# PRESCHOOLERS' HEART RATE AND PHYSICAL ACTIVITY RESPONSE TO THREE DIFFERENT MOTIVATIONAL CLIMATES: MASTERY, PERFORMANCE, AND UNPLANNED FREE PLAY

Except where reference is made to the work of others, the work described in this dissertation is my own or was done in collaboration with my advisory committee. This dissertation does not include proprietary or classified information.

________________________________________

Loraine Elizabeth Parish

Certificate of Approval:

____________________________
Mark G. Fischman
Professor
Kinesiology

____________________________
Mary E. Rudisill, Chair
Professor
Kinesiology

____________________________
Danielle D. Wadsworth
Assistant Professor
Kinesiology

____________________________
David M. Shannon
Professor
Educational Foundations,
Leadership, and Technology

____________________________
Jared A. Russell
Assistant Professor
Kinesiology

____________________________
George T. Flowers
Interim Dean
Graduate School

# PRESCHOOLERS' HEART RATE AND PHYSICAL ACTIVITY RESPONSE TO THREE DIFFERENT MOTIVATIONAL CLIMATES: MASTERY, PERFORMANCE, AND UNPLANNED FREE PLAY

Loraine Elizabeth Parish

A Dissertation

Submitted to

the Graduate Faculty of

Auburn University

in Partial Fulfillment of the

Requirements for the

Degree of

Doctor of Philosophy

Auburn, Alabama
May 10, 2008

PRESCHOOLERS' HEART RATE AND PHYSICAL ACTIVITY RESPONSE TO

THREE DIFFERENT MOTIVATIONAL CLIMATES: MASTERY,

PERFORMANCE, AND UNPLANNED FREE PLAY

Loraine Elizabeth Parish



____________________________

Signature of Author

____________________________

Date of Graduation

DISSERTATION ABSTRACT

PRESCHOOLERS' HEART RATE AND PHYSICAL ACTIVITY RESPONSE TO THREE DIFFERENT MOTIVATIONAL CLIMATES: MASTERY, PERFORMANCE, AND UNPLANNED FREE PLAY

Loraine Elizabeth Parish

Doctor of Philosophy, May 10, 2008
(M.S., Arizona State University, 2001)
(B.S., Auburn University, 1998)

184 Typed Pages

Directed by Mary E. Rudisill

Although people of all ages benefit from regular, moderate intensity physical activity (U.S. Department of Health and Human Services, 1996) many children are showing less interest and participation in physical education and are adopting sedentary lifestyles (Sallis et al., 1992; U.S. Department of Health and Human Services, 1996). Incorporating regular, planned physical programs, as opposed to unplanned free play, into early childhood and preschool education programs may provide an effective means by which to engage young children in physical activity. In order to develop curricula that maximize engagement in physical activity it is important to identify teaching approaches that motivate young children to be physically activity. The purpose of the current study was to investigate the influence of three motivational environments (mastery-oriented climate [MC], performance-oriented climate [PC], and unplanned free play [FP] [i.e.,

high autonomy with limited instruction and equipment]), on the physical activity behaviors of 27 preschoolers (11 boys, 16 girls) between the ages of 3- and 5-years-old (*M* age = 4.5, *SD* = 1.1 years) and at risk for developmental delay and poor health. The physical activity environment was manipulated according to Ames' (1992a, 1992b) guidelines for creating a mastery-oriented and a performance-oriented climate. Participants engaged in six, 30-minute physical activity sessions for each of the three conditions during which physical activity was measured via heart rate monitoring and accelerometers and physical activity intensity level was categorized using PAHR > 50. As shown by the manipulation check results, the physical activity teachers created three different motivational physical activity climates. Analyses of the physical activity data indicated that heart rate and PAHR > 50 were not significantly different across the three conditions. Although accelerometer count did not differ between the MC and PC conditions, both conditions were significantly higher compared to the FP condition. Heart rate and accelerometer count did not change over the six physical activity sessions of each condition. Although PAHR > 50 differed between sessions during the MC and PC conditions, there was no clear trend of change over the six physical activity sessions for the FP condition. The results of this study provide preliminary insight into young children's physical activity engagement during different motivational climates. In conclusion, future research should to be conducted to better understand the impact of motivational climate on young children's physical activity.

ACKNOWLEDGEMENTS

Thank you to everyone who contributed to the completion of my dissertation. A special thanks to my family, Mickey and Sheila Parish, Chad, Suzanne, Anna, and Olivia Parish, Megan Parish-Máté and Gábor Máté, Audrey Wagster, and Paul and Diane St. Onge, for your endless support. Thank you to my mentor and dissertation chair, Dr. Mary Rudisill; committee members, Dr. Mark Fischman, Dr. Danielle Wadsworth, Dr. Jared Russell, and Dr. David Shannon; and outside reader, Dr. Jill Salisbury-Glennon. Your research and writing expertise and constructive feedback made this project a success and an entertaining read for any extremely bored individual. I express gratitude to my research assistants, namely Adam Knott, Rachel Miedema, Simone Resende, and the HLHP 2251 students, for the 550 hours you dedicated to data collection and analysis. Thank you to the Auburn Daycare (Moton Center) preschoolers who participated in this study; the Department of Kinesiology and College of Education for providing funding for this project; Dr. Wendi Weimar for use of the Biomechanics Laboratory's video equipment; and Susie Montana for serving as the Actiheart model. Much appreciation to Gerry Landers, Jeanine Fittipaldi-Wert, Casey Breslin, Lisa Brouillette, Sarah Wall, Amy Baker, and Ryan Maddox for your friendship. Most importantly, thank you to my colleague, friend, and husband, Paul St. Onge. Your encouragement helped me finish this project with a smile on my face.

Style manual used: American Psychological Association Publication Manual, fifth edition.

Computer software used: Microsoft Word.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

# INTRODUCTION

According to the Surgeon General, people of all ages reap health benefits from moderate and regular physical activity (U.S. Department of Health and Human Services, 1996). Unfortunately, a significant number of children are showing less interest and participation in physical education and are adopting sedentary lifestyles (Sallis et al., 1992; U.S. Department of Health and Human Services, 1996). Brown, Pfeiffer, McIver, Dowda, Almeida, and Pate (2006) report preschool aged children spend approximately 80 percent of their day stationary. Even when allowed to engage in outdoor free play, preschoolers spend most of the time engaged in sedentary or stationary activities such as sitting/squatting, lying down, standing, and walking (Brown et al., 2006).

Not only are young children sedentary during the early years, their tendency towards inactivity continues later in life. Pate, Baranowski, Dowda, and Trost (1996) report that 3- to 4-year-old children who engage in less physical activity than their peers, remain less active after age three years. This trend of physical activity decline continues into adolescence and adulthood (Centers for Disease Control and Prevention [CDC], 1998; Pate, Long, & Heath, 1994). Objective measurements have shown that physical activity declines dramatically with age, resulting in a 50 percent decrease among children and adolescents between ages 6 and 16 (Rowland, 1990). These trends suggests that parents, practitioners, and researchers should focus their efforts on engaging young children in physical activity and help them start building the foundation for a lifetime of physical activity.

In addition to declines in daily physical activity among young children and the increased likelihood of sedentary behaviors continuing in the later years, childhood obesity rates in the United States have increased significantly in recent decades (e.g., Hedley, Ogden, Johnson, Carrol, Curtin, & Flegal, 2004; National Association for Sport and Physical Education [NASPE], 2002; Strauss & Pollack, 2001; Troiano & Flegal, 1998). From 1971-1974 to 1988-1994, the prevalence of overweight among 4- and 5-year-old children nearly doubled from 5.8 percent to more than 10 percent (Ogden, Troiano, Briefel, Kuczmarski, Flegal, & Johnson, 1997). Between 1999 and 2002, the prevalence rate of overweight among children ages 2 to 5 years was 10.3 percent (Hedley et al., 2004). According to researchers and government agencies, obese children have a greater chance of being obese adults than children who are not obese (U.S. Department of Human Services, n.d.), and childhood health and physical activity behaviors may be precursors to related adult behaviors (Caspersen, Nixon, & DuRant, 1998; U.S. Department of Health and Human Services, 1996). A sedentary lifestyle in childhood has been associated with the development of the early adult onset chronic diseases such as coronary heart disease, type 2 diabetes mellitus, hyperlipidemia, hypertension, and obesity (e.g., Blair & Brodney, 1999; NASPE, 2002; Serdula, Ivery, Coates, Freedman, Williamson, & Byers, 1993; U. S. Department of Health and Human Services, 1991).

The recent increased prevalence rate of sedentary behavior, overweight and obesity, and adult onset diseases in young children is leading to a growing health concern. Although there are a number of factors impacting these trends (e.g., genetics, poor nutrition, stress, low socio-economic status, etc.), physical inactivity is a strong contributor (e.g., Koplan, Liverman, & Kraak, 2005; Triano & Flegal, 1998; U.S. Department of Health and Human Services, 1996). Therefore, a number of initiatives (e.g., Active Start, Healthy People 2010, Physical Activity and Health: A Report of the Surgeon General) have advocated engaging young children in enriched environments and learning opportunities that emphasize fundamental motor skill development and daily physical activity (NASPE, 2002; U.S. Health and Human Services Department, 1996, 2000).

In 1996, the Surgeon General's report (U.S. Department of Health and Human Services, 1996) indicated that all people over 2 years of age should engage in moderate physical activity at least 30 minutes (min) a day for general health and the prevention of heart disease. The National Association for Sport and Physical Education (NASPE) (2000) continued with this emphasis by releasing Active Start: A Statement of Physical Activity Guidelines for Children Birth to Five Years. Active Start states that "all children birth to age 5 should engage in daily physical activity that promotes health related fitness and movement skills" (p. 2). Active Start also proposes the following guidelines for preschool aged children. "Preschoolers should…

- Guideline 1: accumulate at least 60 min of daily, planned physical activity.
- Guideline 2: engage in at least 60 min and up to several hours of daily, unplanned physical activity and should not be sedentary for more than 60 min at a time except when sleeping.
- Guideline 3: develop competence in movement skills that are building blocks for more complex movement tasks.

- Guideline 4: have indoor and outdoor areas that meet or exceed recommended safety standards for performing large muscle activities." (pp. 9-11)

Additionally, *Active Start* encourages individuals responsible for the well-being of preschoolers, to be aware of the importance of physical activity and facilitate the child's movement skills.

Approximately 57.2 percent of 3- to 5-year-olds who are not enrolled in kindergarten (66.5 percent of African American 3- to 5-year-olds) spend the majority of their day in child care, with the largest percent of a child's care coming from center-based programs (Casper, 1996; Federal Interagency Forum on Child and Family Statistics, 2004). Capizzano and Adams (2000) report that 40 percent of 3- to 4-year-old children whose mothers are employed, spend more than 35 hours per week in non-parental child care. Because many preschool aged children spend a large portion of their day in childcare and because the preschool years are a critical time for establishing healthy habits, such as engagement in physical activity (Birch & Fisher, 1998), early childhood center-based programs may be an appropriate means by which to decrease sedentary behavior and engage young children in healthful physical activity. Center-based physical activity programs should not only enhance physical activity engagement, but also emphasize fundamental motor skill development and motivation to be active. A sole focus on fundamental motor skill development and/or physical activity engagement may not result in motivation to lead a physically active lifestyle throughout childhood, adolescence, and adulthood (Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006). Thus, comprehensive early childhood programs that highlight fundamental motor skill development, physical activity engagement, and motivation to be physically active are critical.

Although early childhood educators may implement one of many types of learning environments to help children develop fundamental motor skills and engage in physical activity, children typically engage in unplanned free play at preschool or daycare. While free play may allow children to practice fundamental motor skills and engage in physical activity, it lacks important feedback and encouragement from teachers that helps young children develop an intrinsic motivation towards physical activity and master movement.  Therefore, it is important for early childhood educators to create planned programs that not only emphasize fundamental motor skill development and physical activity engagement but also foster one's motivation to move.

Researchers (Ames & Archer, 1988; Nicholls, 1984, 1989) report that two climates typically emerge as impacting one's motivation to engage in achievement behaviors such as physical activity. The first motivational climate, a mastery-oriented climate, is characterized by children driving their own learning and engagement in movement and the teacher facilitating an environment in which effort and personal improvement define success. The second motivational climate, a performance-oriented climate, is characterized by the teacher driving the class and emphasizing that outperforming others defines one's success. In such a climate, children have very little autonomy to drive their own learning and make choices about physical activity engagement.

Many studies investigating the impact of the motivational climate on physical activity behavior, report that older children and adolescents engage in adaptive physical activity behaviors (i.e., engagement in physical activity; intrinsic motivation towards physical activity; adherence to activity; intentions to be physically active in the future; positive affect and high perceived competence regarding physical activity; and a belief that effort and ability lead to success) when exposed to a mastery motivational climate (Dunn, 2000; Maehr, 1983, 1984; Ntoumanis & Biddle, 1999b; Parish & Treasure, 2003; Treasure, 1997; Yoo, 1999). However, when exposed to a performance-oriented climate, these individuals engage in more maladaptive physical activity behaviors (i.e., low engagement in physical activity; extrinsic or amotivation towards physical activity; negative attitudes, boredom, and low perceived competence regarding physical activity; and a belief that ability leads to success (Dunn, 2000; Maehr, 1983, 1984; Ntoumanis & Biddle, 1999b; Parish & Treasure, 2003; Treasure, 1997; Yoo, 1999).

To date, only one study has investigated the relationship between the motivational climate and physical activity behaviors in young children. This study found that a mastery motivational climate (versus unplanned free play) may be an effective means by which to engage toddlers in moderate to high intensity, intrinsically motivating physical activity (Parish, Rudisill, & St. Onge, 2007). The remainder of related studies focus on the impact the motivational climate has on motor skill development and perceived physical competence. Contrary to research with older children and adolescents, some studies in this body of literature support both mastery motivational (i.e., mastery-oriented) and teacher-directed (i.e., low autonomy, performance-oriented) interventions as leading to more positive physical activity behaviors, namely improvements in fundamental motor skill performance, among young children representing a variety of racial and ethnic populations as well as ability levels (Robinson, 2007; Valentini &

Rudisill, 2004b). Further analysis of these and other studies indicate that mastery motivational interventions lead to significantly greater improvements in fundamental motor skill performance with these improvements being maintained 6 months following the intervention and significantly higher perceived competence when compared to teacher-directed and control groups (Martin, Rudisill, & Hastie, in press; Valentini & Rudisill, 2004a, 2004b).

Although the findings regarding the motivational climate, physical activity, fundamental motor skill performance, and perceived competence are promising, concerns have been raised regarding the closeness to which these studies' motivational climate interventions adhered to the components of mastery- and performance-oriented climates proposed by Epstein (1988, 1989) and conceptualized by Ames (1992a, 1992b). In order to help early childhood educators create and implement physical education programs that meet *Active Start* (1996) guidelines, interventions that closely adhere to Ames' (1992a, 1992b) descriptions of mastery- and performance-oriented climates need to be studied in order to determine which type of motivational climate (i.e., mastery, performance, or unplanned free play) engages young children in health promoting physical activity.

## *Statement of Purpose*

The purpose of this study was to investigate the influence of three motivational learning environments (mastery-oriented climate [MC], performance-oriented climate [PC], and unplanned free play [FP] [i.e., high autonomy with limited instruction and equipment]), on the physical activity behaviors (i.e., physical activity heart rate, accelerometer count, and Physical Activity Heart Rate-50 Index [PAHR-50]), of preschool aged children at risk for developmental delay and poor health. Specifically, the physical activity environment was manipulated according to Ames' (1992a, 1992b) conceptualization of Epstein's (1988, 1989) TARGET structure to emphasize either effortful engagement in physical activity or outperforming others, or involve no motivational emphasis. Physical activity was measured via heart rate monitoring and accelerometers, and physical activity intensity level was categorized using PAHR-50.

### *Hypothesis*

- Physical activity heart rate, accelerometer count, and PAHR > 50 will be significantly higher during the MC condition than the FP and PC conditions, respectively.

### *Assumption*

- Physical activity heart rate, accelerometer count, and PAHR > 50 will not change over time for the MC, FP, or PC conditions. Specifically, it is expected that the participants will not demonstrate a learning effect/reactivity over the course of the study.

### *Delimitations*

The delimitations setting the scope of this study were:

- Participants were 1 Caucasian and 26 African American preschoolers.
- Participants attended a subsidized, National Association for the Education of Young Children (NAEYC) accredited daycare in Auburn, Alabama. To be

eligible for services at this daycare facility, at least one parent must be employed or enrolled in school/training and make no more monthly income than is allowable (e.g., ranging from $342 per month for a family of two up to $3745 per month for a family of eight or more) (State of Alabama, Department of Human Resources, 2006).

- Participants were exposed to mastery-oriented, performance-oriented, and unplanned free play climates in the academic classroom and during outdoor play.
- The mastery-oriented climate (MC) condition was the motivational emphasis of an established motor skill development program within the daycare. However, the regular mastery-oriented motor skill development program was implemented outdoors. During this study, the program was implemented in a more controlled, indoor gymnasium and emphasized engagement in moderate to vigorous intensity physical activity and skill development.
- The dependent measures were physical activity heart rate, accelerometer count, and PAHR > 50.

### *Limitations*

The limitations of this study were:

- Children from one daycare center, a majority of whom are African American (*n* = 26 African American, *n* = 1 Caucasian), were assessed. Therefore the findings may not be generalized to other samples.

- The conditions of interest were implemented in a naturalistic setting. Although care was taken to control for variables that may impact the results of the study, it was impossible to control for all variables.
- Although the accelerometer component of the Actiheart monitor has been validated in adults (Brage, Brage, Franks, Ekelund, & Wareham, 2005), it has not be validated in children in a naturalistic environment. Caution was taken when interpreting the accelerometer results.
- Due to the lack of developmentally appropriate perception of the motivational climate instruments, participants' perception of the motivational climate was not assessed. Rather, the components of each motivational climate were measured via a manipulation check.

## *Definition of Terms*

*Preschoolers* include young children from age 2.5 years to lawful school age. Lawful school age is the minimum age (i.e., children must be 5 years of age on or before September 1, of a given year) at which a child may be admitted to public school kindergarten (State of Alabama, Department of Human Resources, 2006).

*Daycare* refers to center-based childcare.

*Full-time daycare* refers to a childcare facility at which children spend most or all of the day during most or all of the week, Monday through Friday, equating to approximately 25 hours per week.

*Developmentally appropriate* is defined as the suitability of the instruction, activity, or equipment for the present performance or ability level of the preschooler (NASPE, 2002).

*Physical activity* involves any bodily movement of the skeletal muscles that results in energy expenditure. During physical activity, young children explore their environment and improve their language, creative thinking, and imagination (NASPE, 2002). Physical activity involves movement ranging along a continuum of intensity from sedentary to vigorous. In young children, bouts of physical activity are characterized by short, yet frequent, episodes of moderate to vigorous intensity activities (1-, 2- to 4-, and 5- to 10-min bursts) interspersed with low intensity, or even sedentary, activities (Benham-Deal, 2005; Sallo & Silla, 1997).

*Sedentary* refers to physical inactivity (i.e., sitting, especially for extended periods of time) (NASPE, 2002).

*Moderate to vigorous intensity* physical activity ranges from bodily movements that can be easily maintained and increase heart rate and breathing to movements that result in fatigue over a short period of time and elevate heart rate and breathing to levels higher than those observed for moderate activity (NASPE, 2002). Activities that are considered moderate to vigorous in intensity include running, cycling, climbing, and jumping. Young children typically engage in a total of 30 to 40 min of moderate to vigorous intensity physical activity per day (i.e., 12 hour period) (Benham-Deal, 2005; Sallo & Silla, 1997).

*Physical activity heart rate* refers to an individual's heart rate while engaged in physical activity. The physical activity heart rate of 3- to 5-year old children is categorized as low (< 129 beats per minute [bpm], or < 65 percent age-predicted heart rate maximum [HR max]), moderate (130-159 bpm, or 65-75 percent HR max), or vigorous (> 160 bpm, or > 75 percent HR max) intensity (Benham-Deal, 2005; Sallo & Silla, 1997).

*Accelerometer count* refers to the Actiheart monitor's accelerometer output. The accelerometer output is derived from the magnitude of electrical current passing through an analog to digital converter (Mini Mitter Company, Inc., 2004).

*Resting heart rate (RHR)* was calculated using the mean of the lowest 10 consecutive data points (2.5 min) of heart rate during nap time (Parish et al., 2007).

*Physical Activity Heart Rate index (PAHR-50)* is an index of high intensity activity calculated by multiplying RHR by 1.5 (Logan, Reilly, Grant, & Paton, 2000).

*TARGET* is an acronym standing for Task, Authority, Recognition, Grouping, Evaluation, and Time. *Task* refers to the type of task and task options available within a learning environment; *Authority* refers to the distribution of authority and student autonomy within the learning environment; *Recognition* refers to the formal and informal feedback, recognition, and rewards that are given within the learning environment; *Grouping* refers to the grouping structure that emerges within a learning environment; *Evaluation* refers to the implementation of a system for evaluating student progress; and *Time* refers to the time constraints placed on learning. Proposed by Epstein (1988, 1989) and conceptualized by Ames (1992a, 1992b), these environmental factors and instructional cues aid practitioners in organizing their instruction in terms of performance- and mastery-oriented climates and help researchers identify important cues and factors that impact one's achievement goal state.

*High autonomy* refers to situations emphasizing child-driven learning. In such environments, the teacher facilitates the learning process.

*Mastery-oriented climate (MC)*, also mastery motivational, refers to a high autonomy learning environment that emphasizes learning and skill mastery based on exerting maximal effort and self-referenced criteria for determining success. During this study, the mastery-oriented climate condition incorporated such an emphasis as it relates to physical activity.

*Low autonomy* learning environments involve teacher directed learning with limited student involvement in the learning process.

*Performance-oriented climate (PC)*, also teacher-centered and low autonomy, refers to a low autonomy learning environment that emphasizes outperforming others (i.e., winning) and focusing on normative- and other-referenced criteria for judging one's success. During this study, the performance-oriented climate condition paralleled the concepts of direct instruction and incorporated a performance focus.

*Unplanned free play (FP)* refers to play time during which children are solely responsible for their own engagement in physical activity and play. During unplanned free play children experience high autonomy such that each child may choose and create tasks in which to engage. Physical activity and play are initiated by the children as they explore their environment and equipment. Although equipment is easily accessible for use, these curricula incorporate minimal teacher involvement (e.g., instruction, modeling, feedback). Teacher-child interaction of any kind is limited to reprimands for rule breaking and/or injury prevention and care. During this study, the unplanned free play condition reflected such a climate.

# LITERATURE REVIEW

The purpose of the following study is to investigate the impact of different motivational climates, namely a mastery-oriented climate (MC), a performance-oriented climate (PC), and unplanned free play (FP) (i.e., high autonomy with limited instruction and equipment), on the physical activity behaviors of preschool-age children at risk for developmental delay and poor health. The rationale for this study is grounded within the framework of early childhood mastery motivation and achievement goal theory. The following sections detail the importance of mastery motivation during the early years and the constructs of achievement goal theory. Additionally, the current literature investigating the relationship between the motivational climate and variables specific to motor development, engagement in physical activity, and perceived physical competence is described.

## *Mastery Motivation*

According to White (1959), young children have an innate desire and intrinsic motivation to learn about their environment. This curiosity is driven by feelings of pleasure and efficacy that result from successfully mastering or learning a skill. Thus children are said to be mastery motivated from birth.

Mastery motivation is a multifaceted, intrinsic psychological force that originates without the need for extrinsic rewards and stimulates young children to attempt to master skills or tasks that are moderately challenging for them based on an intrinsic interest in the mastery process (Morgan, Harmon, & Maslin-Cole, 1990; Morgan, MacTurk, & Hrncir, 1995). Hauser-Cram (1998) suggested that there are three components of this definition that are imperative to understanding mastery motivation: (a) the child has an innate, intrinsic drive to master tasks without direction from an adult; (b) mastery motivated children exhibit persistence at task mastery even in the face of challenge; and (c) children select moderately challenging tasks to master without guidance from an adult. Although young children are naturally motivated to master tasks, they prefer to engage in tasks that are somewhat challenging and they exert maximal effort even when completing these difficult tasks.

Originally, mastery motivation referred only to the mastery of inanimate objects (i.e., demonstrating intense persistence at mastering tasks and/or objects [e.g., toys, games, & puzzles] while showing flat affect). However, after further research, mastery motivation was found to include additional components, namely social (Wachs & Combs, 1995) and gross motor (Morgan et al., 1993) mastery motivation. Social mastery motivation refers to children's drive to influence and participate in social interactions with their primary caregiver (i.e., mother, father, childcare provider) and/or another child by making recurrent attempts to seek contact with and proximity to these people. Often times these recurrent interactions with the primary caregiver and/or a peer, drive children's object mastery motivation (Wachs & Combs, 1995). Gross motor mastery motivation refers to the intrinsic drive to master play experiences and fundamental gross motor skills (Morgan et al., 1993) and should be considered the driving force behind young children learning how to crawl, walk, and run.

According to Morgan and Yang (1995), the early development of mastery motivation is a precursor for future achievement motivation; thus it is critical to foster the development of mastery motivation during the early years. Before age 9 months, mastery motivation is solely driven by a desire for novelty and preference to control the environment (Barrett & Morgan, 1995). As mastery motivation develops, young children (i.e., ages 9 months and older) become increasingly more influenced by external/societal standards of performance (Barrett & Morgan, 1995). According to Hauser-Cram and Shonkoff (1995) and Hauser-Cram (1998), primary caregivers have a powerful impact on a child's development of mastery motivation. Therefore it is important for these adults to encourage and foster a child's attempts to master tasks of interest to the child. Adult intrusive behavior and interfering with mastery attempts (i.e., telling a child faced with the challenge of mastering a task, how to complete the task; e.g., that puzzle piece goes here), as well as negative affective interactions between a primary caregiver and a child decrease mastery motivation. Hauser-Cram and Shonkoff (1995) reported that positive affective and emotional responses by the primary caregiver are extremely important in developing a child's mastery motivation. Harter (1981) and Hauser-Cram (1998) reported that caregivers who support child autonomy by (a) modeling mastery motivation; (b) creating a stimulating environment (i.e., auditory, visual, olfactory, tactile, and kinesthetic stimulation, smiles, vocalizations); and (c) providing positive and corrective feedback focused on maintaining involvement in challenging tasks, increase a child's mastery motivated interest in objects, social interactions, and motor skills. In order to nurture a child's intrinsic psychological drive to learn, it is important for pre-school and daycare teachers to model and support mastery motivated approaches to learning. Achievement goal theory provides a framework to explain how teachers can create a motivational learning environment that positively impacts a child's mastery motivation, as well as behavioral, cognitive, and affective outcomes.

## *Achievement Goal Theory*

### *An Overview*

Achievement goal theory contends that individuals participate in achievement contexts such as academics, sport, and physical education for the main purpose of demonstrating competence or ability (Nicholls, 1989). Nicholls (1984) posits that two achievement goal states, namely ego and task involvement, operate within achievement contexts and govern how individuals interpret their ability and define success.

Ego-involvement is based on a differentiated sense of ability (i.e., individuals determine if ability, luck, or effort led to their successful/unsuccessful performance), normative referenced and/or social comparisons, and a belief that success is directly related to ability. When ego-involved, participation becomes a means to an end, namely outperforming others (Nicholls, 1984). By out-performing others, individuals perceive themselves to be successful. Additionally, an individual who is ego-involved believes exerting high amounts of effort is a sign of low ability. Therefore, individuals who are ego involved view participation as an opportunity to demonstrate high ability (i.e., success), while exerting minimal effort, in reference to others. In contrast, task-involvement is based on performing a task with an undifferentiated conception of ability, meaning the individual chooses not to differentiate ability, luck, and effort as leading to success. Attributions of success are based on effort and individuals seek to improve or master a skill in reference to their own previous personal performance. To learn is to demonstrate ability and task mastery is perceived as an end in and of itself (Nicholls, 1984). An individual who is task-involved tends to exert high amounts of effort in order to master a skill for the sake of learning. Thus success is achieved when a task is mastered while exerting maximum effort.

Nicholls (1984) also contends that individuals operate differently in achievement contexts and adopt different goal states based on the interplay between their dispositional goal orientation and their perception of the situation at hand. Dispositional goal orientations involve an individual's predisposing tendency to adopt a specific goal orientation based on past experiences. The dispositional tendencies determining one's goal state are ego-orientation and task-orientation. These dispositions impact an individual's behaviors, thoughts, and emotions. The situational construct involves an individual's perception of the relevant cues within a certain situation. Situational cues are typically interpreted as mastery-oriented or performance-oriented. The individual's perception and interpretation of the salient cues within the situation leads to the adoption of a goal state for that particular achievement situation (Ames, 1992a, 1992b; Ames & Archer, 1988; Nicholls, 1984).

Nicholls (1984, 1989) proposes that ego- and task-involved goal states are embedded in the dispositional goal orientations. Although an individual's goal state is determined by the interaction between dispositional goal orientations and one's perception of environmental cues, dispositions are not stable personality characteristics.

Rather, they are tendencies that are largely impacted by environmental cues. Dispositional goal orientations differ from situation to situation depending on the individual's interpretation of the cues within each achievement context. For example, in a mastery-oriented academic setting, an individual may demonstrate high task-orientation and low-ego orientation. However, in a performance-oriented sport or physical education setting, that same individual may demonstrate low task-orientation and high-ego orientation. The following sections describe the relationship between achievement goal states and conception of ability and detail the dispositional goal orientation and motivational situation (i.e., climate) constructs of achievement goal theory.

### *Achievement Goal States and Conception of Ability*

According to Nicholls (1984), an individual's cognitive, affective, and behavioral development impacts the achievement goal state that is adopted, specifically regarding the changes in one's conception of ability over time. Young children have a difficult time differentiating effort, ability, and luck. Therefore, they tend to view achievement situations as opportunities for learning, focus their attention on skill mastery, and make self-referenced attributions of success. Children believe effort leads to success, which implies learning and more ability. Thus children have a tendency to be more task-involved (i.e., mastery motivated). The mastery motivation literature, as detailed in later sections, supports this contention. Specifically, young children are primarily mastery oriented, but with age become more aware of ego involvement (Nicholls, 1989).

As children enter later childhood, adolescence, and adulthood, the two goals states (i.e., task and ego involvement) become more transitory in nature and the goal state adopted by an individual becomes more dependent upon his/her goal orientation (i.e., task and ego oriented) and the motivational climate (i.e., mastery and performance oriented). Beginning in late childhood, individuals can choose to adopt a more differentiated and norm-referenced conception of ability, meaning they can differentiate the concepts of ability, effort, and luck and decide if achievement and success are based on skill level, the amount of effort exerted, or luck. Additionally adolescents compare their ability to that of others and judge their level of success on outperforming others. This differentiated, norm-referenced conception of ability leads to a more ego-involved individual. Although high skilled, ego-involved individuals flourish in environments emphasizing outperforming others; low skilled, ego-involved individuals drop out of or become minimally involved in tasks in which they demonstrate low ability (Nicholls, 1984). Feelings of incompetence and failure to outperform others especially after exerting maximum effort, drives these individuals to drop out.

Due to the current trend of emphasizing early stimulation and acquiring normative standards of ability, children may develop a more mature conception of ability at a younger age. Although they may not be able to express their conception of ability, children as young as 4 to 8 years old may demonstrate behaviors and express feelings indicating their ability to differentiate effort, ability, and luck.

Because adolescents and young adults are continually exposed to learning environments and achievement situations that promote outperforming others, these individuals adopt ego-involved approaches to achievement behavior. This developmental progression of goal involvement is representative of the idea that although one's disposition might lead them toward adopting a particular goal orientation, the perceived situational cues can undermine the dispositional tendencies and influence the goal orientation adopted (Dweck & Leggett, 1988; Nicholls, 1984, 1989; Treasure & Roberts, 1995, 2001).

*The Individual*

Ames (1992a, 1992b), Ames and Archer (1987, 1988), Dweck and Leggett (1998), and Nicholls (1984, 1989) describe dispositional goal orientations in terms of ego- and task-oriented goals. An ego goal orientation, or maladaptive view of motivation, is characterized by focusing on outperforming others, while exerting low amounts of effort (Nicholls, 1984) or by using deceptive strategies (Walling & Duda, 1995). Individuals who adopt an ego goal orientation believe that success is determined by one's own ability (Duda, Fox, Biddle, & Armstrong, 1992) and a successful performance results from outperforming others. In general, those who are ego-oriented believe that exerting large amounts of effort to complete a task indicates low ability. Therefore, these individuals aim to succeed (i.e., outperform others in reference to normative standards) while exerting less effort than others. Because of their belief that intrinsic factors, such as ability, lead to success and their desire to demonstrate high ability while exerting minimal effort, ego-oriented individuals avoid challenging tasks (Dweck & Leggett, 1988) and engage in tasks they are confident they can successfully complete (Wigfield, Eccles, & Rodriguiz, 1998). These individuals exhibit low persistence in the face of failure (i.e., mistakes, being outperformed), as failure indicates a lack of ability and inferiority to those individuals who are successful. Ego-oriented individuals tend to avoid engaging in learning and problem solving strategies as they view learning as a means to an end and they hesitate to ask for help from others (Ames, 1992a, 1992b).

In contrast, achievement motivation researchers (Ames & Archer, 1988; Ames, 1992a, 1992b; Nicholls, 1984, 1989; Dweck & Leggett, 1998) describe a task goal orientation as focusing on learning new skills and seeking out and mastering challenging tasks. Task-oriented individuals enjoy learning for the sake of learning (i.e., learning is an end in and of itself) and learning is due to motivation, effort, and hard work (Biddle, Akande, Vlachopoulos, & Fox, 1996; Duda, Fox, Biddle, & Armstrong, 1992; Duda & White, 1992; Fox, Goudas, Biddle, Duda, and Armstrong, 1994; Spray, Biddle, & Fox, 1999). In turn, learning indicates skill mastery and skill mastery is viewed as a success outcome. Even when faced with challenge, task-oriented individuals persist in the face of difficulty and/or failure. When skills are mastered, these individuals attribute their success to effort and ability and experience positive affect (i.e., pride, pleasure, intrinsic reward) in their accomplishment. Additionally, task-oriented individuals are concerned with their own personal progress. They tend to make self-referenced assessments of ability based on past experience and previous performance, engage in self-monitoring and self-instructional strategies to aid in learning situations, and spend large amounts of time engaged in on-task behavior. They are also likely to seek assistance when faced with difficult tasks and to develop the ability to self-regulate their own learning (Solmon & Boone, 1993).

Although achievement goal theory research originated within the academic realm, it has also been applied to sport, physical education, and physical activity settings with children and adults of various ages. In regards to physical education and physical activity, research has shown that task and ego goal orientations are correlated with beliefs about causes of success, intrinsic motivation, and physical activity behaviors. In a sample of children age 10-11 years, Duda et al. (1992) found task orientation to be strongly correlated with the belief that success in sport is due to motivation/effort. On the other hand, ego orientation was found to be strongly correlated with the belief that ability is the cause of success. Similar results have been reported for 12-14 year old and 16-18 year old adolescents (Biddle et al., 1996; Spray et al., 1999). Goudas, Biddle, and Fox (1994) found that task orientation was directly related to intrinsic interest for a variety of sport skills (i.e., football, netball, and gymnastics), but the relationship between ego orientation and intrinsic motivation was moderated by perceptions of competence. Researchers have also provided correlational evidence associated with achievement goal orientations and physical activity behavior. Fox et al. (1994) found physical activity participation to be higher for those high in task orientation, either singly or in combination with a high ego orientation. Similarly, Spray and Biddle (1997) discovered sport involvement was higher for those high in task orientation both overall and for those high in perceived competence. In contrast, low sport involvement was evident for those in the low task oriented/low ego oriented group, especially when they reported low perceived competence.

After researchers (Ames, 1992a, 1992b; Ames & Archer, 1988; Dweck & Leggett, 1998; Nicholls, 1984, 1989) extrapolated a variety of characteristics that differentiate individuals who are ego-oriented from those who are task-oriented, Ames and Archer (1987, 1988) focused their efforts on characterizing the situational cues that interact with one's dispositional goal orientation to determine his/her goal state. A detailed description of the situational component of achievement goal theory is provided in the following section.

*The Climate*

As stated previously, not only does one's disposition contribute to the adopted goal state, but task- and ego-involvement are also influenced by situational cues (i.e., performance- and mastery-oriented) operating within the achievement context (Ames & Archer, 1988; Nicholls, 1984, 1989). While dispositions determine the probability of adopting a certain goal state and demonstrating a particular pattern of behavior, perceptions of the motivational climate (i.e., situational or environmental cues) have the ability to potentially change these probabilities and consequently impact behavior (Dweck & Leggett, 1988; Nicholls, 1984, 1989; Treasure & Roberts, 1995, 2001). Dweck & Leggett (1988) report that in achievement contexts demonstrating vague or weak situational cues, an individual's dispositional tendency better predicts his/her goal involvement than the situational cues. However, when the situational cues strongly favor either mastery- or performance-oriented motivational climates, one's disposition is less likely to predict goal-involvement. Rather, the motivational cues operating within the situation determine one's goal-involvement and the resulting cognitions, affect, and behaviors. Thus, to increase the likelihood of adaptive patterns of achievement behavior (i.e., task involvement) being adopted, strong mastery-oriented climates should be implemented in achievement contexts.

Ames and Archer (1987, 1988) investigated the differences between mastery- and performance-oriented motivational climates and discovered that the salience of the mastery and performance cues perceived by an individual in a learning situation influence the goal orientation, and in turn goal state, the individual adopts. This finding led Ames and Archer (1987, 1988) to develop strategies for investigating and identifying key environmental characteristics and instructional cues that are indicative of and lead to the adoption of performance- and/or mastery-oriented achievement goals. These key environmental characteristics and instructional cues, conceptualized by Ames (1992a, 1992b), are based on Epstein's (1988, 1989) six dimensional TARGET structure. The acronym TARGET stands for Task, Authority, Recognition, Grouping, Evaluation, and Time. Epstein (1988, 1989) originally developed these constructs as a means to assist teachers in organizing their classroom instruction to positively influence students' motivation and learning. Ames (1992a, 1992b) described the TARGET components in terms of performance- and mastery-oriented climates and designed strategies to implement Epstein's TARGET structures in classroom settings. Details regarding the characteristics of a performance- and mastery-oriented climate are detailed in later sections.

Ames' (1992a, 1992b) TARGET structure is commonly used by researchers and practitioners for identifying important instructional cues and environmental factors that impact one's achievement goal state. Ames (1992a) suggests that by organizing these constructs to reflect a mastery-oriented climate and implementing them in a variety of instructional settings, one's motivation can be positively influenced. A description of the TARGET structure follows.

The *task* component of the TARGET structure refers to the type of task and task options available within a learning environment including the content and sequence of the curriculum, design of the instructional activities (i.e., classroom work and homework), task difficulty, and the material required to complete a task. By providing a variety of task structures, students have a large range of options from which to choose their preferred activities. Raffini (1993) also suggests that teachers need to understand each student's skill level in order to provide a variety of challenging tasks. This will, in turn, foster the mastery goals of all learners, regardless of skill level.

*Authority* refers to the distribution of authority and student autonomy within the learning environment. The authority construct of the TARGET structure emphasizes that teachers and students collaborate in the instructional decision making process. Specifically, teachers and students should share responsibility for making choices, giving directions, monitoring progress, creating and enforcing rules, creating and providing rewards, and evaluating success (Epstein, 1988). Although the students' commitment to learning and motivation toward mastery goals is enhanced in such a high autonomy learning environment, it is important to point out that the primary authority within the classroom is the teacher. The teacher acts as a facilitator of learning rather than an agent of control.

The *recognition* element refers to the formal and informal feedback, recognition, and rewards that are given within the learning environment. Recognition is given for students' effort and mastery-focused accomplishments based on each individual's past accomplishments, skill level, and current achievements. By de-emphasizing social comparisons and emphasizing recognition based on personal accomplishment, teachers boost students' motivation towards skill mastery (Ames, 1992a, Epstein, 1988, 1989).

*Grouping* refers to the grouping structure that emerges within a learning environment. This structure determines whether, how, and why students who are similar or different (i.e., based on gender, race, ability, goals, or interest) are brought together or kept apart for instruction, play, and physical activity. Ames (1992a) and Epstein (1988) point out that a teacher can enhance students' motivation toward task mastery by providing flexible, heterogeneous grouping arrangements and allowing students to group themselves within the learning environment.

*Evaluation* refers to the implementation of a system for evaluating student progress. Specifically, the evaluation criteria should incorporate moderately challenging standards, fair and clear procedures for monitoring progress, and explicit and frequent information about progress. Because students easily understand their own level of effort, skill, and means of improving, an effective evaluation structure fosters student motivation toward task mastery. To foster mastery motivation, teachers should evaluate students based on individual progress, improvement, and mastery; provide evaluative feedback that is individualized, private, and meaningful; involve students in the evaluation process; and foster opportunities for students to experience success.

Finally, the *time* component refers to the time constraints placed on learning, namely, the appropriateness of the workload, the pace of instruction, and the amount of time allocated to completing tasks (Ames, 1992b). Ames (1992a) and Epstein (1989) recommend that teachers respect each student's pace of learning by incorporating a flexible schedule for completing assignments and tasks. This allows students of all abilities ample time to improve skill level and create work and practice schedules that foster mastery motivation.

In summary, the TARGET structure provides a conceptual framework for teachers to create a classroom climate that emphasizes mastery motivation. By placing value on the learning process, self-referenced standards of success, and opportunities for self-regulated learning, teachers can foster motivation towards mastery. Because the environment in which children learn influences a number of cognitive, affective, and behavioral variables, it is important for practitioners and researchers to be aware of the learning environment they create.

## *Motivational Climate Research*

### *An Overview*

The vast majority of past and current achievement goal theory research focusing on the motivational climate in academia, sport, and physical education has been conducted with children, adolescents, and young adults. According to this body of literature, a mastery-oriented climate plays an important role in enhancing the achievement behavior of learners of all ages (Ames, 1992a, 1992b; Epstein, 1988, 1989). Based upon previous research, students who perceive their educational experience to be mastery-oriented and highly autonomous demonstrated the following outcomes:

- an intrinsic interest in physical education (Cury et al., 1996)
- a belief that success (i.e., learning) is achieved through intrinsic interest, effort (Carpenter & Morgan, 2000; Treasure & Roberts, 2001), hard work, and cooperation (Ames, 1984a, 1984b; Ames & Archer, 1988; Seifriz, Duda, & Chi, 1992; Treasure, 1997; Walling & Duda, 1995; Walling, Duda, & Chi, 1993);

- positive affect (i.e., satisfaction, attitude towards the class, enjoyment, less boredom), high perceived competence, high intrinsic motivation, low tension, and a belief that effort and ability cause success (Carpenter & Morgan, 2000; Dunn, 2000; Kavussanu & Roberts, 1996; Ntoumanis & Biddle, 1999b; Treasure, 1997);
- a focus on (Carpenter & Morgan, 2000; Papaioannou & Kouli, 1999) and positive attitude towards learning and effort (Ames, 1992b; Corno & Rohrkemper, 1985; Nicholls, 1989; Treasure, 1997);
- a preference for challenging tasks (Ames, 1984a, 1984b; Ames & Archer, 1988; Treasure & Roberts, 2001)
- frequent use of effective learning strategies, self instruction, and self monitoring types of thoughts (Ames, 1984a, 1984b; Ames & Archer, 1988);
- a perception that the teacher maintains equality in the physical education classroom, behaving similarly towards girls and boys and high and low achievers (Duda, Olson, & Templin, 1991; Papaioannou 1995, 1998);
- significantly greater levels of persistence during learning (Ames & Archer, 1988; Butler 1987; Rudisill, 1991), enjoyment (Goudas, 1998; Kavussanu & Roberts, 1996; Lloyd & Fox, 1992; Ntoumanis & Biddle, 1999a, 1999b; Ommundsen, Roberts, & Kavussanu, 1998; Theeboom, DeKnop, & Weiss, 1995; Treasure & Roberts, 2001) and satisfaction (Goudas, 1998; Theeboom et al., 1995; Treasure & Roberts, 2001) than when engaged in less student-driven climates;
- greater exerted effort and lower levels of performance worry than when engaged in less student-driven climates (Seifriz et al., 1992; Walling et al., 1993)

- an increase in adherence to activity (Yoo, 1999), intrinsic motivation, and sense of self-reliance (Maehr, 1983, 1984);
- an increase in perceived competence (Harter, 1978; Harter, Whitsell, & Kowalski, 1992; Rudisill, 1989a, 1989b; Theeboom et al., 1995; Valentini & Rudisill, 2004b), perceived ability (Burton,1989), perceived sport competence, social acceptance, and scholastic competence (Newsham, 1989), perceived academic efficacy, and general well being (Kaplan & Maehr, 1999);
- improvements in motor skill performance (Martin, et al., in press; Theeboom et al., 1995; Valentini & Rudisill, 2004a; Wall, Rudisill, Parish, & Goodway, 2004);
- intentions to be physically active in the future (Ntoumanis & Biddle, 1999b; Parish & Treasure, 2003); and
- more physical activity engagement than students who perceive a low autonomy (Parish & Treasure, 2003) or free play experience (incorporating a high autonomy climate without the implementation of the six TARGET structures) (Parish, St. Onge, Rudisill, Weimar, & Wall, 2005; Parish et al., 2007).

*Early Childhood Physical Activity*

Achievement goal theory, specifically regarding motivational climate, has not been studied extensively in young children. The research that has been conducted focuses on the effectiveness of mastery-oriented versus performance-oriented interventions in improving fundamental motor skill development and perceived physical competence in young children (Martin et al., in press; Robinson, 2007; Valentini & Rudisill, 2004a, 2004b).

Valentini & Rudisill (2004b) investigated the influence of a mastery motivational (i.e., mastery-oriented) intervention and a teacher-centered (i.e., direct instruction, performance-oriented) intervention on the motor skill performance (i.e., locomotor and object-control fundamental motor skills) of kindergarten children demonstrating developmental delays. Sixty children between the ages of 5 and 6 years participated in the study and were randomly assigned to a mastery, teacher-centered, or control group. The mastery motivational and teacher-centered groups participated in a 12-week intervention (i.e., 24 sessions, 35 min per session) while the control group received no intervention. Results indicated that students in the mastery motivational intervention group demonstrated better locomotor and object control motor skills than the students in the teacher-centered intervention or the control group.

Further, Valentini & Rudisill (2004b) eliminated the teacher-centered condition from the first study and assigned a group of 67 developmentally-delayed kindergarteners to a mastery motivational or a low autonomy (e.g., performance-oriented) intervention group. Although analyses revealed that both groups improved in locomotor and object-control skills following a 12-week intervention period (i.e., 24 sessions, 35 min per session), the mastery motivational group's improvements were significantly greater than those of the low autonomy group regarding locomotor skills. Additionally, the mastery motivational group experienced higher perceived physical competence following the 12-week intervention than did the low autonomy group. Follow-up investigation extended the findings of the first portion of this study and indicated that performance levels and perceived competence were maintained for the mastery motivational group 6 months following the intervention. Motor skill performance declines were observed in the control group.

Valentini & Rudisill (2004a) investigated the impact of a mastery motivational climate on the motor skill development of kindergarteners with and without disabilities to children (between the ages of 5.9 to 10.9 years) with and without disabilities. As in the previous studies (Valentini & Rudisill, 2004b), participants (N = 104) were randomly assigned to either a mastery motivational intervention group or a control group and further divided into one of four subgroups based on disability (i.e., mastery motivational with disabilities, mastery motivational without disabilities, control with disabilities, control without disabilities). Following a 12-week intervention (i.e., 24 sessions, 60 min per session), results showed that children participating in the mastery motivational with and without disabilities groups demonstrated significant motor skill performance improvements from pre- to post-intervention. No significant differences were reported for the control group.

Martin, et al., (in press) investigated the impact of a 6-week mastery motivational climate versus a low autonomy physical education intervention on kindergartener's motor skill performance. Sixty-four children participated in 30, 30-min lessons over the course of a 6-week period. The results indicated that a mastery motivational climate positively impacted children's fundamental locomotor and object-control skills, whereas the low autonomy physical education intervention did not.

More recently, Robinson (2007) examined the influence of the motivational climate on the fundamental object control skill performance and perceived physical competence of preschoolers. Participants were randomly assigned to a mastery motivational intervention, a low autonomy intervention, or a control condition (i.e., neither mastery motivational nor low autonomy) and were exposed to 18, 30-min sessions emphasizing engagement in fundamental object control skills. Prior to the start of the intervention, all participants demonstrated similar fundamental object control skill scores and perceived physical competence. Post-intervention results indicated that participants exposed to both the mastery motivational and low autonomy conditions experienced improvements in fundamental object control skill performance. A retention test conducted 9 weeks following the completion of the intervention sessions indicated that the mastery motivational and low autonomy groups experienced a decline in fundamental object control skill scores. However, fundamental object control skills scores were still significantly higher at retention than scores prior to the intervention. The control group did not experience improvements in fundamental object control skill scores from pre- to post-intervention or at the 9-week follow-up. In regards to perceived physical competence, the mastery motivational group, compared to the low autonomy and control groups, reported significantly higher perceived physical competence following the intervention and at retention. No differences in perceived physical competence emerged at post-test or retention for the low autonomy and control interventions. Likewise, reported perceived physical competence scores for these two groups did not differ from each other.

Although the studies detailed above, in general, support that mastery motivational interventions result in significantly better motor skill development and perceived physical competence when compared to interventions incorporating low autonomy or a control group, little is known about the impact similar programs have on the physical activity levels of young children. To date, only one study has focused on the physical activity of young children who participate in mastery motivational programs. Parish et al. (2005, 2007) investigated the impact of a mastery motivational physical activity session versus a non-planned free play session on the physical activity heart rate and accelerometer count of 21 African American toddlers (*M* age = 2.5 years old) attending full-time daycare. Results indicated that during the mastery motivational physical activity session, toddlers had an average heart rate 15 bpm higher and an accelerometer count 19 counts higher than during the non-planned free play condition. Likewise, participants spent approximately 71 percent of the mastery motivational physical activity session versus approximately 31 percent of the non-planned free play session engaged in vigorous physical activity. In other words, the mastery motivational physical activity session resulted in more vigorous physical activity than did the free play session. The preliminary findings of this study provide insight into toddler's heart rate and accelerometer count during two different physical activity settings. To understand more about the impact of programming on the heart rate and physical activity intensity of pre-school aged children, further research is imperative.

*Summary*

In summary, young children are by nature motivated to master new and moderately challenging tasks. Thus, when presented with an environment focused on skill learning and mastery, children are motivated to achieve. Achievement goal theory provides a framework for describing the relationship between an individual's dispositional motivation, the climate's motivational emphasis, and the impact each of these constructs have on one’s achievement motivation. A wealth of literature has been conducted in academia, sport, and physical education but mostly focuses on older populations (i.e., middle school, high school, and college aged). The research conducted with younger children has investigated the relationship between the motivational climate, fundamental motor skill development, and perceptions of competence. Although these studies have contributed significantly to the field of early childhood education, they have not investigated the relationship between the motivational climate and physical activity engagement.

The current study aims to investigate the impact of 3 different motivational conditions (i.e., MC, PC, and FP) on the physical activity heart rate, accelerometer count, and intensity of young children. Because being physically active is critical to the development of fundamental motor skills and learning the foundation for engaging in lifetime activity, it is important to engage young children in intrinsically motivating physical activity early on in life. A mastery-oriented climate may be an effective means by which to help children set the stage for a lifetime of engagement in physical activity. However a performance-oriented climate may be equally effective at engaging young children in physical activity. This study aims to contribute to the fields of motor development and early childhood education by providing a clearer picture of the impact of situational cues on the physical activity behavior of preschool aged children. In the future, this study’s findings may lead to early childhood centers adopting physical activity curricula that emphasize a mastery- or performance-oriented approach to teaching fundamental motor skills and motivating young children to engage in physical activities throughout the lifespan.

METHOD

## *Participants*

The participants in this study were 27 preschool aged children (n = 11 boys, n = 16 girls), between the ages of 3- and 5-years-old (*M* age = 4.5, *SD* = 1.1 years), attending a nationally accredited, subsidized daycare in Auburn, Alabama. The daycare center serves mostly African American children from the local community who are environmentally at-risk for developmental delay and poor health. As indicated by the Center for Disease Control and Prevention's (2000) Body Mass Index (BMI)-for-Age charts, these children qualify as at risk for overweight ($\geq 85^{th}$ and $<95^{th}$ percentile for BMI-for-age) (*M* BMI for boys = 17.1 $kg/m^2$, *SD* = 2.6; *M* BMI for girls = 17.8 $kg/m^2$, *SD* = 3.4). The children are divided by age into 3 classrooms with each classroom being taught by a full-time teacher and a part-time teacher's aide. The teacher to student ratio in classrooms A (*M* age = 3.7, *SD* = 0.7 years), B (*M* age = 4.3, *SD* = 0.7 years), and C (*M* age = 5.2, *SD* = 0.7 years) are 1:10, 1:14, and 1:17, respectively. These ratios are in accordance with the State of Alabama, Department of Human Resources (2006) teacher-to-student ratio requirements (i.e., 1:11 for 2.5- to 4-years-olds, 1:18 for children 4 years old up to lawful school age) for preschool aged children. Each participant's age, height, weight, and BMI are presented in Appendix K.

On a typical day (e.g., 6:30 a.m. to 5:30 p.m., 11 hours), the children participate in unplanned indoor free play (2 hours and 30 min), learning centers (30 min), large and small group, teacher-initiated activities (1 hour and 30 min), unplanned outdoor physical activity (1 hour and 10 min), eat breakfast (40 min) and lunch (40 min), and take a nap (2 hours and 30 min). The remaining 1 hour and 30 min of the day is spent maintaining the classroom (i.e., preparing for meals and nap time, brushing teeth, washing up, applying lotion, moving from one activity to another, roll call, health check, etc.). See Appendix A for more detailed Daycare Schedules. Although the children are given the opportunity to engage in physical activity on a daily basis, the majority of indoor free play and outdoor physical activity is unplanned. Thus, during the school day, the children fall short of meeting the recommended daily physical activity standards proposed by Active Start (NASPE, 2000). According to NASPE (2002), preschoolers should accumulate at least 60 min of planned, physical activity/play and at least 60 min and up to several hours of unplanned, free play on a daily basis.

*Procedure*

After receiving human subjects approval from the Institutional Review Board for Research Involving Human Subjects at Auburn University and prior to the start of data collection, all children enrolled in the daycare (approximately 42) were recruited to participate in a physical activity program that emphasized three different motivational approaches to teaching. A letter (Appendix B) and informed consent form (Appendix C) were sent home to the custodial care giver(s) of each child attending the daycare requesting permission for their child to participate in the study. One week was provided for parents to return the informed consent. Informed consent forms were returned for 38 children, five of whom withdrew their enrollment from the daycare after data collection began. An additional three participants withdrew from data collection over the course of the study, however continued participating in the physical activity program. Participants missing more than two sessions of any of the three physical activity intervention conditions were eliminated from the data analysis due to insufficient data. Three participants were eliminated for excessive absences, thus the data from 27 participants was analyzed.

Upon receiving consent of each child enrolled at the daycare center, the children participated in a 3-day play environment acclimation period. The acclimation period allowed participants the opportunity to become familiar with the gymnasium in which data collection occurred. The gymnasium is located within walking distance of the daycare center (i.e., less than one block). Although participants engaged in unplanned, free play, no data was collected during the acclimation period. Rather, data collection began following the acclimation period with a 3-day baseline period and an 18-day intervention period. The intervention period consisted of 6 sessions each of three conditions: (a) a mastery-oriented motivational climate (MC); (b) a performance-oriented motivational climate (PC); and (c) unplanned free play (FP) (i.e., high autonomy with limited instruction and equipment).

To maintain class consistency between baseline and intervention periods and State of Alabama Department of Human Resources (2006) requirements for teacher-to-student ratio for preschool aged children, participants were divided into two physical activity classes for the baseline and intervention periods. Physical activity class 1 (*M* age = 4.0, *SD* = 0.8) years combined classrooms A and B and physical activity class 2 (*M* age = 5.2, *SD* = 0.7) years was made up of the children from classroom C. Due to the within-subjects nature of this study the class as a unit should have no impact on the study's outcome. This study was primarily concerned with the impact of different motivational climates on participants' physical activity. By exposing all participants to each of the motivational climates, the premise of achievement goal theory, that strong situational cues are more likely to predict goal-involvement and achievement behavior than one's disposition (Dweck & Leggett, 1988; Nicholls, 1984, 1989; Treasure & Roberts, 1995, 2001), may be fully investigated.

Throughout the intervention period, both classes were exposed to identical play sessions (i.e., condition, stations, equipment, teachers, etc.) and the same two physical activity teachers. One of the teachers was the researcher conducting this study, while the other teacher was a university professor. These teachers are Caucasian females who are experts in early childhood motor development and have had extensive experience in implementing each condition. As required by daycare policy, the classroom teachers were present throughout the baseline and intervention periods. The classroom teachers monitored the baseline play sessions (i.e., the physical activity teachers will not be present) and were asked to refrain from participating in implementing the conditions. Thus, the daycare teachers served only as observers for the entire intervention period. To ensure the teachers were able to properly identify children and to preserve proper implementation of each condition, participants wore name tags during the study.

*Baseline Period.* Prior to implementation of the three conditions (i.e., MC, PC, FP), participant's height and weight, baseline physical activity behavior (i.e., physical activity heart rate and accelerometer count), and resting heart rate were collected. Appendix K includes each participant's height, weight, and resting heart rate. All baseline play sessions occurred at the same time each day during the daycare's morning, unplanned free play period. See Appendix A for the Sample Daycare Schedules. The baseline play sessions took place in the gymnasium (45 x 54 feet) which was not set up with stations, activities, or manipulative equipment. Equipment was set out around the perimeter of the gymnasium floor in a visible location and available for the children to use. The mean gymnasium temperature was 81.3 ($SD$ = 2.4) degrees Fahrenheit, with 58.5 ($SD$ = 0.04) percent humidity during the baseline sessions.

Baseline physical activity heart rate and accelerometer count were measured during three separate play sessions using Actiheart monitors. At 9:00 a.m., the participants in Class 1 and 9:45 a.m., the participants in Class 2 walked from the daycare center to the gymnasium. Classroom teachers and research assistants accompanied the participants. Upon arrival at the gymnasium, a researcher or trained research assistant placed a heart rate monitor on each participant's chest using Actiheart monitor protocol (Mini Mitter Company, Inc., 2004). The heart rate monitor remained on the child throughout the morning, unplanned physical activity period (i.e., Class 1 from 9:30-10:00 a.m. and Class 2 from 10:15-10:45 a.m.). On a randomly selected baseline data collection day, each child continued to wear the heart rate monitor during the afternoon rest/nap period (approximately 3:00 p.m.) in order to measure resting heart rate. See Appendix D for a Data Collection Schedule. The researcher checked the monitor periodically throughout the play sessions and nap period to verify proper placement of the electrodes on the chest and attachment of the monitor to the electrodes. The researcher also took special care to ensure each participant's comfort while wearing the monitor.

Two video cameras (Canon ZR800 Digital Video Camcorders) were mounted on tri-pods to record the 3 baseline physical activity sessions. Additionally, a wireless microphone was attached to the classroom teacher's shirt to document the teacher's involvement in each session. Filming began when the first participant entered and ended when the final participant and the teacher exited the gymnasium (Morgan, Sproule, Weigand, & Carpenter, 2005). Each session was described according to the Behavioral Evaluation Strategies and Taxonomies (BEST) (Morgan et al., 2005; Sharpe & Koperwas, 1999). To minimize reactivity to the video cameras and prevent the cameras from interfering with the baseline sessions, the cameras were placed in an unobtrusive section of the play area. Because children and teachers may move freely around the gymnasium during unplanned free play, care was taken to minimize participants and the teacher moving out of the cameras' field of view. Following participation in each of the baseline play sessions, participants returned to their classroom and engaged in learning centers and small group activities.

The baseline period provided descriptive information regarding each participant's physical activity levels prior to exposure to the conditions and the researchers serving as teachers during the three conditions (see Table 1). The 3-day baseline also allowed participants the opportunity to become familiar with the heart rate monitors, the procedure for placing the heart rate monitors on the chest, and accustomed to the placement of video cameras in the physical activity setting.

*Table 1.* Means and standard deviations for physical activity heart rate (bpm), accelerometer count, and PAHR > 50 (percentage of 25-min physical activity session with physical activity heart rate greater than 50 percent of RHR) for the 25-min physical activity portion of each baseline session.

| | Physical Activity Heart Rate | | Accelerometer Count | | PAHR > 50 | |
|---|---|---|---|---|---|---|
| Session | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| 1 | 154.28 | 17.26 | 87.04 | 40.15 | 85.59 | 20.18 |
| 2 | 156.97 | 16.18 | 83.35 | 34.43 | 85.57 | 26.16 |
| 3 | 155.40 | 16.91 | 82.94 | 34.80 | 84.51 | 25.45 |

Following the baseline period, all participants received 25 min of physical activity instruction for 18 days and were exposed to each condition an equal number of times throughout the intervention period. The next section describes the intervention period in detail.

*Intervention Period.* During the intervention period, all participants received 18 days of physical activity instruction (i.e., 6 sessions each of 3 physical activity conditions- MC, PC, and FP). To prevent the order in which the conditions are presented negatively impacting the study's results, the conditions were divided into 6 sets of 3 conditions (i.e., each set included 1 session of each of the 3 intervention conditions) such that all possible orders of conditions occur (e.g., MC, PC, FP; MC, FP, PC; PC, FP, MC; PC, MC FP; FP, PC, MC; FP, MC, PC). The 6 sets of conditions were then presented to participants in random order. Table 2 shows the order in which the conditions were presented. Intervention instruction did not occur on Saturday and Sunday. The intervention play sessions took place at the same time each day replacing the daycare's morning, unplanned free play session.

*Table 2.* Condition order schedule.

| Week Ending | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| June 29th | | | Gym | Gym | Gym |
| July 6th | Closed | Closed | Closed | Baseline 1 | Baseline 2 |
| July 13th | Baseline 3 | PC 1 | MC 1 | FP 1 | FP 2 |
| July 20th | MC 2 | PC 2 | FP 3 | PC 3 | MC 3 |
| July 27th | MC 4 | FP 4 | PC 4 | PC 5 | FP 5 |
| August 3rd | MC 5 | MC 6 | PC 6 | FP 6 | |

Gym = Play environment acclimation; No data collection

Closed = Daycare closed for a holiday

PC = Performance-oriented motivational climate

MC = Mastery-oriented motivational climate

FP = Unplanned free play

All 30 min play sessions consisted of a (a) 3 min introduction and instruction period; (b) 25 min physical activity engagement, fundamental motor skill instruction, and practice; and (c) 2 min closure to the lesson. The introduction consisted of a brief review of the rules for engagement, overview of the stations available, a skill demonstration of each station, and a description of the goals for each station and the play session as a whole. The fundamental motor skill and physical activity portion of the session focused on engaging in developmentally appropriate motor skills and moderate to vigorous physical activity. The closing involved a brief relaxation activity aimed at helping the participants calm down before re-entering the classroom setting.

The intervention activity sessions took place in the gymnasium (i.e., the same setting in which baseline occurred). The mean gymnasium temperature and percent humidity for all intervention activity sessions was 81.8 (*SD* = 2.6) degrees Fahrenheit and 59.4 (*SD* = 0.09) percent, respectively. The gymnasium was set up each morning prior to the intervention play sessions. For the MC and PC conditions, equipment was strategically placed across the play area in 5 activity stations. Consideration was made during set-up to ensure child safety. No set up took place for the FP with the exception that equipment was set out on one-side of the gymnasium floor for children to use if they so choose. Following participation in the intervention conditions, children returned to their classroom with the classroom teachers and participated in large and small group activities.

Actiheart monitors were used to monitor physical activity heart rate and accelerometer count during the intervention conditions. During the intervention period, a heart rate monitor was placed on each participant prior to engagement in the physical activity sessions (9:15 a.m. for Class 1 and 10:00 a.m. for Class 2) and remained on the child until the conclusion of the intervention play session (9:45 a.m. for Class 1 and 10:45 a.m. for Class 2). A researcher or trained research assistant used Actiheart monitor protocol (Mini Mitter Company, Inc., 2004) to attach the monitor to each participant's chest. Throughout each intervention physical activity session participants' physical activity heart rates and counts were recorded. Periodically throughout data collection, the heart rate monitor was checked to ensure it was working properly. The heart rate data was downloaded and the relevant data (e.g., baseline, intervention conditions, and resting heart rate) was labeled. Start and end times for each play session and nap time were documented in order to extrapolate the heart rates of interest from the raw data.

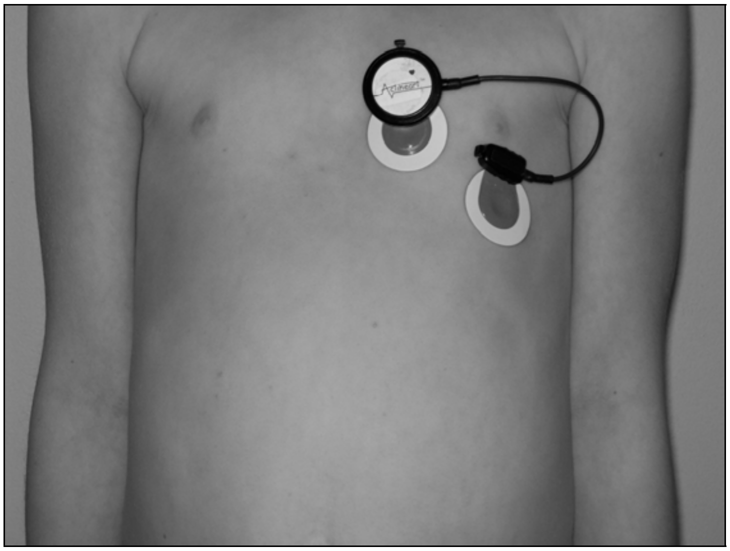
Two video cameras (Canon ZR800 Digital Video Camcorders) were set up in an area with a clear view of the play area and the physical activity teacher of interest but in a section of the gymnasium that did interfere with the participants' play behavior or teachers' instruction during the intervention play sessions. Each physical activity teacher wore a live wireless microphone to record their involvement in all physical activity sessions. The microphones were set to different frequencies such that each teacher's verbal instructions and feedback were captured by one of the video cameras (e.g., Physical activity teacher A wore microphone A, set at frequency 3. Camera A captured teacher A's verbal and behavioral involvement in the session. Physical activity teacher B wore microphone B, set at frequency 2, and captured by camera B.). The cameras recorded the 18 intervention play sessions such that the manipulation check (i.e., BEST) may be completed. Filming began when at least one participant arrived in the gymnasium and continued until the participants were dismissed by the teachers (Morgan et al., 2005).

Lesson plans from Valentini (1997) were modified to meet the needs of this pre-school aged population and the conditions of interest. Appendix F includes a sample lesson plan adapted for each condition. For example, when lesson plan 1 was implemented, the activity stations were identical for the MC and PC conditions; however, the motivational emphasis changed. No lesson plans were used for the FP conditions, but the same equipment available during lesson plan 1 for the MC and PC conditions was made available during the FP condition. The activities and equipment used during this study were developmentally appropriate. The 5 activity stations designed for each lesson plan emphasized moderate to high intensity physical activity participation through engagement in fundamental motor skills. The fundamental motor skills included locomotor skills (e.g., run, gallop, hop, leap, horizontal jump, and slide), object-control skills (e.g., strike a stationary object, stationary dribble, catch, kick, overhand throw, and underhand roll), and balance. Refer to Appendix G for a list of equipment that was used.

*Measures & Equipment*

*Actiheart monitor.* The Actiheart monitor (12 grams, 38 mm in diameter x 195 mm in length; stock number 510-0001-01) by Mini Mitter™ (a Respironics Company) is a combined heart rate monitor and accelerometer that was used to measure physical activity heart rate, resting heart rate, and accelerometer count. The Actiheart monitor attaches to the chest with two biocompatible ECG electrodes placed on both sides of the heart along the parallel of the space between the fourth and fifth ribs. See Figure 1 for a diagram showing the proper placement of the ECG electrodes and monitor on the chest. Parish et al. (2007) and Wall and Rudisill (2006) report that the placement of the Actiheart monitor (as shown in Figure 1) is well tolerated by young children.

Figure 1. Actiheart monitor placement on the chest.



The heart rate and accelerometer components of the Actiheart recorded data (i.e., physical movement or accelerometer count and heart rate) at 15-sec epochs (i.e., intervals). The Actiheart measured heart rate by detecting the QRS complex and analyzing the R-R interval durations. The R-R intervals were averaged, converted to a BPM value, and stored in the Actiheart's memory at the end of each epoch. When vertical movement was detected by the Actiheart, the accelerometer generated a raw voltage signal which was converted to digital at a rate of 32 times per second. At end of each epoch, the digital data was summed and stored in the Actiheart's memory. The stored heart rate and accelerometer data was later downloaded to a computer via a standard USB connection (Mini Mitter Company, Inc., 2004). According to Brage et al. (2005), the Actiheart monitor appears to be a valid and reliable measure of movement and heart rate during rest and treadmill walking and running conditions in adults. Specifically, the monitor has been shown to demonstrate reliability for heart rates ranging from 30 to 250 bpm (Brage et al., 2005). Recent studies also support that the Actiheart monitor is a valid measure of heart rate among toddlers (Parish et al., 2007; Wall & Rudisill, 2006). For a more detailed technical description of the Actiheart monitor and for more information regarding reliability and validity of the instrument in standardized mechanical situations and in adults see Brage et al. (2005).

In the present study, the mean physical activity heart rate and count for each participant for each of the 18 intervention play sessions were calculated and used for the analysis. Start and stop times of the sessions were recorded to identify when the children were engaged in physical activity. Data was downloaded to a computer following each activity session.

*Physical Activity Heart Rate-50 (PAHR-50) Index.* Physical activity intensity will be calculated using the PAHR-50 Index. The PAHR-50 Index classifies vigorous physical activity intensity as PAHR > 50, the percentage of time spent with heart rate 50 percent above resting heart rate. Previous research indicated that this index is an appropriate and reliable measure for physical activity intensity in young children (Durant et al., 1993). Durant et al. (1993) report significant Cronbach's alphas for within day ($\alpha = .88$) and between day ($\alpha = .56$) reliability. In this study, PAHR > 50 was calculated for the 25 min physical activity portion of the session (i.e., excluding the 3-min introduction and 2-min closing) for baseline and each condition.

*Behavioral Evaluation Strategies and Taxonomies (BEST) Software.* BEST software (Sharpe & Koperwas, 1999) is a system by which quantitative data within a physical activity environment may be collected and analyzed. Specifically, by observing live or videotaped situations, researchers count multiple events which are coded according to a pre-determined definable taxonomy. The computer keyboard is configured according to the pre-determined taxonomy which allows for the recording of multiple and overlapping frequency (how many) and duration (how long) quantitative behaviors by depressing the appropriate computer keyboard numbers and letters. After the quantitative contextual data is coded, total duration and/or frequency scores are calculated for each key. A feature of BEST is the software's ability to assess rater agreement by calculating Cohen's kappa coefficient (Cohen, 1960).

In order to use BEST as a means to quantify teacher behavior in terms of mastery- and performance-oriented motivational climates, Morgan et al. (2005) developed definitions specific to mastery- and performance-oriented climates for each TARGET component and assigned each definition a computer keyboard letter/number key. The definitions of the mastery- and performance-oriented TARGET components focused on the teacher's, not the students', behaviors and cues. When depressed, the computer keyboard keys for the recognition and evaluation structures recorded frequency of occurrence while the keys for task, authority, grouping, and time calculated overall duration (in seconds). In addition to the mastery- and performance-oriented keys, Morgan, et al. (2005) also defined "neither" keys as identifying components of the motivational climate that were neither mastery- nor performance-oriented.

For this study, BEST was used to quantify each teacher's mastery- and performance-oriented behaviors while leading the three different physical activity conditions (i.e., MC, PC, FP). The components of the TARGET structure were defined such that when depressed/recorded, the BEST keys would quantifiably differentiate between the MC, PC, and FP conditions. Table 3 identifies the 16 keys used to assess the three physical activity conditions implemented during the current study. The definition for each TARGET structure was derived from the work of Morgan et al. (2005). Additional codes, not related to TARGET, were added to quantify the FP condition, the general recognition provided by each teacher, and the length of class time the teachers spent engaged in management and instruction.

*Table 3.* BEST computer keyboard letter/number assignments and descriptions in relation to the TARGET structures and the three physical activity conditions.

| TARGET Structure | Condition | Key | Description (output) |
|---|---|---|---|
| Task | MC | 1 | Adapt Task (duration)- The teacher offers a variety of tasks with multiple challenge levels for each task (matched to each participant's skill level), emphasizing self-referenced goals and personal improvement. |
| | PC | Q | Inflex Task (duration)- The teacher offers the same tasks for all participants with one challenge level for each task (matched to a normative standard chosen by the teacher), emphasizing norm-referenced goals and outperforming others. |
| | Neither | A | Unplanned Free Play (duration)- The teacher offers play equipment only. No tasks with clear purposes or goals are available. |

| TARGET Structure | Condition | Key | Description (output) |
|---|---|---|---|
| Authority | MC | 2 | Kids Decis (duration)- The teacher and participants collaborate on decisions regarding choice of activity, challenge level, rules, grouping, etc. |
| | PC | W | Tchr Decis (duration)- The teacher makes all decisions regarding the activities, challenge level, rules, grouping, etc. |
| Recognition | MC | 4 | Imprv Rec (frequency)- The teacher recognizes participants for an/a individual/group's effort, engagement in physical activity, and skill improvement. |
| | PC | R | Win Luck (frequency)- The teacher recognizes participants for an/a individual/group's winning (i.e., outperforming others) or luck. |
| | Neither | D | Gen Rec (frequency)- The teacher provides general recognition for an individual/group. |
| Grouping | MC | 6 | Kids Grp (duration)- The teacher allows the participants to decide with whom they want to play and group themselves |

| TARGET Structure | Condition | Key | Description (output) |
|---|---|---|---|
| | PC | Y | Tchr Grp (duration)- The teacher groups the participants. |
| Evaluation | MC | 8 | Prev Cmpr (frequency)- The teacher compares an/a individual/group’s effort, engagement in physical activity, or skill improvement to that of previous trials. |
| | PC | I | Other Cmpr (frequency)- The teacher compares an/a individual/group’s ability to that of other participants/groups. |
| Time | MC | 0 | Flex Time (duration)- The teacher allows participants to choose the length of time they prefer to practice any given task. |
| | PC | P | Inflex Time (duration)- The teacher chooses the length of time the participants engage in each activity. |
| Other | | L | Class Manage (duration)- The time the teacher spends enforcing class rules, disciplining participants, or aiding injured participants. |

| TARGET Structure | Condition | Key | Description (output) |
| --- | --- | --- | --- |
| | | M | Instruct (duration)- The time the teacher spends explaining activity stations, giving skill demonstrations, or modeling activities (i.e., skill specific instruction). |

Note. Source: Adapted from Morgan, et al. (2005)

*Developmentally Appropriate Equipment.* Throughout all three conditions participants had access to the same stations and developmentally appropriate equipment. Not only did participants have access to a number of stations emphasizing locomotor and object-control fundamental motor skills, they also had the opportunity to engage in physical play activities using various manipulative and striking implements. This equipment included items such as paddles, balls, scarves, scooters, golf clubs, hockey sticks, balloons, and a balance beam. During the MC and PC conditions, the equipment was organized and distributed across the play area. For the FP sessions, the equipment was placed around the perimeter of the gymnasium but was not organized and set-up in stations. Appendix G includes a list of developmentally appropriate equipment that was used during the present study.

## *Design*

Detailed descriptions of the physical activity conditions (i.e., MC, PC, FP) in reference to the TARGET dimensions (Epstein, 1988, 1989) are provided below.

*Mastery-oriented Climate (MC) Condition*

The mastery-oriented climate (MC) condition is a high autonomy environment that is based on effort and self-referenced criteria of ability/success (Ames, 1992a, 1992b). According to Ames (1992a, 1992b), it is exemplified by a focus on skill mastery, effortful engagement, and intrinsic motivation. In this study, the MC provided each participant the opportunity to be in charge of his/her own physical activity engagement by participating in a variety of challenging and diverse tasks. Participants had the opportunity to select the tasks in which they engaged and the challenge level at which they performed each task. The teachers implementing the MC provided recognition to each participant based on his/her individual progress and effort and evaluated participants in reference to attempts at task mastery and individual improvement. Within the MC, participants were given the opportunity to make choices, involve themselves in leadership roles, participate in a variety of movement experiences and peer interactions (i.e., cooperative, independent, etc.), and were allowed to choose the length of time they engaged in a skill activity (i.e., based on his/her personal capabilities or motivation). The details of the MC in reference to Epstein's (1988, 1989) TARGET structures are provided below and also summarized in Table 4.

*Table 4.* Characteristics of the MC in relation to TARGET.

| TARGET Structure | Description |
|---|---|
| Task | • Five activity stations were set-up by the teachers.<br>• Multiple levels of task difficulty and challenge were imbedded within each activity station.<br>• Participants chose the activities in which to engage.<br>• Opportunity for novelty, creativity, and problem solving was given. |
| Authority | • Teachers and participants collaborated on creating and enforcing rules.<br>• Participants chose stations, challenge level, and with whom they wanted to play (i.e., high autonomy).<br>• Teachers facilitated engagement in physical activity.<br>• Participants self-regulated their engagement in physical activity. |
| Recognition | • Recognition was based on exerting effort, engaging in physical activity and motor skill, making attempts to master a task, and skill improvement relative to previous performance.<br>• Recognition and feedback were given on a daily basis. |
| Grouping | • Groups dynamically emerged and were flexible.<br>• Participants chose with whom, if anyone, they wanted to play. |

| TARGET Structure | Description |
|---|---|
| Evaluation | • Evaluation was based on individual physical activity engagement and effort.<br>• Teachers evaluated participants on a regular, individual basis.<br>• Activity stations were set-up such that participants also evaluated their own activity engagement based on visual feedback imbedded within the station. |
| Time | • Timing was flexible.<br>• Participants determined time spent engaged in a skill.<br>• No time constraints were placed on engagement in a specific activity.<br>• Teachers provided verbal cues to help participants recognize the length of time remaining in an activity session (e.g., 2 min left in the activity session). |

Note. Source: Adapted from Valentini (1997)

*Task*. Within the MC, teachers provided participants with multiple tasks from which to choose such that participants may match their ability with tasks that were moderately challenging to them. Teachers laid out equipment and set up a variety of activity stations (i.e., 5 stations emphasizing fundamental motor skills and large muscle movements) which incorporated meaningful, developmentally appropriate activities with varying levels of challenge. These activities were designed to meet the different ability levels of all participants so they may experience regular success. The activities also aimed to meet curricular goals for promoting motor development in this age group. Together, the activities and curricular goals enhanced motor skill development and facilitated engagement in physical activity. For example, at the throwing station, participants were given the option to throw at different sized targets from varying distances away (e.g., 1 foot, 3 feet, or 5 feet), using a football, baseball, or yarn ball. Teachers also emphasized problem solving and facilitated creative and unique ways of accomplishing tasks. Providing participants the freedom to make choices regarding skill engagement and challenge level increased opportunities for success, motivation to engage, and actual skill participation. Throughout the MC, participants were given the freedom to explore their environment, move in creative ways, generate unique movement activities, and initiate social interactions with peers and teachers.

*Authority*. The MC emphasized autonomy and independence, thus encouraging participants to be self-directed and in charge of their own engagement in physical activity and skill mastery. Participants filled leadership roles and collaborated with the teachers on creating rules for appropriate and safe behavior. The teacher monitored the participants to ensure these rules for appropriate behavior were followed. During the MC, participants were given the freedom to choose the stations and challenge levels at which they wanted to engage. Through this decision making process, teachers assisted participants and facilitated their engagement, rather than told the participants what to do. The participants dictated their physical activity and the teachers guided them through effortful engagement, learning, decision-making, and problem solving processes.

*Recognition*. The recognition component of the MC focused on effortful attempts to participate in and master tasks, engagement in moderate to vigorous physical activity, and skill improvement in reference to previous performance/outings. Teachers recognized participants on a daily basis for their effort, accomplishments, and/or improvement. Recognition was given on an individual basis. Teachers also interjected verbal (e.g., knowledge of performance) and visual (e.g., skill demonstration) corrective feedback based on mastery criteria defined by Payne and Isaacs (2002), while encouraging and supporting mastery attempts made by each participant. For instance, when a participant accomplished a task that he or she had been attempting to master, the teachers acknowledged this accomplishment by giving the participant a pat on the back and verbally congratulating him or her.

*Grouping*. During the MC, teachers allowed groups to emerge dynamically. Participants chose with whom, if anyone, they wanted to play. Therefore, grouping varied throughout each MC session.

*Evaluation*. Teachers evaluated participants' engagement in physical activity, effort, and attempts at skill mastery, based on a self-referenced criterion for success (i.e., previous performance). In addition, evaluation was individualized for each participant. In some instances, stations within the MC offered participants the opportunity to evaluate themselves because feedback was naturally imbedded in the tasks itself. For example, if a participant was attempting to roll a ball and knock down 10 boxes, that participant was able to evaluate his/her success in accomplishing his/her goal by counting the number of boxes that were knocked down following the roll. In such a task, the teacher did not need to provide feedback on the participant's performance outcome. The participant evaluated his or her own performance. When feedback was not naturally imbedded in a task, teachers provided participants with skill demonstrations and information such as “I like the way you reached with your arms when you jumped.” and “Great job, you stepped with the correct foot.”

*Time*. In the MC, teachers allowed optimal time for physical activity engagement and skill mastery to occur. Time spent participating in each activity station and practicing different skills was flexible with participants determining the length of practice time they preferred per station. In other words, during the MC, participants were afforded enough time to fully investigate an activity and to make mastery attempts at that given activity. Participants were encouraged to explore an activity on their own terms, such that each participant had an optimal amount of time to practice activities and exert effort to learn those activities. Skill engagement was flexible and participant driven, with no time constraints for physical activity engagement being imposed by the teachers. Throughout the MC, teachers gave verbal cues to help the participants manage their time (e.g., “We have 5 min remaining in class.”). Teachers also engaged the participants in planned activities which indicated the amount of time remaining in the activity session. For example, with 2 min remaining in each activity session, the teachers engaged the participants in an activity (e.g., deep breathing, running road, etc.) to close the activity session and prepare participants to return to the classroom.

### *Performance-oriented Climate (PC) Condition*

The performance-oriented climate (PC) condition paralleled the concepts of direct instruction (Rink, 2006) and the achievement goal theory based performance-oriented environment (Ames & Archer, 1988). According to Rink (2006), direct instruction is characterized by clear lesson objectives, high teacher monitoring of lesson objectives, and structured learning activities. Likewise, the PC emphasized a performance-oriented approach to learning and engagement in achievement behavior, as proposed by Ames and Archer (1988), in which the teacher directs participant engagement and learning while the participant has limited involvement in the development of lesson objectives, engagement in physical activity, and the learning process. Additionally, the PC emphasized outperforming others (i.e., winning) and focused on normative- and other-referenced criteria for judging one's ability and success. The following sections and Table 5 outline the characteristics of the PC based on Epstein's (1988, 1989) six-dimensional TARGET structure.

*Table 5.* Characteristics of the PC in relation to TARGET.

| TARGET Structure | Description |
|---|---|
| Task | • Five activity stations were set-up by the teachers.<br>• One level of difficulty or challenge within each activity station was provided.<br>• Teachers chose activities in which participants engaged.<br>• Few opportunities for novelty, creativity, and to vary the task existed. |

| TARGET Structure | Description |
|---|---|
| Authority | • There was little or no autonomy or distribution of authority.<br>• Limited collaboration between teachers and participants for creating rules and lesson objectives occurred.<br>• Teachers directed engagement in physical activity.<br>• Participants had no freedom of choice (i.e., low autonomy). |
| Recognition | • Recognition was based on outperforming others, achieving normative standards of success, commanding directions, or reprimands for rule violation.<br>• Recognition and feedback were given in front of other participants. |
| Grouping | • Teachers assigned participants to groups.<br>• Groups remained the same throughout each activity session and rotated from station to station as a unit. |
| Evaluation | • Evaluation was based on winning, performance outcome, and out-performing other participants.<br>• Participants were evaluated irregularly.<br>• Evaluations were made publicly and were also naturally imbedded within the activity stations. |

| TARGET Structure | Description |
|---|---|
| Time | • Timing was on a fixed schedule rotation (e.g., 5 min per activity station).<br>• Teachers dictated time allotted per station.<br>• All participants were allotted the same amount of time for engagement and skill practice.<br>• Teachers provided auditory cues to identify when participants rotated to a new station and to indicate the length of time remaining in the activity session (i.e., 2 min left in the activity session). |

Note. Source: Adapted from Valentini (1997)

*Task*. Within the PC, the teacher laid out the play equipment and set up developmentally appropriate activities in 5 stations. During the PC, the lesson plan and stations matched those of the MC. However, the instructional climate differed. The stations offered a variety of activities in regards to task options but incorporated limited levels of difficulty and challenge. The lack of variation in challenge level may lead participants, especially those who are less skilled, to experience more failure (Nicholls, 1984). Participants were allowed to participate in only one station at a time (5 min per station), but had the opportunity to engage in all stations during the physical activity period. Additionally, they were expected to complete the task exactly as described by the teacher (including task, challenge level, technique, and intensity level). For example, independent of skill level, participants were directed to throw at a target from a designated point determined by the teacher. The teacher decided where participants stood when throwing an object at the target. All participants were expected to throw from the same set point and to engage in throwing only at the throwing station. In summary, the PC lacked a variety of developmentally appropriate task options, tasks of varying difficulty/challenge, and novel tasks.

*Authority*. During the PC, participants had little or no autonomy, thus were not involved in instructional decision-making. Limited collaboration between teachers and participants took place within the PC. The teacher directed in which activity stations participants engaged; created and presented the rules of appropriate behavior; enforced the rules; and decided on and implemented the consequences for breaking the rules. In other words, participants were encouraged to follow the teacher's directions and instructions without the opportunity to make decisions about their own movement exploration. Participants were expected to follow the teachers' rules for engagement and instructions regarding the task at each station. In the PC, teachers provided direct instruction and dictated rule compliance while the participant acted as an agent of control and had limited autonomy.

*Recognition*. The recognition aspect of the PC was given on a daily basis and focused on recognizing performance based on the performance of others and performance outcomes. For example, participants were recognized when they out-performed (i.e., beat) a classmate. Thus, participant recognition and success was made in reference to others. Additionally, recognition was given in public (i.e., in front of other participants). Within the PC, recognition for effortful task engagement, corrective feedback, and encouragement was given in reference to others. The teachers recognized participants for outperforming someone else, to command directions, or to reprimand a participant for violating a rule. Teachers also provided recognition and reinforcement for a participant's ability to adhere to the teacher's rules for engagement and instructions for each activity station.

*Grouping*. Within the PC, the teachers randomly assigned each participant to a group. The groups were identified by different colored stickers labeled "1" for group 1, "2" for group 2, so on and so forth. The groups remained the same throughout each PC intervention session and rotated from station to station as a unit.

*Evaluation*. Similar to the recognition component of the PC, evaluation within this condition emphasized performance outcome, winning, and outperforming other participants. When performance evaluations were made, the teachers made them in public. Due to the nature of motor skill tasks, evaluative information such as knowledge of results was naturally imbedded within the stations and tasks.

*Time*. The PC operated on a fixed schedule rotation, meaning the teachers determined the amount of time each group of participants spent learning at a station. In other words, every 5 min the teachers indicated a station change (via a whistle blow) and participants rotated (in their intact group) in a clockwise fashion to the next station. Teachers also provided a verbal cue to indicate the length of time remaining in the activity period (i.e., 2 min left in the activity session). All participants were allowed the same amount of time for engagement in physical activity, regardless of skill or fitness level. In summary, while engaging in the task at each station, the teachers managed how each participant spent his/her time and when the time at the station ended.

*Unplanned Free Play (FP) Condition*

The FP condition (i.e., control) consisted of a physical activity program typical of the participant's daycare center. While the FP emphasized a high autonomy learning environment for participants, it offered limited instruction, teacher modeling of activities and motor skills, and minimal equipment. The following sections and Table 6 outline the characteristics of the FP based on Epstein's (1988, 1989) six-dimensional TARGET structure.

*Table 6.* Characteristics of the FP in relation to TARGET.

| TARGET Structure | Description |
|---|---|
| Task | • No activity stations were set-up by the teachers.<br>• Equipment was distributed around the play area but not organized into activity stations.<br>• Participants were solely responsible for creating activities.<br>• Activity difficulty level was driven by participant skill level and motivation for challenge.<br>• Opportunity for creativity and problem solving was given. |

| TARGET Structure | Description |
|---|---|
| Authority | • Participants chose activities, challenge level, and with whom they wanted to play (i.e., high autonomy).<br>• Teachers observed and monitored the activity session (i.e., no involvement in the learning process).<br>• Participants self-regulated their physical activity engagement and were fully responsible for their own effortful engagement in physical activity and mastery attempts at motor skills. |
| Recognition | • Teachers provided minimal recognition.<br>• Recognition was based on eliminating dangerous, unwanted behaviors.<br>• Recognition was given in public, upon occurrence. |
| Grouping | • Participants chose with whom, if anyone, they wanted to play.<br>• Grouping varied throughout each activity session. |
| Evaluation | • Teachers were passive observers and provided limited evaluative information.<br>• Participants were responsible for gathering evaluative information from that which was naturally imbedded within each activity. |

| TARGET Structure | Description |
|---|---|
| Time | • Participants determined the length of time engaged in a skill.<br>• Teachers provided auditory cues to indicate length of time remaining in the activity session (i.e., 2 min left in the activity session). |

*Task*. During the FP condition no stations were set-up by the teachers. Rather, equipment was placed around the perimeter of the play area and participants were responsible for obtaining the equipment and creating and engaging in activities that were developmentally appropriate. Because the FP was highly autonomous, participants were solely responsible for their own engagement in physical activity. They were given the freedom to explore movement and perform any task of their choice at their personal skill, challenge, and preferred intensity level. In the FP, the teacher had limited to no involvement in creating or modifying tasks/activities or encouraging participants to engage in physical activities. The lack of teacher assistance and involvement in creating a successful experience for the participants or help the participants with problem solving might have negatively impacted the participants' motivation to engage in motor skills.

*Authority*. Due to the high-autonomy nature of the FP, participants were given opportunities to fill leadership roles, select the activities and task challenge level in which they wanted to engage, and create their own rules for engagement. Within the FP, teachers engaged in no motor skill or physical activity instruction. However, general physical activity rules (i.e., no pushing/shoving, take turns, sit on scooters, return equipment to area from which you took it) were implemented. The only involvement the teachers had in the FP was monitoring the activity session to ensure basic safety of all participants. The teacher observed and monitored misbehavior and intervened when a participant was at risk of injury. Participants were solely responsible for engaging in physical activity and deciding what to do during the activity sessions. Teachers sat and observed the participants as they engaged in physical activity.

*Recognition*. Minimal teacher recognition of participants' effort, physical activity engagement, accomplishments, improvement, or performance outcome was provided. Most recognition that occurred in the FP focused on eliminating unwanted, dangerous behaviors.

*Grouping*. Similar to the MC, within the FP, participants were given the opportunity to group themselves and/or work independently. Although participant-selected groups stayed the same throughout some of the FP activity sessions (i.e., best friends chose to play together the entire activity session), grouping also varied during and between activity sessions (i.e., one participant engaged in activity on his own for a while, then played chase with a classmate.)

*Evaluation*. As with many movement activities, knowledge of results were imbedded within the activities the participants chose to perform during the FP. For example, if a participant chose to kick a ball at a target and the ball continued to miss the target towards the right, the participant was aware that adjustments needed to be made to his/her kicking technique in order to hit the target. A teacher did need to inform the participant his/her kicks were off target. This knowledge of results was inherent in the task. Additionally, teachers were passive observers within the activity condition, providing limited, if any, evaluative information to the participants.

*Time*. As in the MC, participants explored activities on their own terms with no time constraints placed on engagement. Participants determined the length of time they engaged in a task. Within the FP, a participant chose to spend the entire activity session dribbling and shooting a basketball or engaging in as many different activities as possible, such as jumping off of a platform, to pushing a friend on a scooter, to arranging turtles based on their color. Teachers provided a verbal cue to indicate when 2 min were left in the activity session.

### *Dependent Variables and Data Reduction*

The 25 min physical activity portion of each session provided two sets of 100 data points (i.e., 100 physical activity heart rates and 100 accelerometer counts) per participant with each data point representing the mean physical activity heart rate and accelerometer count over a 15 s period. The 100 physical activity heart rates and 100 accelerometer counts were used to determine mean physical activity heart rate and count, respectively, during each baseline and intervention physical activity session for each participant. The mean of the lowest consecutive 10 data points (2.5 min) of heart rate during rest/nap time was used to determine resting heart rate (Parish et al., 2007) and to calculate PAHR-50 for each baseline and intervention activity session. To account for individual differences, the PAHR-50 was calculated using each individual's resting heart rate. Following each session, physical activity heart rate and accelerometer count data was stored in the Actiheart monitor's memory until downloaded to a computer via a standard USB connection.

During this study, BEST (Morgan et al., 2005) was used to ensure the fidelity of the MC and the PC conditions created by the teachers and to assess the teachers' behaviors during the FP condition. The BEST manipulation check was completed for all physical activity sessions following the completion of the study. The entire 30-min session, including the 3-min introduction, 25-min physical activity portion of the session, and the 2-min closing, was evaluated for all six physical activity sessions of the three conditions. To facilitate evaluation of the two physical activity classes and two teachers independently, a 30-min video of physical activity class 1, teacher A; class 1, teacher B; class 2, teacher A; and class 2, teacher B were evaluated. More than 36 hours were spent to evaluate 72 videos and categorize the motivational climate created by the teachers.

Two trained research assistants, blind to the purpose of the study and the motivational climate of each physical activity session, used BEST to categorize both teachers' cues and behaviors. After being trained to use the BEST software coding system, the research assistants had to demonstrate kappa coefficients greater than .80 corresponding to almost perfect agreement (Cohen, 1960) for inter-rater reliability before conducting analyses of the teachers. The researcher (an expert at identifying the components of mastery- and performance-oriented motivational climates) and the research assistants independently viewed 25 percent of the physical activity sessions for each condition, in order to assess inter-rater reliability. Intra-rater reliability consistency was assessed when each research assistant independently re-analyzed 25 percent of the physical activity sessions of each condition. Establishing inter- and intra-rater reliability required an additional 18 hours of video re-evaluation for the research assistants and 9 hours of video evaluation by the expert. More than 63 hours total were invested in conducting the manipulation check analysis.

## *Statistical Analyses*

### *Power Analysis*

A power analysis based on the results from Parish et al. (2007) was used to determine the number of participants (*N*) necessary to satisfy statistical assumptions for the current study. Power was calculated from the results of two measures, mean heart rate and PAHR > 50, which both had an effect size of .44 (Parish et al., 2007). To calculate the *N* for this present study, beta was set at .80 and alpha was set at .05. This is considered typical for the behavioral sciences (Cohen, 1977). Table 3.4.1 of Cohen (1977) was consulted. The table presented effect sizes in .10 units of change, and .44 falls between 0.40 ($N = 37$) and 0.50 ($N = 22$). The following formula was used to determine *N*: 37 - 22 = 15; 15 x .40 = 6; 6 - 37 = 31; $N = 31$.

The power analysis suggested that a sample of 31 participants would produce meaningful treatment differences. For this study a convenience sample of approximately 42 participants was invited to participate in the study. Based on the power analysis this number of participants is adequate to produce statistical differences between the three intervention conditions. Of the 42 children asked to participate, 38 returned informed consent forms providing a sample exceeding the size suggested by the power analysis. Five of the participants withdrew their enrollment from the daycare after data collection began; three participants withdrew from the study; and three participants were eliminated due to excessive absences (i.e., missed 83.3%, 61.1%, and 50.0%, respectively, of the 18 physical activity sessions). Due to these unanticipated events after data collection had begun, the sample size of 31 participants indicated by the power analysis was not met. Therefore, the data from a total of 27 participants were included in the final analyses.

*Statistical Tests for Significant Findings*

Participant demographic and baseline data was used for descriptive purposes. A 3 (Physical activity condition) x 6 (Session) within-subjects ANOVA was conducted to test the effect of physical activity condition on each of the three dependent variables. The three conditions of interest (i.e., independent variables) were a mastery motivational climate physical activity program (MC), a low autonomy physical activity program (PC), and unplanned free play (FP). The six physical activity sessions were the lessons in which the participants engaged for each condition. The three dependent measures were physical activity heart rate, accelerometer count, and PAHR > 50. The data used in these analyses was established by averaging each participant's physical activity heart rate, accelerometer count, and PAHR > 50 collected during the 25-min physical activity portion of each session (see Appendix L). In the event a significant main effect emerged, a pairwise comparison follow-up was conducted. If a significant interaction effect between condition and session was found, a follow-up one-way ANOVA was conducted for each condition. The *p*-value was set at the $p < .05$ level.

*Manipulation Check*

To ensure the integrity of the three physical activity conditions, the Behavioral Evaluation Strategies and Taxonomies: BEST software (Morgan et al., 2005) was used to assess rater agreement and conduct a condition manipulation check. Inter- and intra-rater reliability were determined using kappa coefficients calculated by the BEST software, with .80 set as the minimum accepted kappa. The 16 BEST keys were collapsed to 6 subscales, one each for the duration and frequency output associated with the MC, PC, and FP conditions. The 6 subscale variables, namely, MC duration, MC frequency, PC duration, PC frequency, FP duration, FP frequency, were used to evaluate the climate created by the physical activity teacher. A series of Pearson correlation coefficients were run to determine teacher consistency across the 1) two physical activity classes (i.e., classes 1 and 2) each session (i.e., sessions 1 through 6); 2) two physical activity teachers (i.e., teacher s A and B) each session; and 3) the six sessions of each condition (i.e., MC, PC, and FP). In the event that the Pearson coefficient was greater than .80, the variables were considered to be the same and thus were collapsed together. Classes 1 and 2, teachers A and B, and physical activity sessions 1 through 6 were combined permitting the evaluation of overall differences between the three conditions.

# RESULTS

It was hypothesized that physical activity heart rate, accelerometer count, and PAHR > 50 would be significantly higher during the MC condition than the FP and PC conditions, respectively. Additionally, it was expected that physical activity heart rate, accelerometer count, and PAHR > 50 would not change over time for the MC, FP, or PC conditions.

The following sections present the results from the overall and follow-up statistical analyses conducted for hypothesis testing of physical activity heart rate, accelerometer count, and PAHR > 50. Findings from the BEST manipulation check, specifically, inter- and intra-rater reliability results for the research assistants who completed the BEST and results from a series of analyses to determine teacher consistency across physical activity classes, teachers, and sessions of each condition are reported. Finally, the results from an evaluation assessing the overall differences between the three conditions for BEST are described.

## *Physical Activity Heart Rate*

Means and standard deviations for physical activity heart rate are shown in Table 7. The main effect for condition was not significant, $F(2, 52) = .705$, $\eta^2 = .026$, $p = .499$. Contrary to the hypothesis, these findings indicate that the three physical activity conditions (i.e., MC, PC and FP) did not produce significantly different physical activity heart rates among participants.

*Table 7.* Means and standard deviations for physical activity heart rate (bpm).

| | MC | | PC | | FP | | Overall | |
|---|---|---|---|---|---|---|---|---|
| Session | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| 1 | 152.20 | 20.37 | 153.52 | 12.51 | 147.78 | 14.21 | 151.17 | 16.05 |
| 2 | 153.09 | 13.65 | 148.63 | 16.28 | 149.46 | 16.27 | 150.39 | 15.38 |
| 3 | 146.69 | 11.90 | 145.64 | 14.64 | 149.79 | 16.53 | 147.37 | 14.41 |
| 4 | 154.77 | 14.65 | 154.59 | 14.30 | 152.64 | 16.49 | 154.00 | 15.02 |
| 5 | 152.99 | 13.51 | 153.76 | 12.51 | 151.80 | 17.77 | 152.85 | 14.61 |
| 6 | 157.04 | 12.19 | 152.55 | 15.34 | 154.46 | 17.10 | 154.68 | 14.94 |
| Overall | 152.80 | 11.10 | 151.45 | 10.58 | 150.99 | 13.41 | 151.74 | 15.20 |

A significant main effect for session was found, $F(5, 130) = 5.666$, $\eta^2 = .179$, $p < .001$, therefore a pairwise comparison follow-up was conducted to determine the differences between session regardless of condition. The follow-up analysis revealed that physical activity heart rate during session 2 was significantly lower than physical activity heart rate during session 4 and session 6. Likewise physical activity heart rate during session 3 was significantly lower than physical activity heart rate during sessions 2, 4, 5, and 6. Although these findings indicate that physical activity heart rate recorded during sessions 2 and 3 was significantly different than other sessions, the differences did not systematically change over the six sessions. Additionally, the information gained from these significant differences are not meaningful because physical activity heart rate during all sessions fell within the moderate to vigorous physical activity intensity range, defined as 130-159 bpm (Benham-Deal, 2005; Sallo & Silla, 1997).

The interaction between condition and session for physical activity heart rate violated Mauchley's test of sphericity (Mauchley's W = .015, $p$ = .001). Therefore, adjusted degrees of freedom were used to report the interaction effect between condition and session. A non-significant interaction for physical activity heart rate emerged, $F(7.854, 204.214) = .849$, $\eta^2 = .032$, $p = .559$ and provides support for the assumption that physical activity heart rate would not substantially change over the course of the six physical activity sessions (time).

*Accelerometer Count*

Means and standard deviations for accelerometer count are shown in Table 8. The main effects for condition, session, and the interaction between condition and session for accelerometer count violated Mauchley's test of sphericity, Mauchley's W = .577, $p$ = .001; Mauchley's W = .286, $p$ = .008; and Mauchley's W = .037, $p$ = .044, respectively. Therefore, Huynh-Feldt adjusted degrees of freedom were used to evaluate the main effects and interaction. A significant main effect for condition emerged, $F(1.461, 37.989) = 4.03$, $\eta^2 = .134$, $p = .037$. When accelerometer counts for each session were collapsed across condition, pairwise comparisons revealed that accelerometer counts during the MC ($M$ = 92.53, $SD$ = 34.78) and PC ($M$ = 94.97, $SD$ = 36.63) conditions were significantly higher than during the FP condition ($M$ = 85.23, $SD$ = 41.50), but did not differ from each other. These findings partially support the hypothesis in that MC ($p$ = .039) and PC ($p$ =

.041) accelerometer counts were significantly higher than accelerometer counts during the FP condition. However, accelerometer counts during the MC condition were not significantly higher than those recorded during the PC condition, as was hypothesized.

*Table 8.* Means and standard deviations for accelerometer count.

| | MC | | PC | | FP | | Overall | |
|---|---|---|---|---|---|---|---|---|
| Session | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| 1 | 70.13 | 22.73 | 81.35 | 31.49 | 67.53 | 33.60 | 73.00 | 29.89 |
| 2 | 92.71 | 35.03 | 95.45 | 42.16 | 92.14 | 50.48 | 93.43 | 42.51 |
| 3 | 85.80 | 33.69 | 75.91 | 29.91 | 77.90 | 38.97 | 79.77 | 34.21 |
| 4 | 101.83 | 41.82 | 109.99 | 42.44 | 88.47 | 35.88 | 100.10 | 40.64 |
| 5 | 105.16 | 29.22 | 107.53 | 22.96 | 90.67 | 47.41 | 101.12 | 35.15 |
| 6 | 99.88 | 33.54 | 99.57 | 36.42 | 94.65 | 36.97 | 98.03 | 35.31 |
| Overall | 92.53 | 21.92 | 94.97 | 19.37 | 85.23 | 32.79 | 90.91 | 37.89 |

A significant main effect for session was also found, $F(4.059, 105.545) = 9.935$, $\eta^2 = .276$, $p < .001$, therefore a pairwise comparison follow-up was conducted. The follow-up analysis revealed that accelerometer count during session 1 was significantly lower than accelerometer count recorded during sessions 2, 4, 5, and 6. Likewise accelerometer count during session 3 was significantly lower than during sessions 2, 4, 5, and 6. These findings suggest that participants engaged in less movement, as indicated by accelerometer count, during session 1 and session 3. Although the teachers took care to set-up activity stations and provide equipment that would engage participants in similar amounts of object-control and locomotor movements across sessions, these results may possibly be attributed to more stationary, object control focused activity stations being offered during sessions 1 and 3 compared to sessions 2, 4, 5, and 6.

A non-significant interaction effect between condition and session was established for accelerometer count, $F(8.629, 224.359) = 1.061$, $\eta^2 = .039$, $p = .392$. This finding indicates that accelerometer count did not change over the six sessions (time).

### *Physical Activity Heart Rate > 50*

Means and standard deviations for PAHR > 50 are shown in Table 9. The main effects for condition, session, and the interaction between condition and session for PAHR > 50 violated Mauchley's test of sphericity, Mauchley's W = .561, $p = .001$; Mauchley's W = .22, $p = .003$; and Mauchley's W = .019, $p = .003$, respectively. Therefore, adjusted degrees of freedom were used to test the main effects for condition, session, and the interaction between condition and session. A non-significant main effect for condition, $F(1.444, 37.535) = 1.303$, $\eta^2 = .048$, $p = .276$, was found.

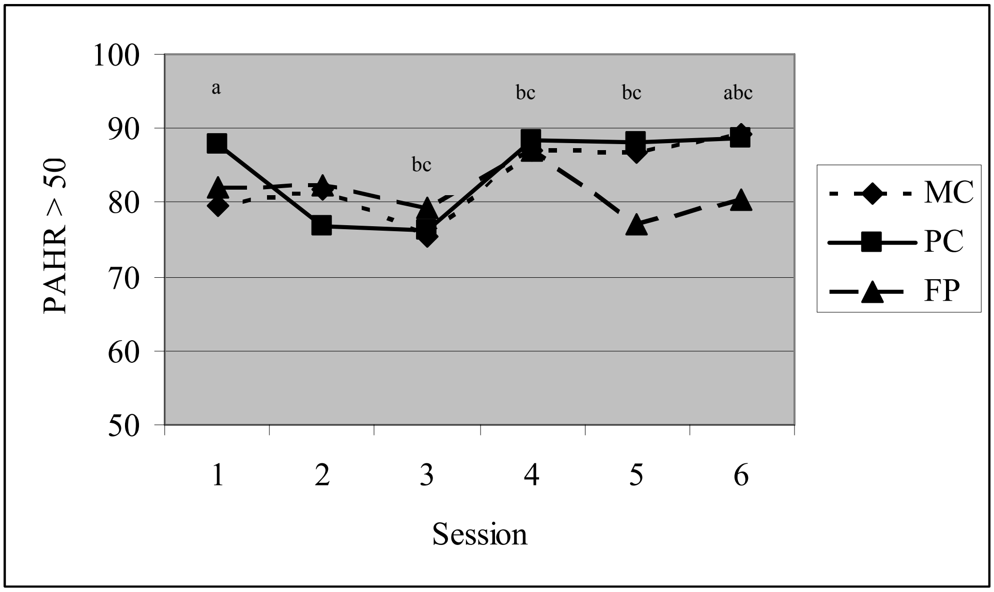
*Table 9.* Means and standard deviations for PAHR > 50.

| | MC | | PC | | FP | | Overall | |
|---|---|---|---|---|---|---|---|---|
| Session | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| 1 | 79.67 | 13.28 | 87.78 | 18.85 | 81.96 | 23.79 | 83.14 | 19.20 |
| 2 | 81.63 | 16.58 | 76.77 | 24.65 | 82.27 | 24.71 | 80.23 | 22.17 |
| 3 | 75.42 | 16.71 | 76.19 | 16.39 | 79.36 | 25.55 | 76.99 | 19.83 |
| 4 | 87.11 | 21.88 | 88.52 | 15.47 | 86.89 | 23.31 | 87.41 | 20.27 |
| 5 | 86.70 | 11.45 | 88.24 | 15.81 | 77.08 | 21.08 | 84.01 | 17.12 |
| 6 | 89.32 | 11.18 | 88.77 | 14.13 | 80.45 | 25.96 | 86.18 | 18.47 |
| Overall | 83.31 | 12.12 | 84.38 | 13.56 | 81.29 | 21.07 | 82.99 | 19.79 |

A significant main effect for session, $F(3.816, 99.215) = 6.106$, $\eta^2 = .19$, $p < .001$, was also found, therefore, a pairwise comparison follow-up analysis was conducted. Results of the follow-up analysis indicate that PAHR > 50 was significantly lower during session 2 than during session 4 and session 6. Additionally, PAHR > 50 during session 3 was significantly lower than during sessions 4, 5, and 6. These findings indicate that PAHR > 50 was not consistently different across the six physical activity sessions. Additionally, because during all sessions, participants were engaged in moderate to vigorous activity for greater than 75% of the class period, these significant differences are not meaningful.

As shown in Figure 2, a significant interaction effect between condition and session was established for PAHR > 50, $F(7.587, 197.251) = 3.225$, $\eta^2 = .11$, $p = .002$. Therefore three follow-up one-way ANOVAs were conducted for each condition. The follow-up one-way ANOVA for the MC condition violated Mauchley's test of sphericity, Mauchley's W = .203, $p < .001$. Therefore, Huynh-Feldt adjusted degrees of freedom were used to report the findings for the overall within-subjects effects. The follow-up analysis for the MC condition revealed a significant overall effect for session, $F(3.570, 92.816) = 6.489$, $\eta^2 = .200$, $p < .001$. The pairwise comparisons revealed that PAHR > 50 during MC session 1 was significantly lower than PAHR > 50 during session 6. Likewise, PAHR > 50 during MC session 3 was significantly lower than PAHR > 50 during session 4, session 5, and session 6. Follow-up analyses of the PC condition revealed a significant overall effect for session, $F(5, 130) = 6.208$, $\eta^2 = .193$, $p < .001$. The pairwise comparisons show that PAHR > 50 during PC session 3 was significantly lower than PAHR > 50 during session 4, session 5, and session 6. For the FP condition, the follow-up one-way ANOVA violated Mauchley's test of sphericity, Mauchley's W = .203, $p < .001$. Therefore, Huynh-Feldt adjusted degrees of freedom were used to test the overall within subjects effects. The follow-up analysis resulted in a non-significant overall effect for session, $F(4.195, 109.073) = 1.554$, $\eta^2 = .056$, $p = .189$. Although differences in PAHR > 50 emerged between sessions during the MC and PC conditions, respectively, these findings, as well as the findings for the FP condition, do not depict a clear trend of change over the six sessions (time).

Figure 2. Graphic representation of the Condition x Session interaction for PAHR > 50 means.




Note. [a] denotes a significant difference between MC sessions 1 and 6 at the $p < .05$ level.

[b] denotes a significant difference between MC session 3 and sessions 4, 5, and 6 at the $p < .05$ level.

[c] denotes a significant mean difference between PC session 3 and sessions 4, 5, and 6 at the $p < .05$ level.

*Manipulation Check*

To ensure the integrity of the teachers' cues and behaviors during the three physical activity conditions, the BEST software (Morgan et al., 2005) was used to conduct a condition manipulation check and assess rater agreement. The BEST manipulation check included 16 keys which were used to quantify the motivational cues and behaviors of the two teachers. The BEST was conducted for the two teachers leading the two classes for the six sessions of three physical activity conditions. As calculated by the BEST software, Appendix L shows the inter-rater reliability kappa coefficients, which were all greater than .80. Appendix L also shows the intra-rater reliability kappa coefficients for coder 1 and coder 2. Intra-rater reliability ranged between .85 and 1.00. Because a kappa coefficient greater than .80 corresponds to almost perfect agreement (Cohen, 1960), these findings indicate that the expert coder, coder 1, and coder 2 demonstrated a high degree of inter-rater agreement when conducting BEST. Thus coders 1 and 2 were well-trained and prepared to independently analyze the teachers' cues and behaviors during the physical activity sessions. Similarly, coders 1 and 2 demonstrated a high degree of intra-rater agreement, indicating consistency among each coder throughout the BEST analyses.

To establish the consistency of the two teachers between the two classes across the six sessions for the three conditions, a set of three Pearson product correlation coefficients were calculated using the 16 BEST keys' output as the data. A total of 87 correlations were conducted and all emerged significant with all *r*-values exceeding the .80 level. The first set of Pearson product correlations coefficients compared the two teachers for each of the 36 classes. The *r* values presented in Appendix M indicate a high level of consistency between the two teachers throughout the study, with all correlations significant with *r* values ranging between .987 and 1.000. This high level of consistency between the two teachers permitted the teachers' data to be collapsed together for further analyses.

For the second set of Pearson correlation analyses, the consistency of the motivational climate implemented by each teacher throughout the three physical activity conditions was assessed. BEST data recorded for class 1 and class 2 were combined. As shown in Appendix M, teacher A and teacher B implemented highly similar motivational cues and behaviors for the MC, PC, and FP conditions.

For the third set of three analyses, the relationship between the motivational climates implemented during each of the six physical activity sessions was assessed for each condition. BEST data recorded for classes 1 and 2 and teachers A and B were combined. As shown in Appendix M, the motivational climate implement for each session remained consistent across each physical activity condition. All values were statistically significant and all *r*-values exceeded the .80 criteria indicating that all 6 sessions of each condition were consistent with each other.

Sixteen one-way ANOVAs were used to assess each of the 16 BEST keys to determine if they differed between the three physical activity conditions. Morgan, Kingston, and Sproule (2005) used similar statistical analyses to assess the fidelity of teacher behaviors when implementing different motivational climates during physical education. The data used to conduct these one-way ANOVAs were derived from the reduction of the teacher, class, and session data into 16 variables representing each of the three physical activity conditions. Appendix M shows the means, standard deviations, and ANOVA results. The results of the one-way ANOVAs strongly indicate that the teachers created three different motivational environments in the physical activity setting. The reviewers, who were blind to the purpose of the study and the conditions of the physical activity environments, categorized the teachers' cues and behaviors such that the BEST keys selected significantly represented the correct condition implemented. Specifically, the key codes which represented the mastery-oriented condition, namely "adapt task," "kids decis," "imprv rec," "kids grp," kids cmpr," and "flex time", had significantly greater means during the mastery-oriented condition than during the other environments. Similarly the key codes that corresponded with a performance-oriented condition, namely “inflex task,” “tchr decis,” “win luck,” tchr grp,” “othr cmpr,” and “inflex time”, had significantly greater means during the performance-oriented condition than during the other conditions. As a final validation of the success of the instructors, the “free play” key code was significantly higher during the unplanned free play condition ($M$ = 1572.80 sec) than during the other two physical activity conditions, which each had an average of less than 1 sec of free play (MC $M$ = .09 sec, PC $M$ = .06 sec) over six sessions.

# DISCUSSION

Research with older children and adolescents has shown that a mastery-oriented climate significantly enhances achievement behavior (e.g., Maehr, 1983, 1984; Ntoumanis & Biddle, 1999b; Parish & Treasure, 2003; Yoo, 1999). When individuals perceive a mastery-oriented climate they adopt a high autonomy, mastery approach to achievement by demonstrating adaptive physical activity behaviors. Conversely, children and adolescents involved in a motivational climate featuring low autonomy and performance-salient instructional cues exhibit reduced achievement and maladaptive behaviors. Individuals participating in mastery-oriented climates not only report higher intrinsic motivation to be physically active and intentions to be physically active in the future, they also adhere to activity and engage in more physical activity than students who perceive a low autonomy climate (e.g., Maehr, 1983, 1984; Ntoumanis & Biddle, 1999b; Parish & Treasure, 2003; Yoo, 1999). Although this research with older populations indicates that a mastery motivational climate leads to adaptive physical activity behaviors and a performance-oriented climate undermines adaptive behaviors, more research investigating the relationship between the motivational climate and adaptive physical activity behaviors in young children needs to be conducted. Parish et al. (2007) found that a mastery motivational climate (versus unplanned free play) may be an effective means by which to engage toddlers in moderate to high intensity, intrinsically motivating physical activity (Parish, Rudisill, & St. Onge, 2007). However, this study simply provided preliminary insight regarding the impact of the motivational climate on the physical activity behaviors of young children. The majority of intervention literature currently available does not focus on engagement in physical activity, rather it focuses on motor skill development and perceived physical competence (e.g., Martin, Rudisill, & Hastie, in press; Robinson, 2007; Valentini & Rudisill, 2004a, 2004b). The current study investigated the impact of three motivational climates, namely mastery-oriented, performance-oriented, and unplanned free play, on preschoolers' physical activity, measured by heart rate, accelerometer count, and PAHR > 50.

### *Manipulation Check*

Before discussing the results of the hypothesis testing, manipulation checks were conducted to ensure the motivational climates were implemented as described. Unlike previous studies which manipulated the motivational climate, the conditions of this study were documented as differing motivationally based on the teachers' adherence to TARGET (Ames, 1992a, 1992b). As the BEST manipulation check strongly indicated, the teachers consistently created three different motivational climates, as intended. When presenting the MC and PC conditions, the teachers created motivational climates aligned with those proposed by achievement goal theory (Nicholls, 1984, 1989). The FP condition did not purposefully provide cues containing elements of the motivational climates outlined in achievement goal theory. Instead, it was unplanned and incorporated minimal teacher involvement.

During the MC condition, teachers created a high autonomy environment involving multiple activity stations incorporating various levels of challenge, collaboration with participants on rule making, participant recognition for effortful engagement and improvement, and evaluation based on previous performance. Additionally, teachers allowed participants to choose with whom they wanted to play and to move freely from station to station. The goals of the activity stations set-up during the MC condition emphasized effort and personal improvement leading to success.

Conversely, when participants were exposed to the PC condition, the teachers demonstrated low autonomy cues by setting up activity stations with a single challenge level, enforcing their own rules, determining how long participants engaged in each activity station, and combining participants into teacher determined groups. During the PC condition teachers recognized participants for outperforming others and evaluated participants based on their ability to win. The activity stations in the PC condition emphasized performance-based outcomes such as winning and performing better than others as leading to success.

Finally, during the FP condition teacher involvement was minimal and limited to reprimands for rule breaking and/or injury prevention and care. Equipment was made available but no activity stations were set up by the teachers. Rather participants were solely in charge of using the available equipment to create activities of their own. In summary, the manipulation check showed that three different climates were implemented during this study, allowing conclusions to be drawn from the statistical analyses. The following section is predicated upon the three climates emerging as conceptually different from each other.

### *Hypothesis Testing*

Because the teachers successfully manipulated their cues and behaviors to provide the students with different motivational climates, it can be ensured that hypothesis testing and conclusions about participants' physical activity throughout the three different conditions were in fact, associated with accurate salient cues relevant for each specific motivational climate. The hypothesis that physical activity heart rate, accelerometer count, and PAHR > 50 would be significantly higher during the MC condition than the FP and PC conditions, respectively, was partially supported only by accelerometer count. The findings for physical activity heart rate and PAHR > 50 did not support the hypothesis.

The finding that physical activity heart rate and PAHR > 50 were not significantly higher during the MC condition than the FP and PC conditions, respectively, can be attributed to the outcome that all participants were found to be moderately active. That is, despite the condition being implemented, mean physical activity heart rate fell between 130 and 159 bpm, and is considered moderate physical activity for preschoolers (Benham-Deal, 2005; Sallo & Silla, 1997). Likewise, PAHR > 50, a measure derived from physical activity heart rate and resting heart rate indicating the percentage of time an individual spends engaged in moderate to vigorous physical activity, averaged between 80-90%. These findings suggest that participants, regardless of condition, spent the vast majority of the 30-min physical activity sessions engaged in moderate to vigorous physical activity.

For accelerometer count the hypothesis was partially supported. Specifically, accelerometer count did not differ between the MC and PC conditions but during the FP condition it was 7.3 and 9.8 counts lower than during the MC and PC conditions, respectively. These findings, which show participants moved significantly less during the FP condition than the MC and PC conditions, may be attributed to the planned implementation of the TARGET structure during the MC and PC comparison-based activities versus the unplanned nature of the FP condition. The MC and PC conditions, despite the different motivational emphases, engaged participants in a variety of activity stations that were intriguing, challenging, and developmentally appropriate. In the MC condition, the teachers served as facilitators of the participants' physical activity engagement by modeling activities, providing effort related feedback and encouragement, and demonstrating enthusiasm toward physical activity. For example, in the MC condition, the children exhibited excitement and moved more vigorously when the teachers joined them in a game of chase or completed an obstacle course and encouraged them to try hard. During the PC condition the teachers served as directors of engagement in physical activity by instructing the participants exactly how to perform the activity at each station and emphasizing comparisons through competition and winning. For example, participants who typically chose to engage in low intensity physical activity or sedentary behavior during the MC and FP conditions, engaged in the activity stations because it was one of the teachers' rules; and participants who enjoyed competition engaged in physical activity because the teacher encouraged them to excel based on the comparison to others' performance. This teacher involvement during the MC and PC conditions contributed to the participants' physical activity. Therefore participants were equally as active in the MC and PC conditions, regardless of the motivational emphasis implemented by the teacher. On the contrary, during the FP condition, engagement in physical activity was solely up to the discretion of the participant. Although the FP condition was considered highly autonomous, as was the MC condition, mere autonomy did not result in the same amount of movement as the MC condition, despite a nonsignificant difference between conditions for physical activity heart rate. The difference in accelerometer count emerging between the MC and FP conditions may possibly be due to participants engaging in moderate to vigorous intensity activities requiring little vertical movement (e.g., scooters) but still leading to moderate intensity physical activity heart rates during the FP condition. On the contrary, during the MC condition, teachers encouraged participants to engage in a variety of moderate to vigorous activities incorporating vertical movement. Overall, the findings for accelerometer count suggest that planned programs, incorporating teacher involvement lead to more physical movement in 3- to 5-year-olds than do unplanned FP settings. It should be noted that the accelerometer component of the Actiheart monitor has not been validated in children in a naturalistic setting. Additionally, categorizations of physical activity intensity have not been identified for young children with this instrument and should not be compared to other accelerometers. For this reason, caution should taken when interpreting the accelerometer results.

In order to investigate the impact of the motivational climate on physical activity and ensure that differences between the dependent variables were due to the influences of the motivational climate and not due to variations in class durations, the physical activity portion of each session was held constant at 25 min. Implementation of this control, however, effected overall session duration (including the introduction, physical activity period, and closing). Specifically, the three conditions required different total durations (including introduction, 25-min physical activity period, and closing) to complete; an average of 31 min was required to implement the MC condition, a mean of 39 min was necessary to implement the PC condition, and an average of 28 min was needed to implement the FP condition. Controlling for the length of the physical activity portion of each session and not for overall session duration produced longer sessions during the PC condition than the MC and FP conditions.

In addition to requiring more time to implement, the teachers also reported that the PC condition demanded considerably more classroom management (i.e., enforcing class rules, disciplining participants, or aiding disgruntled participants) than the MC and FP conditions. The teachers spent a greater percentage of the PC sessions (37.56%) engaging in class management, compared to the MC (16.33%) and FP (15.00%) conditions. In accordance with early education literature (Stipek, Feiler, Byler, Ryan, Millburn, & Salmon, 1998; Stipek, Feiler, Daniels, & Millburn, 1995), teachers reported that the PC condition resulted in less compliant classroom behaviors (e.g., rule breaking; such as not performing the activity stations as described by the teachers, not staying with intact group, not rotating to the next station when instructed to do so, rotating to the incorrect station) among participants and in turn required more class management to maintain participant compliance with the PC condition rules for engagement.

Coupled with the longer introduction and closing periods and increased class management requirements, the PC condition required more time overall to engage participants in 25 min of physical activity than the MC and FP conditions. In a naturalistic preschool setting, each day’s activities are allotted a certain period of time (e.g., Appendix A), with little flexibility available in the event, an activity requires more time than planned. If the current study implemented each of the three conditions according to a more realistic preschool schedule, the PC condition (versus the MC and FP conditions) would have allowed the participants less time to engage in physical activity due to the greater amount of time the teachers needed to introduce and close the PC sessions. Therefore ensuring that participants had equal time to engage in physical activity during each session of the MC, PC, and FP conditions, may have impacted the results of the study from a practical perspective. Future studies investigating the impact of the motivational climate on physical activity should consider controlling for the overall session length (according to the time allotted for physical activity in the preschool daily schedule) rather than the length of the physical activity portion of the session. Likewise, researchers and practitioners should consider the implications of these findings when selecting the motivational climate they choose to implement in order to meet the demands of the daily preschool class schedule, minimize class management, and maximize engagement in physical activity.

### *Assumption*

The assumption that physical activity heart rate, accelerometer count, and PAHR > 50 would not change over time for the MC, PC, or FP conditions was supported. While differences occurred between some of the sessions for PAHR > 50, no clear trend emerged for any of the dependent variables indicating that participants were more or less active, as shown by an increase or decrease in physical activity heart rate, accelerometer count, or PAHR > 50, over time. The purpose of this assumption was to show that a learning effect/reactivity to the study was not present and that the 3-day reactivity to the gym and 3-day baseline (reactivity to equipment) was successful. If a learning effect and/or reactivity to the study did occur, a clear increase in the three measures would have emerged.

### *Interpretation of Findings*

Informal observations made during this study support that participants conceptually differentiated the three conditions created by the teachers. For example, during MC sessions, participants understood they could freely rotate from activity station to station; during the PC condition, participants knew that when the whistle sounded they were to “stop, squat, point” and wait until the teachers told them to rotate to the next station; and throughout the FP sessions participants were aware the teachers chose not to “play” with them. Likewise, observations made during this study suggest that some participants’ motivation towards and engagement in physical activity was influenced by the motivational cues emphasized by the teachers. Most interestingly, during the PC sessions, participants observed to be more competitive than the MC and FP sessions (i.e., ego-oriented disposition), became openly discouraged when they did not win (i.e., demonstrated learned helplessness). These participants often gave up (i.e., dropped out) before completing an activity, pouted or cried, or expressed “I’m not good,” “I can’t do it,” “I’ll never get it right,” and “I want to go home because this activity is not fun.” These observations suggest that preschool-aged children who are by nature mastery-driven (Nicholls, 1989; White 1959), are aware of the teachers’ performance-based motivational cues and adopt goal involvement aligned with the achievement outcomes emphasized by the teacher (i.e., in this case, ego involvement). Additionally, these informal observations suggest that although young children are not capable of demonstrating mature conceptions of ability (Nicholls, 1984), they are able to describe their ability in terms of goodness/badness, as supported by the early education literature (Stipek & Greene, 2001). This implies that young children describe their success in terms of global self-worth, as opposed to skill level (i.e., high/low skilled), and thus their internal views of physical activity may remain vulnerable over time (National Research Council and Institute of Medicine, 2000).

Research support for observations made during this study is provided in the early education and mastery motivation literature. A collaborative project by National Research Council and Institute of Medicine (2000) reports that while most young children are disposed towards mastery motivated cognitions and behaviors (i.e., task involvement) (Stipek & Ryan, 1997), not all young children display a positive bias towards achievement. Rather, all aspects of achievement motivation are malleable and may be significantly impacted by the motivational climate in the early years. In support of the observations made during the current study, Stipek and her colleagues (1995, 1998) report that performance-oriented, early childhood education classrooms undermine preschoolers' motivation by depressing achievement motivation and discouraging mastery behavior. Likewise, because young children's natural drive towards mastery motivation is malleable, their motivation may be enhanced when engaging in mastery-oriented classroom settings. No studies, to date, have evaluated the influence of the motivational climate on young children's short- and long-term motivation towards physical activity and engagement in physical activity. Research in classroom settings has shown that young children's motivation is influenced by the teacher's motivational cues and behaviors.

The lack of research using the achievement goal theory framework with young children in the physical activity realm is surprising considering the well-established relationship between the early education classroom motivational climate and young children's motivation and achievement behavior. Efforts to foster mastery motivation through the implementation of mastery-oriented early childhood education classrooms may offset the trend for declines in mastery motivation upon entering school (Stipek & Hoffman, 1980; Stipeck & Tannatt, 1984; Wigfield et al, 1997). This logic also applies to the physical activity realm in that enhancing achievement motivation associated with physical activity may offset the typical decline that occurs with age.

Setting the stage for an active lifestyle by engaging children in physical activity at an early age has important implications for health and habitual physical activity across the lifespan (NASPE, 2002). Thus it is imperative for educators to engage young children in planned movement experiences that promote healthy physical activity habits. The current study exposed preschool-aged children to three different motivational climates. As measured by physical activity heart rate and PAHR > 50, all conditions (i.e., MC, PC, and FP), regardless of motivational emphasis, engaged participants in moderate to vigorous physical activity for over 80% of each 30-min activity session. For accelerometer count, neither the MC condition nor the PC condition emerged as engaging participants in more movement. However the MC and PC conditions resulted in more movement than the FP condition. In summary, this study offers preliminary insight into preschoolers' heart rate and physical activity behaviors during three different motivational climates. Additional research is imperative in order to develop planned physical activity curricula that not only engage young children in moderate to vigorous physical activity but also foster motivation and adaptive physical activity achievement behaviors over the lifespan.

### *Conclusions*

Based on the results of this study, the following conclusions are justified:

- When the length of time to engage in physical activity is controlled (i.e., 25-min physical activity period), MC, PC, and FP conditions do not differ in terms of physical activity heart rate and PAHR > 50. For accelerometer count, the MC and PC conditions also do not differ. They both, however, produce higher accelerometer counts than the FP condition.

### *Implications for Future Research*

Future research should continue to investigate the tenets of achievement goal theory as they relate to the physical activity behaviors of young children. Because one's dispositional goal orientation and perception of the motivational climate influence the goal state adopted and resulting achievement behaviors, developmentally appropriate metrics (i.e., quantitative and qualitative) of these achievement goal theory constructs as they relate physical activity settings need to be developed for young children. After these assessments are developed, the relationship between the motivational cues fostered by preschool physical activity teachers and the maturing preschooler's disposition towards physical activity; perception of the motivational climate; motivation to engage in physical activity; and actual physical activity behaviors may be further investigated. Additionally, future research should extend beyond achievement goal theory and consider the cognitive development of the participant, as well as their needs for self actualization. These factors have the potential to influence one's understanding of the motivational climate being implemented and his/her behavioral response to the motivational climate.

As stated previously, the accelerometer component of the Actiheart monitor has not been validated in young children in a naturalistic setting. Validation of this instrument should occur in order to fully interpret the findings of this study and future studies using Actiheart monitors. To better understand the long term implications of the preschool physical activity motivational climate on engagement in physical activity across the lifespan, longitudinal research is warranted.

## REFERENCES

Ames, C. (1984a). Achievement attributions and self-instructions under competitive and individualistic goal structures. *Journal of Educational Psychology, 76,* 478-487.

Ames, C. (1984b).Competitive, cooperative, and individualistic goal structure: A cognitive-motivational analysis. In R. Ames & C. Ames (Eds.), *Research on motivation in education* (Vol.1*,* pp. 177-208). New York: Academic Press.

Ames, C. (1992a). Achievement goals, motivational climate, and motivational processes. In G. C. Roberts (Ed.), *Motivation in sport and exercise* (pp. 161-176). Champaign, IL: Human Kinetics Publishers.

Ames, C. (1992b). Classroom: Goals, structures, and student motivation*. Journal of Educational Psychology, 84,* 409-414.

Ames, C. (1992c). Achievement goals and the classroom motivational climate. In J. Meece & D. Schunck (Eds.), *Student perceptions in the classroom* (pp. 327-348). Hillsdale, NJ: Erlbaum.

Ames, C., & Archer, J. (1988). Achievement of goals in the classroom: Students' learning strategies and motivation process. *Journal of Educational Psychology, 80,* 260-267.

Barrett, K. C., & Morgan, G. A. (1995). Continuities and discontinuities in mastery motivation in infancy and toddlerhood: A conceptualization and review. In R. H.

MacTurk & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 57-93). Norwood, NJ: Ablex.

Benham-Deal, T. (2005). Preschool children's accumulated and sustained physical activity. *Perceptual and Motor Skills, 100,* 443-450.

Biddle, S., Akande, A., Vlachopoulos, S., & Fox, K. (1996). Towards an understanding of children's motivation for physical activity: Achievement goal orientations, beliefs about sport success, and sport emotion in Zimbabwean children. *Psychology & Health, 12,* 49-55.

Birch, L. L., & Fisher, J. O. (1998). Development of eating behaviors among children and adolescents. *Pediatrics, 101,* 539-549.

Blair, S. N., & Brodney, S. (1999). Effects of physical inactivity and obesity on morbidity and mortality: Current evidence and research issues. *Medicine and Science in Sports and Exercise, 31(Suppl.),* 646-662.

Brage, S., Brage, N., Franks, P. W., Ekelund, U., & Wareham, N. J. (2005). Reliability and validity of the combined heart rate and movement sensor Actiheart. *European Journal of Clinical Nutrition, 59,* 561-570.

Brown, W. H., Pfeiffer, K. A., McIver, K. L., Dowda, M., Almeida, M. J. C. A., & Pate, R. R. (2006). Assessing preschool children's physical activity: The observational systems for recording physical activity in children-pre-school version. *Research Quarterly for Exercise and Sport, 77,* 167-176.

Butler, R. (1987). Task-involving and ego-involving properties of evaluations: The effects of different feedback conditions on motivational perceptions, interest and performance. *Journal of Educational Psychology, 79,* 474-482.

Capizzano J., & Adams, G. (2000). The hours that children under 5 spend in child care: Variations across states. *Assessing the New Federalism Series B, No. 8*. Washington, D. C.: The Urban Institute.

Carpenter, P. J., & Morgan, K. (2000). Motivational climate, personal goal perspectives, and cognitive and affective responses in physical education classes. *European Journal of Physical Education, 4,* 31-44.

Casper, L. M. (1996). Who's minding our preschoolers? *Current Population Reports, No. 3,* (p. 70). Washington, D. C.: United States Bureau of the Census.

Centers for Disease Control and Prevention. (2000). CDC growth charts: United States. *Advance Data, 314,* 1-28. Retrieved October 1, 2007, from http://www.cdc.gov/nchs/data/ad/ad314.pdf

Centers for Disease Control and Prevention. (1998). Youth risk behavior surveillance: United States, 1997. *Morbidity and Mortality Weekly Report, 47,* 1-89.

Cohen, J. (1960). A coefficient of agreement for nominal scales, *Educational and Psychological Measurement,* 20, 37–46.

Cohen, J. (1977). *Statistical power analysis for the behavioral sciences* (Rev. ed.). New York, NY: Academic Press.

Corno, L., & Rohrkemper, M. (1985). The intrinsic motivation to learn in the classroom. In C. Ames & R. Ames (Eds.), *Research on motivation in education* (Vol. 2, pp. 53-90). New York: Academic Press.

Cury, F., Biddle, S., Famose, J., Goudas, M., Sarrazin, P., & Durand, M. (1996). Personal and situational factors influencing intrinsic motivation of adolescent girls in school physical education: A structural equation modeling analysis. *Educational Psychology, 16,* 305-315.

Duda, J. L., Fox, K. R., Biddle, S. J., & Armstrong, N. (1992). Children's achievement goals and beliefs about success in sport. *British Journal of Educational Psychology, 62,* 313-323.

Duda, J. L., Olson, L. K., & Templin, T. J. (1991). The relationship of task and ego orientation to sportsmanship attitudes and the perceived legitimacy of injurious acts. *Research Quarterly for Exercise and Sport, 62,* 79-87.

Duda, J. L., & White, S. A. (1992). Goal orientations and beliefs about the causes of success among elite skiers. *Sport Psychologist, 6,* 334-343.

Dunn, J. C. (2000). Goal orientation, perceptions of the motivational climate, and perceived competence of children with movement difficulties. *Adapted Physical Activity Quarterly, 17,* 1-19.

Durant, R. H., Baranowski, H., Davis, H., Rhodes, T., Thompson, W. O., Greaves, K. A., & Puhl, J. (1993). Reliability and variability of indicators of heart-rate monitoring in children. *Medicine and Science in Sports and Exercise, 25,* 389-395.

Dweck, C., & Leggett, E. (1998). A social-cognitive approach to motivation and personality. *Psychological Review, 95,* 256-273.

Epstein, J. (1988). Effective schools or effective students? Dealing with diversity. In R. Hawkins & B. MacRae (Eds.), *Policies for America's public schools* (pp. 89-126). Norwood, NJ: Ablex.

Epstein, J. (1989). Family structure and student's motivation: A development perspective. In C. Ames and R. Ames (Eds.), *Research on motivation in education* (Vol. 3, pp. 259-295). New York: Academic Press.

Federal Interagency Forum on Child and Family Statistics. (2004). *America's children: Key national indicators of well-being.* Washington: DC. Retrieved May 30, 2007, from http://childstats.gov/.

Fox, K., Goudas, M., Biddle, S., Duda, J., & Armstrong, N. (1994). Children's task and ego goal profiles in sport. *British Journal of Educational Psychology, 64,* 253-261.

Goudas, M. (1998). Motivational climate and intrinsic motivation of young basketball players. *Perceptual and Motor Skills, 86,* 323-327.

Goudas, M., Biddle, S., & Fox, K. (1994). Perceived locus of causality, goal orientations, and perceived competence in school physical education. *British Journal of Educational Psychology, 64,* 453-463.

Harter, S. (1978). Effectance motivation reconsidered: Toward a developmental model. *Human Development, 21,* 34-64.

Harter, S., Whitesell, N. R., & Kowalski, P. (1992). Individual differences in the effects of educational transitions on young adolescent's perceptions of competence and motivational orientation. *American Educational Research Journal, 29,* 777-807.

Hauser-Cram, P. (1998). I think I can, I think I can: Understanding and encouraging mastery motivation in young children. *Young Children, 53,* 67-71.

Hauser-Cram, P., & Shonkoff, J. P. (1995). Mastery motivation: Implications for interventions. In R.H. MacTurk, & G.A. Morgan (Eds.), *Mastery motivation:*

*Origins, conceptualizations, and applications* (pp. 257-272). Norwood, NJ: Ablex.

Hedley, A. A., Ogden, C. L., Johnson, C. L., Carroll, M. D., Curtin, L. R., & Flegal, K. M. (2004). Prevalence of overweight and obesity among U.S. children, adolescents, and adults, 1999–2002. *Journal of the American Medical Association, 291,* 2847-2850.

Kaplan, A., & Maehr, M. L. (1999). Achievement goals and student well-being. *Contemporary Educational Psychology, 24,* 330-358.

Kavussanu, M., & Roberts, G. (1996). Motivation in physical activity contexts: The relationship of perceived motivational climate to intrinsic motivation and self-efficacy. *Journal of Sport and Exercise Psychology, 18*, 264-280.

Keating, X. D., Kulinna, P. H., & Silverman, S. (1999). Measuring teaching behaviors, lesson context, and physical activity in school physical education programs: Comparing the SOFIT and the C-SOFIT instruments. *Measurement in Physical Education and Exercise Science, 3,* 207-220.

Koplan, J. P., Liverman, C. T., & Kraak, V. I. (2005). *Preventing childhood obesity: Health in the balance.* Washington DC: National Academies Press.

Logan, N., Reilly, J. J., Grant, S., & Paton, J. Y. (2000). Resting heart rate definition and its effect on apparent levels of physical activity in young children. *Medicine and Science in Sports and Exercise, 32,* 162-166.

Lloyd, J., & Fox, K. (1992). Achievement goals and motivation to exercise in adolescent girls: A preliminary intervention study. *British Journal of Physical Education Research Supplement, 11*, 12-16.

Maehr, M. L. (1983). On doing well on science. Why Johnny no longer excels, why Sarah never did. In S. G. Paris, G. M. Olson, and H. W. Stevenson (Eds.), *Learning and motivation in the classroom* (pp. 179-210). Hillsdale, NJ: Lawrence Erlbaum and Associates.

Maehr, M. L. (1984). Meaning and motivation: Toward a theory of personal investment. In R. Ames & C. Ames (Eds.), *Research on motivation in education* (Vol. 1, pp. 115-144). New-York: Academic Press.

Martin, E. H., Rudisill, M. E., & Hastie, P H. (in press). The effectiveness of a mastery motivational climate motor skill intervention in a naturalistic physical education setting. *Physical Education and Sport Pedagogy.*

McKenzie, T. L., Sallis, J. F., Patterson, T. L., Elder, J. P., Berry, C. C., Atkins, C., Buono, M., & Nader, P. R. (1991). BEACHES: An observation system for assessing children's eating and physical activity behaviors and associated events. *Journal of Applied Behavior Analysis, 24,* 141-151.

Mini Mitter Company, Inc. (2004). *Actiheart* [Manual]. Bend, OR: Mini Mitter Company, Inc.

Morgan, G. A., Harmon, R. J., & Maslin-Cole, C. A. (1990). Mastery motivation: Definition and measurement. *Early Education and Development, 1,* 318-339.

Morgan, G. A., Maslin-Cole, C. A., Harmon, R. J., Busch-Rossnagel, N. A., Jennings, K. D., Hauser-Cram, P., & Brockman, L. (1993). Parent and teacher perceptions of young children's mastery motivation: Assessment and review of research. In D. Messer (Ed.), *Mastery motivation in early childhood*: *Development, measurement and social processes* (pp. 109-131). London: Routledge.

Morgan, G. A., MacTurk, R. H., & Hrncir, E. J. (1995). Mastery motivation: Overview, definitions and conceptual issues. In R.H. MacTurk, & G.A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 1-18). Norwood, NJ: Ablex.

Morgan, G.A., & Yang, R.K. (1995). Toward a multifaceted conceptualization of mastery motivation and an organized summary of research. In R.H. MacTurk, & G.A. Morgan (Eds.). *Mastery motivation: Origins, conceptualizations, and applications* (pp. 317-337). Norwood, NJ: Ablex.

Morgan, K., Kingston, K., & Sproule, J. (2005). Effects of different teaching styles on the teacher behaviours that influence the motivational climate and pupils' motivation in physical education. *European Physical Education Review, 11(3),* 257-285.

Morgan, K., Sproule, J., Weigand, D., & Carpenter, P. (2005). A computer-based observational assessment of the teaching behaviours that influence motivational climate in physical education. *Physical Education and Sport Pedagogy, 10,* 83-105.

National Association for Sport and Physical Education. (2002). *Active start*. Oxon Hill, MD: AAHPERD Publications.

National Research Council and Institute of Medicine. (2000). Communication and learning. In J. P. Shonkoff & D. A. Phillips (Eds.), *From neurons to neighborhoods: The science of early childhood development* (pp. 124-162). Washington, DC: National Academy Press.

Newsham, S. L. (1989). The effects of a task-oriented physical education program on the self-perception of third, fourth, and fifth grade students. *Dissertation Abstracts International, 50* (06), 2631B. (UMI No. 8921305)

Nicholls, J. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. *Psychological Review, 91*, 328-346.

Nicholls, J. G. (1989). *The competitive ethos and democratic education.* Cambridge, MA: Harvard University Press.

Ntoumanis, N., & Biddle, S. J. H. (1999a). Affect and achievement goals in physical education: A meta-analysis. *Scandinavian Journal of Medicine and Science in Sports, 9*, 315-332.

Ntoumanis, N., & Biddle, S. J. H. (1999b). A review of motivational climate in physical activity. *Journal of Sports Sciences, 17*, 643-665.

Ogden, C. L., Troiano, R. P., Briefel, R. R., Kuczmarski, R. J., Flegal, K.M., Johnson, C. L. (1997). Prevalence of overweight among preschool children in the United States, 1971 through 1994. *Pediatrics, 99,* E1.

Ommundsen, Y., Roberts, G. C., & Kavussanu, M. (1998). Perceived motivational climate and cognitive and affective correlates among Norwegian athletes. *Journal of Sport Sciences*, *16,* 153-164.

Papaioannou, A. (1994). The development of a questionnaire to measure achievement orientations in physical education. *Research Quarterly for Exercise and Sport, 65,* 11-20.

Papaioannou, A. (1995). Differential perceptual and motivational patterns when different goals are adopted. *Journal of Sport and Exercise Psychology, 17,* 18-34.

Papaioannou, A. (1998). Students' perceptions of the physical education class environment for boys and girls and the perceived motivational climate. *Research Quarterly for Exercise and Sport, 69,* 267-275.

Papaioannou, A., & Kouli, O. (1999). The effect of task structure, perceived motivational climate, and goal orientations on student's task involvement and anxiety. *Journal of Applied Sport Psychology, 11,* 51-71.

Parish, L. E., & Treasure, D. C. (2003). Physical activity and situational motivation in physical education: Influence of the motivational climate and perceived ability. *Research Quarterly for Exercise and Sport, 74,* 173-182.

Parish, L. E., Rudisill, M. E., & St. Onge, P. M. (2007). Mastery motivational climate: Influence on physical play heart rate and intensity in African American toddlers. *Research Quarterly for Exercise and Sport, 78,* 171-178.

Parish, L. E., St. Onge, P. M., Rudisill, M. E., Weimar, W., & Wall, S. J. (2005). Mastery motivational motor skills program: Influence on heart rate and physical activity levels in toddlers (Abstract). *Journal of Sport & Exercise Psychology, 27,* S121.

Pate, R. R., Baranowski, T., Dowda, M., & Trost, S. G. (1996). Tracking of physical activity in young children. *Medicine and Science in Sport and Exercise, 28,* 92-96.

Pate, R. R., Long, B. J., & Heath, G. (1994). Descriptive epidemiology of physical activity in adolescents. *Pediatric Exercise Science, 6,* 434-447.

Payne, V. G., & Isaacs, L. D. (2002). *Human motor development: A lifespan approach* (6th ed.). Mountain View, CA: Mayfield.

Pepler, D. J., & Craig, W. M. (1995). A peel behind the fence: Naturalistic observations of aggressive children with remote audiovisual recording. *Developmental Psychology, 31,* 548-553.

Raffini, J. P. (1993). *Winners without losers: Structure and strategies for increasing student motivation to learn.* Boston, MA: Allyn and Bacon.

Rink, J. E. (2006). Research on teaching physical education. In E. Barrosse (Ed.). *Teaching physical education for learning* (pp. 55-56). New York, NY: McGraw-Hill.

Robinson, L. E. (2007). Getting an "Active Start": The effect of project "SKIP" on object control skills in preschoolers who are disadvantaged. *Dissertation Abstracts International, 68*(06), 258A. (UMI No. 3268891)

Rowland, T. W. (1990). *Exercise and children's health.* Champaign, IL: Human Kinetics.

Rudisill, M. E. (1989a). Influence of self-concept of ability and causal dimension orientations on intrinsic motivation, performance, and expectations of performance during perceived failure. *Research Quarterly for Exercise and Sport, 60,* 166–175.

Rudisill, M. E. (1989b). The influence of various achievement goal orientations on perceived competence and the attributional process. *Journal of Human Movement Studies, 16,* 55–73.

Rudisill, M. E. (1991). The influence of various achievement goal orientations of children's perceived competence and the attributional process. *Journal of Human Movement Studies, 18,* 44–61.

Sallo, M., & Silla, R. (1997). Physical activity with moderate to vigorous intensity in preschool and first-grade schoolchildren. *Pediatric Exercise Science, 9,* 44-54.

Sallis, J. F., Simons-Morton, B. G., Stone, E. J., Corbin, C. B., Epstein, L. H., Faucette, N., et al. (1992). Determinants of physical activity and interventions in youth. *Medicine and Science in Sport and Exercise, 24,* 248-257.

Seifriz, J. J., Duda, J. L., & Chi, L. (1992). The relationship of perceived motivational climate to intrinsic motivation and beliefs about success in basketball. *Journal of Sport and Exercise Psychology, 14,* 375-391.

Serdula, M. K., Ivery, D., Coates, R. J., Freedman, D. S., Williamson, D. F., & Byers, T. (1993). Do obese children become obese adults? A review of the literature. *Preventive Medicine, 22,* 167-177.

Sharpe, T., & Koperwas, J. (1999). *BEST: Behavioral Evaluation Strategy and Taxonomy Software.* Thousand Oakes, CA: SAGE.

Solmon, M. A., & Boone, J. (1993). The impact of student goal orientation in physical education classes. *Research Quarterly for Exercise and Sport, 64,* 418-424.

Spray, C. M., & Biddle, S. J. H. (1997). Achievement goal orientations and participation in physical education among male and female sixth form students. *European Physical Education Review, 3, 83-90.*

Spray, C. M., Biddle, S. J. H., & Fox, K. R. (1999). Achievement goals, beliefs about the causes of success, and report emotion in post-16 physical education. *Journal of Sports Sciences, 17,* 213-219.

State of Alabama Department of Human Resources. (2006). *Minimum standards for day care centers and nighttime centers: Regulations and procedures*. Retrieved March 38, 2007, from http://www.dhr.state.al.us/Search.asp

Stipek, D. J., Feiler, R., Daniels, D., & Millburn, S. (1995). Effects of different instructional approaches on young children's achievement and motivation. *Child Development, 66,* 209-223.

Stipek, D. J., Feiler, R., Byler, P., Ryan, R., Millburn, S., & Salmon, J. (1998). Good beginnings: What difference does the program make in preparing young children for school? *Journal of Applied Developmental Psychology, 19,* 41-66.

Stipek, D. J., & Greene, J. K. (2001). Achievement motivation in early childhood: Cause for concern or celebration? In S. L. Golbeck (Ed.), *Psychological perspectives on early childhood education: Reframing dilemmas in research and practice (The Rutgers Invitational Symposium on Education Series).* (pp.64-91). Mahwah, NJ: Lawrence Erlbaum.

Stipek, D. J., & Hoffman, J. M. (1980). Development of children's performance-related judgments. *Child Development, 5,* 92-94.

Stipek, D. J., & Ryan, R. H. (1997). Economically disadvantaged preschoolers: Ready to learn but further to go. *Developmental Psychology, 33(4),* 711-723.

Stipeck, D. J., & Tannatt, L. M. (1984). Children's judgments of their own and their peers' academic competence. *Journal of Educational Psychology, 76,* 75-84.

Strauss, R. S., & Pollack, H. A. (1998). Epidemic increase in childhood overweight, 1986–1998. *Journal of the American Medical Association, 286,* 2845-2848.

Theeboom, M., De Knop, P. D., & Weiss, M.R. (1995). Motivational climate, psychological responses, and motor skill development in children's sport: A field-based intervention study. *Journal of Sport Psychology, 17,* 294-311.

Treasure, D. C. (1997). Perceptions of the motivational climate and elementary school children's cognitive and affective response. *Journal of Sport & Exercise Psychology, 19,* 278-290.

Treasure D. C., & Roberts, G. C. (1995). Applications of achievement goal theory to physical education: Implications for enhancing motivation. *Quest, 47,* 475-489.

Treasure, D. C., & Roberts, G. C. (2001). Students' perceptions of the motivational climate, achievement beliefs, and satisfaction in physical education. *Research Quarterly for Exercise and Sport, 72,* 165-175.

Troiano, R. P., & Flegal, K. M. (1998). Overweight children and adolescents: Description, epidemiology, and demographics. *Pediatrics, 101,* 497-504.

United States Department of Health and Human Services. (n.d.). Overweight and obesity: Health consequences. Retrieved October 6, 2005, from http://www.surgeongeneral.gov/topics/obesity/calltoaction/fact_consequences.htm

U. S. Department of Health and Human Services. (1991). National Education Program: Report of the Expert Panel on Blood Cholesterol Levels in Children and Adoslecents. NIH Publication No. 91-2732.

U. S. Department of Health and Human Services. (1996). *Physical Activity and Health: A Report of the Surgeon General.* Atlanta, GA: Centers for Disease Control and

Prevention. Retrieved May 31, 2007, from http://www.cdc.gov/nccdphp/sgr/sgr.htm

U. S. Department of Health and Human Services. (2000). *Healthy People 2010*. Washington, DC: U. S. Department of Health and Human Services, Public Health Service. Retrieved May 31. 2007, from http://www.healthypeople.gov/About/

Valentini, N. C. (1997). The influence of two motor skill interventions on the motor skill performance, perceived physical competence, and intrinsic motivation of kindergarten children. Unpublished master's thesis, Auburn University, Auburn, AL.

Valentini, N. C., & Rudisill, M E. (2004a). An inclusive mastery climate intervention and the motor skill development of children with and without disabilities. *Adapted Physical Activity Quarterly, 21,* 330-347.

Valentini, N. C., & Rudisill, M E. (2004b). Motivational climate, motor-skill development, and perceived competence: Two studies of developmentally delayed kindergarten children. *Journal of Teaching in Physical Education, 23,* 216-234.

van der Mars, H., Darst, P., Volger, B., & Cusimano, B. (1998). Students' physical activity level and teachers' active supervision during fitness instruction. J*ournal of Teaching in Physical Education, 18,* 57-75.

Wachs, T. D., & Combs, T. T. (1995). The domains of infant mastery motivation. In R.H. MacTurk & G.A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 147-164). Norwood, NJ: Ablex.

Wall, S. J., & Rudisill, M. E. (2008). Effectiveness of outdoor physical activity on lowering cortisol levels in African American toddlers attending full-time day care. Manuscript submitted for publication.

Wall, S. J., & Rudisill, M. E., & Gladden, B. (2008). Effects of acute physical play on afternoon cortisol levels in African American toddlers attending full-time daycare. Manuscript submitted for publication.

Wall, S. J., Rudisill, M. E., Parish, L., & Goodway, J. D. (2004). A comparison of three movement settings on the development of fundamental motor skills in young children [Abstract]. *Journal of Sport & Exercise Psychology, 26,* S-194.

Walling, M. D., & Duda, J. L. (1995). Goals and their associations with beliefs about success in and perceptions of the purposes of physical education. *Journal of Teaching in Physical Education, 14,* 140-156.

Walling, M. D., Duda, J. L., & Chi, L. (1993). The perceived motivational climate in sport questionnaire: Construct and predictive validity. *Journal of Sport & Exercise Psychology, 15,* 172-183.

White, R. W. (1959). Motivation reconsidered: The concept of competence**.** *Psychological Review, 66,* 297-333.

Wigfield, A., Eccles, J. S., Yoon, K. S., Harold, R. D., Arbreton, A. J. A., Freedman-Done, C., & Blumenfeld, P. C. (1997). Change in children's competence beliefs and subjective task values across the elementary school years: A 3- year study. *Journal of Educational Psychology, 89,* 451-469.

Wigfield, A., Eccles, J. S., & Rodriguiz, D. (1998). The development of children's motivation in school contexts. In P. D. Pearson & A. Iran-Nejad (Eds.), *Review of* *research in education, Vol. 23* (pp. 73-118). Washington, DC: American Educational Research Association.

Wrotniak, B. H., Epstein, L. H., Dorn, J. M., Jones, K. E., & Kondilis, V. A. (2006). The relationship between motor proficiency and physical activity in children. (Abstract). *Pediatrics, 118,* 2531.

Yoo, J. (1999). Motivational climate and perceived competence in anxiety and tennis performance. *Perceptual & Motor Skills, 96,* 403-413.

APPENDICES

Appendix A—Daycare Schedule

## Appendix A—Daycare Schedule

Daycare Schedule Classroom A

| | |
|---|---|
| 6:30 – 8:00 a.m. | Arrival; greeting; unplanned, indoor free play |
| 8:00 – 8:30 a.m. | Mixed group time (all classes) |
| 8:30 – 9:00 a.m. | Restroom; wash-up; breakfast |
| 9:00 – 9:30 a.m. | Roll call; health check |
| 9:30 – 10:00 a.m. | Unplanned, outdoor free play |
| 10:00 – 10:15 a.m. | Water; restroom |
| 10:15 – 10:30 a.m. | Large group time (i.e.; music; stories; finger play) |
| 10:30 – 11:00 a.m. | Activity time; Learning centers |
| 11:00 – 11:15 a.m. | Clean-up |
| 11:15 – 11:30 a.m. | Large group; restroom; wash-up; lunch; rest/nap preparation |
| 11:30 a.m. – 12:00 p.m. | Lunch |
| 12:00 – 12:30 p.m. | Restroom; wash-up |
| 12:30 –2:30 p.m. | Rest/Nap time |
| 2:30 – 2:45 p.m. | Wake-up; put cots away |
| 2:45 – 3:00 p.m. | Snack; lotion-up |
| 3:00 – 3:45 p.m. | Unplanned, outdoor physical activity |
| 3:45 – 4:00 p.m. | Story time |
| 4:00 – 5:30 p.m. | Unplanned, indoor free play; Departure |

Daycare Schedule Classroom B

| | |
|---|---|
| 6:30 – 8:30 a.m. | Arrival; greeting; unplanned, indoor free play; mixed group time (all classes) |
| 8:30 – 9:00 a.m. | Breakfast; brush teeth; free play |
| 9:00 – 9:15 a.m. | Large group time; roll call; health check |
| 9:15 – 10:10 a.m. | Activity time; learning centers; clean-up |
| 10:10 – 10:30 a.m. | Small group time |
| 10:30 – 11:00 a.m. | Unplanned, outdoor free play; water; restroom |
| 11:00 – 11:30 a.m. | Large group time; lunch and rest/nap preparation |
| 11:30 a.m. – 2:30 p.m. | Lunch; restroom; rest/nap time |
| 2:30 – 3:15 p.m. | Wake-up; snack; wash-up; lotion-up; put cots away |
| 3:15 – 3:30 p.m. | Large group time |
| 3:30 – 4:00 p.m. | Unplanned, outdoor physical activity |
| 4:00 – 5:30 p.m. | Unplanned, indoor free play; Departure |

Daycare Schedule Classroom C

| | |
|---|---|
| 6:30 – 8:00 a.m. | Arrival; greeting; unplanned, indoor free play |
| 8:00 – 8:30 a.m. | Mixed group time (all classes) (i.e.; music; stories; finger play) |
| 8:30 – 9:00 a.m. | Breakfast; wash-up; unplanned, indoor free play |
| 9:00 – 9:15 a.m. | Large group time; roll call; health check |
| 9:15 – 9:55 a.m. | Unplanned, outdoor free play; water; restroom |
| 9:55 – 10:15 a.m. | Small group time |
| 10:15 – 11:15 a.m. | Activity time; learning centers; clean-up |
| 11:15 – 11:30 a.m. | Large group time, lunch and rest/nap preparation |
| 11:30 a.m. – 12:00 p.m. | Lunch; brush teeth |
| 12:30 –2:30 p.m. | Rest/Nap time |
| 2:30 – 3:15 p.m. | Wake-up; snack; wash-up; lotion-up |
| 3:15 – 4:00 p.m. | Modified activity time (i.e., large group; giving out good work papers and stickers in folders) |
| 4:00 – 4:30 p.m. | Unplanned, outdoor physical activity |
| 4:30 – 5:30 p.m. | Games, music, and stories; unplanned, indoor free play; departure |

Appendix B—Letter to Custodial Caregiver

Appendix B—Letter to Custodial Caregiver

Dear Auburn Day Care Parent:

This summer your child will participate in the Auburn Day Care Motor Development Program. The Motor Development Program is offered and run by faculty and students from the Health and Human Performance Department (HLHP) at Auburn University. During the program, your child will engage in fun activities that will help him/her develop basic motor skills like throwing, catching, hopping, and skipping. He/she will also learn the importance of being physically active and enjoying movement.

Each program session will include multiple stations that encourage movement. Your child will have the opportunity to use colorful equipment and play with their classmates. The Motor Development Program teachers from Auburn will give your child feedback and pointers to help him/her improve his/her skills. During the program, your child will also become familiar with how Kindergarten Physical Education class is run.

In addition to engaging in physical activity and motor skill development, your child will also have the opportunity to participate in a study. The study will involve wearing a heart rate monitor, which attaches to two stickers on the chest, during the Motor Development Program. The goal of the study is to determine how active preschool aged children are when they move. During the study we will also assess your child's motor skills and ask questions about his/her self perceptions and motivation. All of the information we gather from your child (physical play heart rate, perceived competence, motivation, and motor skill development) help the teachers, parents, and Motor Development teachers from Auburn learn about the health of Auburn Day Care children.

If you are interested in your child participating, please complete the attached Informed Consent Form and the Descriptive Information Sheet.

We look forward to helping your child develop his/her motor skills and learn how to be physically active and healthy. Should you have questions or desire additional information, please call Dr. Mary Rudisill (334) 844-1458 or Lori Parish (334) 844-2772.

Sincerely,

Lori Parish

Appendix C—Informed Consent Form

Appendix C—Informed Consent Form

## INFORMED CONSENT FOR DETERMINING THE EFFECTIVENESS OF THE PRESCHOOL MOTOR DEVELOPMENT PROGRAM AT AUBURN DAY CARE

I will be conducting assessments of the children participating in the Auburn Day Care Motor Development Program. I am interested in determining the effects motor development programming has on the children's motor skill development, perceptions of physical competence, physical activity level, and mastery motivation. The assessments measure actual motor skill performance (measured by the Test of Gross Motor Development), perceptions of physical competence (measured by the Pictorial Scale of Perceived Competence and Acceptance), physical activity level (measured by a heart rate monitor and the System of Observing Fitness Instruction Time), and mastery motivation (measured by the Dimensions of Mastery Questionnaire-17). Additionally, descriptive information, including height, weight, Body Mass Index, sex, race, and date of birth, will be collected.

The Pictorial Scale of Perceived Competence and Acceptance will be verbally administered to your child at the beginning and end of the motor development program. This assessment will take approximately 30 minutes to complete each time it is administered. The Dimensions of Mastery Questionnaire (DMQ) will be verbally administered to your child at three different times over the course of the motor development program. Each DMQ assessment will take approximately 30 minutes to complete. Children will also be assessed on the Test of Gross Motor Development (TGMD). The TGMD should take approximately 30 minutes to complete and will be administered and videotaped prior to and following the motor development program. Also, all sessions within the motor development program will be video-taped so we can determine the physical activity level of your child. We will use the System of Observing Fitness Instruction Time (SOFIT) to assess your child's physical activity. This assessment requires no additional time from your child beyond normal participation in the motor development program. Heart rate monitors will record your child's heart beat while engaged in the motor development program and throughout the school day. It takes approximately 5 minutes to place the heart rate monitor on your child. The results will be used for future programming of the Motor Development Program as well as provide specific instructional information about the progress of your child. Following is an explanation of each assessment:

The Pictorial Scale of Perceived Competence and Acceptance for preschool children will be used to assess perceived competence and acceptance. This assessment consists of 26 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.

The Dimensions of Mastery Questionnaire-17 is used to measure mastery motivation for children from infancy through elementary school-age. This assessment consists of 36 age-appropriate statements about how children perceive their behavior. Children verbally respond to questions regarding their behavior on a scale of 1 'not at all typical' to 4 'very typical'. Children answer questions related to their persistence on motor skills, cognitive tasks, interacting with other children, interacting with adults, and pleasure in learning/mastering skills. Motor skill program teachers will complete a pen and paper version of the Dimensions of Mastery Questionnaire-17.

The Test of Gross Motor Development is a measure of fundamental motor skill competence in children ages 3- to 10- years. The 12-item test includes 6 locomotor skills (running, jumping, hopping, leaping, galloping, and sliding) and 6 object-control skills (rolling, throwing, catching, striking, bouncing, and kicking).

**Page 1 of 2** **Parental/Guardian initials ___________**

The 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, walking, or very active.

A Heart Rate Monitor will be used to measure the children's heart rate throughout their day at the day care. Heart rate is one way to determine if your child is getting adequate exercise 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 check the monitor throughout the day, taking special care to ensure comfort for your child.

Descriptive Information including height, weight, Body Mass Index, 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$^2$.

There are no foreseeable risks or discomforts associated with the Test of Gross Motor Development, the Pictorial Scale of Perceived Competence and Acceptance, heart rate monitor, the System of Observing Fitness Instruction Time, or the Dimensions of Mastery Questionnaire-17. 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 Motor Development Intervention 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 Health and Human Performance, or Auburn Cay Care. Your child's performance or responses will in no way affect your child's standing in the day care. 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. 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 ________

**Page 2 of 2**

Appendix D—Data Collection Schedule

Appendix D—Data Collection Schedule

| Time | Task |
| --- | --- |
| 8:00 a.m. | Physical activity teachers and research assistants arrive at gymnasium and set-up (activity stations, cameras, mics, Actiheart monitors, etc.) |
| 9:00 a.m. | Class 1 walks from daycare center to gymnasium |
| 9:15 a.m. | Place Actiheart monitors on Class 1 participants |
| 9:30 a.m. | Baseline/Condition implementation begins; Cameras begin recording |
| 9:45 a.m. | Class 2 walks from daycare center to gymnasium |
| 10:00 a.m. | Baseline/Condition ends; Cameras end recording; Remove Actiheart monitors from Class 1 participants; Place monitors on Class 2 participants |
| 10:05 a.m. | Class 1 walks from gymnasium to daycare center |
| 10:15 a.m. | Baseline/Condition implementation begins; Cameras begin recording |
| 10:45 a.m. | Baseline/Condition implementation ends; Cameras end recording; Remove Actiheart monitors from Class 2 participants |
| 10:50 a.m. | Class 2 walks from gymnasium to daycare center; Physical activity teachers and research assistants break down (activity stations, cameras, mics, Actiheart monitors, etc.) |
| 11:30 a.m. | Physical activity teachers and research assistants depart gymnasium |
| Afternoon | Research assistants download and reduce heart rate data; Set-up Actiheart monitors for the next day |

Appendix E—Sample Lesson Plans

Appendix E—Sample Lesson Plans

Sample MC Lesson Plan

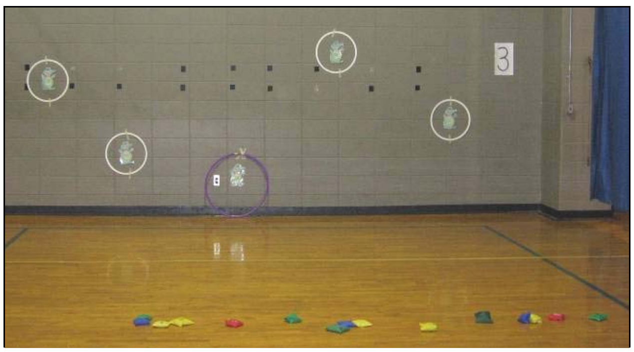
| Time | Activity Stations | Components |
|---|---|---|
| 3 min | Introduction | Introduce the activity session to the participants as a "preschool play day" (i.e., a physical activity program similar to that of a developmentally appropriate preschool program).<br>Discuss the safety rules and rules for engagement with the participants.<br>Describe and demonstrate the activity stations. |
| 25 min | Station 1: Strike (Hockey) | Equipment: Cones, hockey sticks, a variety of balls<br>Activity: Strike balls of varying sizes/weights and moving at different speeds (e.g., fast, slow, stationary) with a hockey stick into goals of various widths.<br>Goal: Work hard to strike the ball into any goal. |
| | Station 2: Balance | Equipment: Balance pads of varying stability<br>Activity: Balance on one or both feet or even seated with your feet and hands in the air.<br>Goal: Create unique ways to balance. Count how long you can balance without touching the ground. |
| | Station 3: Overhand Throw | Equipment: Bean bags, targets, tape<br>Activity: Throw bean bags at different sized targets from different positions and distances from the target.<br>Goal: Throw the ball as hard as you can. |
| | Station 4: Jump (Jumping Sacks) | Equipment: Hopping sacks, scarves, hula hoops<br>Activity: Hop to the pink hula hoop containing scarves, pick up one scarf, jump back to where you started, and place your scarf in the group's aqua hula hoop. Keep going until all of the scarves are in the aqua hula hoop.<br>Goal: Work together to move all of the scarves from the pink to the aqua hula hoop. Practice bending your knees and jumping as far as you can. |

| Time | Activity Stations | Components |
|---|---|---|
| | Station 5: Cardio-Respiratory (Scooters) | Equipment: Scooters, buckets, bean bags, foam ring, tape<br>Activity: Ride a scooter (e.g., seated and pulling with feet and legs; prone pulling with arms; on knees pushing with hands; pushing a friend) along a pathway to the bucket, select a bean bag, scoot back to where you started, and put the bean bag in the group's foam ring. Keep going until all bean bags are in the foam ring.<br>Goal: Work as a team to move all of the bean bags from the buckets to the foam ring. Ride your scooter in different ways to build strong muscles. |
| 2 min | Closing | Engage participants in a relaxation activity such as stretching, deep breathing, or yoga.<br>Ask participants to help clean-up the play area. |
| Notes:<br>Allow participants to adapt each station to meet their personal level of development.<br>Allow participants to choose the length of time they engage in each activity. | | |

Photos of Sample MC Lesson Plan Stations

Station 1

Station 3




Station 4

Station 2

Station 5

Sample PC Lesson Plan

| Time | Activity Stations | Components |
|---|---|---|
| 3 min | Introduction | Introduce the activity session to the participants as a "kindergarten play day" (i.e., a physical activity program similar to that of a kindergarten physical education class).<br>Explain the safety rules and rules for engagement.<br>Describe and demonstrate exactly how the participants should engage at each activity station.<br>Divide participants into groups. |
| 5 min | Station 1: Strike (Hockey) | Equipment: Cones, hockey sticks, one size of balls, flat and foam rings<br>Activity: Stand in the ring a set distance from the goal. Strike a ball with a hockey stick in between cones (i.e., goal), which are a set width apart.<br>Goal: Count how many times your ball goes in the goal. Try to make more goals than your friends. |
| 5 min | Station 2: Balance | Equipment: Balance pads<br>Activity: Stand in a circle and balance on the balance pads the exact same way.<br>Goal: Count how long you can balance without falling off the balance pad. Watch your friends and try to balance longer than they do. |
| 5 min | Station 3: Overhand Throw | Equipment: Bean bags, targets, flat rings, tape<br>Activity: Stand in a ring a set distance from the target. Throw the bean bag at the target.<br>Goal: Count how many times you hit the target. Try to hit the target more times than your friends. |
| 5 min | Station 4: Jump (Jumping Sacks) | Equipment: Jumping sacks, scarves, hula hoop, foam rings<br>Activity: Jump in a sack to the hula hoop of scarves, pick up one scarf, jump back, and place the scarf in your foam ring. Keep going until the scarves are gone from the hula hoop.<br>Goal: Race each other and try to win by getting the most scarves in your foam ring. |

| Time | Activity Stations | Components |
|---|---|---|
| 5 min | Station 5: Cardio-Respiratory (Scooters) | Equipment: Scooters, buckets, bean bags, flat ring, tape<br>Activity: Sit on a scooter using your feet to move down the straight pathway to a bucket, pick a bean bag out of the bucket, ride the scooter back, and put the bean bag in the flat ring at the end of the path. Keep going until all bean bags from your bucket are in your flat ring.<br>Goal: Race each other and try to win by getting all of your bean bags from the bucket to the ring first. |
| 2 min | Closing | Engaged participants in a relaxation activity such as stretching, deep breathing, or yoga.<br>Tell participants to help clean-up the play area. |

Notes:
Participants must engage in each activity station exactly as the teacher describes.
Participants must move from station to station (clockwise) as a group every 5 min.
Indicate when it is time to move to a new station by blowing a whistle.

Photos of Sample PC Lesson Plan Stations

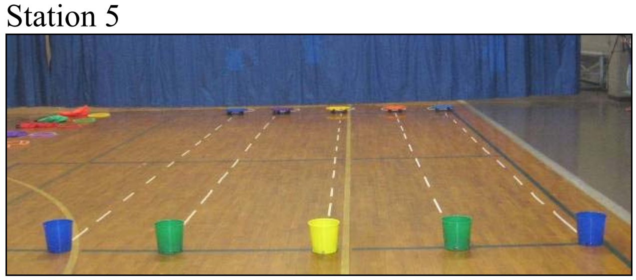
Station 1

Station 2

Station 3

Station 4

Station 5



Sample FP Lesson Plan

| Time | Activity Stations | Components |
|---|---|---|
| 3 min | Introduction | Introduce the activity session to the participants as a "free play day" (i.e., a physical activity program similar to recess).<br>Encourage participants to follow good safety rules and rules for engagement. |
| 25 min | No activity stations were set-up. | <u>Equipment</u>: Cones, hockey sticks, a variety of balls, bean bags, targets, hopping sacks, scarves, flat rings, foam rings, hula hoops, scooters, buckets, tape<br><u>Activity</u>: Engage in any task using any of the available equipment.<br><u>Goal</u>: None |
| 2 min | Closing | Participants helped clean-up the play area. |
| Notes:<br>Passively observe the participants playing and only intervene when a participant's safety is in danger. | | |

Photo of Sample FP Lesson Plan Equipment

Equipment

# Appendix F—Activity Stations for Each Lesson

Appendix F—Activity Stations for Each Lesson

| Lesson | Station 1 | Station 2 | Station 3 | Station 4 | Station 5 |
|---|---|---|---|---|---|
| PC 1<br>MC 1<br>FP 1 | Strike (Hockey) | Balance | Overhand Throw | Jump (Jumping Sacks) | Cardio-Respiratory (Scooters) |
| FP 2<br>MC 2<br>PC 2 | Kick | Cardio-Respiratory (Hoppy Balls) | Overhand Throw, Catch | Strike (Paddles, Balloons) | Balance, Leap, Run (Obstacle Course) |
| FP 3<br>PC 3<br>MC 3 | Toss, Catch (Scarf) | Roll (Bowling) | Putt (Golf) | Dribble | Cardio-Respiratory (Run) |
| MC 4<br>FP 4<br>PC 4 | Dance | Cardio-Respiratory (Scooters) | Dribble, Shoot (Basketball) | Overhand/ Underhand Throw, Catch | Leap |
| PC 5<br>FP 5<br>MC 5 | Tumbling | Hop | Underhand Throw | Strike (Paddles, Tees, Balls) | Jump, Leap, Run (Obstacle Course) |
| MC 6<br>PC 6<br>FP 6 | Roll, Catch (Giant Ball) | Toss, Strike, Catch (Beach Ball) | Cardio-Respiratory (Run) | Push Cars/ Trucks | Roll, Toss, Catch (Foam Rings) |

# Appendix G—Equipment List

Appendix G—Equipment List

Laminated props and throwing targets

Felt putting target

Balls (e.g., 3-and 4-inch All-balls, bumpy balls, SloMo balls, playground balls, beach balls, basketballs, footballs, oversized bumpy ball)

Scooters

Balance pads

Poly spots

Boundary markers (e.g., cones, flat rings, tape, orange ribbon)

Direction markers (e.g., laminated arrows)

Cardboard boxes

Ribbon wands

Paddles

Balloons

Hockey sticks

Golf clubs

Hoppy balls

Bean bags

Leaping sticks

Scarves

Capes

Tumbling mats

Wooden rings with stands

Foam rings

Hula hoops

Hopping sacks

Push toys (e.g., cars, trucks)

Tees (e.g., cones for striking, Frisbee rings for kicking)

Basketball hoop

Buckets

Pompom shakers

Jump ropes

CD player with music CD

Oversized dice

Appendix H—Data Collection Sheet

Appendix H—Data Collection Sheet

Date: ____________________ Research Assistant: ___________________________

Class (circle one): Class 1 (9:30-10:00 a.m.) Class 2 (10:15-10:45 a.m.)

Condition (circle one): Baseline MC PC FP

Condition Start Time: ____________ Condition Stop Time: ____________

Comments:

| Participant ID Code | HR Monitor # | Notes |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# Appendix I—Demographic Data

## Appendix I—Demographic Data

| Participant Code | Age (years) | Height (in) | Weight (lbs) | Body Mass Index ($kg/m^2$) | Resting Heart Rate (bpm) |
|---|---|---|---|---|---|
| C1001 | 3.8 | 41.5 | 40.8 | 16.7 | 78 |
| C1002 | 3.4 | 39.0 | 47.0 | 21.7 | 97 |
| C1004 | 3.7 | 36.8 | 34.8 | 18.1 | 84 |
| C1005 | 3.8 | 42.0 | 69.9 | 27.9 | 95 |
| C1006 | 4.0 | 39.5 | 35.4 | 16.0 | 76 |
| C1007 | 3.8 | 39.5 | 35.7 | 16.1 | 86 |
| C1008 | 3.5 | 37.5 | 37.4 | 18.7 | 93 |
| C1011 | 4.8 | 42.5 | 51.9 | 20.2 | 99 |
| C1013 | 4.2 | 41.8 | 36.2 | 14.6 | 97 |
| C1014 | 3.8 | 40.0 | 48.9 | 21.5 | 75 |
| C1016 | 4.4 | 40.5 | 32.5 | 13.9 | 91 |
| C1017 | 4.2 | 40.3 | 35.4 | 15.4 | 82 |
| C1018 | 3.9 | 42.0 | 39.1 | 15.6 | 75 |
| C1019 | 4.7 | 41.8 | 35.8 | 14.4 | 89 |
| C1020 | 4.2 | 38.5 | 32.7 | 15.5 | 79 |
| C1021 | 4.5 | 41.3 | 35.6 | 14.7 | 85 |
| C2026 | 5.3 | 42.3 | 38.6 | 15.2 | 85 |
| C2027 | 5.0 | 44.8 | 50.7 | 17.8 | 81 |
| C2028 | 5.3 | 47.0 | 70.4 | 22.4 | 87 |
| C2030 | 5.8 | 44.5 | 46.6 | 16.5 | 63 |
| C2031 | 4.9 | 44.3 | 46.5 | 16.7 | 76 |
| C2032 | 5.2 | 44.0 | 45.6 | 16.6 | 71 |
| C2034 | 5.3 | 46.5 | 52.2 | 17.0 | 64 |
| C2035 | 5.3 | 43.0 | 41.3 | 15.7 | 90 |
| C2036 | 4.8 | 41.5 | 45.2 | 18.5 | 80 |
| C2039 | 5.0 | 47.8 | 63.4 | 19.5 | 84 |
| C2041 | 5.4 | 44.5 | 44.1 | 15.7 | 72 |
| *M* | 4.5 | 42.0 | 44.2 | 17.5 | 83 |
| *SD* | .7 | 2.8 | 10.5 | 3.1 | 10 |

Appendix J—Baseline Physical Activity Data

Appendix J—Baseline Physical Activity Data

Mean Physical Activity Heart Rate (bpm) Data for Each Baseline Session

| Participant Code | Baseline 1 | Baseline 2 | Baseline 3 |
|---|---|---|---|
| C1001 | 170.08 | 170.08 | 170.08 |
| C1002 | 160.26 | 168.80 | 164.53 |
| C1004 | 130.60 | 149.41 | 140.00 |
| C1005 | 167.19 | 173.38 | 161.00 |
| C1006 | 123.19 | 120.19 | 114.24 |
| C1007 | 165.52 | 180.50 | 157.69 |
| C1008 | 132.95 | 128.26 | 123.57 |
| C1011 | 159.87 | 155.92 | 161.12 |
| C1013 | 171.02 | 171.02 | 171.02 |
| C1014 | 172.56 | 172.56 | 172.56 |
| C1016 | | | |
| C1017 | 167.13 | 167.13 | 167.13 |
| C1018 | | | |
| C1019 | 180.18 | 180.18 | 180.18 |
| C1020 | 149.44 | 149.44 | 149.44 |
| C1021 | 143.13 | 147.22 | 160.83 |
| C2026 | 124.38 | 142.98 | 133.68 |
| C2027 | 158.93 | 158.00 | 163.94 |
| C2028 | 164.00 | 164.00 | 164.00 |
| C2030 | 134.60 | 139.82 | 134.90 |
| C2031 | 169.26 | 157.34 | 158.20 |
| C2032 | 146.61 | 146.61 | 146.61 |
| C2034 | 131.91 | 139.54 | 145.97 |
| C2035 | 175.08 | 175.08 | 175.08 |
| C2036 | 166.46 | 168.00 | 174.60 |
| C2039 | 152.27 | 158.34 | 154.33 |
| C2041 | 140.38 | 140.38 | 140.38 |

Note. Highlighted cells represent sessions for which mean substitutions were made.

Participants C1016 and C1018 were absent for all three baseline sessions.

Mean Accelerometer Count Data for Each Baseline Session

| Participant Code | Baseline 1 | Baseline 2 | Baseline 3 |
|---|---|---|---|
| C1001 | 98.69 | 98.69 | 98.69 |
| C1002 | 141.71 | 127.03 | 134.37 |
| C1004 | 28.09 | 49.40 | 38.74 |
| C1005 | 92.45 | 100.32 | 84.57 |
| C1006 | 34.28 | 33.70 | 20.33 |
| C1007 | 83.31 | 86.99 | 85.25 |
| C1008 | 29.37 | 21.29 | 13.21 |
| C1011 | 130.61 | 71.47 | 111.41 |
| C1013 | 60.84 | 60.84 | 60.84 |
| C1014 | 128.76 | 128.76 | 128.76 |
| C1016 | | | |
| C1017 | 135.45 | 135.45 | 135.45 |
| C1018 | | | |
| C1019 | 88.23 | 88.23 | 88.23 |
| C1020 | 48.90 | 48.90 | 48.90 |
| C1021 | 105.33 | 65.80 | 117.67 |
| C2026 | 41.60 | 65.48 | 53.54 |
| C2027 | 39.20 | 74.50 | 65.04 |
| C2028 | 118.44 | 118.44 | 118.44 |
| C2030 | 110.51 | 62.45 | 58.77 |
| C2031 | 111.10 | 135.19 | 102.98 |
| C2032 | 66.36 | 66.36 | 66.36 |
| C2034 | 75.52 | 63.25 | 115.37 |
| C2035 | 110.15 | 110.15 | 110.15 |
| C2036 | 178.47 | 149.37 | 98.14 |
| C2039 | 62.77 | 65.70 | 62.30 |
| C2041 | 55.89 | 55.89 | 55.89 |

Note. Highlighted cells represent sessions for which mean substitutions were made.

Participants C1016 and C1018 were absent for all three baseline sessions.

Mean PAHR > 50 (% time) Data for Baseline Session

| Participant Code | Baseline 1 | Baseline 2 | Baseline 3 |
|---|---|---|---|
| C1001 | 98.39 | 98.39 | 98.39 |
| C1002 | 81.82 | 100.00 | 90.91 |
| C1004 | 69.35 | 2.09 | 35.72 |
| C1005 | 88.71 | 94.35 | 83.06 |
| C1006 | 54.17 | 58.06 | 37.90 |
| C1007 | 100.00 | 100.00 | 96.77 |
| C1008 | 24.19 | 12.10 | 0.00 |
| C1011 | 65.88 | 60.48 | 66.13 |
| C1013 | 85.48 | 85.48 | 85.48 |
| C1014 | 96.77 | 96.77 | 96.77 |
| C1016 | | | |
| C1017 | 95.16 | 95.16 | 95.16 |
| C1018 | | | |
| C1019 | 95.97 | 95.97 | 95.97 |
| C1020 | 95.97 | 95.97 | 95.97 |
| C1021 | 87.10 | 87.90 | 96.72 |
| C2026 | 38.71 | 82.26 | 60.48 |
| C2027 | 98.37 | 100.00 | 100.00 |
| C2028 | 87.90 | 87.90 | 87.90 |
| C2030 | 98.37 | 100.00 | 96.77 |
| C2031 | 93.68 | 91.94 | 98.39 |
| C2032 | 99.17 | 99.17 | 99.17 |
| C2034 | 96.77 | 98.39 | 96.77 |
| C2035 | 100.00 | 100.00 | 100.00 |
| C2036 | 100.00 | 100.00 | 100.00 |
| C2039 | 87.90 | 96.77 | 98.39 |
| C2041 | 100.00 | 100.00 | 100.00 |

Note. Highlighted cells represent sessions for which mean substitutions were made.

Participants C1016 and C1018 were absent for all three baseline sessions.

Mean Physical Activity Data for All Baseline Sessions

| Participant Code | Physical Activity Heart Rate (bpm) | Accelerometer Count | PAHR > 50 (%time) |
|---|---|---|---|
| C1001 | 170.08 | 98.69 | 98.39 |
| C1002 | 164.53 | 134.37 | 90.91 |
| C1004 | 140.00 | 38.74 | 35.72 |
| C1005 | 167.19 | 92.45 | 88.71 |
| C1006 | 119.21 | 29.44 | 50.04 |
| C1007 | 167.91 | 85.19 | 98.92 |
| C1008 | 128.26 | 21.29 | 12.10 |
| C1011 | 158.97 | 104.50 | 64.17 |
| C1013 | 171.02 | 60.84 | 85.48 |
| C1014 | 172.56 | 128.76 | 96.77 |
| C1017 | 167.13 | 135.45 | 95.16 |
| C1019 | 180.18 | 88.23 | 95.97 |
| C1020 | 149.44 | 48.90 | 95.97 |
| C1021 | 150.39 | 96.27 | 90.57 |
| C2026 | 133.68 | 53.54 | 60.48 |
| C2027 | 160.29 | 59.58 | 99.46 |
| C2028 | 164.00 | 118.44 | 87.90 |
| C2030 | 136.44 | 77.24 | 98.38 |
| C2031 | 161.60 | 116.42 | 94.67 |
| C2032 | 146.61 | 66.36 | 99.17 |
| C2034 | 139.14 | 84.72 | 97.31 |
| C2035 | 175.08 | 110.15 | 100.00 |
| C2036 | 169.69 | 141.99 | 100.00 |
| C2039 | 154.98 | 63.59 | 94.35 |
| C2041 | 140.38 | 55.89 | 100.00 |
| *M* | 155.55 | 84.44 | 85.23 |
| *SD* | 16.29 | 34.25 | 22.86 |

Note. Baseline data for participants C1016 and C1018 are excluded above due to absence during all baseline sessions. These participants met the study's overall inclusion criteria thus their intervention physical activity data was included in the analyses.

Appendix K—Intervention Physical Activity Data

## Appendix K—Intervention Physical Activity Data

Mean Physical Activity Heart Rate (bpm) Data for Each MC Session

| Participant Code | MC1 | MC2 | MC3 | MC4 | MC5 | MC6 |
|---|---|---|---|---|---|---|
| C1001 | 154.20 | 150.45 | 158.20 | 154.20 | 153.25 | 154.89 |
| C1002 | 153.61 | 156.59 | 144.96 | 159.89 | 147.79 | 158.84 |
| C1004 | 141.17 | 150.79 | 134.69 | 135.40 | 147.51 | 141.91 |
| C1005 | 141.31 | 131.79 | 148.03 | 135.48 | 160.92 | 152.05 |
| C1006 | 131.55 | 128.63 | 138.65 | 155.37 | 139.68 | 151.82 |
| C1007 | 165.50 | 170.70 | 149.68 | 174.71 | 145.86 | 150.79 |
| C1008 | 141.31 | 132.91 | 122.31 | 131.35 | 152.44 | 161.87 |
| C1011 | 147.24 | 152.12 | 149.89 | 171.33 | 164.14 | 151.78 |
| C1013 | 154.60 | 171.41 | 172.85 | 168.59 | 184.79 | 176.23 |
| C1014 | 159.81 | 147.22 | 155.96 | 151.59 | 124.15 | 144.57 |
| C1016 | 167.25 | 163.46 | 160.05 | 183.22 | 154.57 | 174.95 |
| C1017 | 157.16 | 157.92 | 157.16 | 171.91 | 157.17 | 141.64 |
| C1018 | 135.93 | 139.38 | 127.85 | 145.73 | 136.43 | 130.26 |
| C1019 | 171.11 | 176.23 | 160.84 | 158.33 | 166.63 | 166.63 |
| C1020 | 129.01 | 152.69 | 147.98 | 154.46 | 136.79 | 140.47 |
| C1021 | 144.76 | 156.44 | 147.99 | 155.30 | 143.81 | 162.31 |
| C2026 | 134.94 | 148.82 | 148.82 | 145.40 | 151.41 | 163.54 |
| C2027 | 178.19 | 167.63 | 144.18 | 172.15 | 167.63 | 176.01 |
| C2028 | 173.36 | 173.41 | 165.10 | 173.48 | 163.99 | 169.87 |
| C2030 | 124.40 | 140.57 | 135.58 | 152.87 | 152.76 | 154.25 |
| C2031 | 160.25 | 162.37 | 148.39 | 155.54 | 162.56 | 169.63 |
| C2032 | 146.84 | 147.16 | 134.36 | 161.66 | 147.16 | 145.76 |
| C2034 | 219.65 | 154.55 | 143.91 | 142.97 | 159.20 | 165.71 |
| C2035 | 161.65 | 161.84 | 150.65 | 156.24 | 170.24 | 170.42 |
| C2036 | 154.25 | 166.01 | 134.87 | 151.95 | 166.74 | 159.69 |
| C2039 | 143.77 | 141.97 | 148.64 | 128.79 | 143.11 | 159.78 |
| C2041 | 116.69 | 130.24 | 129.00 | 130.92 | 130.24 | 144.36 |
| *M* | 152.20 | 153.09 | 146.69 | 154.77 | 152.99 | 157.04 |
| *SD* | 20.37 | 13.65 | 11.90 | 14.65 | 13.51 | 12.19 |

Note. Highlighted cells represent days when participants were absent. For these days, the participant's mean MC physical activity heart rate was used in the analysis.

Mean Accelerometer Count Data for Each MC Session

| Participant Code | MC1 | MC2 | MC3 | MC4 | MC5 | MC6 |
|---|---|---|---|---|---|---|
| C1001 | 75.98 | 56.84 | 81.54 | 75.98 | 97.76 | 67.79 |
| C1002 | 111.90 | 94.66 | 104.43 | 112.48 | 127.50 | 120.40 |
| C1004 | 53.10 | 67.12 | 64.75 | 50.27 | 91.71 | 65.39 |
| C1005 | 49.07 | 85.17 | 97.12 | 53.23 | 103.34 | 58.19 |
| C1006 | 46.88 | 54.38 | 40.85 | 84.76 | 107.78 | 96.10 |
| C1007 | 69.55 | 55.40 | 136.43 | 205.44 | 84.10 | 68.22 |
| C1008 | 20.58 | 46.35 | 14.51 | 18.48 | 98.92 | 98.88 |
| C1011 | 55.89 | 72.38 | 103.07 | 149.56 | 149.56 | 107.23 |
| C1013 | 39.42 | 77.10 | 44.08 | 86.70 | 150.39 | 64.93 |
| C1014 | 82.36 | 107.30 | 122.05 | 100.13 | 87.59 | 144.36 |
| C1016 | 90.51 | 82.35 | 78.60 | 145.99 | 84.65 | 60.95 |
| C1017 | 103.78 | 73.27 | 103.78 | 172.24 | 103.79 | 65.84 |
| C1018 | 62.12 | 56.74 | 55.45 | 72.15 | 86.05 | 40.23 |
| C1019 | 118.05 | 154.70 | 156.07 | 121.89 | 137.68 | 137.68 |
| C1020 | 59.73 | 87.81 | 73.52 | 99.85 | 80.78 | 77.22 |
| C1021 | 65.36 | 94.07 | 107.02 | 141.13 | 66.00 | 134.66 |
| C2026 | 63.58 | 114.14 | 114.14 | 84.74 | 149.29 | 158.93 |
| C2027 | 91.38 | 87.29 | 55.48 | 96.06 | 87.29 | 106.25 |
| C2028 | 66.77 | 158.12 | 81.48 | 87.92 | 73.55 | 93.57 |
| C2030 | 71.42 | 154.36 | 93.82 | 139.91 | 147.92 | 119.40 |
| C2031 | 102.66 | 85.02 | 139.23 | 83.52 | 140.39 | 121.89 |
| C2032 | 65.19 | 80.12 | 56.40 | 107.12 | 80.12 | 91.80 |
| C2034 | 63.17 | 157.88 | 119.98 | 152.70 | 151.72 | 135.24 |
| C2035 | 59.76 | 84.69 | 79.27 | 72.20 | 92.10 | 120.10 |
| C2036 | 55.32 | 161.84 | 52.87 | 101.60 | 124.91 | 168.19 |
| C2039 | 91.93 | 79.46 | 74.73 | 42.39 | 59.78 | 81.90 |
| C2041 | 57.96 | 74.57 | 57.89 | 90.97 | 74.57 | 91.46 |
| *M* | 70.13 | 92.71 | 85.80 | 101.83 | 105.16 | 99.88 |
| *SD* | 22.73 | 35.03 | 33.69 | 41.82 | 29.22 | 33.54 |

Note. Highlighted cells represent days when participants were absent. For these days, the participant's mean MC physical activity heart rate was used in the analysis.

Mean PAHR > 50 (% time) Data for Each MC Session

| Participant Code | MC1 | MC2 | MC3 | MC4 | MC5 | MC6 |
|---|---|---|---|---|---|---|
| C1001 | 92.44 | 86.27 | 91.94 | 92.44 | 94.44 | 97.12 |
| C1002 | 74.48 | 79.69 | 59.68 | 91.89 | 55.56 | 85.58 |
| C1004 | 76.19 | 86.72 | 61.79 | 70.27 | 82.42 | 75.48 |
| C1005 | 47.73 | 16.41 | 62.10 | 20.97 | 82.86 | 65.38 |
| C1006 | 81.61 | 73.44 | 83.06 | 100.00 | 87.74 | 94.06 |
| C1007 | 96.59 | 100.00 | 80.33 | 98.11 | 88.89 | 93.68 |
| C1008 | 60.23 | 43.75 | 7.26 | 20.41 | 60.19 | 82.52 |
| C1011 | 59.09 | 64.84 | 64.52 | 91.96 | 75.93 | 48.08 |
| C1013 | 62.50 | 87.00 | 92.23 | 91.74 | 100.00 | 88.52 |
| C1014 | 79.55 | 85.79 | 78.23 | 100.00 | 75.00 | 96.15 |
| C1016 | 84.39 | 85.94 | 69.35 | 97.32 | 72.22 | 97.12 |
| C1017 | 91.39 | 82.81 | 91.39 | 99.19 | 91.40 | 92.16 |
| C1018 | 87.70 | 89.06 | 69.35 | 100.00 | 92.59 | 87.50 |
| C1019 | 76.14 | 85.16 | 74.19 | 92.86 | 82.09 | 82.09 |
| C1020 | 69.32 | 89.06 | 91.94 | 99.11 | 90.38 | 98.06 |
| C1021 | 72.09 | 85.16 | 71.74 | 92.38 | 78.70 | 92.31 |
| C2026 | 69.35 | 83.87 | 83.87 | 84.55 | 95.28 | 86.27 |
| C2027 | 91.13 | 91.78 | 79.67 | 99.19 | 91.78 | 97.12 |
| C2028 | 87.10 | 89.84 | 79.84 | 99.19 | 95.28 | 90.25 |
| C2030 | 85.48 | 89.84 | 83.74 | 100.00 | 100.00 | 96.08 |
| C2031 | 84.68 | 88.28 | 77.42 | 94.31 | 97.22 | 95.10 |
| C2032 | 91.94 | 93.46 | 87.80 | 100.00 | 93.46 | 94.12 |
| C2034 | 100.00 | 88.28 | 84.48 | 94.87 | 100.00 | 97.06 |
| C2035 | 83.06 | 84.08 | 75.00 | 78.33 | 87.96 | 96.04 |
| C2036 | 99.19 | 86.72 | 67.59 | 92.17 | 99.07 | 93.33 |
| C2039 | 83.87 | 81.25 | 84.09 | 52.50 | 84.91 | 94.23 |
| C2041 | 63.79 | 85.54 | 83.87 | 98.33 | 85.54 | 96.15 |
| *M* | 79.67 | 81.63 | 75.42 | 87.11 | 86.70 | 89.32 |
| *SD* | 13.28 | 16.58 | 16.71 | 21.88 | 11.45 | 11.18 |

Note. Highlighted cells represent days when participants were absent. For these days, the participant's mean MC physical activity heart rate was used in the analysis.

Mean Physical Activity Data for All MC Sessions

| Participant Code | Physical Activity Heart Rate (bpm) | Accelerometer Count | PAHR > 50 (%time) |
|---|---|---|---|
| C1001 | 154.20 | 75.98 | 92.44 |
| C1002 | 153.61 | 111.90 | 74.48 |
| C1004 | 141.91 | 65.39 | 75.48 |
| C1005 | 144.93 | 74.35 | 49.24 |
| C1006 | 140.95 | 71.79 | 86.65 |
| C1007 | 159.54 | 103.19 | 92.93 |
| C1008 | 140.36 | 49.62 | 45.73 |
| C1011 | 156.08 | 106.28 | 67.40 |
| C1013 | 171.41 | 77.10 | 87.00 |
| C1014 | 147.22 | 107.30 | 85.79 |
| C1016 | 167.25 | 90.51 | 84.39 |
| C1017 | 157.16 | 103.78 | 91.39 |
| C1018 | 135.93 | 62.12 | 87.70 |
| C1019 | 166.63 | 137.68 | 82.09 |
| C1020 | 143.57 | 79.82 | 89.64 |
| C1021 | 151.77 | 101.37 | 82.06 |
| C2026 | 148.82 | 114.14 | 83.87 |
| C2027 | 167.63 | 87.29 | 91.78 |
| C2028 | 169.87 | 93.57 | 90.25 |
| C2030 | 143.41 | 121.14 | 92.52 |
| C2031 | 159.79 | 112.12 | 89.50 |
| C2032 | 147.16 | 80.12 | 93.46 |
| C2034 | 164.33 | 130.12 | 94.12 |
| C2035 | 161.84 | 84.69 | 84.08 |
| C2036 | 155.58 | 110.79 | 89.68 |
| C2039 | 144.34 | 71.70 | 80.14 |
| C2041 | 130.24 | 74.57 | 85.54 |
| *M* | 152.80 | 92.53 | 83.31 |
| *SD* | 11.10 | 21.92 | 12.12 |

Mean Physical Activity Heart Rate (bpm) Data for Each PC Session

| Participant Code | PC1 | PC 2 | PC 3 | PC 4 | PC 5 | PC 6 |
|---|---|---|---|---|---|---|
| C1001 | 151.08 | 145.08 | 145.08 | 118.85 | 155.31 | 155.08 |
| C1002 | 150.34 | 143.77 | 148.21 | 151.28 | 157.40 | 151.06 |
| C1004 | 143.08 | 129.65 | 129.70 | 143.55 | 135.41 | 146.74 |
| C1005 | 127.90 | 130.58 | 141.84 | 153.50 | 148.27 | 148.94 |
| C1006 | 150.66 | 139.18 | 145.83 | 141.20 | 144.75 | 153.35 |
| C1007 | 162.87 | 160.97 | 146.33 | 159.74 | 153.21 | 136.15 |
| C1008 | 154.65 | 116.34 | 128.82 | 162.57 | 162.47 | 148.11 |
| C1011 | 154.29 | 151.37 | 146.46 | 150.46 | 143.26 | 153.72 |
| C1013 | 158.02 | 174.44 | 168.38 | 166.53 | 156.40 | 172.65 |
| C1014 | 165.88 | 126.26 | 147.35 | 150.66 | 168.92 | 108.01 |
| C1016 | 164.31 | 158.35 | 159.31 | 182.61 | 169.59 | 151.70 |
| C1017 | 159.62 | 134.95 | 156.73 | 154.66 | 162.77 | 153.75 |
| C1018 | 135.45 | 126.13 | 148.36 | 140.38 | 128.22 | 134.18 |
| C1019 | 160.98 | 152.89 | 156.11 | 169.74 | 149.10 | 177.06 |
| C1020 | 157.89 | 148.37 | 158.67 | 156.38 | 143.24 | 144.53 |
| C1021 | 156.15 | 148.08 | 140.15 | 146.19 | 148.99 | 162.39 |
| C2026 | 138.37 | 148.01 | 148.01 | 151.03 | 152.47 | 150.19 |
| C2027 | 157.10 | 150.90 | 147.80 | 158.10 | 160.83 | 168.21 |
| C2028 | 172.99 | 175.77 | 175.29 | 176.20 | 172.88 | 178.60 |
| C2030 | 131.53 | 140.60 | 125.00 | 143.93 | 132.76 | 150.66 |
| C2031 | 158.48 | 160.47 | 136.76 | 165.41 | 163.38 | 148.09 |
| C2032 | 157.56 | 161.27 | 143.44 | 158.36 | 153.01 | 152.58 |
| C2034 | 151.14 | 155.67 | 104.42 | 170.18 | 159.97 | 139.59 |
| C2035 | 177.69 | 177.31 | 162.62 | 136.95 | 173.31 | 165.58 |
| C2036 | 168.51 | 168.44 | 151.27 | 178.08 | 170.24 | 180.70 |
| C2039 | 145.97 | 159.76 | 145.91 | 150.31 | 151.44 | 148.46 |
| C2041 | 132.52 | 128.48 | 124.56 | 136.95 | 133.84 | 138.78 |
| *M* | 153.52 | 148.63 | 145.64 | 154.59 | 153.76 | 152.55 |
| *SD* | 12.51 | 16.28 | 14.64 | 14.30 | 12.51 | 15.34 |

Note. Highlighted cells represent days when participants were absent. For these days, the participant's mean PC physical activity heart rate was used in the analysis.

Mean Accelerometer Count Data for Each PC Session

| Participant Code | PC 1 | PC 2 | PC 3 | PC 4 | PC 5 | PC 6 |
|---|---|---|---|---|---|---|
| C1001 | 67.69 | 72.92 | 72.92 | 21.90 | 91.07 | 111.00 |
| C1002 | 114.36 | 85.33 | 105.72 | 101.22 | 145.41 | 134.12 |
| C1004 | 42.17 | 42.76 | 63.68 | 84.07 | 72.81 | 56.60 |
| C1005 | 34.99 | 55.35 | 85.00 | 134.17 | 108.63 | 91.87 |
| C1006 | 47.51 | 54.55 | 75.68 | 45.05 | 99.67 | 131.64 |
| C1007 | 88.33 | 74.49 | 70.90 | 127.72 | 86.85 | 72.81 |
| C1008 | 33.75 | 26.79 | 30.98 | 159.82 | 107.87 | 55.76 |
| C1011 | 121.33 | 123.23 | 95.14 | 112.01 | 113.56 | 124.26 |
| C1013 | 38.66 | 130.69 | 72.42 | 66.79 | 93.40 | 120.44 |
| C1014 | 106.88 | 80.99 | 114.47 | 153.37 | 133.54 | 39.91 |
| C1016 | 92.46 | 73.91 | 51.92 | 176.76 | 133.68 | 26.03 |
| C1017 | 70.13 | 54.75 | 98.10 | 78.21 | 98.94 | 80.03 |
| C1018 | 55.45 | 26.85 | 66.19 | 55.47 | 64.31 | 64.44 |
| C1019 | 120.51 | 137.11 | 140.49 | 92.22 | 103.66 | 129.06 |
| C1020 | 48.97 | 75.00 | 88.99 | 159.80 | 89.65 | 77.83 |
| C1021 | 96.74 | 84.45 | 43.07 | 137.19 | 151.14 | 125.41 |
| C2026 | 70.76 | 129.09 | 129.09 | 187.06 | 131.23 | 127.32 |
| C2027 | 100.63 | 52.89 | 61.56 | 71.65 | 106.85 | 107.49 |
| C2028 | 95.99 | 171.98 | 112.70 | 114.43 | 92.39 | 88.71 |
| C2030 | 59.20 | 133.17 | 55.48 | 77.73 | 97.14 | 181.88 |
| C2031 | 73.63 | 101.69 | 89.70 | 115.15 | 107.60 | 93.31 |
| C2032 | 92.62 | 116.85 | 56.51 | 95.82 | 86.89 | 79.64 |
| C2034 | 162.40 | 192.42 | 8.24 | 186.63 | 122.31 | 94.90 |
| C2035 | 60.38 | 113.87 | 83.77 | 111.68 | 153.11 | 104.56 |
| C2036 | 96.91 | 138.47 | 64.01 | 99.78 | 125.13 | 175.05 |
| C2039 | 108.14 | 120.54 | 37.31 | 92.35 | 103.09 | 92.66 |
| C2041 | 95.87 | 107.02 | 75.53 | 111.68 | 83.35 | 101.77 |
| *M* | 81.35 | 95.45 | 75.91 | 109.99 | 107.53 | 99.57 |
| *SD* | 31.49 | 42.16 | 29.91 | 42.44 | 22.96 | 36.42 |

Note. Highlighted cells represent days when participants were absent. For these days, the participant's mean PC accelerometer count was used in the analysis.

Mean PAHR > 50 (% time) Data for Each PC Session

| Participant Code | PC 1 | PC 2 | PC 3 | PC4 | PC5 | PC 6 |
|---|---|---|---|---|---|---|
| C1001 | 97.12 | 82.35 | 82.35 | 49.04 | 97.12 | 86.11 |
| C1002 | 66.53 | 55.56 | 64.88 | 67.31 | 75.73 | 69.16 |
| C1004 | 93.27 | 54.17 | 62.30 | 88.46 | 68.93 | 93.20 |
| C1005 | 8.82 | 17.36 | 45.69 | 74.04 | 62.50 | 65.74 |
| C1006 | 100.00 | 77.62 | 91.94 | 96.15 | 97.06 | 88.89 |
| C1007 | 100.00 | 99.31 | 85.12 | 97.12 | 86.68 | 51.85 |
| C1008 | 96.15 | 1.39 | 22.02 | 77.67 | 92.86 | 64.81 |
| C1011 | 61.54 | 54.86 | 50.00 | 53.40 | 29.79 | 62.96 |
| C1013 | 76.61 | 79.86 | 85.71 | 86.54 | 72.06 | 99.07 |
| C1014 | 99.04 | 68.75 | 76.47 | 94.23 | 100.00 | 94.44 |
| C1016 | 82.19 | 68.75 | 76.76 | 99.04 | 92.31 | 74.07 |
| C1017 | 100.00 | 59.72 | 84.52 | 100.00 | 98.08 | 88.46 |
| C1018 | 89.77 | 74.31 | 91.67 | 99.04 | 89.42 | 94.39 |
| C1019 | 84.34 | 70.83 | 73.81 | 98.08 | 80.00 | 98.98 |
| C1020 | 100.00 | 85.42 | 91.67 | 100.00 | 98.04 | 97.22 |
| C1021 | 100.00 | 71.53 | 69.64 | 82.98 | 76.67 | 94.34 |
| C2026 | 77.42 | 90.75 | 90.75 | 91.26 | 98.04 | 96.30 |
| C2027 | 94.35 | 95.83 | 78.21 | 98.08 | 93.27 | 98.15 |
| C2028 | 94.35 | 95.83 | 96.69 | 96.15 | 98.06 | 99.07 |
| C2030 | 91.94 | 100.00 | 87.82 | 100.00 | 98.08 | 100.00 |
| C2031 | 95.16 | 96.53 | 71.15 | 97.12 | 94.23 | 98.15 |
| C2032 | 100.00 | 99.31 | 87.18 | 100.00 | 100.00 | 100.00 |
| C2034 | 94.35 | 97.92 | 70.51 | 100.00 | 99.04 | 99.07 |
| C2035 | 95.16 | 94.44 | 76.28 | 56.73 | 99.03 | 84.33 |
| C2036 | 95.97 | 100.00 | 84.62 | 100.00 | 98.94 | 100.00 |
| C2039 | 83.06 | 92.31 | 77.42 | 88.46 | 91.35 | 98.15 |
| C2041 | 92.90 | 88.19 | 82.05 | 99.04 | 95.19 | 100.00 |
| *M* | 87.78 | 76.77 | 76.19 | 88.52 | 88.24 | 88.77 |
| *SD* | 18.85 | 24.65 | 16.39 | 15.47 | 15.81 | 14.13 |

Note. Highlighted cells represent days when participants were absent. For these days, the participant's mean PC PAHR > 50 was used in the analysis.

Mean Physical Activity Data for PC Sessions

| Participant Code | Physical Activity Heart Rate (bpm) | Accelerometer Count | PAHR > 50 (%time) |
|---|---|---|---|
| C1001 | 145.08 | 72.92 | 82.35 |
| C1002 | 150.34 | 114.36 | 66.53 |
| C1004 | 138.02 | 60.35 | 76.72 |
| C1005 | 141.84 | 85.00 | 45.69 |
| C1006 | 145.83 | 75.68 | 91.94 |
| C1007 | 153.21 | 86.85 | 86.68 |
| C1008 | 145.49 | 69.16 | 59.15 |
| C1011 | 149.92 | 114.92 | 52.09 |
| C1013 | 166.07 | 87.07 | 83.31 |
| C1014 | 144.51 | 104.86 | 88.82 |
| C1016 | 164.31 | 92.46 | 82.19 |
| C1017 | 153.75 | 80.03 | 88.46 |
| C1018 | 135.45 | 55.45 | 89.77 |
| C1019 | 160.98 | 120.51 | 84.34 |
| C1020 | 151.51 | 90.04 | 95.39 |
| C1021 | 150.33 | 106.33 | 82.53 |
| C2026 | 148.01 | 129.09 | 90.75 |
| C2027 | 157.16 | 83.51 | 92.98 |
| C2028 | 175.29 | 112.70 | 96.69 |
| C2030 | 137.41 | 100.77 | 96.31 |
| C2031 | 155.43 | 96.85 | 92.06 |
| C2032 | 154.37 | 88.06 | 97.75 |
| C2034 | 146.83 | 127.81 | 93.48 |
| C2035 | 165.58 | 104.56 | 84.33 |
| C2036 | 169.54 | 116.56 | 96.59 |
| C2039 | 150.31 | 92.35 | 88.46 |
| C2041 | 132.52 | 95.87 | 92.90 |
| *M* | 151.45 | 94.97 | 84.38 |
| *SD* | 10.58 | 19.37 | 13.56 |

Mean Physical Activity Heart Rate (bpm) Data for Each FP Session

| Participant Code | FP1 | FP 2 | FP 3 | FP 4 | FP 5 | FP 6 |
|---|---|---|---|---|---|---|
| C1001 | 160.74 | 145.78 | 141.59 | 145.78 | 134.99 | 145.79 |
| C1002 | 176.69 | 165.96 | 165.97 | 166.95 | 154.24 | 165.96 |
| C1004 | 137.37 | 150.43 | 127.62 | 134.88 | 143.30 | 142.65 |
| C1005 | 137.14 | 135.20 | 134.88 | 135.20 | 141.63 | 127.14 |
| C1006 | 122.65 | 119.84 | 113.84 | 142.94 | 128.34 | 142.40 |
| C1007 | 141.98 | 164.74 | 149.38 | 152.34 | 163.08 | 142.52 |
| C1008 | 141.53 | 126.65 | 116.59 | 126.17 | 132.50 | 124.14 |
| C1011 | 138.39 | 146.28 | 145.68 | 155.45 | 154.77 | 160.20 |
| C1013 | 143.87 | 169.26 | 172.51 | 174.46 | 167.43 | 165.51 |
| C1014 | 171.66 | 157.59 | 143.71 | 160.65 | 157.59 | 154.35 |
| C1016 | 150.28 | 150.28 | 139.32 | 147.01 | 141.57 | 173.23 |
| C1017 | 155.86 | 170.80 | 157.29 | 157.29 | 156.04 | 146.44 |
| C1018 | 135.00 | 125.68 | 150.80 | 139.11 | 101.95 | 153.78 |
| C1019 | 165.41 | 172.54 | 172.80 | 172.54 | 165.61 | 186.35 |
| C1020 | 133.57 | 129.24 | 133.09 | 139.33 | 143.95 | 149.99 |
| C1021 | 146.60 | 140.35 | 142.18 | 143.39 | 137.85 | 137.93 |
| C2026 | 153.68 | 146.30 | 146.30 | 157.53 | 151.36 | 122.65 |
| C2027 | 166.65 | 144.77 | 164.09 | 177.31 | 163.00 | 162.18 |
| C2028 | 169.53 | 170.98 | 174.22 | 172.37 | 180.08 | 170.50 |
| C2030 | 138.90 | 170.61 | 151.42 | 129.91 | 154.37 | 163.29 |
| C2031 | 160.84 | 168.70 | 165.74 | 167.77 | 178.20 | 163.37 |
| C2032 | 151.83 | 130.02 | 149.12 | 147.81 | 144.27 | 142.56 |
| C2034 | 139.22 | 133.55 | 161.51 | 148.39 | 161.93 | 169.96 |
| C2035 | 131.01 | 156.69 | 162.29 | 182.07 | 179.40 | 162.29 |
| C2036 | 149.16 | 160.05 | 173.83 | 175.31 | 176.54 | 191.20 |
| C2039 | 142.08 | 144.71 | 149.88 | 142.69 | 144.94 | 143.96 |
| C2041 | 128.29 | 138.35 | 138.64 | 126.73 | 139.67 | 160.14 |
| *M* | 147.78 | 149.46 | 149.79 | 152.64 | 151.80 | 154.46 |
| *SD* | 14.21 | 16.27 | 16.53 | 16.49 | 17.77 | 17.10 |

Note. Highlighted cells represent days when participants were absent. For these days, the participant's mean FP physical activity heart rate was used in the analysis.

Mean Accelerometer Count Data for Each FP Session

| Participant Code | FP 1 | FP 2 | FP 3 | FP 4 | FP 5 | FP 6 |
|---|---|---|---|---|---|---|
| C1001 | 96.96 | 61.79 | 38.14 | 61.79 | 50.28 | 61.80 |
| C1002 | 145.13 | 123.01 | 123.02 | 109.77 | 114.14 | 123.01 |
| C1004 | 79.11 | 94.91 | 31.93 | 55.75 | 32.50 | 67.03 |
| C1005 | 39.40 | 40.73 | 31.67 | 40.73 | 53.61 | 38.24 |
| C1006 | 18.59 | 47.91 | 16.13 | 76.75 | 49.57 | 88.46 |
| C1007 | 70.95 | 73.86 | 80.53 | 80.21 | 97.21 | 78.51 |
| C1008 | 22.51 | 16.90 | 14.18 | 16.14 | 23.22 | 7.44 |
| C1011 | 73.28 | 78.51 | 47.17 | 135.92 | 77.23 | 106.63 |
| C1013 | 15.67 | 60.80 | 68.20 | 110.88 | 118.97 | 74.90 |
| C1014 | 107.81 | 111.20 | 91.39 | 132.06 | 111.20 | 113.54 |
| C1016 | 42.19 | 42.19 | 19.72 | 21.23 | 22.16 | 105.66 |
| C1017 | 101.09 | 131.65 | 105.62 | 105.62 | 79.38 | 110.35 |
| C1018 | 13.34 | 21.39 | 71.39 | 48.31 | 13.91 | 100.36 |
| C1019 | 96.16 | 132.11 | 150.54 | 132.11 | 136.47 | 145.28 |
| C1020 | 47.89 | 38.41 | 31.84 | 112.47 | 64.74 | 53.50 |
| C1021 | 70.89 | 88.71 | 68.04 | 141.11 | 50.31 | 49.63 |
| C2026 | 78.27 | 98.20 | 98.20 | 84.38 | 152.34 | 77.83 |
| C2027 | 116.10 | 57.60 | 78.78 | 117.57 | 97.06 | 115.25 |
| C2028 | 70.01 | 148.48 | 130.94 | 58.20 | 93.25 | 92.85 |
| C2030 | 68.18 | 228.01 | 133.97 | 56.74 | 158.66 | 158.23 |
| C2031 | 115.65 | 201.88 | 119.82 | 80.33 | 176.18 | 146.07 |
| C2032 | 75.92 | 69.55 | 67.19 | 100.01 | 73.98 | 57.24 |
| C2034 | 60.30 | 116.91 | 116.53 | 133.95 | 152.78 | 146.38 |
| C2035 | 30.97 | 128.95 | 96.20 | 102.48 | 122.40 | 96.20 |
| C2036 | 62.16 | 120.68 | 99.93 | 117.60 | 175.37 | 142.88 |
| C2039 | 45.29 | 78.26 | 94.48 | 99.33 | 67.23 | 84.97 |
| C2041 | 59.45 | 75.05 | 77.79 | 57.24 | 83.96 | 113.25 |
| *M* | 67.53 | 92.14 | 77.90 | 88.47 | 90.67 | 64.65 |
| *SD* | 33.60 | 50.48 | 38.97 | 35.88 | 47.41 | 36.97 |

Note. Highlighted cells represent days when participants were absent. For these days, the participant's mean FP accelerometer count was used in the analysis.

Mean PAHR > 50 (% time) Data for Each FP Session

| Participant Code | FP 1 | FP 2 | FP 3 | FP4 | FP5 | FP 6 |
|---|---|---|---|---|---|---|
| C1001 | 96.55 | 94.82 | 96.05 | 94.82 | 91.87 | 94.3 |
| C1002 | 93.10 | 88.35 | 88.36 | 93.27 | 78.69 | 88.35 |
| C1004 | 87.93 | 93.55 | 56.58 | 67.31 | 80.33 | 95.19 |
| C1005 | 22.41 | 23.33 | 19.35 | 23.33 | 41.94 | 9.62 |
| C1006 | 63.64 | 49.22 | 42.11 | 89.42 | 67.72 | 94.23 |
| C1007 | 87.07 | 100.00 | 96.05 | 93.17 | 99.09 | 83.65 |
| C1008 | 60.34 | 2.42 | 0.00 | 6.73 | 27.03 | 1.92 |
| C1011 | 21.55 | 42.74 | 51.32 | 56.63 | 61.79 | 76.92 |
| C1013 | 41.46 | 90.63 | 94.74 | 99.04 | 76.60 | 80.49 |
| C1014 | 94.83 | 91.40 | 88.16 | 99.01 | 91.40 | 83.61 |
| C1016 | 78.67 | 78.67 | 61.84 | 90.38 | 65.32 | 97.12 |
| C1017 | 97.41 | 99.22 | 94.12 | 94.12 | 100.00 | 79.84 |
| C1018 | 97.41 | 91.13 | 86.84 | 100.00 | 12.10 | 82.61 |
| C1019 | 95.69 | 83.96 | 89.47 | 83.96 | 94.17 | 56.52 |
| C1020 | 84.48 | 88.71 | 88.16 | 95.19 | 93.33 | 83.87 |
| C1021 | 89.66 | 75.81 | 75.00 | 77.67 | 78.63 | 66.94 |
| C2026 | 81.82 | 71.72 | 71.72 | 98.28 | 68.33 | 38.46 |
| C2027 | 98.28 | 89.06 | 98.39 | 100.00 | 94.84 | 88.46 |
| C2028 | 98.28 | 100.00 | 95.93 | 100.00 | 83.87 | 99.04 |
| C2030 | 100.00 | 100.00 | 96.72 | 100.00 | 83.61 | 100.00 |
| C2031 | 95.69 | 100.00 | 97.00 | 100.00 | 83.61 | 97.12 |
| C2032 | 99.14 | 96.09 | 100.00 | 100.00 | 98.85 | 99.04 |
| C2034 | 98.28 | 98.44 | 95.87 | 99.16 | 83.33 | 100.00 |
| C2035 | 42.24 | 87.50 | 78.27 | 100.00 | 83.33 | 78.27 |
| C2036 | 98.28 | 97.66 | 98.61 | 100.00 | 82.91 | 100.00 |
| C2039 | 96.55 | 88.49 | 88.98 | 83.90 | 76.86 | 96.15 |
| C2041 | 92.24 | 98.44 | 92.97 | 92.50 | 81.67 | 100.00 |
| *M* | 81.96 | 82.27 | 79.36 | 86.89 | 77.08 | 80.45 |
| *SD* | 23.79 | 24.71 | 25.55 | 23.31 | 21.08 | 25.96 |

Note. Highlighted cells represent days when participants were absent. For these days, the participant's mean FP PAHR > 50 was used in the analysis.

Mean Physical Activity Data for All FP Sessions

| Participant Code | Mean Physical Activity Heart Rate (bpm) | Mean Accelerometer Count | Mean PAHR > 50 (%time) |
|---|---|---|---|
| C1001 | 145.78 | 61.79 | 94.82 |
| C1002 | 165.96 | 123.01 | 88.35 |
| C1004 | 139.38 | 60.21 | 80.15 |
| C1005 | 135.20 | 40.73 | 23.33 |
| C1006 | 128.34 | 49.57 | 67.72 |
| C1007 | 152.34 | 80.21 | 93.17 |
| C1008 | 127.93 | 16.73 | 16.41 |
| C1011 | 150.13 | 86.46 | 51.82 |
| C1013 | 165.51 | 74.90 | 80.49 |
| C1014 | 157.59 | 111.20 | 91.40 |
| C1016 | 150.28 | 42.19 | 78.67 |
| C1017 | 157.29 | 105.62 | 94.12 |
| C1018 | 134.39 | 44.78 | 78.35 |
| C1019 | 172.54 | 132.11 | 83.96 |
| C1020 | 138.19 | 58.14 | 88.96 |
| C1021 | 141.38 | 78.11 | 77.28 |
| C2026 | 146.30 | 98.20 | 71.72 |
| C2027 | 163.00 | 97.06 | 94.84 |
| C2028 | 172.94 | 98.96 | 96.19 |
| C2030 | 151.42 | 133.97 | 96.72 |
| C2031 | 167.43 | 139.99 | 95.57 |
| C2032 | 144.27 | 73.98 | 98.85 |
| C2034 | 152.43 | 121.14 | 95.85 |
| C2035 | 162.29 | 96.20 | 78.27 |
| C2036 | 171.02 | 119.77 | 96.24 |
| C2039 | 144.71 | 78.26 | 88.49 |
| C2041 | 138.64 | 77.79 | 92.97 |
| *M* | 150.99 | 85.23 | 81.29 |
| *SD* | 13.41 | 32.79 | 21.07 |

Appendix L—Inter- and Intra-rater Reliability Results

Appendix L— Inter- and Intra-rater Reliability Results

Inter-rater reliability results.

| Condition | MC | | | | | |
|---|---|---|---|---|---|---|
| Session | 2 | 2 | 2 | 2 | 6 | 6 |
| Class | 1 | 2 | 1 | 2 | 2 | 1 |
| Teacher | A | A | B | B | B | B |
| Expert & Coder 1 *kappa* | 1.00 | 1.00 | 1.00 | .90 | .99 | .90 |
| Expert & Coder 2 *kappa* | .94 | 1.00 | .80 | 1.00 | .94 | .89 |
| Coder 1 & Coder 2 *kappa* | .93 | 1.00 | .80 | 1.00 | 1.00 | .99 |
| Condition | PC | | | | | |
| Session | 1 | 1 | 1 | 1 | 4 | 4 |
| Class | 1 | 2 | 1 | 2 | 1 | 2 |
| Teacher | A | A | B | B | A | A |
| Expert & Coder 1 *kappa* | .90 | 1.00 | 1.00 | 1.00 | 1.00 | .95 |
| Expert & Coder 2 *kappa* | 1.00 | .98 | .81 | .96 | .96 | .91 |
| Coder 1 & Coder 2 *kappa* | 1.00 | .97 | .82 | .96 | 1.00 | 1.00 |
| Condition | FP | | | | | |
| Session | 3 | 3 | 3 | 3 | 5 | 5 |
| Class | 1 | 2 | 1 | 2 | 1 | 2 |
| Teacher | A | A | B | B | B | B |
| Expert & Coder 1 *kappa* | .95 | .90 | .90 | 1.00 | .99 | 1.00 |
| Expert & Coder 2 *kappa* | .83 | .91 | .91 | .90 | .93 | .90 |
| Coder 1 & Coder 2 *kappa* | .82 | .89 | .89 | .90 | 1.00 | .90 |

Intra-rater reliability results for coder 1.

| Condition | MC | | | | | |
|---|---|---|---|---|---|---|
| Session | 3 | 3 | 6 | 6 | 6 | 6 |
| Class | 2 | 2 | 1 | 1 | 2 | 2 |
| Teacher | A | B | A | B | A | B |
| Coder 1 *kappa* | .90 | .89 | 1.00 | .95 | .90 | .96 |
| Condition | PC | | | | | |
| Session | 4 | 4 | 4 | 4 | 5 | 5 |
| Class | 1 | 1 | 2 | 2 | 1 | 2 |
| Teacher | A | B | A | B | B | B |
| Coder 1 *kappa* | .99 | .85 | .90 | .89 | .95 | 1.00 |
| Condition | FP | | | | | |
| Session | 4 | 4 | 5 | 5 | 5 | 5 |
| Class | 1 | 2 | 1 | 1 | 2 | 2 |
| Teacher | A | A | A | B | A | B |
| Coder 1 *kappa* | .90 | .90 | .99 | .95 | .99 | .95 |

Intra-rater reliability results for coder 2.

| Condition | MC | | | | | |
|---|---|---|---|---|---|---|
| Session | 1 | 1 | 2 | 2 | 2 | 2 |
| Class | 1 | 2 | 1 | 1 | 2 | 2 |
| Teacher | A | A | A | B | A | B |
| Coder 2 *kappa* | .92 | .94 | .90 | .98 | .94 | .90 |
| Condition | PC | | | | | |
| Session | 1 | 1 | 1 | 1 | 2 | 2 |
| Class | 1 | 1 | 2 | 2 | 1 | 2 |
| Teacher | A | B | A | B | B | B |
| Coder 2 *kappa* | .99 | .98 | 1.00 | .91 | .96 | .96 |
| Condition | FP | | | | | |
| Session | 2 | 2 | 3 | 3 | 3 | 3 |
| Class | 1 | 1 | 1 | 1 | 2 | 2 |
| Teacher | A | B | A | B | A | B |
| Coder 2 *kappa* | .91 | .91 | .93 | .93 | .90 | .99 |

# Appendix M—BEST Manipulation Check Results

Appendix M— BEST Manipulation Check Results

Pearson product correlation coefficient output for each physical activity condition based on session and class

| | | MC | PC | FP |
|---|---|---|---|---|
| Session | Class | *r* | *r* | *r* |
| 1 | 1 | .996 | 1.000 | .987 |
| | 2 | .999 | 1.000 | .986 |
| 2 | 1 | .999 | .999 | .994 |
| | 2 | .999 | .996 | .999 |
| 3 | 1 | .988 | 1.000 | .998 |
| | 2 | .995 | .999 | .995 |
| 4 | 1 | .999 | 1.000 | .999 |
| | 2 | .995 | 1.000 | .994 |
| 5 | 1 | .998 | 1.000 | .998 |
| | 2 | 1.000 | 1.000 | .999 |
| 6 | 1 | .984 | 1.000 | .998 |
| | 2 | .998 | 1.000 | .999 |

Note. All values were significant at the $p < .001$ level.

Pearson product correlation coefficient output for each physical activity condition based on session and teacher

| | | MC | PC | FP |
|---|---|---|---|---|
| Session | Teacher | *r* | *r* | *r* |
| 1 | A | 1.000 | .999 | .998 |
| | B | .999 | .999 | .999 |
| 2 | A | 1.000 | .995 | 1.000 |
| | B | 1.000 | .988 | .998 |
| 3 | A | .985 | .999 | .999 |
| | B | .954 | .998 | .987 |
| 4 | A | .999 | 1.000 | .995 |
| | B | .995 | 1.000 | .994 |
| 5 | A | .993 | 1.000 | .998 |
| | B | