et al. (1997) examined the effect of a physical education intervention on after-school physical activity. In order for children to meet the daily recommendation of 60 minutes of physical activity, it is important that they are physically activity outside of the physical education setting.

Physical activity interventions (out-of-school physical activity included)

Interventions within the physical education setting are important, but the recommended physical education lesson is 30 to 45 minutes in length for elementary students due to the short attention span and low physical endurance of this population (NASPE, 2009a). In order for children to meet the national recommendation of 60 minutes of daily physical activity, it is necessary for physical activity to occur outside of physical education class. Furthermore, during the last decade, participation in physical education class has declined from 42% to 36% for high school students (Lowry, Wechsler, Kann, & Collins, 2001). This emphasizes the importance of developing strategies to promote physical activity participation in childhood that is maintained through adulthood. Yet, limited research has focused on the influence of interventions on physical activity outside of physical education.

The Sports, Play, and Active Recreation for Kids physical education intervention measured out-of-school physical activity by accelerometer and one-day physical activity recall (Sallis et al., 1997). However, no baseline measures were collected. It was only possible to determine out-of-school physical activity between the treatment and control conditions, with no conclusion of the effect of each. It is possible that children assigned to a particular condition were more physically active before the intervention compared to the other. Regardless, no significant group differences were found in weekday or weekend out-of-school physical activity (Sallis et al., 1997). A three year follow-up of the Child and Adolescent Trial for Cardiovascular Health (CATCH) intervention indicated that children of the intervention group participated in significantly more out-of-school vigorous physical activity (McKenzie et al., 1996). Two of the key components of CATCH were to emphasize enjoyment during physical education and to provide children with the skills necessary to participate in physical activity (McKenzie et al., 1994).

Donnelly et al. (1996) conducted a nutrition and physical activity program in third to fifth grade children. The study included one control (n = 236) and one treatment school (n = 102). The 2-year intervention was implemented by classroom teachers. Thy physical activity component included 30-40 minutes per day, three days per week of activities designed to increase energy expenditure. Direct observation of physical activity during intervention sessions indicated significantly greater physical activity engagement for the intervention school compared to the control school. Out-of-school physical activity was measured by a one day self-report survey. Across the two year intervention period, children of the control school engaged in significantly more out-of-school physical activity. Out-of-school physical activity of children of the treatment school declined over the intervention period (Donnelly et al., 1996).

The effect of an intervention on out-of-school physical activity has also been examined in middle and high school students. The “Active by Choice Today” (ACT) study was a randomized trial designed to increase physical activity in low-income, minority sixth grade students enrolled in 24 middle schools (n = 1,563; Wilson et al., 2011). This intervention occurred for 17 weeks and sessions were held for two hours after school, three days per week. Physical activity was measured by a self-report three-day physical activity questionnaire. Results indicated significant increases in MVPA of the intervention group during intervention sessions (9.1 min. per session; 27 min. per week) and the total day (4.87 min per day). However, no significant effects were found for the intervention group on physical activity on non-program days at two weeks post-intervention.

Project Active Teens was a three-year longitudinal intervention implemented in the 9th grade physical education program (Dale, Corbin, & Cuddihy, 1998). Physical activity was measured through self-report questionnaires. Lessons were designed to teach students health-related knowledge about physical activity and fitness and behavioral strategies to increase physical activity such as goal setting. The control group consisted of transfer students who were previously exposed to traditional physical education programs. Results indicated that after years one and two of the study, boys displayed significantly more moderate physical activity. However, no significant differences were found for girls. In the final year of the study, no significant differences of physical activity for boys or girls were reported (Dale, Corbin, & Cuddihy, 1998).

Summary

It is recommended that elementary school students engage in at least 60 minutes of daily physical activity (NASPE, 2004). Due to the short amount of time dedicated to physical education, it is imperative that students engage in physical activity outside of the school setting in order to meet this recommendation. In a recent review, Slingerland and Borghouts (2011) concluded that physical education-based interventions are effective in increasing physical activity during the intervention; however, there is a need for interventions to promote after-school physical activity. A potential approach is to design interventions that are grounded in theories of motivation. Knowledge and curriculum-based interventions may be a key component of interventions, but it is also important to determine if students' motivation to engage in physical activity can be changed over time.

Conclusions

Physical education programs reach millions of students per year. Two goals of physical education are to promote motor skill competence and provide opportunities for students to engage in physical activity. The assumption of the existence of a relationship between motor competence and physical activity is at the "…heart of our physical education programs" (Clark, 2005, p.44). It is necessary for children to become competent in a variety of fundamental motor skills during early elementary school physical education programs. This allows children to apply these skills to participate in more complex sports and games during later elementary school physical education. Furthermore, it is recommended that elementary school students engage in at least 60 minutes of daily physical activity. Due to the limited time devoted to daily physical education it is important that students engage in physical activity outside of the school setting. Wallhead and Buckworth (2004) state that "…if physical educators are able to increase students' perceived competence and subsequent enjoyment of their experiences in physical education, these affective outcomes of physical education will transfer into motivation to adopt a physically active lifestyle outside of school" (p. 286). Physical education-based interventions are effective in promoting physical activity within the intervention environment (Slingerland & Borghouts, 2011). However, there is a need to develop interventions that are grounded in motivational theory and promote the adoption of a physically active lifestyle outside of the school setting.

Chapter III

Method

The purpose of this dissertation was to determine the effect of two instructional climates (mastery, performance) on a) motor skill competence, b) physical activity behavior during physical education and after-school, and c) psychosocial variables (i.e., attitude toward and enjoyment of physical activity and physical education, perceived physical competence) in elementary school-aged children. This chapter provides an overview of the research design and variables of interest. The context of the study, participant information, instrumentation, research procedures, and the characteristics of the intervention are also included. Finally, data analyses and statistical procedures will be presented.

Theoretical Approach

From a theoretical perspective, this study was grounded within Achievement Goal Theory (Ames & Archer, 1988; Dweck & Legett, 1988; Elliott & Dweck, 1988). Based on this theory, a mastery and performance instructional climate was emphasized throughout the implementation of the intervention. Each approach emphasized certain aspects of the learning environment based on previous research. Research in the classroom has established that the instructional climate can be manipulated to promote a mastery or performance goal orientation (Ames 1992a, b). This dissertation examined the influence of instructional climates on motor skill competence, physical activity during physical education and after-school, and psychosocial variables.

Participants and setting

48 2nd graders (mastery, *n* = 23; performance, *n* = 25), predominantly African American, from an elementary school located in Lee County School District of Alabama participated in this dissertation. A similar number of boys and girls were randomly assigned to each climate (mastery = 10 boys; 13 girls; performance = 13 boys; 12 girls). See Table 4 for descriptive information of participants. An additional form was attached to the consent form and sent home with students. The following question was asked of parents: Does your child participate in an after-school program, organized sport, or any other form of structured activity? Seven indicated that their child participated in some form of extracurricular activity. These students were systematically assigned to the mastery and performance climates (mastery = two boys, two girls; performance = two boys, one girl). Activities included football, cheerleading, and dance.

Table 4. Descriptive information for included participants.

		Height (in.)	Weight (lbs.)	Age (years)
Group	*N*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*
Mastery	23	50.8 (3.4)	67.8 (22.7)	7.8 (.54)
Performance	25	51.3 (2.9)	72 (23.2)	7.7 (.43)
Total	48	51.1 (3.1)	70 (22.8)	7.8 (.48)

Research design

This study was a pretest-posttest randomized, between-subjects design. Three 2nd grade classrooms participated in the study. At this elementary school, physical education is provided to more than one classroom of each grade level at a time. All second grade classes attended physical education class at the same time. Each student was randomly assigned to the treatment (mastery climate) or the comparison condition (performance climate). Each physical education class lasted 50 minutes. For the purpose of this dissertation, this time period was divided into two 25 minute periods. During the first 25 minutes, either the treatment or comparison group engaged in the physical education intervention that provided opportunities for physical activity and motor skill instruction. The other group engaged in project-related research activities (i.e., completion of psychosocial assessments and pedometer surveys) until it was time for the groups to switch for the last 25 minutes of the time period. All procedures were approved by Auburn University's Institutional Review Board prior to data collection. Parental consent and child assent were also obtained prior to data collection (See Appendix A).

Instrumentation

The following instrumentation and procedures were used for data collection.

Sex, Race, Height, Weight

Descriptive and anthropometric measures were assessed. Race, age, and sex were collected through school records. Height was measured to the nearest 0.1 centimeter using a Digital Medical Scale (Seca Floor Scale 769, SECA Corp. Hanover, MD). Height was measured without shoes, coats, and other heavy outerwear. Children were instructed to keep their shoulders in a relaxed position, allow their arms to hang freely and their eyes forward (researcher aligned head in the Franfurt plane). Weight was measured to the nearest 0.1 kg using the same scale.

Fundamental motor skill competence

Children completed the Test of Gross Motor Development-2nd edition (TGMD-2; Ulrich, 2000). The TGMD-2 is a valid, reliable, and process-oriented assessment for use in children between the ages of three and ten years. The TGMD-2 assesses 12 motor skills separated into two subscales: object control (strike, throw, catch, kick, dribble, and roll) and locomotor skills (run, gallop, slide, leap, hop, and jump). A researcher demonstrated the proper execution of the skill and children completed one practice and two formal trials. All trials of the TGMD-2 were videotaped and coded through video analysis. Inter- and intra-rater reliability (>90%) was established for the primary researcher. Each skill was evaluated on three to five performance criteria. A score of zero was given for each trial if a criterion was not performed. See Appendix B for a sample scoring sheet for each subscale of the TGMD-2.

For the object control subscale, a child could receive a maximum of 5 points for strike, 3 points for catch, and 4 points for the overarm throw, dribble, kick, and roll for each trial. Performances on the two formal trials were summed with a range of possible scores from 0 to 48. For the locomotor subscale, a child could receive a maximum of 5 points for hop, 3 points for leap, and 4 points for the run, gallop, jump, and slide for each trial. Performances on the two formal trials were summed with a range of possible scores from 0 to 48. Raw scores for the object control and locomotor subscales were summed and used for analyses. The range of total TGMD score is 0-96.

Physical activity

Physical activity was assessed through three methods. Physical activity during physical education was evaluated with the System for Observing Fitness Instruction Time (SOFIT) and New Lifestyles Yamax NL-200 pedometers. After-school physical activity was assessed with the Omron HJ-720ITC pedometer.

SOFIT is an objective measure of students' physical activity levels and is commonly used in physical education settings (McKenzie, Sallis, & Nader, 1991). SOFIT uses momentary time sampling analysis (10-second observe, 10-second record) to objectively quantify three aspects of physical education: student physical activity level, lesson context, and teacher behaviors. Physical activity codes include: lying down, sitting, standing, walking, and very active. Sedentary behaviors represent the percentage of time spent lying down, sitting, and standing. Moderate-to-vigorous physical activity represents the percentage of time spent walking and very active. Lesson context is coded as management, knowledge content, fitness, skill practice, game play, or other. Teacher prompts for physical activity are coded as in-class prompts, out-of-class prompts, or neither. All procedures were aligned with the SOFIT protocol. Four participants were randomly selected from each climate, with an equal representation of sex for each physical education class. Each child was observed for four minutes before the researcher rotated to a different child. After the fourth child was observed, the first child was observed again and the process was repeated until the end of the class. SOFIT assessed students' physical activity behaviors during each intervention session and were coded through video analyses. One researcher with prior experience of coding SOFIT during physical education attended a two hour training session to establish inter- and intra-rater reliability (>90%) prior to formal data coding.

New Lifestyles Yamax NL-200 pedometers were used to measure steps during physical education. The *Lifestyle SW200* is a battery-operated and lightweight device (2" l x 1 ½" w x ¾" h, ¾ oz) that measures vertical oscillation of body movement, and provides a total count of accumulated steps. Previous reliability and validity testing of the pedometer showed that the Yamax accurately records the number of steps taken, has the most consistency between units, and is the most accurate at moderate activity levels

(Bassett et al., 1996; Bassett, Cureton, & Ainsworth, 2000). Prior to data collection, a 20-step field-based pedometer check was conducted to assess step count measurement accuracy for all pedometers. The equipment check demonstrated that the pedometers accurately counted steps (error was +/- 1 step) for children.

Each child was assigned a Yamax pedometer for the duration of the study. Prior to entering the gymnasium, the pedometer was secured to a Velcro belt that was placed around the child's waist and adjusted so that the pedometer was located on the right side in midline with the quadriceps. The pedometer was reset to zero and closed so that the step count was not visible. At the end of each physical education class, the pedometers were removed. Upon removal, pedometers were opened which disables step accumulation. Total step counts were recorded by a research technician. From video analyses, the exact length of the physical education lesson was used to calculate steps per min for each class. If students arrived late to class, the time was recorded in order to accurately calculate steps per minute. Students must have been present for 80% of the intervention session (i.e., 16 minutes) in order for pedometer step counts to be included for analyses.

The Omron HJ-720ITC assessed physical activity after-school (Omron Healthcare, Inc). The HJ-720ITC pedometer is a small battery-operated device that features dual piezoelectric sensors, allowing steps to be accumulated in a vertical and horizontal plane. The pedometer has been validated in prescribed and self-paced conditions and demonstrates an absolute error of <3.0% during a 100 meter walk-test (Holbrook, Barreira, & Kang, 2009). The Omron pedometer offers a 7-day recall on the display, 41-day storable memory of daily step counts, records step accumulation by time, resets automatically at midnight, and cannot be reset manually. Pedometers were calibrated specifically to each child based on weight and stride length. The procedure for weight measurement has been described previously. Stride length was calculated by placing a measuring tape of 30 feet in length on the floor. Individually, children walked ten steps from the start of the tape measure. The total distance was divided by 10 to obtain a step length. This value was converted to stride length in feet and inches to calibrate the pedometer. A 20-step field test was conducted on a random sample of pedometers to validate that they were functioning correctly and to assess measurement error. All tested pedometers demonstrated less than three steps of error.

Each child received a demonstration and explanation on how to wear the pedometer and how and when to remove it (i.e., only during showering, bathing, swimming, or sleeping). Children were instructed to wear the pedometer on the right hip directly in line with their right knee and to clip the pedometer onto the waistband of their shorts/pants. If this was not possible, the pedometer was to be placed in their right pocket. Each child received an instructional packet upon receiving the pedometer for the first time and periodically throughout the study. For the typical week, upon arrival to school on Wednesday morning pedometers were placed on the right hip (anterior to the iliac crest) and secured by the plastic clip provided by the pedometer manufacturer. On the following Wednesday, researchers collected all of the pedometers. Each child was assigned two pedometers. Once one pedometer was collected, the second pedometer was given to children to wear for the next week. Pedometers were collected on Wednesday due to the possibility of children forgetting to wear the pedometers to school on Monday. Data from the pedometers were downloaded using the Omron Health Management software. When data is exported to a Microsoft Excel spreadsheet, a variable titled "Used" is created for each hour of the day. This variable indicates whether the pedometer was used at any point during the specified hour, regardless if any steps were recorded. A zero indicates it was not used and a one indicates that it was used. For all future discussion of Omron pedometer data, a given hour was included for analyses if the "Used" variable indicated the pedometer was used, regardless if steps were recorded.

Validation checks were also performed every weekday to determine if children wore pedometers the previous day. A researcher administered a brief survey that asked children yes or no questions related to if they wore their pedometer for the entire day and if they removed the pedometer for any reason other than expected times (i.e., showering, swimming, sleeping). Any unusual or extreme responses were checked with the children for clarification. Also, children were asked if they participated in any organized physical activity the previous day (i.e., sport practice, after-school program). This protocol is established as an acceptable method of conducting validity checks on pedometer wear-time and determining children's previous day's physical activity (Brusseau et al., 2011). This survey was administered directly before or after physical education class, dependent upon the group (treatment or control) that received physical education first on a given day.

The elementary school dismisses at 2:30 p.m. Upon discussion with school administration, unless there were special circumstances, all children who rode the bus arrived home no later than 3:00 p.m. The after-school time period was defined as 3:00 – 6:00 p.m. on weekdays. If children wore the pedometer for two out of the three hours, their step counts were included for analyses. Pedometer step counts were summed and converted to a steps per minute variable based on the number of minutes the pedometer was worn.

Baseline. Children were given pedometers on 9/26/2011 and they were collected on 10/9/2011. During this time, the school was not closed for any reason. Weekend days were not a variable of interest of this dissertation and were removed for data analyses. Children must have worn the pedometer after-school for at least two hours on at least three days. All days that met these criteria were combined to create a mean variable of baseline after-school steps per minute.

Post-Intervention. Children were given pedometers on 11/10/2011 and they were collected on 11/29/2011. During this time, the school was closed on the following days: 11/11/2011(Teacher's Professional Development; 11/23/11; 11/24/11; and 11/25/11 (Thanksgiving Break). Pedometer data from these days were not included for analyses. To create a post-intervention variable of after-school steps per minute, children must have worn the pedometer after-school for at least two hours per day for three days.

Attitude towards physical activity and physical education

Sallis, Alcaraz, McKenzie, and Hovell (1999) provide several items designed to measure attitude towards physical activity and physical education. There are four subscales of the assessment that measures attitude towards: 1) after-school physical activity preferences; 2) after-school physical activity; 3) physical education; and 4) physical activity that makes an individual sweat. Test-retest reliability coefficients of the subscales range from .27 to .67 based on two administrations of the survey that were four days apart. Chronbach's alpha for the subscales range from .43 to .82. Reliability was established with a sample of 732 fourth- and fifth-grade children. For after-school physical activity preferences, children selected one phrase from each of the following phrase pairs: play indoors/play outdoors; play a running game with friends/take a walk with friends; take a walk with friends/watch TV; watch TV/play a running game with friends. For each response, the following score was given: 1 (watch TV), 2 (take a walk with friends/play indoors), and 4 (play outdoors/play a running game with friends). For the three remaining subscales, children chose one of the following word pairs: nice/awful; unhealthy/healthy; sad/happy; important/unimportant; fun/boring. The words awful, unhealthy, sad, unimportant, and boring received a score of 0. The remaining words received a score of 1. This scoring was consistent with the assessment research protocol (Sallis et al., 1999). See Appendix C for a full description.

Attitude toward physical activity and physical education was measured pre- and post-intervention. The assessment was administered to children in their regular classroom. A trained researcher handed out the assessment and instructed children to follow along as the questions and responses were read aloud. Two other researchers were present to assist during the assessment.

For data analyses, student responses (i.e., subscales) were combined to create: a) total attitude towards physical activity and b) attitude toward after-school physical activity. Total attitude was calculated by summing the responses for all subscales. Attitude towards after-school physical activity was calculated by summing the two subscales that measured this construct (i.e., section E and I of the assessment, see Appendix C). The mean replacement method was used to replace missing values. If an individual answered all but one question within a subscale, the missing value was replaced with the mean value of the responses of the other items in the subscale. If an individual did not answer more than one question within a subscale, their data for the entire subscale was considered missing.

Enjoyment towards physical activity and physical education

Sallis et al. (1999) provide an assessment to measure enjoyment. This assessment includes four questions that used a six-face (happy to sad) response format: 1) How do you feel about taking a walk for exercise?, 2) How do you feel about physical education class?, 3) How do you feel about doing physical activities with a lot of running?, 4) How do you feel about doing physical activities that make you sweat? The happiest face was given a value of six and the saddest face was given a score of one (See Appendix D). The test-retest reliability coefficient of the assessment is .82 based on two administrations of the survey that were four days apart. Chronbach's alpha for the assessment is .75. Reliability was established with a sample of 732 fourth- and fifth-grade children.

Enjoyment was assessed for approximately four to six students per day, immediately following physical education. The same students that were observed for SOFIT and an additional one to two students per day completed the enjoyment assessment. The goal was to measure each child once per week and to assess enjoyment for each child on different days of the week throughout the intervention. Based on responses to the enjoyment assessment, two variables were created for data analyses: a) total enjoyment (questions one through four) and b) enjoyment towards physical education (question two). Responses were combined for weeks one and two to create a variable that represented enjoyment during the beginning of the intervention, and weeks four and five that represented enjoyment towards the end of the intervention. For a measure of total enjoyment (questions one through four), responses were summed across the four questions and divided by four to create an average response. The same procedure was followed for enjoyment towards physical education (question two). These scoring procedures are consistent with previous research (Sallis et al., 1999).

Perceived Physical Competence

Children completed the perceived physical competence subscale of Harter and Pike's (1984) Pictorial Scale of Perceived Competence and Social Acceptance for Young Children. This assessment was designed for use with first and second grade children. The perceived physical competence subscale includes six items presented on pictorial plates that represent one's specific sex (male, female) and race/ethnicity (Black, White, or Hispanic). This subscale assessed each child's perceived competence in swinging, climbing, dribbling, hopping, running, and jumping rope. On each pictorial plate, two pictures were displayed side by side; one picture depicts a child who is competent in a particular task, and the other depicts a child who is not competent. The child selects the picture that is more like him- or herself. Then, the child focuses on the selected picture and indicates whether she or he is just a little bit like the child in the picture or a lot like the child in the picture. The range of scores for each item on the subscale is 1 (low competence) to 4 (high competence). Internal consistency for the individual subscale ranges from .65 to .89, with a reliability of .86 for the combined subscale measure. The reliability of the total scale is .89 (Harter & Pike, 1984). Each participant followed the standardized procedures according to manual guidelines. Perceived physical competence was measured pre- and post-intervention. For analyses, responses on the six items were summed and averaged to create one variable according to manual guidelines (Harter &

Pike, 1984). This assessment was administered by three researchers who successfully completed a training session to ensure accurate measurement.

Intervention

Typical Physical Education Program

It is important to provide a description of the typical second grade physical education program that the participants were exposed to prior to the start of the study. The physical education teacher is certified and has been employed at this elementary school for eight years. The typical physical education class was 50 minutes in length. This assumes that all three of the second grade classrooms arrived on time to the gymnasium; however, students often arrived 5 – 10 minutes late to physical education class. There were approximately 53 second grade students in the gymnasium during physical education class. The gymnasium is small and inefficiently shaped. The space is an auditorium and includes a small, elevated stage. The overall space is about one-half of a typical-sized basketball court-style gymnasium. It is very difficult to teach effectively and provide high-quality physical education to elementary school students (kindergarten through sixth grade) in this setting. It is impossible for all students, or even most students, to be engaged in an activity at the same time, so often students were stationary while waiting for their turn.

Prior to the start of class, students walked into the gymnasium and sat quietly in rows. If students were noisy during this time, the actual start of class was delayed. From informal observations, several minutes of the beginning of class was spent with students sitting quietly and waiting for class to start. Typically, one of the students led the class in their “daily exercises”. Exercises included fitness (i.e., jumping jacks and push-ups) and stretching activities. Then, the teacher demonstrated the lesson for the day. Students engaged in the lesson for the remainder of the class. Most frequently, it appeared that a formalized lesson plan was implemented.

In addition, free play during physical education was regularly provided. At the very least, every Friday was dedicated to free play. The class often went to the outdoor playground and engaged in free play (if the weather permitted). If the class stayed inside, basketballs or other equipment were provided for students to use. Throughout the course of the week (i.e., Monday through Thursday) “minutes” were taken away from students for misbehavior. This included misbehavior while in their regular classroom or during physical education class. In a recent position statement, NASPE stated that withholding physical activity as a form of behavior management is an inappropriate practice (NASPE, 2009b).

Physical education intervention

A school-based intervention was implemented within the physical education setting. Prior to the start of the acclimation period, the primary researcher observed the physical education class taught by the classroom teacher for one week (i.e., typical PE). Then, a two week acclimation period occurred. During this time, students were exposed to the research procedures and the measurement of the variables of interest along with the instructional climates. Students’ physical activity behaviors were measured by observation and pedometers during physical education and after-school. Students also completed the attitude, enjoyment, and perceived physical competence assessments during this period. Three sample lesson plans specific for the treatment (mastery) and comparison (performance) groups were also implemented during this week. The aim of this acclimation period was to ensure that each child had adjusted to characteristics of each climate during physical education class and become familiar with the research procedures, assessments, and the researchers. All intervention sessions were videotaped.

Two instructional climates were used to conduct the intervention (mastery and performance). The intervention focused on providing opportunities to develop fundamental motor skills and engage in physical activity. The intervention occurred five days per week for five weeks. The school was closed on 11/11/11 for professional development. The total number of lessons implemented was 24. Each session lasted 25 minutes. This included five minutes of transition between groups, a three to five minute introduction and 15 minutes of motor skill instruction. This resulted in 480 minutes of motor skill instruction and practice. It was determined a priori that each child must be present for 20 physical education lessons (>80%) to be included in data analysis. All children met this inclusion criterion.

Regardless of instructional climate, children engaged in the same lesson plan with slight modifications based on theoretical approach. Lesson plans emphasized motor skill development. Each lesson plan included one or two locomotor and two object control activities. See Appendix E for a list of the fundamental motor skills that were emphasized and the critical elements/key phrases that were used by the researcher to teach each skill. The same lesson plans were taught during each climate on the same day. See Appendix F for a sample lesson plan. Prior to motor skill instruction, the teacher introduced the activities to the class and provided instructions and knowledge with regard to the objectives of the lesson. The same trained researcher with prior experience in teaching physical education implementing each climate (mastery, performance) led all intervention sessions of each condition. This was done to control for possible effects of different teachers on the outcomes of interest.

Mastery motivational climate

The mastery motivational climate is theoretically grounded in achievement goal theory and emerged from research in academic settings (Ames 1992a, b; Ames & Archer, 1988). Research has identified six dimensions that can be manipulated to emphasize mastery motivation (Epstein 1988, 1989). The six dimensions are known as the TARGET structure and include *task, authority, recognition, grouping, evaluation,* and *time*. A mastery climate is a child-centered learning experience and encourages children to independently navigate the environment by choosing the task, level of task difficulty, the amount of time spent in task engagement, and which peers to engage with during an intervention session. Teacher feedback of performance is made on effort, knowledge, and skill development and emphasizes private recognition based on improvement specific to each child. The following is a description of a typical intervention session that emphasized a mastery climate. There were four stations of two locomotor and two object control skills provided throughout the gym (Ex. Sliding, hopping, throwing, and catching). There were three levels of difficulty provided for each task. At the end of the introduction, children were allowed to independently navigate the stations for 15 minutes. Children chose which tasks and at what level of difficulty to engage in for any length of time. They were also allowed to choose which peers to engage with. The teacher's role while implementing a mastery climate is to facilitate an environment that provides children with optimal control of their engagement.

Performance climate

The comparison condition of the intervention implemented a performance climate. This is a teacher-centered approach and children were not provided opportunities to make decisions. This climate provided one level of difficulty for each activity. The teacher chose which tasks the children engaged in, whom they engaged with (by forming groups based on random assignment), and how long children engaged at each station. Teacher feedback emphasized individual ability and was based on public recognition of comparison to peers and normative standards. The following is a description of a typical intervention session that implemented a performance climate. There were four stations of two locomotor and two object control skills provided throughout the gym (Ex. Sliding, hopping, throwing, and catching). There was one level of difficulty provided for each task. After the introduction, children were randomly assigned to four groups of approximately six children each. Children stayed with this group for the duration of the intervention session. Then, each group was assigned to an activity station and the 15 minute session of skill instruction began. After five minutes, each group rotated to the next station. Thus, each group spent five minutes at each station and was not allowed to engage with peers of their choice. The performance climate used a fading schedule to increase task difficulty as the intervention progressed. Lessons one through eight provided easy modifications of tasks that were provided at each station. Lessons nine through 16 provided moderate modifications of tasks. Lessons 17 to 24 provided difficult modifications of tasks. The teacher's role while implementing a performance climate is to make most engagement decisions within the learning environment. The teacher provides structure and order to the intervention session and children are not provided opportunity to make choices regarding their engagement. See Table 4 for a description of how each approach (mastery, performance) manipulated the TARGET structure. See Table 5 for a description of the time table of data collection.

Table 5. A description of how each instructional climate (mastery, performance) manipulated the TARGET structure during intervention sessions.

Mastery (High Autonomy)	Instructional Climates (Ames, 1992a,b; Epstein, 1988)	Performance (Low Autonomy)
• High variety, challenge, and novelty of tasks • Modification permitted	*Task*	• Low variety, challenge and novelty of tasks • Modification not permitted
• Child-centered. Support for autonomy regarding instructional decision-making	*Authority*	• Teacher-centered. No support for autonomy regarding instructional decision-making
• Process of skill performance	*Recognition*	• Outcome of skill performance
• Choice of grouping	*Grouping*	• No choice of grouping
• Private recognition	*Evaluation*	• Public recognition
• Varied	*Time*	• Fixed

Table 6. Timetable.

		TGMD-2	SOFIT (during PE)	Pedometer (after-school PA)	Enjoyment of PE	Attitude toward PA and PE	Perceived Physical Compe-tence
Week 1- 2	Parent consent. Descriptive data collection.	--------------	-------------	-------------	-------------	------------	------------
Week 3-4	Acclimation period/Baseline physical activity	--------------	Yes	Yes	Yes	------------	------------
Week 5	Pre-intervention assessments	Yes	-------------	Yes	-------------	Yes	Yes
Week 6	Intervention begins (Week 6 – Week 11, M-F, from 10:35-11:25).	--------------	Yes	Yes	Yes	------------	------------
Week 7	Intervention continues-download pedometer data	--------------	Yes	Yes	Yes	------------	------------
Week 8	Intervention continues-Mid-Intervention assessments	________	Yes	Yes	Yes	------------	------------
Week 9	Intervention continues-download pedometer data	--------------	Yes	Yes	Yes	------------	------------
Week 10	Intervention continues-	--------------	Yes	Yes	Yes	------------	------------
Week 11	Last week of intervention	--------------	Yes	Yes	Yes	------------	------------
Week 12	Post-intervention assessments	Yes	-------------	Yes	-------------	Yes	Yes
Week 22	Retention assessment (following a 10-week retention period).	Yes	-------------	-------------	-------------	------------	------------

Intervention integrity checks

Integrity checks were performed for each intervention session to ensure that each climate was consistent with a predefined set of standards. It is important that each climate created the desired learning environment to ensure that results could be interpreted as due to the treatment versus the comparison conditions. Integrity checks occurred through video analyses by an individual blind to the study design and hypotheses (see Appendix G for the checklist).

Teacher feedback

Rink (2010) defines teacher feedback as verbal and visual information that provides information to individuals regarding their performance. In addition, teacher feedback "…maintains student focus on the learning task and serves to motivate and monitor student responses" (Rink, 2010, p. 139). It is important that teacher feedback is monitored for consistency between the two instructional climates. Feedback was measured on 33% of the sessions for each climate. Rink (2010) developed a coding instrument that was used to measure the frequency of different types of feedback. This instrument identifies several dimensions of teacher feedback and definitions are provided (Rink, 2010, p. 341). See Appendix H for a sample teacher feedback coding sheet.

1. Target. Teacher feedback can be directed to the class (more than 50% of students), a group (two or more students), or an individual (one student).
2. Type. Feedback is either evaluative or corrective. Evaluative feedback is a statement of judgment about past performance. Corrective feedback is a statement of how future performance may be improved.

3. Level of specificity. General feedback is provided on overall performance such as 'great job', 'good throw', or 'you did well'. Specific feedback provides explicit information of performance such as 'great follow-through with your arm, 'nice aim, you hit the target'.
4. Positive or negative. Positive feedback includes positive language regarding what the student did right or should do correctly. Negative feedback includes negative language regarding what the student did or should do.
5. Process or product-oriented. Process-oriented feedback provides information about *how* the movement was performed, regardless of outcome. Product-oriented feedback provides information about the outcome of the movement, regardless of *how* the movement was performed.
6. Self-referenced or peer comparison. Self-referenced feedback provides information to students' based on their individual past performances. Peer comparison feedback provides information to students' on their performance based on comparison to performance of their peers.

Data Analysis

Data analyses were conducted using Statistical Package for the Social Sciences, version 18.0 (SPSS, Inc., Chicago, IL). Descriptive statistics were calculated for age, height, and weight. This study focused on research questions that were interested in between-subjects differences between the treatment (mastery) and the comparison group (performance) and within-subjects differences at two (pre- and post-intervention) or three (pre-, post-, retention) time periods. Each research question was answered using the appropriate ANOVA procedures to determine if group differences existed on one or more dependent variables. Research questions also focused on changes over time to determine how dependent variables changed throughout the intervention. For these analyses, the first two weeks and the last two weeks of the intervention were identified as two time points of interest to represent the beginning and end of the intervention, respectively. See Table 6 for a summary of research questions, variables of interest, and analyses conducted.

A power analysis was conducted to determine the number of participants needed in this study. Several hypotheses were examined using ANOVA statistical procedure to determine whether there are significant differences between the treatment and comparison group on motor skill competence. The alpha level was set at .05. To achieve power of .80 and a medium effect size of at least ($f^2 = .35$), a total sample size of 44 was required to detect a significant model (F (1, 42) = 4.07). A power analysis was also conduced to detect significant differences on physical activity during physical education. To achieve power of .80 and a medium effect size of at least ($f^2 = .35$), a total sample size of 30 was required to detect a significant model (F (1, 28) = 4.2).

Table 7. Data analysis for each research question.

Research Questions	Dependent Variable(s)	Independent Variable(s)	Analyses
1. What was the effect of two instructional climates on motor skill competence at post-intervention and following a retention period?	TGMD raw scores	Climate (mastery, performance) Time (pre-, post-intervention, retention)	2 (climate) X 3 (time) mixed between-within subjects ANOVA
2. What was the effect of instructional climate (typical physical education, mastery and performance climates) on students' physical activity behaviors during physical education?	Percent time spent in MVPA (SOFIT) Steps per min (Pedometers)	Climate (typical physical education, mastery, performance)	2 independent samples Kruskal-Wallis test. As needed, post hoc Tukey's HSD procedures were conducted.
3. What was the effect of two instructional climates on students' after-school physical activity behaviors?	Steps per min accumulated after-school	Climate (mastery, performance) Time (pre- and post-intervention)	2 (climate) X 2 (time) mixed between-within subjects ANOVA
4. What was the effect of two instructional climates on students' attitude toward physical activity and physical education?	Total Attitude Attitude towards after-school physical activity	Climate (mastery, performance) Time (pre- and post-intervention)	2 ANOVAs were conducted for each variable of attitude 2 (climate) X 2 (time) mixed between-within subjects ANOVA
5. What was the effect of two instructional climates on students' enjoyment of physical education and	Total enjoyment Enjoyment of physical education	Climate (mastery, performance) Time (Beginning and end of intervention)	2 ANOVAs were conducted for each variable of enjoyment 2 (climate) X 2 (time) mixed

physical activity?			between-within subjects ANOVA
6. What was the effect of two instructional climates on students' perceived physical competence?	Perceived physical competence	Climate (mastery, performance) Time (pre- and post-intervention)	2 (climate) X 2 (time) mixed between-within subjects ANOVA

Chapter IV

Results

Chapter four focuses upon the results of implementing a 5-week intervention that included two instructional climates (mastery, performance) on several variables of elementary school-aged children. Results are presented relative to the research questions of interest.

Fifty-one children were initially recruited for participation in this study. Forty-nine children returned signed parental consent forms and provided assent to participate in the study (96.1% participation rate). One participant who provided parental consent and assent was not included for any analyses due to several absences and lack of completion of assessments. Thus, the final sample size for pretest and posttest assessment was 48. Following the conclusion of the intervention and retention testing, three students (2 girls, 1 boy) relocated to a new school. Total and group sample sizes are provided within the results of each variable.

The intervention integrity checks were performed for each climate during all intervention sessions. Results indicated that greater than 90% of the criteria for the integrity checks were met for all sessions. This indicates the instructional climates were implemented appropriately.

Feedback was analyzed on 33% of the intervention sessions for each climate and aligns with Rink's (2010) procedures and instrumentation to assess instructional feedback in physical education settings. See Appendix H. The mastery climate emphasized feedback based on self-referenced standards and the process of movement. The performance climate emphasized feedback based on peer-comparison and the outcome of movement. However, it is important to note that the performance climate also received feedback regarding the process of movement. This was to ensure that each climate received high-quality instruction. See Table 8 for the percentage of each type of feedback received by each climate. Results indicated that the feedback provided by each climate was consistent with the characteristics of a mastery and performance instructional climate.

Table 8. Percentage of each type of feedback provided to the mastery and performance climate during the intervention.

	n	Peer Comparison	Self-Referenced	Outcome	Process
Mastery	8	0.0	17.1	8.6	74.3
Performance	8	8.3	15.0	21.1	55.5

Research Question #1: What was the effect of two instructional climates (mastery, performance) on motor skill competence at post-intervention and following a retention period?

Hypothesis #1: Students assigned to the mastery climate intervention will demonstrate significantly higher motor skill competence.

Table 9 displays descriptive statistics for pre- and post-intervention TGMD-2 raw scores for each sex and climate. Descriptive data confirms that pre-intervention scores on the TGMD-2 were similar between participants' assigned to mastery (*M* = 66.1) and performance climates (*M* = 63.6). Furthermore, Table 10 provides raw scores for each skill at pre- and post-intervention, and following a 10-week retention period.

Table 9. Raw TGMD-2 scores at pre- and post-intervention and following a 10-week retention period.

		TGMD-2 Raw Score					
			Pre		Post		Retention
Group	Sex	*n*	*Mean (SD)*	*n*	*Mean (SD)*	*n*	*Mean (SD)*
M	B	10	70.8 (7.5)	10	81.7 (10)	9	82.1 (4.3)
M	G	13	62.5 (9.5)	13	80 (6.6)	12	79.8 (3.6)
M	T	23	66.1 (9.5)	23	80.7 (8.1)	21	80.8 (4)
P	B	13	61.2 (11.5)	13	80.9 (7.9)	13	79.5 (8.9)
P	G	12	66.2 (7.6)	12	83.2 (5.9)	11	83.1 (2.6)
P	T	25	63.6 (10)	25	82 (7)	24	81.2 (6.9)

NOTE: M = Mastery; P = Performance; B = Boys; G = Girls; T = Total

Table 10. Raw TGMD-2 scores for each skill at pre- and post-intervention and following a 10-week retention period.

Improvement of Individual Skills of the TGMD

Object Control Skills

	Strike (Max = 10)			Dribble (Max = 8)			Catch (Max = 6)		
	Pre	Post	Retention	Pre	Post	Retention	Pre	Post	Retention
Group	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*
Mastery	7.2 (2.4)	8.7 (1.5)	9.2 (.87)	5.5 (2.3)	7.2 (1.5)	7.1 (1.2)	5 (1)	5.7 (.69)	5.5 (.81)
Performance	7.8 (2.2)	9.4 (.91)	9.1 (1.3)	6 (2.2)	7.8 (.58)	7.7 (.62)	5.1 (1.3)	5.5 (.92)	5.8 (.61)

	Kick (Max = 8)			Throw (Max = 8)			Roll (Max = 8)		
	Pre	Post	Retention	Pre	Post	Retention	Pre	Post	Retention
Group	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*
Mastery	6.6 (1.5)	7.4 (.73)	7.3 (1)	4 (2.5)	5 (2.4)	5.5 (2.1)	3.8 (1.8)	6.5 (1.8)	5.7 (1.8)
Performmance	7 (.84)	7.3 (.85)	7.4 (.72)	3.5 (2.6)	6.4 (1.3)	6 (1.8)	3.5 (2)	6 (1.5)	5.7 (1.6)

Locomotor Skills

	Run (Max = 8)			Gallop (Max = 8)			Hop (Max = 10)		
	Pre	Post	Retention	Pre	Post	Retention	Pre	Post	Retention
Group	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*
Mastery	7.8 (.6)	7.9 (.46)	7.9 (.44)	4.5 (2.2)	5 (2.3)	4.5 (2.1)	7.7 (1.9)	9.1 (1.3)	9.3 (1)
Performance	7.9 (.28)	7.9 (.4)	8 (.2)	2.9 (1.8)	4.1 (2.1)	4.4 (2.1)	8.1 (1.7)	9.5 (1.1)	9.4 (1.1)

	Leap (Max = 6)			Jump (Max = 8)			Slide (Max = 8)		
	Pre	Post	Retention	Pre	Post	Retention	Pre	Post	Retention
Group	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*
Mastery	4 (1.1)	5 (.93)	5 (.92)	3.8 (1.7)	6.6 (1.5)	6.9 (1.3)	6.3 (2.9)	6.6 (2.2)	7 (2.1)
Performance	4.2 (1.1)	4.8 (1.1)	4.7 (1.1)	3.9 (2.2)	6.4 (1.8)	6.5 (1.8)	3.7 (3.6)	6.8 (2.6)	6.5 (2.3)

A mixed between-within subjects ANOVA was conducted to assess the impact of two instructional climates (mastery, performance) on participants' raw TGMD-2 scores at three time periods (pre- and post-intervention, retention). There was no significant main effect of climate ($F(1, 43) = .001$, $p = .98$, $\eta 2 < .001$). This suggests no difference in TGMD score between the two instructional climates at any time point. There was a main effect of time ($F(1, 43) = 153.6$, $p < .001$, $\eta 2 = .78$). Planned contrasts indicate that post-TGMD score was significantly higher than pre- TGMD score ($p < .001$) and no significant difference between post- and retention TGMD score ($p = .56$). This indicates that regardless of climate, TGMD scores increased significantly from pre- to post-intervention and were maintained from post-intervention to retention assessment. There was a non-significant interaction between climate and time ($F(1, 43) = 1.1$, $p = .29$, $\eta 2 = .03$). The assumption of homogeneity of variance was upheld by Levene's test for pre- ($p = .98$), post- ($p = .57$), and retention TGMD score ($p = .07$). See Figure 1.

The hypothesis that students assigned to the mastery climate would demonstrate significantly greater improvements in motor skill competence was not upheld. However, the effectiveness of both instructional climates is apparent by the similar improvement of TGMD scores from pre- to post-intervention and this maintenance of improvement from post-intervention to retention.

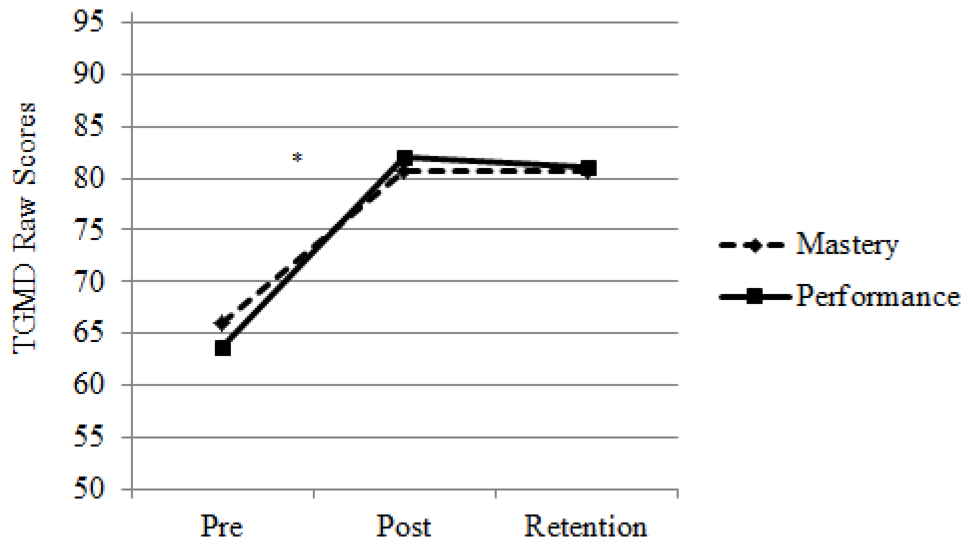

Figure 1. Mean raw TGMD scores for each instructional climate at each time point of assessment. * indicates a significant difference of TGMD score at pre- and post-intervention.

Research Question #2: What was the effect of instructional climate (typical physical education, mastery and performance) on students' physical activity behaviors during physical education?

Hypothesis #2: Students assigned to the mastery climate intervention would engage in significantly more physical activity during physical education.

Physical activity was measured during physical education through two methods: direct observation (SOFIT) and pedometers. SOFIT also provides information about the context of the physical education class and teacher behavior. During typical physical education, the mean lesson length was 42.3 minutes. During the mastery and performance climate sessions, the mean lesson length was 19.7 and 20.1 minutes, respectively. Table 11 provides a description of SOFIT results for typical physical education and the two instructional climates.

Table 11. Mean percentage of class time and mean minutes per class spent in each category of the SOFIT protocol during typical physical education and each instructional climate. * indicates that the mastery climate spent a significantly less percentage of class time dedicated to management tasks compared to the performance climate and typical physical education. * indicates that the students spent a significantly higher percentage of class time engaged in MVPA during each instructional climate compared to typical physical education.

System for Observing Fitness and Instruction Time

Category	Typical PE		Mastery		Performance	
	% of Time	Minutes	% of Time	Minutes	% of Time	Minutes
Student Activity	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Lying down	.4 (.39)	.17 (.17)	.45 (1.2)	.09 (.23)	.16 (.51)	.03 (.1)
Sitting	51.7 (23.1)	21.8 (10)	17.5 (8.4)	3.4 (1.8)	19.3 (5.7)	3.78 (1.1)
Standing	10.7 (7.4)	4.4 (3)	14.1 (7.4)	2.7 (1.4)	13.5 (5.3)	2.6 (.97)
Walking	14.1 (2.7)	5.9 (1)	32.9 (10.2)	6.4 (2)	29.1 (9.1)	5.7 (1.8)
Very Active	23.1 (13.9)	9.6 (5.6)	35.1 (11.6)	6.8 (2.4)	37.9 (9.4)	7.3 (1.8)
MVPA	37.3 (16.6)	15.6 (6.6)	68 (5.6)*	13.2 (1.5)	67 (4.8)*	13 (.9)
Lesson Context						
Management	54.6 (6.6)	24.1 (2.8)	9.9 (3.8)*	1.9 (.78)	23.5 (7.2)	4.6 (1.5)
General Knowledge	10.9 (8.8)	4.8 (3.9)	16.5 (4.4)	3.2 (.78)	16.2 (4.3)	3.2 (.9)
Fitness	7.9 (7.2)	3.4 (3.1)	0 (0)	0 (0)	0 (0)	0 (0)
Skill Drills	9.4 (8.2)	4.1 (3.6)	73.6 (5.6)	14.2 (1.7)	60.4 (8.6)	11.8 (1.5)
Game Play	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Other	17.3 (29.9)	7.8 (13.5)	0 (0)	0 (0)	0 (0)	0 (0)
Teacher Behavior						
Promoting In-Class PA	.26 (.45)	.11 (.19)	29.2 (12.9)	5.6 (2.5)	28.2 (13)	5.5 (2.6)
Promoting Out-of-Class PA	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Demonstration	4.1 (3.5)	1.8 (1.5)	17.1 (22.3)	1.9 (.68)	13.9 (12.4)	1.9 (.54)
General Instruction	6.8 (5.3)	3 (2.3)	28.1 (12.3)	5.3 (2.5)	26.1 (8.1)	4.8 (1.9)
Class Management	43.1 (6.5)	19 (2.5)	21.9 (8.1)	3.7 (1.5)	30.1 (10.7)	5.1 (1.9)
Observing	45.8 (11.1)	20.3 (5.4)	2.4 (2.4)	.46 (.48)	.98 (1.33)	.2 (.27)
Other Tasks	0 (0)	0 (0)	1.3 (1.84)	.26 (.36)	.7 (1.4)	.14 (.27)

An important aspect of physical education class is the amount of time spent in management tasks. Management refers to time spent during a lesson when students are not intended to be engaged in physical education content. This includes time devoted to tasks that are not related to instruction such as class business (e.g., attendance) or behavior management. Management also includes time spent in transition (i.e., group selection, changing equipment, rotating between stations). During typical physical education, 54.6% of class time was devoted to management tasks. In contrast, 9.9% and 23.5% of class time was spent in management tasks during the mastery and performance climates, respectively. A non-parametric procedure was calculated to determine differences between climates. An independent samples Kruskal-Wallis test indicates a significant difference between climates on percent of class time spent in management tasks ($H(2) = 33.02$, $p < .001$). Pairwise comparisons indicate that the mastery ($p < .001$) climate spent significantly less time in management compared to the performance climate ($p < .001$) and typical physical education ($p < .001$). There was no significant difference between the performance climate and typical physical education ($p = .361$).

The primary physical activity outcome of SOFIT is the mean percent of time spent in MVPA throughout the observed lessons. Results indicated that students engaged in an average of 37.3 (typical physical education, boys: 48.4; girls: 27.1), 68 (mastery, boys: 65.5; girls: 72.7), and 67 (performance, boys: 71.7; girls: 66.7) percent of class time in MVPA.

A non-parametric procedure was calculated to determine differences between climates. An independent samples Kruskal-Wallis test indicates a significant difference between climates on percent of class time students spent in MVPA ($H(2) = 8.53$, $p =$

.014). Pairwise comparisons indicate that students assigned to the mastery (p = .011) and the performance (p = .023) climates spent significantly more time in MVPA than typical physical education. There was no significant difference between mastery and performance climates (p = .62). MVPA during the intervention was higher, regardless of climate, compared to typical physical education.

Physical activity during physical education class was also assessed through students wearing pedometers. Results indicated that students engaged in an average of 32.3 (typical physical education, boys: 32.3; girls: 32.3), 47.1 (mastery, boys: 53.6; girls: 42.1), and 45.7 (performance, boys: 47; girls: 44.3) steps per minute. See Figure 2. A one-way ANOVA indicated significant differences in mean steps per minute between climates ($F(2, 92) = 20.7$, $p < .001$). The assumption of homogeneity of variance was upheld by Levene's test (p = .68). Tukey's HSD post hoc comparisons indicated that steps per minute was significantly greater for the mastery ($p < .001$) and performance ($p < .001$) climates compared to typical physical education. There was no significant difference between the mastery and performance climate (p = .89). The hypothesis that students assigned to the mastery climate would demonstrate significantly higher levels of physical activity during physical education was not upheld.

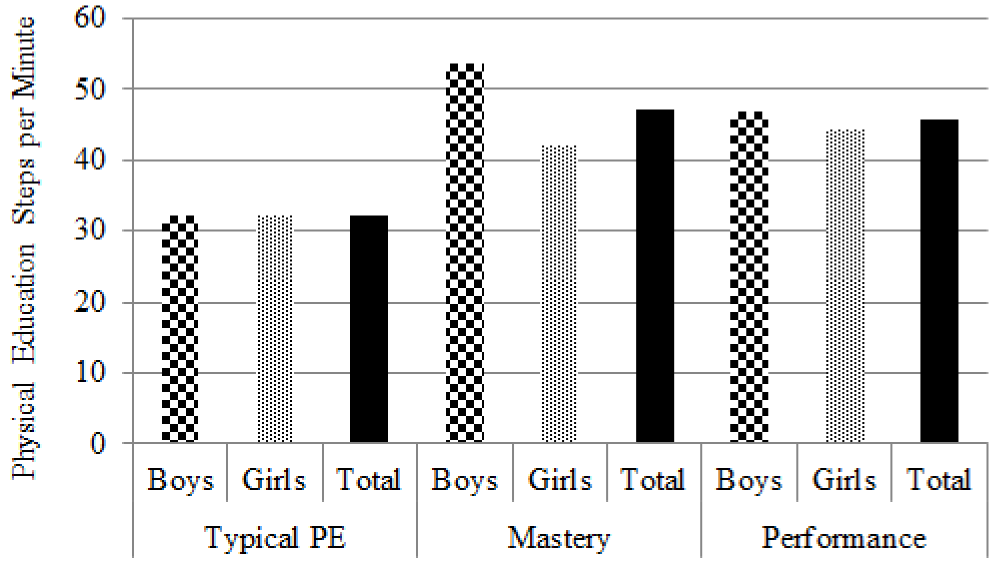

Figure 2. Physical Education mean step count (steps per minute).

<u>Research Question #3</u>: What was the effect of two instructional climates (mastery, performance) on students' after-school physical activity behaviors?

<u>Hypothesis #3</u>: Students assigned to the mastery climate intervention will engage in significantly more after-school physical activity.

A mixed between-within subjects ANOVA was conducted to assess the impact of two instructional climates (mastery, performance) on participants' after-school physical activity (steps per minute) at two time periods (pre- and post-intervention). Due to the inclusion criteria of after-school pedometer data, the total sample size was 24 (n = 14 [mastery, four boys, 10 girls]; n = 10 [performance, four boys, six girls]). The compliance rate of students wearing pedometers after-school was 50%. See Figure 3. There was no significant main effect of climate ($F(1, 22) = .94$, $p = .343$, $\eta 2 = .041$), time ($F(1, 22) = .4$, $p = .54$, $\eta 2 = .018$), or interaction between climate and time ($F(1, 22) = .99$, $p = .33$, $\eta 2 = .043$). Results indicate that after-school physical activity did not change for either climate from pre- to post-intervention. The assumption of homogeneity of variance was upheld by Levene's test for pre- (p = .48) and post- afterschool physical activity (p = .74). The hypothesis that students assigned to the mastery climate would demonstrate significantly higher levels of after-school physical activity was not upheld.

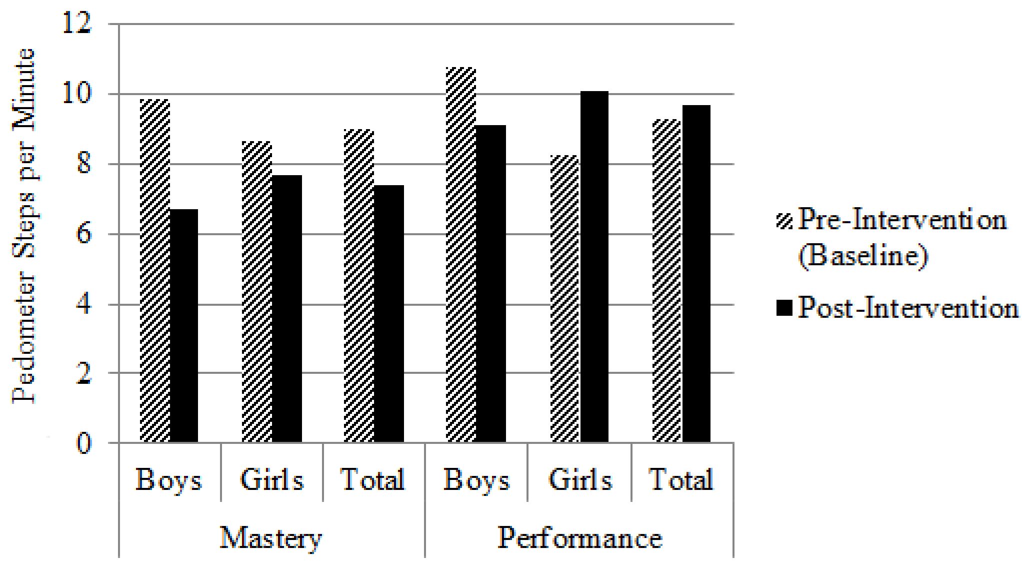

Figure 3. Mean after-school steps per minute at pre- and post-intervention.

<u>Research Question #4</u>: What was the effect of two instructional climates (mastery, performance) on students' attitude toward physical activity and physical education?

<u>Hypothesis #4</u>: Students assigned to the mastery climate will show significantly higher positive attitudes toward physical activity and physical education.

Table 12 provides descriptive statistics for pre- and post-intervention scores on attitude towards physical education and physical activity. For total attitude, the maximum score possible is 29. For attitude towards after-school physical activity, the maximum score possible is 19.

Table 12. Mean scores for total attitude and attitude towards after-school physical activity.

		Attitude			
		Total Attitude		Attitude- After-School	
Group	*n*	Pre	Post	Pre	Post
Mastery	23	23.7 (3.8)	23 (4.3)	15.5 (2.9)	15.1 (2.9)
Performance	24	22.2 (3.9)	22 (4)	14.6 (2.1)	14.5 (2.5)

Total Attitude

A mixed between-within subjects ANOVA was conducted to assess the impact of two instructional climates (mastery, performance) on participants' attitude towards physical activity at two time periods (pre- and post-intervention). The total sample size included 47 participants (n = 23 [mastery]; n = 24 [performance]). There were no significant main effects of climate ($F(1, 45) = 1.7$, $p = .21$, $\eta 2 = .04$), time ($F(1, 45) = .34$, $p = .56$, $\eta 2 = .007$), or the interaction between climates and time ($F(1, 45) = .17$, $p = .69$, $\eta 2 = .004$). Results indicate that attitude did not change for either climate from pre- to post-intervention. The assumption of homogeneity of variance was upheld by Levene's test for attitude at pre- ($p = .36$) and post-intervention ($p = .29$).

Attitude toward after-school physical activity

A mixed between-within subjects ANOVA was conducted to determine if attitude towards after-school physical activity changed between climates at two time periods (pre- and post-intervention). There were no significant main effects of climate ($F(1, 45) = 1.51$, $p = .23$, $\eta 2 = .032$), time ($F(1, 45) = .17$, $p = .68$, $\eta 2 = .004$), or the interaction between climates and time ($F(1, 45) = .11$, $p = .74$, $\eta 2 = .002$). Results indicate that attitude towards after-school physical activity did not change for either climate from pre- to post-intervention. The assumption of homogeneity of variance was upheld by Levene's test for attitude at pre- ($p = .35$) and post-intervention ($p = .23$).

Research Question #5: What was the effect of two instructional climates (mastery, performance) on students' enjoyment of physical education and physical activity?

Hypothesis #5: Students assigned to the mastery climate will show significantly higher enjoyment of physical education and physical activity.

Table 13 provides descriptive data for total enjoyment and enjoyment of physical education during the beginning (weeks one and two) and the end (weeks four and five) of the intervention. The maximum score possible is 6 which indicates the highest level of enjoyment measured by the assessment.

Table 13. Descriptive statistics for total enjoyment and enjoyment of physical education (PE) at the beginning and end of the intervention.

	Enjoyment			
	Wks 1 and 2		Wks 4 and 5	
	Total	PE	Total	PE
Group	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*
Mastery	4.8 (.96)	5.5 (1)	5.1 (.91)	5.6 (.97)
Performance	4.8 (1.1)	5.3 (1.4)	4.9 (1.2)	5.4 (1.5)

A mixed between-within subjects ANOVA was conducted to assess the impact of two instructional climates (mastery, performance) on participants' total enjoyment towards physical education and physical activity at two time periods (beginning and end of intervention). Due to the inclusion criteria of enjoyment data, the total sample size was 42 (n = 22 [mastery]; n = 20 [performance]). There was no significant main effect of climate ($F(1, 40) = .18$, $p = .68$, $\eta 2 = .004$), time ($F(1, 40) = 1.55$, $p = .22$, $\eta 2 = .04$), or interaction between climate and time ($F(1, 40) = .24$, $p = .63$, $\eta 2 = .006$). Results indicate that enjoyment did not change for either climate from the beginning to the end of the intervention. The assumption of homogeneity of variance was upheld by Levene's test for enjoyment at the beginning ($p = .63$) and end of the intervention ($p = .47$).

A mixed between-within subjects ANOVA was conducted to determine if enjoyment of physical education changed between climates at two time periods (beginning and end of intervention). Question B of the enjoyment survey specifically assesses enjoyment during physical education. Responses to this question were analyzed separately. There was no significant main effect of climate ($F(1, 40) = .26$, $p = .62$, $\eta 2 = .006$), time ($F(1, 40) = .85$, $p = .36$, $\eta 2 = .02$), or interaction between climate and time ($F(1, 40) = .01$, $p = .92$, $\eta 2 < .001$). Results indicate that enjoyment of physical education did not change for either climate from the beginning to the end of the intervention. The assumption of homogeneity of variance was upheld by Levene's test for physical education enjoyment at the beginning ($p = .35$) and end of the intervention ($p = .34$).

Research Question #6: What was the effect of two instructional climates (mastery, performance) on students' perceived physical competence?

Hypothesis #6: Students assigned to the mastery climate will show significantly higher enjoyment of perceived physical competence.

Table 14 provides descriptive data for participants' pre- and post-intervention perceived physical competence scores. The maximum score is four which indicates the highest level of perceived physical competence measured by the assessment.

Table 14. Descriptive statistics for perceived physical competence at pre- and post-intervention.

		Perceived Physical Competence	
Group		Pre	Post
	n	*Mean (SD)*	*Mean (SD)*
Mastery	22	3.5 (.49)	3.7 (.39)
Performance	25	3.5 (.65)	3.6 (.46)

A mixed between-within subjects ANOVA was conducted to assess the impact of two instructional climates (mastery, performance) on participants' perceived physical competence at two time periods (pre- and post-intervention). The total sample size included 47 participants (*n* = 22 [mastery]; *n* = 25 [performance]). There was no significant main effect of climate ($F(1, 45) = .22$, $p = .64$, $\eta 2 = .005$), time ($F(1, 45) = 1.1$, $p = .3$, $\eta 2 = .02$), or interaction between climate and time ($F(1, 45) = .35$, $p = .56$, $\eta 2 = .008$). Results indicate that perceived physical competence did not change for either climate from pre- to post-intervention. The assumption of homogeneity of variance was upheld by Levene's test for perceived physical competence at pre- ($p = .95$) and post-intervention ($p = .41$).

The hypotheses of research questions four, five, and six stated that students assigned to the mastery climate would exhibit higher measures of attitude, enjoyment, and perceived competence. These hypotheses were not upheld.

Chapter V

Discussion

Physical education is the largest, publicly supported intervention that reaches millions of children. The purpose of high-quality physical education programs is to promote students' development of the "…knowledge, skills, and confidence to enjoy a lifetime of physical activity" (NASPE, 2011, p. 2). Two specific goals of physical education are to promote competence in fundamental motor skills and to provide an opportunity for students to engage in physical activity (NASPE, 2011). Due to the minimal amount of school time dedicated to physical education, it is important to understand the influence of physical education beyond the boundaries of the gymnasium.

There are many factors that influence participation in physical activity of school-age children. These factors include fundamental motor skill competence (Morgan et al., 2008; Wrotniak et al., 2006), attitude towards and enjoyment of physical activity and physical education (Sallis, Prochaska, & Taylor, 2000; Trost et al., 1997), and perceived physical competence (Crimi, Hensley, & Finn, 2009; Sallis, Prochaska, & Taylor, 2000). Physical educators play an important role in promoting positive experiences in physical education class that leads to an enjoyment of physical activity and an increase of perceived physical competence. It has been speculated that that positive changes in psychosocial variables related to physical activity experiences will increase motivation to engage in a physically active lifestyle outside of school and throughout the lifespan (Wallhead & Buckworth, 2004). Correlational studies have demonstrated associations between psychosocial variables and physical activity (Crimi, Hensley, & Finn, 2009; Sallis, Prochaska, & Taylor, 2000). However, no intervention studies have attempted to change psychosocial variables and determine the influence of these changes on physical activity outside of the school setting.

Physical education experiences that emphasize a mastery climate promote adaptive motivational strategies and positive affect compared to a performance climate (Ntoumanis & Biddle, 1999; Treasure & Roberts, 2001). Furthermore, researchers have implemented mastery-based interventions that resulted in an increase in fundamental motor skill competence (Robinson & Goodway, 2009, Valentini & Rudisill, 2004a, b) and physical activity during physical education (Wadsworth et al., 2010). It is important to design and implement physical education interventions that are grounded in theories of motivation that aim to increase intrinsic motivation.

The primary purpose of this dissertation was to determine the effect of two instructional climates (mastery, performance) on: a) motor skill competence, b) physical activity during physical education and after school, and c) psychosocial variables (i.e., attitude toward and enjoyment of physical activity and physical education, perceived physical competence). This section will present a discussion regarding the characteristics of the typical physical education program and each instructional climate, relevant findings, strengths and limitations of this dissertation, potential directions for future research, conclusions, practical implications, and key messages.

Description of Instructional Climates

As mentioned, the typical physical education class is 50 minutes. However, for the purpose of this dissertation, the class was randomly divided into two climates and class time was reduced to 25 minutes for each climate. Furthermore, five minutes were dedicated to daily transitioning between climates from the hallway into the gymnasium.

Formal lesson plans of the intervention were an average of 19.7 and 20.1 minutes in length for the mastery and performance climates, respectively.

The implementation of two distinct and salient instructional climates (mastery, performance) was imperative to the expectations of the research hypotheses. Hypotheses were developed based on the characteristics of the climates that were grounded in achievement goal theory. As reported, the intervention integrity checks established that each climate was implemented according to a set of predetermined criteria that manipulated the TARGET structure. The mastery climate promoted a child-centered learning experience and encouraged students to independently navigate the environment by choosing the task, level of task difficulty, the amount of time spent engaged in each task, and which peers to engage with during intervention sessions. The performance climate promoted a teacher-centered learning experience and students were not provided opportunities to contribute to the decision-making process regarding engagement. Students were instructed to engage in specific tasks for a predetermined amount of time. Students were only provided one level of difficulty for tasks. Also, students were not permitted to choose who to engage with during the intervention.

Other key components of the instructional climates were the type of evaluation (i.e., feedback) and recognition provided to students. During the mastery climate, feedback was predominantly provided based on the process (i.e., *how* the movement was performed) and performance was compared to self-referenced improvement. In contrast, the performance climate emphasized feedback on the product of movement (i.e., the outcome) and performance was evaluated by peer comparison. Results indicated that the feedback provided to each climate were consistent with the characteristics of a mastery and performance instructional climate.

Differences between Typical Physical Education and Instructional Climates

One of the barriers identified in providing opportunities for students to engage in MVPA during physical education is the substantial amount of time dedicated to management tasks (Department of Health and Human Services, 2010). Multisite studies have evaluated typical elementary physical education programs and found that 21.1% (McKenzie et al., 1995), 21.5% (McKenzie et al., 2001), and 23.1% (Bevans, Fitzpatrick, Sanchez, Riley, & Forrest, 2010) of class time is dedicated to management tasks. One of the striking findings of the present dissertation is that 54.6% of class time was dedicated to management tasks during typical physical education. This is substantially higher than previously reported percentages.

During the course of this intervention, an average of 9.9% and 23.5% of class time was dedicated to management tasks in mastery and performance climates, respectively. The mastery climate resulted in significantly less time dedicated to management tasks compared to typical physical education and the performance climate. There was no significant difference between the performance climate and typical physical education. The time dedicated to management tasks during a performance climate is very similar to previous studies of typical physical education (Bevans et al., 2010; McKenzie et al., 1995; McKenzie et al., 2001). These results suggest that the characteristics of a mastery climate allow more class time to be dedicated to students reaching goals of the lesson plan. This includes more time for instruction, motor skill practice, and physical activity engagement. Specifically, the physical education teacher will be able to spend more time engaged in positive teaching behaviors such as providing knowledge and feedback to individual students and encouraging participation in physical activity.

There were other findings from direct observation that warrant discussion. Results indicated that 10.9% of class time during typical physical education was dedicated to demonstration and instruction related to a lesson plan. In contrast, 45.2% and 40% of class time was spent in providing instruction and demonstrating activities for the mastery and performance climates, respectively. This suggests that typical physical education does not provide regular instruction to support the learning of fundamental motor skills along with promoting physical activity. Also, it appears that the instructional climates implemented high-quality lesson plans that emphasized teaching and demonstrating activities to students.

An important finding was that during typical physical education, the teacher spent 45.8% of class time observing students without providing feedback, instruction, or promoting physical activity. Also, the teacher spent less than one percent of class time encouraging student physical activity. During the intervention, regardless of climate, the teacher spent less than 3% of class time in observation without providing any type of instruction or encouragement. Lastly, 29.4% and 28.2% of class time was spent by the teacher promoting physical activity during a mastery and performance climate, respectively. These results suggest that the intervention consisted of high-quality physical education content and positive teacher behaviors such as providing instruction, demonstrating activities, and promoting in-class physical activity.

Changes in Fundamental Motor Skill Competence

Motor competence is needed for individuals to independently engage in their surrounding environment (Clark, 2007). Fundamental motor skills are the building blocks of more complex movements (Clark & Metcalfe, 2002; Seefeldt, 1980). Fundamental motor skills enable children to apply basic movements to participate in sports and games that require more advanced movements during the school-age years and throughout the lifespan (Clark, 1994). Early elementary physical education programs provide the foundation of movement experiences for students. It is important that students reach a basic competence in fundamental motor skills in early elementary school. Physical education during late elementary school emphasizes students applying a variety of skills to participate in sports and games. For example, to participate in a game of baseball or softball, individuals need basic competence in running, catching, throwing, and striking. Emerging evidence suggests that competence in fundamental motor skills is associated with increased physical activity (Robinson, Wadsworth, & Peoples, 2012; Williams et al., 2008), a healthy weight (D'Hondt et al., 2009; Logan & Getchell, 2010; Logan, Scrabis-Fletcher et al., 2011; Williams et al., 2008), higher cardiorespiratory fitness (Hands, 2008), and other psychological, physiological, and behavioral benefits (Lubans et al., 2010).

The initial hypothesis that students assigned to the mastery climate would significantly increase fundamental motor skill competence compared to the performance climate was not upheld. The present sample completed the TGMD at three time points. There were no significant differences in TGMD scores between the instructional climates at any time point, so all students will be discussed as one sample. The TGMD manual provides normative data of skill performance to allow comparison of scores to typically developing peers. At pre-intervention, students scored at the 13th percentile compared to normative data. This demonstrates low competence in fundamental motor skills prior to the start of the intervention and is likely due to a lack of exposure to high-quality physical education and other movement experiences where instruction is provided, rather than developmental delay. At post-intervention, students significantly improved in fundamental motor skill competence and scored at the 51st percentile. Following a 10-week retention period, students maintained their improvements in TGMD performance and scored at the 46th percentile.

The importance of this study is that regardless of instructional climate, fundamental motor skill competence increased significantly from pre- to post-intervention. This suggests that students received high-quality instruction and sufficient opportunities to practice a variety of skills. The results demonstrate that students can improve motor skill competence in 5 weeks if high-quality physical education is provided. The intervention provided was similar in length to other studies that aimed to promote motor skill competence (Logan, Robinson, et al., 2011). It was hypothesized that children assigned to the mastery climate would perform better at post-intervention due to the characteristics of a mastery climate that may increase intrinsic motivation. A key aspect of a mastery climate is providing choice to students as it relates to making engagement related decisions. A recent meta-analysis concluded that for children and adults alike, "…when individuals are allowed to affirm their sense of autonomy through choice they experience enhanced motivation, persistence, performance, and production" (Patall, Cooper, & Robinson, 2008, p. 298). It is possible the students needed to be exposed to a mastery climate for a longer period of time for positive changes in motivation to emerge. However, it is also possible that previous findings are not transferable to the motor domain within the physical education setting. Previous research has determined that motor skill interventions are effective in improving fundamental motor skill competence of young children (Logan, Robinson et al., 2011). However, very few studies have implemented a motor skill intervention in a school-age population within the physical education setting (van Beurden et al., 2003; McKenzie, Alcaraz, Sallis, & Faucette, 1998; Pieron, Cloes, Delfosse, & Ledent, 1996; Salmon et al., 2008). These interventions ranged in duration from six months to three years and all demonstrated positive changes in motor skill competence.

There was a 10-week time period from the end of the intervention to the retention assessment of fundamental motor skills. Regardless of instructional climate, students maintained the skill improvement demonstrated at post-intervention. There are two possible explanations for the retention of skill competence. Students received high-quality instruction and were provided with substantial time to practice skills through a variety of activities during the intervention.

It is also possible that students' participation in typical physical education class or other structured movement experiences during the retention period contributed to the maintenance of skill competence. During the retention period, the elementary school was closed two days for teacher professional development, three days for Thanksgiving break, and 11 days for Christmas. Students participated in 30 typical physical education classes during this time. Based on direct observation of typical physical education (i.e., SOFIT results), skill maintenance is not likely due to the instruction received during typical physical education. Typical physical education class spent a large amount of class time in management tasks and did not provide much instruction. Furthermore, participation in other structured movement programs or organized sports is not likely to have contributed to retention of skill competence. Only seven out of 48 students participated in an after-school organized activity. It is not likely that the activities reported (i.e. football, cheerleading, dance) facilitated direct improvement of the skills that were emphasized during the intervention. At pre-intervention, the students scored very low on the TGMD, suggesting they had not been previously exposed to high-quality instruction. Also, Logan, Robinson et al. (2011) recently found that students do not improve in fundamental movement skills in the short-term as a result of growth and maturation. Thus, the skill improvements are likely due to participation in the intervention that provided the children with high-quality skill instruction and opportunities to practice and receive reinforcement of motor skill performance. Furthermore, motor skill competence was maintained after a only five weeks of instruction and there is potential of further improvement if quality physical education was provided throughout the entire school year.

It is established that the two instructional climates implemented during the intervention were different from each other in important ways. The mastery climate promoted a student-centered learning experience. Students were provided with choice during intervention sessions regarding task selection (type and difficulty), length of time to engage at each station, and with who to engage with. Also, feedback was consistently provided in reference to self-improvement. The performance climate encouraged a teacher-driven learning experience. The teacher made engagement related decisions for the students. Also, feedback emphasized comparison to performance of classmates. Although the climates were different in many characteristics, one similarity was the implementation of high-quality instruction that focused on the process of skill development (i.e., how a movement was performed). However, students in the performance climate *also* received feedback regarding the outcome of performance, regardless of *how* the movement was performed. It was hypothesized that students would be more likely to participate and increase fundamental motor skill competence during the mastery climate compared to the performance climate. This hypothesis is based on previous research on student motivation during mastery-based learning experiences (Ames 1992a, b; Ames & Archer, 1988; Ward, Wilkinson, Graser, & Prusak, 2008; Xiang, McBride, & Guan, 2004). This hypothesis was not upheld.

Despite the differences between the climates, each climate improved similarly from pre- to post-intervention and maintained the improvement following a retention period. From anecdotal evidence, it appears that the physical education teacher typically promotes a performance climate during class; however, it is unknown the type and amount of feedback provided. This includes the teacher-centered approach, peer comparison of performance, and feedback emphasizing the outcome, rather than the process of movement. It is possible that an experimenter effect influenced the results. Research has demonstrated negative student outcomes with regard to performance and psychosocial variables after participation in a performance-based learning environment (Ames, 1992b; Ames & Archer, 1988; Elliott & Dweck, 1988). However, it is possible these negative outcomes were not replicated in the current study because the students responded to a new teacher and received high-quality instruction and feedback that they were not exposed to during typical physical education.

Another important aspect of this dissertation is the inclusion of a retention assessment of fundamental motor skills. Limited research studies have dedicated the time to incorporate a retention assessment following the implementation of a motor skill intervention (Robinson & Goodway, 2009; Salmon et al., 2008; Valentini & Rudisill, 2004b). Robinson and Goodway (2009) found similar maintenance for preschool children of object control skills following a 9-week retention that included a mastery and low-autonomy climate. Valentini and Rudisill (2004b) found that Kindergarten children that participated in a mastery climate maintained skill improvements, while children that participated in a low-autonomy climate significantly declined following a 6-month retention period.

The results of this dissertation provide valuable knowledge to the literature. Students who receive 440 minutes in a 5-week period of high-quality motor skill instruction are likely to increase competence and maintain skill improvement over time. It is important to determine if participation in a motor skill intervention results in longer-term improvements by measuring skill competence following a longer retention period. This research could provide curriculum recommendations with regard to the most effective teaching methods to early elementary physical education teachers.

A key aspect of the intervention, regardless of climate, included providing process-oriented (i.e. *how* the movement was performed) feedback and reinforcement to the students based on the critical elements of fundamental motor skills (See Appendix E). The intervention also supported an environment that allowed a large percentage of class time for students to engage in skill practice. This demonstrates that receiving feedback and sufficient practice time contributes to the development of fundamental motor skill competence and is consistent with previous research (Goodway & Branta, 2003; Robinson & Goodway, 2009). These characteristics of the intervention contributed to providing high-quality instruction to the students.

Results demonstrate that second grade students are capable of making engagement-related decisions during physical education. From a curriculum design standpoint, it might be beneficial to for physical education class content to focus on the teaching and learning for fundamental motor skills in the Fall term. Upon returning from winter break, it is expected that students will retain competence. Therefore, allowing the physical education content in the Spring term to be dedicated to the application of fundamental motor skills to various forms of games and sports. This approach will contribute to the transition of early elementary physical education content to more organized sports and games that is typical of physical education during the later elementary school years.

Physical Activity during Physical Education

There are many health benefits associated with children participating in physical activity such as a healthy weight status (Purslow et al., 2008), higher cardiorespiratory fitness (Rowlands, Eston, & Ingledew, 1999), increased bone health (Janz et al., 2010; Meyer et al., 2011), and increased academic and cognitive performance (Fedewa & Ahn, 2011; Rasberry et al., 2011). Furthermore, physical activity patterns are established in childhood and remain relatively stable through adolescence (Janz, Burns, & Levy, 2005; Telama, Yang, Laakso, & Viikari, 1997). One of the main goals of physical education programs is to promote students' engagement in moderate-to-vigorous physical activity (MVPA).

The Department of Health and Human Services (2010) recommends that students engage in MVPA for at least 50% of the time spent in physical education class. Research consistently demonstrates that students who participate in typical elementary physical education programs do not meet this recommendation (Bevans et al., 2010; Coe, Pivarnik, Womack, Reeves, & Malina, 2006; Levin, McKenzie, Hussey, Kelder, & Lytle, 2001; McKenzie et al., 1995; Nader, 2003; Scruggs et al., 2003; Scruggs, 2007; Simons-Morton, Taylor, Snider, Huang, & Fulton, 1994).

Physical activity during physical education class was assessed through direct observation and pedometers. It is important to note that it is difficult to make direct comparisons between typical physical education and the intervention climates due to the differences of class length. During typical physical education, students spent 37.7% of the class time engaged in MVPA. The class length of typical physical education was 50 minutes. Typical physical education did not meet that national recommendation that students should be engaged in MVPA at least 50% of class time. During the 20 minute intervention sessions during physical education of this study, students in the mastery and performance climates surpassed this recommendation and spent 68% and 67% of class time engaged in MVPA, respectively. Students spent significantly more time engaged in MVPA during the instructional climates compared to typical physical education. This suggests that students participating in the instructional climates exceeded the national recommendations that students should spend at least 50% of class time spent in MVPA. However, it is unknown whether students participating in a mastery or performance climate would spend 67-68% of class time engage in MVPA if the class length was longer.

Several organizations recommend at least 60 minutes of daily MVPA for elementary school students (Centers for Disease Control and Prevention, 2010; NASPE, 2004; World Health Organization, 2010). During typical physical education, students spent an average of 15.6 minutes in MVPA during a 50 minute class. Students spent approximately 13 minutes in MVPA during a 20 minute intervention session (regardless of climate). The intervention promoted students to engage in almost 22% of the recommended 60 minutes of daily physical activity. Based on these findings, it could be inferred that the implementation of high-quality instructional climates during typical physical education (i.e., 50 minute class period) would promote students to engage in at least 50% of daily recommended amount of physical activity. This is an important finding because it suggests that school-based physical education may provide elementary school students an opportunity to accumulate at least half of the daily recommended amount of physical activity during the school hours.

Previous research that provided physical education lessons that promoted physical activity found significantly higher physical activity during a mastery climate compared to a performance climate (Wadsworth et al., 2010). Wadsworth et al.'s study incorporated more physical activity-based activities, while this dissertation focused specifically on motor skill-based activities. Although it was hypothesized that physical activity would be higher for students assigned to the mastery climate, the findings of no difference is not surprising. It is assumed that the amount of physical activity required to engage in skill practice is lower compared to engagement in fitness based activities. For example, to throw a ball towards a wall, pick it up, and repeat several times does not require vigorous physical activity. In addition, due to each climate receiving a daily lesson of physical education that only lasted 20 minutes, it is possible that there was not enough time for differences in physical activity patterns to emerge.

Research has demonstrated that when children are inactive for a period of time they compensate and are highly active during opportunities to engage in physical activity such as physical education (Frémeaux et al., 2011; Van Sluijs, Mcminn, & Griffin, 2007). The mastery and performance climates alternated when each participated in physical education first during intervention sessions. It is possible that children, who rested for 20 minutes prior to their intervention session, compensated and were highly active during the intervention. This may explain physical activity differences between the intervention climates and typical physical education.

<u>Pedometer step counts</u>

Physical activity was also assessed through pedometers during physical education class. Previous research varies substantially in the reported step per minute rates of elementary school students during physical education class. Results indicate that 5^{th} grade boys and girls accumulated 78 and 58 steps per minute, respectively, per 30 minute physical education class (Scruggs, 2007). Dauenhauer and Keating (2011) reported that third through fifth grade boys engaged in 26.2 and 22.6 and girls engaged in 25.3 and 20.7 steps per minute during 30 and 60 minutes physical education lessons, respectively. Other research suggests that boys engage in 49-66.7, while girls engage in 46-60.9 steps per minute (Brusseau et al., 2011; Scruggs, Beveridge, Watson, & Clocksin, 2005). Specifically, first and second grade boys and girls engaged in 60 and 56.8 steps per minute, respectively, during physical education (Scruggs et al., 2003). Based on their results, Scruggs et al. (2003) recommends that first and second grade students engage in 60-63 steps per minute to spend at least 33% of class time engaged in MVPA.

Results of the present study indicated that students engaged in an average of 32.7 (typical physical education, boys: 31.4; girls: 29.6), 47.7 (mastery, boys: 54.2; girls: 42.1), and 45.7 (performance, boys: 47; girls: 44.3) steps per minute during each climate of physical education. There was no statistical difference between steps per minute between the two instructional climates. However, students engaged in significantly more physical activity during the instructional climates compared to typical physical education. Within typical physical education and the performance climate, it appears that boys and girls engaged in similar patterns of physical activity. This is consistent with previous research (Brusseau et al., 2011). However, during a mastery climate it appears boys were more active than girls.

The students included in this dissertation did not meet the recommended physical activity guidelines for pedometer step counts during typical physical education or each of the instructional climates to engage in 60-63 steps per min. However, students did engage in over 67% of class time in MVPA during each climate according to direct observation. There are possible explanations for the discrepancy between pedometer step count values and percentage of time spent in MVPA according to direct observation. For direct observation, students' behavior is classified as MVPA if they walk or are very active at any point during the 10-second observation period. A student could stand in one place for seven seconds, walk for three seconds, and receive a code of walking. If this occurs, the pedometer will only record the minimal steps taken yet according to direct observation, the student received a code of walking for the 10-second observation period. Also, the

SOFIT protocol states that behavior should be classified based on an estimation of the student's energy expenditure. If a student is standing, then winds up and throws a ball to the wall, he/she will receive a code of walking for physical activity behavior. He/she expended more energy than standing stationary, but not enough to warrant a very active classification. Although the example of throwing would lead to a code of walking, the number of steps necessary to engage in a throw is minimal compared to other types of activities. However, the focus of this intervention was fundamental motor skills.

The type of pedometer used to assess physical activity during physical education (i.e., Yamax) is validated and reliable for elementary school-aged children (Bassett et al., 1996; Bassett, Cureton, & Ainsworth, 2000). However, it is possible the pedometers underestimated physical activity due to students inadvertently resetting the pedometers or the pedometer shifting positions on students' body that led to inaccurate measurement of steps.

One of the primary purposes of the intervention was to increase skill competence. Based on anecdotal observations, less physical activity is required to practice object control skills such as throwing, catching, and striking. In order to practice these skills, sustained MVPA is not always necessary. The lesson plans of the intervention included two object control stations and one locomotor station. Students likely engaged in more MVPA during the locomotor station. However, due to space limitations only one locomotor station could be provided each day. The amount of available space was also an issue with regard to the number of students in each climate. Although each climate included half of the typical physical education class (23-25 students), the lack of space was still problematic.

The intervention lesson plans were relatively short (approximately 20 minutes). Thus, it is difficult to compare the rate of step counts accumulated during each instructional climate to previous studies that assessed step counts during a typical physical education class period (i.e., more than 20 minutes per lesson). Due to time constraints, it was not possible to emphasize physical activity participation *and* improvement in fundamental motor skill competence. It is possible that pedometer steps per minute may have increased if the lesson length was longer and allowed for physical activity stations to be provided. The lesson length may also have contributed to the lack of physical activity differences between the instructional climates. There may not have been enough time for students to engage in physical activity for differences to emerge.

After-School Physical Activity

Children participate in physical activity in a variety of settings throughout the typical school day. Physical activity behaviors of elementary school-aged children that occur outside of the school setting have received limited empirical attention. Research has found that elementary school students engage in 63% of their total daily physical activity outside of school (Brusseau et al., 2011). This suggests that the out-of-school hours are especially important to encourage engagement in physical activity. Previous research has also shown that boys are typically more active than girls during the after-school hours (Beighle et al., 2006; Brusseau et al., 2011). However, a major limitation is that previous research has focused on children enrolled in the 3rd through 5th grades which makes direct comparison of results to the present dissertation difficult. Also, the definition of out-of-school time varies between studies. Brusseau et al. (2010) did not provide a definition of the specific time period considered as out-of-school. Beighle et al.

(2006) included a 30-minute period before school and the time period after-school until sunset as the opportunity for children to engage in out-of-school physical activity. The lack of a clear standard to define out-of-school physical activity is problematic.

Limited research has assessed changes in after-school physical activity of elementary school-aged children who participated in a physical education based intervention. Results of previous research are mixed. One study found no significant influence of an intervention on after-school physical activity (Sallis et al., 1997). One study found a positive and significant increase for the intervention group (McKenzie et al., 1996). Two important components of this intervention were the emphasis on enjoyment during physical education and teaching students the necessary fundamental motor skills to participate in physical activity. Finally, one study found a significant and positive increase in after-school physical activity for the control group (Donnelly et al., 1996).

One purpose of this study was to specifically determine physical activity engagement during the *after-school* hours. After-school was defined as 3:00 - 6:00 p.m. The present intervention was grounded in achievement goal theory. The mastery climate was implemented on established principles to enhance intrinsic motivation. Therefore, it was expected that students assigned to the mastery climate would engage in more after-school physical activity. This hypothesis was not upheld. There was no significant difference within or between climates on pedometer-determined after-school physical activity. There are a few possibilities for the lack of difference from pre to post-intervention.

The intervention was implemented in the beginning of October and continued until mid-November. It is possible the weather changed enough during this time period to influence after-school physical activity. However, seasonal changes were not likely to influence after-school physical activity since the intervention was implemented during the fall months. The study occurred in a geographic region that remains relatively warm through the fall season. The average range of temperatures was 50-75 and 41-67 degrees, in October and November, respectively. Research indicates that children are more active after-school during the summer compared to the winter (Rowlands, Pilgrim, & Eston, 2009; Silva, Santos, Welk, & Mota, 2011; Tucker & Gilliland, 2007). Specifically, boys engage in substantially less MVPA after-school during the winter compared to the summer, while girls' physical activity patterns remain more stable (Silva et al., 2011). Another potential explanation is that the opportunities to engage in physical activity may have changed from the beginning to the end of the intervention such as organized sports, after-school programs, or other recreational opportunities. However, only seven out of 48 students included in this study participated in any form of after-school activity.

Based on direct observation (i.e., SOFIT results) of teacher behavior during each instructional climate, prompts were not provided to students that encouraged after-school physical activity. It was not determined a priori that such prompts would not be given. However, due to the short lesson length and the emphasis on motor skill instruction there was simply not enough time during intervention sessions to explicitly encourage after-school physical activity. This may have been a contributing factor to the lack of change in after-school physical activity from pre- to post-intervention (Hastie, van der Mars, Layne, & Wadsworth, 2012).

Another possibility is that daylight savings time affected physical activity during post-intervention assessment. Daylight savings resulted in an hour less of daylight per day starting in the last week of the intervention. This is an issue that is difficult to overcome. If the intervention was implemented during the spring, daylight savings would result in an extra hour of daylight towards the end of the intervention.

An additional potential explanation is the lack of changes in psychosocial variables from pre- to post-intervention between climates. These results will be discussed in the next section. An increase in after-school physical activity was hypothesized based on the assumption that the characteristics of the climates would impact psychosocial variables. However, since there were no changes in these variables between climates, it is not likely that intrinsic motivation was influenced by participation in either climate of the intervention.

A limitation of this dissertation with regard to the assessment of after-school physical activity is the low compliance rate of students who wore the pedometers for a sufficient amount of time on the required number of days to be included for analysis (n = 14 [mastery]; n = 10 [performance]). There were several students who were non-compliant in wearing the pedometers after-school. On a daily basis, the physical education teacher kept track of which students were wearing their pedometer and feedback was provided to encourage compliance. Students received small rewards such as crayons, coloring books, and stickers on a bi-weekly basis if they consistently wore their pedometer during the after-school hours. As pedometers were collected and downloaded on a weekly basis it was possible to determine compliance. Another compliance issue relates to student participation in organized sports. The fall months include the organized sports of football and cheerleading seasons for boys and girls, respectively. The coaches did not allow students to wear the pedometers during practice and games due to safety concerns. Thus, a substantial amount of physical activity may not have been recorded.

Psychosocial Variables

There are psychosocial factors that contribute to children's participation in physical activity. An increase of intrinsic motivation to participate in physical activity is expected when children experience positive psychosocial outcomes related to the physical domain. Research supports this hypothesis as indicated by higher participation in physical activity of elementary school-aged children who demonstrate a) high enjoyment of physical activity and physical education (Crimi, Hensley, & Finn, 2009; DiLorenzo et al., 1998; Hagger, Cale, & Almond, 1997; Sallis, Prochaska, & Taylor, 2000; Trost et al., 1997), b) better attitudes toward physical activity and physical education (Sallis et al., 1999), and c) high perceived competence (Crimi, Hensley, & Finn, 2009; Sallis, Prochaska, & Taylor, 2000; Sollerhed et al., 2008; Welk & Schaben, 2004).

Most previous research has been descriptive studies in which psychosocial variables are associated with physical activity through correlation procedures (Crimi, Hensley, & Finn, 2009; Sallis, Prochaska, & Taylor, 2000; Sallis et al., 1999; Trost et al., 1997). There are very few interventions that were implemented with the intent to *change* psychosocial variables. One strategy to promote positive psychosocial outcomes is the implementation of a mastery climate (Ames & Archer, 1988; Barron & Harackiewicz, 2001; Diener & Dweck, 1978; 1980; Elliot & Dweck, 1988; Halvari, Skjesol, & Bagøien, 2011; Robinson, Goodway, & Rudisill, 2009; Valentini & Rudisill, 2004b).

The psychosocial variables assessed in this study include attitude toward and enjoyment of physical activity and physical education and perceived physical competence. The results indicated no significant changes in any of the psychosocial variables from pre- to post-intervention for either of the instructional climates. Although the intervention was implemented every day for five weeks, this may not have been enough exposure to the characteristics of the instructional climates to change psychosocial variables. Previous studies have shown improvements in perceived competence for preschool children following an intervention that included a similar amount of total instruction time (Robinson, Rudisill, & Goodway, 2009; Valentini & Rudisill, 2004b). Only one previous study targeted enjoyment of elementary students during an intervention that occurred over a six month period (Salmon et al., 2008). It is possible that a longer intervention needs to be implemented to expect positive changes in the psychosocial variables of attitude and enjoyment.

The intervention integrity checks and the measurement of feedback between climates established that the climates were consistent with the intended characteristics of each. Physical education interventions have targeted enjoyment and found positive changes for elementary school-aged children (McKenzie et al., 1996; Salmon et al., 2008). Each of these interventions occurred over at least a one year period. No previous research has attempted to change more than one psychosocial variable by implementing an intervention. If changes in behavior and intrinsic motivation are expected, it is important to use a multifaceted approach that focuses on more than one psychosocial variable. This dissertation provides valuable knowledge about how to target these variables in future studies. It is important to determine if psychosocial variables can be changed during an intervention that is implemented for a longer time period. Additional research is necessary to determine which aspects of an intervention can be manipulated to encourage positive changes in enjoyment, attitude, and perceived competence related to the physical domain.

Strengths of this study

There were strengths and limitations of this dissertation. One of the strengths is that the intervention was implemented every day during a five week period. Often, interventions taught by researchers are implemented once or twice per week. Students were exposed on a consistent basis to the intervention. This ensured that students were not influenced by participation in typical physical education at any point during the intervention. Thus, it can be determined that skill improvements were a result of the instructional climates. Another strength is the inclusion of a retention assessment of fundamental motor skills. It is important for researchers to determine the short and long-term implications of interventions. If the positive benefits of an intervention are not maintained for a substantial amount of time, the meaningfulness of the results may be questioned. An additional strength is the use of multiple methods to assess physical activity during physical education. Direct observation is typically used as the criterion measure of physical activity. This dissertation also used pedometers which allowed a more complete description of physical activity.

One goal of early elementary school physical education programs is to promote competence in fundamental motor skills. However, very few studies have implemented an intervention in the elementary school setting that emphasizes improvement of fundamental movement skills (van Beurden et al., 2003; McKenzie et al., 1998; Pieron, Cloes, Delfosse, & Ledent, 1996; Salmon et al., 2008). Furthermore, only one intervention has targeted physical activity, fundamental motor skills, and at least one psychosocial variable (Salmon et al., 2008). Thus, the results of this intervention provide information related to the feasibility of targeting all three domains within the physical education setting.

Limitations

One limitation of this study is the possibility of an experimenter effect. The primary investigator led all intervention sessions for each of the instructional climates. However, there may have been an experimenter effect because the primary investigator was different than the typical physical education teacher. Based on anecdotal observations, the typical physical education program is very similar to a performance climate. The physical education teacher is the authority regarding engagement related decisions and students are provided very little opportunity to provide input to class activities. Furthermore, feedback is typically based on peer comparison and emphasizes the outcome, rather than the process, of movement. Perhaps the performance climate did not elicit negative changes in psychosocial variables because the students were already accustomed to its characteristics (i.e., teacher-centered approach).

A potential limitation is that students were randomly assigned to participate in the mastery or performance climate during physical education. Random assignment divided the physical education class into two climates that received instruction separately. A key aspect of a mastery climate is *grouping*, which provides children with a choice as it relates to whom to engage with during class. Choice of grouping was provided to children on a daily basis within the mastery climate. However, it is possible that children assigned to the mastery climate were separated from their closest friends based on random assignment. This may have reduced the importance of providing children choice with regard to grouping.

A limitation is that students' weekend physical activity was not assessed. Although weekend physical activity is important, it was beyond the scope of this dissertation. In order to meet the daily recommendation of 60 minutes of MVPA, students need to engage in physical activity outside of the school setting on weekdays. A primary purpose of this study was to determine the influence of instructional climates on after-school physical activity. It is possible that the instructional climates influenced weekend physical activity. Future research is needed to address this limitation.

Finally, a limitation is the relatively short-duration of the intervention. Although it was implemented every day and resulted in significant improvements in fundamental motor skill competence, it was not long enough to change psychosocial variables of students. Due to the school system, Thanksgiving and Christmas breaks, and the scope of this study, it was not possible to implement a longer intervention. Future research should address these limitations.

Future Research

There are several directions for future research. To eliminate the possibility of an experimenter effect, typical physical education teachers should be trained to implement specific instructional climates of interest. Multiple schools should be recruited in order to conduct a randomized control trial at the school level. This would allow inclusion of several treatment and control schools. School-level randomization would prevent the physical education class period from being divided in half to accommodate two instructional climates. This would allow the *grouping* aspect of a mastery climate to remain salient. Also, the intervention needs to be implemented for at least one full semester or an entire school year. Extended exposure to an instructional climate may be needed to expect changes in psychosocial variables. Another possibility is to involve classroom teachers, parents, and after-school programs to reinforce the characteristics of an implemented instructional climate. A multifaceted approach may be more effective in affecting psychosocial variables which may lead to changes in after-school physical activity.

Conclusions

Positive changes were found in physical activity during physical education and fundamental motor skill competence during a mastery (i.e., child-centered) and performance (i.e., teacher-centered) climate. Dudley et al. (2011) concluded that interventions "…that adopted direct or explicit teaching strategies were most effective" (Dudley et al., 2011, p. 367). However, the mastery climate promoted significantly less time spent in management activities which indicated second grade students are capable of making engagement related decisions. This is also important because a mastery climate allows more class time to be spent in instruction and physical activity, rather than management tasks. Researchers should continue to examine how different instructional styles influence student outcomes.

The present intervention did not lead to changes in psychosocial variables related to the physical domain. However, it is important that the intervention was grounded in a theory of motivation. In order for elementary school-age children to meet the recommendation of 60 minutes of daily physical activity they need to engage in physical activity outside of physical education class. Two purposes of physical education is to promote motor skill competence and encourage students to adopt a physically activity lifestyle through childhood and into adulthood. Thus, it is important that the development of interventions is guided by theories of motivation in an attempt to influence intrinsic motivation and change behavior. Other researchers have suggested that perhaps physical education lessons and out-of-school physical activity are two distinct entities and that there may be other factors that affect out-of-school physical activity such as peer and family influences and opportunities to engage in physical activity (Carroll & Loumidis, 2001). Future research is needed to determine the ability of interventions within physical education to influence out-of-school physical activity behaviors of children.

Practical Implications

This dissertation provides valuable information to physical education teachers regarding the amount of time required to improve fundamental motor skills of 2nd grade students. Students improved significantly after exposure to approximately 440 minutes of high-quality physical education lessons. As a whole, students improved from the 13th percentile to the 50th percentile from pre- to post-intervention. This is a substantial improvement for a 5 week intervention. It is unclear whether the students would have continued to improve in fundamental motor skills given a longer intervention. Potentially, a fundamental motor skill unit could be implemented during the fall months in 2nd grade physical education class. If high-quality instruction is provided, it is reasonable to expect the improvements will be maintained until the start of the school following the winter holidays. This expectation is based on the high retention of fundamental motor skills demonstrated by students of the present dissertation (46th percentile). This would allow transition to more complex activities provided during physical education in the spring such as applying fundamental motor skills to play simple forms of games and sports.

In addition, a mastery climate encourages less time to be spent in management tasks during physical education. This is important because it promotes students to take responsibility for their learning by allowing them to make engagement related decisions. Less time spent in management tasks also allows the physical education teacher to spend more time engaging in positive teaching behaviors such as providing instruction and feedback, demonstrating activities, and promoting in-class physical activity.

Results indicate the need to provide additional resources and professional development opportunities for physical educators regarding the implementation of effective and high-quality physical education content that supports multiple goals of physical education and contributes to the healthy development of students.

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Appendices

Appendix A— Institutional Review Board Approved Parental Consent Form

AUBURN UNIVERSITY

COLLEGE OF EDUCATION

KINESIOLOGY

The Auburn University Institutional Review Board has approved this document for use from 8/26/11 to 1/28/12 Protocol # 06-262 EP 0701

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INFORMED CONSENT FOR EXPLORING PHYSICAL ACTIVITY RESPONSE TO DIFFERENT MOTIVATIONAL CLIMATES IN RURAL, AFRICAN-AMERICAN CHILDREN: A SCHOOL-BASED APPROACH TO INCREASING PHYSICAL ACTIVITY THROUGH PHYSICAL EDUCATION

I invite your child to participate in a research project that will be completed within the physical education programs at Loachapoka Elementary School. We are interested in exploring your child's physical activity response to different motivational climates during physical education and at home. The assessment measures will include descriptive information, including height, weight, Body Mass Index [BMI], sex, race, and date of birth along with physical activity (measured by a heart rate monitors [Actihearts], the System of Observing Fitness Instruction Time [SOFIT], step count pedometers). All physical education sessions will be videotaped. The videotapes will be used only for educational and research purposes.

Heart rate monitors will be used to record your child's heartbeat and step count pedometers and accelerometers will be used to assess their physical activity participation while they are engaged during the physical education program and throughout the school day. It takes approximately 5 minutes or less to place the heart rate monitor, step count pedometers and/or accelerometer on your child.

Descriptive information including height, weight, BMI, sex, race, and date of birth will be gathered for your child. Height will be measured using a standard tape measure. Children will be asked to stand with their back against a wall and height will be measured to the nearest centimeter. Children will also stand on a standard scale to measure their weight to the nearest kilogram. Body Mass Index, a measure of overweight and obesity, will be calculated from the height and weight measures using the formula height divided by weight^2. Parents/guardians will be asked to report their child's sex, race, and date of birth.

Perceived competence. The Pictorial Scale of Perceived Competence and Acceptance for Young Children will be verbally administered to your child at the beginning, middle, and end of the study. This assessment will take approximately 15 minutes to complete each time it is administered. The assessment consists of 12 items presented on pictorial plates each of which contains two separate pictures, side by side, one of which depicts a child who is skilled, and the other of which depicts a child who is not so skilled. The child's task is to first select the picture which is most like him/herself. Then, after making this choice, the child focuses on that picture and indicates whether he or she is just a little bit like that child or a lot like that child.

Physical activity assessments include heart rate monitors [Actihearts], the System of Observing Fitness Instruction Time [SOFIT], step count pedometers.

1. Actihearts will measure the children's heart rate during physical education. Heart rate is one way to determine if your child is getting adequate exercise and physical activity necessary for health benefit. Each heart rate monitor is a small device that that is placed on the chest using two adhesive-safe stickers placed on the skin. To make sure the monitor does not move or fall off, a non-adhesive elastic band (i.e. ace bandage) will be lightly wrapped around the chest. The monitor will collect heart rate every five seconds. A trained researcher will take special care to ensure comfort for your child.
2. System of Observing Fitness Instruction Time is an observational measure used to determine how intense a child is engaged in physical activity. Physical activity intensity level is recorded every 20 seconds. Child physical activity levels are coded on a scale of '1' to '5' corresponding to the student's body position: lying down, sitting, standing,

Page 1 of 2 Parental/Guardian initials ________ walking, or very active. SOFIT will be assessed through videotape and the assessment requires no additional time from your child beyond normal participation in the physical education.

3. Pedometers will be used to assess children's physical activity during physical education and out-of-school. Pedometers will be attached to the waistband of each child by an investigator at the start of data collection. Children will wear the pedometers during school and at home. These devices are small and lightweight (28 x 27 x10 mm x 17 g). The step count pedometer will collect data as it counts the number of steps while playing, and the accelerometers will measure the body's movement in both the vertical (i.e., up and down) and horizontal (i.e., side to side) direction.

Will you or your child receive compensation for participating? Participants and parents will be compensated for their participation in this project. Specifically, parents will receive a $10.00 gift card to Wal-Mart for returning the pedometer at the end of the study. Compensation is not based on whether or not the child participates for the duration of the study, simply that the equipment is returned at the conclusion of the study, or upon deciding to withdraw from the study.

There are no foreseeable risks or discomforts associated with the heart rate monitor, the System of Observing Fitness Instruction Time, and step count pedometers. The only identified risk for using heart rate monitors is that a child may feel that the monitor is uncomfortable or distracting. The heart rate monitor model we plan to use for this study was specially designed for children's physical education classes. These monitors have been used in scientific studies and daily physical education class with school-aged children for many years. **Please note that any child who expresses a desire to quit the assessments will be allowed to stop immediately. Participants will also be told that they can remain in the Physical Education Program without completing the assessments.** To preserve confidentiality, the children's performance and responses will be reported as group results only. I am informing you that any information obtained from the assessments may be used in any way thought best for education and publication. Unless otherwise notified by you, I plan to present the results of this program assessment at a scientific conference and publish the results in an appropriate journal. In any presentation or publication, the data will remain anonymous.

Your decision whether or not to allow your child to participate will not jeopardize his/her future relations with Auburn University, the Department of Kinesiology, or Loachapoka Elementary School. Your child's performance or responses will in no way affect your child's standing in the childcare center. At the conclusion of the assessments, a summary of group results will be made available to all interested parents and educators. Should you have any questions or desire further information, please call Dr. Mary Rudisill at (334)844-1458 (phone) or rudisme@auburn.edu (email). You will be provided a copy of this form to keep.

For more information regarding your rights as a research participant you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board by phone (334)-844-5966 or e-mail at hsubjec@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED YOU MUST DECIDE WHETHER OR NOT TO ALLOW YOUR CHILD TO PARTICIPATE. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO ALLOW YOUR CHILD'S PARTICIPATION IN THE STUDY.

Child's Name ______________________________

Parent/Guardian Signature ______________________ Date ________

Investigator Signature ________________________ Date ________

The Auburn University Institutional Review Board has approved this document for use from 8/26/11 to 1/28/12
Protocol # 06-262EP0701

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Appendix B— Scoring sheet of TGMD-2

ID #		Assessment Date:		
Preferred Hand		**LOCOMOTOR SKILLS**		
Preferred Foot				
Skill	Performance Criteria	Trial 1	Trial 2	Score
Run	Arms move in opposition to legs, elbows bent			
	Brief period where both feet are off the ground			
	Narrow foot placement landing on heel or toe (i.e., not flat footed)			
	Nonsupport leg bent approximately 90 degrees (i.e., close to buttocks)			
Gallop	Arms bent and lifted to waist level at takeoff			
	A step forward with the lead foot followed by a step with the trailing foot to a position adjacent to or behind the lead foot			
	Brief period when both feet are off the floor			
	Maintains a rhythmic pattern for four consecutive gallops			
Hop	Nonsupport leg swings forward in pendular fashion to produce force			
	Foot of nonsupport leg remains behind body			
	Arms flexed and swing forward to produce force			
	Takes off and lands three consecutive times on preferred foot			
	Takes off and lands three consecutive times on nonpreferred foot			
Leap	Take off on one foot and land on the opposite foot			
	A period where both feet are off the ground longer than running			
	Forward reach with the arm opposite the lead foot			
Horizontal Jump	Preparatory movement includes flexion of both knees and arms extended behind body			
	Arms extend forcefully forward and upward reaching full extension above the head			
	Take off and land on both feet simultaneously			
	Arms are thrust downward during landing			
Slide	Body turned sideways so shoulders are aligned with the line on the floor			
	A step sideways with lead foot followed by a slide of the trailing foot to a point next to the lead foot			
	A minimum of four continuous step-slide cycles to the right			
	A minimum of four continuous step-slide cycles to the left			

ID #		Assessment Date:		
Preferred Hand		**OBJECT CONTROL SKILLS**		
Preferred Foot				
Skill	Performance Criteria	Trial 1	Trial 2	Score
Striking a Stationary Ball	Dominant hand grips bat above nondominant hand			
	Nonpreferred side of body faces the imaginary tosser with feet parallel			
	Hip and shoulder rotation during swing			
	Transfers body weight to front foot			
	Bat contacts ball			
Stationary Dribble	Contacts ball with one hand at about belt level			
	Pushes ball with fingertips (not a slap)			
	Ball contacts surface in front of or to the outside of foot on preferred side			
	Maintains control of ball for four consecutive bounces without having to move the feet to retrieve it			
Catch	Preparation phase where hands are in front of the body and elbows are flexed			
	Arms extend while reaching for the ball as it arrives			
	Ball is caught by hands only			
Kick	Rapid continuous approach to the ball			
	An elongated stride or leap immediately prior to ball contact			
	Nonkicking foot placed even with or slightly in back of the ball			
	Kicks ball with instep of preferred foot (shoelaces) or toe			
Overarm Throw	Windup is initiated with downward movement of hand/arm			
	Rotates hips and shoulders to a point where the nonthrowing side faces the wall			
	Weight is transferred by stepping with the foot opposite the throwing hand			
	Follow-through beyond ball release diagonally across the body toward the nonpreferred side			
Underhand Roll	Preferred hand swings down and back, reaching behind the trunk while chest faces cones			
	Strides forward with foot opposite the preferred hand toward the cones			
	Bends knees to lower body			
	Releases ball close to the floor so ball does not bounce more than 4 inches high			

Appendix C—Attitude toward physical activity and physical education assessment
Adapted from Sallis et al., 1999

Check the activity in each pair you would rather do if you had to choose.

E. After school would rather:

1.		Play indoors	OR	Play outdoors	
2.		Play a running game with friends	OR	Take a walk with friends	
3.		Take a walk with friends	OR	Watch TV	
4.		Watch TV	OR	Play a running game with friends	

Check one word from each pair.

F. Physical Education class is:

1.		nice	OR	awful	
2.		unhealthy	OR	healthy	
3.		sad	OR	happy	
4.		important	OR	unimportant	
5.		fun	OR	boring	

H Physical activities that make me tired make me sweat are

1.		nice	OR	awful	
2.		unhealthy	OR	healthy	
3.		sad	OR	happy	
4.		important	OR	unimportant	
5.		fun	OR	boring	

I Doing physical activities after school

1.		nice	OR	awful	
2.		unhealthy	OR	healthy	
3.		sad	OR	happy	
4.		important	OR	unimportant	
5.		fun	OR	boring	

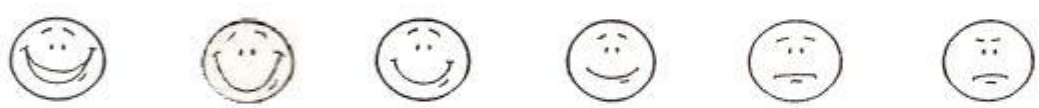
Appendix D— Enjoyment Assessment

HOW DO YOU FEEL ABOUT. . .

Put a check on the ONE face that best describes your feelings about that question. Be sure to check only ONE face.

A. How do you feel about taking a walk for exercise?

B. How do you feel about PE class?



C. How do you feel about doing physical activities with a lot of running?

D. How do you feel about doing physical activities that make you tired or make you sweat?

Appendix E— Example of skills and critical elements

Skill	Critical Element(s)	Key Phrase(s)
Strike	Eyes focused on ball	"Keep your eyes on the ball"
	Swing is level	"Swing straight through"
	Sideways step toward target	"Step with your front foot"
	Trunk rotates	"Twist & Strike" "Step and rotate/turn hips"
Throw	Eyes focused on target	"Keep your eyes forward"
	Sideways stance	"Make a 'T' with your arms and point to the target"
	Step with opposition	"Step with your opposite foot"
	Arm reaches behind body	"Wind-Up" "Reach back"
	Follow-through across body	"Follow-through across your body and reach for the shoelaces of your opposite foot"
	Hips and shoulders rotate	"Twist and throw"
Catch	Eyes focused on ball	"Keep your eyes on the ball"
	Arms bent and ready for ball	"Keep your elbows bent"
	Reach with hands	"Reach forward to meet the ball"
	Catch using fingertips/hands	"Catch away from your body"
	Arms bend on contact with ball	"Bend elbows when you catch"
Run	Arms move in opposition, elbows bent	"Pump your arms"
	Brief period where both feet off ground	"Run as fast as you can"
	Heel or toe strike	
	Nonsupport leg bent 90 degrees	
Jump	Knees bent and arms extended behind body	"Bend your knees and reach back"
	Arms extend forcefully upon lift-off and extend above head	"Reach to the sky"
	Take off and land on both feet simultaneously	
	Arms thrust downward during landing	"Throw your arms down as you land"

Appendix F—Sample Lesson Plan

Lesson Plan 1
Strike, Kick, Run & Leap

Skill	Activity	Purpose	Level of Difficulty
Strike	Strike a balloon with a large, mesh paddle.	To strike a balloon in the air as many times as possible without allowing the balloon to touch the ground.	Easy
	Strike a balloon with a smaller, circular foam paddle with a short handle.		Moderate
	Strike a balloon with hand		Difficult
Kick	Kick a ball into a goal from a short distance	To kick a ball into a goal.	Easy
	Kick a ball into a goal from a medium distance		Moderate
	Kick a ball into a goal from a long distance		Difficult
Run and Leap	Move at least 5 balls before the song ends; Leap over obstacle	Try to see how many balls you can move from one bucket to the other before the song ends.	Easy
	Move at least 10 balls before the song ends		Moderate
	Move at least 15 balls before the song ends		Difficult

NOTE: The performance climate provided only an easy task variation for each station.

Appendix G— Intervention integrity checks

Intervention Integrity Check

Observer________________ Climate________________ Session __________

Place an "X" if the criteria was met during the intervention session.

All intervention sessions	1.1	1.2	1.3	1.4	1.5
1. General introduction to lesson and clear instructions were provided at each station.					
2. Presented critical cues for each motor skill					
3. Demonstration (teacher and student)					
4. Check for understanding					
5. Stations aligned as described in lesson plan					
6. Time assigned to each station met (20 minutes for mastery or 5 minutes for performance-oriented climate)					
7. Provided positive, specific, corrective, or evaluative feedback					
8. Assisted participants with difficult task attempts					
9. Provided a closing review of critical cues for each motor skill					

Mastery Climate	1.1	1.2	1.3	1.4	1.5
1. *Task*: A range of task difficulty provided at each station					
2. *Authority*: Full autonomy environment					
3. *Recognition*: Participants received feedback based on self-referenced standards					
4. *Grouping*: Independently chosen					
5. *Evaluation*: Provided feedback privately					
6. *Time*: Participants chose for how long to engage at each station					

Performance-oriented Climate	1.1	1.2	1.3	1.4	1.5
1. *Task*: One level of task difficulty provided at each station					
2. *Authority*: Limited support for autonomy					
3. *Recognition*: Participants received feedback based on normative standards (i.e. comparison to peers)					
4. *Grouping*: Teacher chosen					
5. *Evaluation*: Provided feedback publicly					
6. *Time*: The teacher chose how long children engaged at each station					

Appendix H—Teacher feedback instrument (Adapted from Rink, 2010)

	Class	Group	Individual
Evaluative General	Positive: Peer/Out Peer/Pro SR/Out SR/Pro Peer: Self-Ref: Out: Proc: Negative:	Positive: Peer/Out Peer/Pro SR/Out SR/Pro Peer: Self-Ref: Out: Proc: Negative:	Positive: Peer/Out Peer/Pro SR/Out SR/Pro Peer: Self-Ref: Out: Proc: Negative:
Specific	Positive: Peer/Out Peer/Pro SR/Out SR/Pro Peer: Self-Ref: Out: Proc: Negative:	Positive: Peer/Out Peer/Pro SR/Out SR/Pro Peer: Self-Ref: Out: Proc: Negative:	Positive: Peer/Out Peer/Pro SR/Out SR/Pro Peer: Self-Ref: Out: Proc: Negative:
Corrective General	Positive: Peer/Out Peer/Pro SR/Out SR/Pro Peer: Self-Ref: Out: Proc: Negative:	Positive: Peer/Out Peer/Pro SR/Out SR/Pro Peer: Self-Ref: Out: Proc: Negative:	Positive: Peer/Out Peer/Pro SR/Out SR/Pro Peer: Self-Ref: Out: Proc: Negative:
Specific	Positive: Peer/Out Peer/Pro SR/Out SR/Pro Negative:	Positive: Peer/Out Peer/Pro SR/Out SR/Pro Negative:	Positive: Peer/Out Peer/Pro SR/Out SR/Pro Negative: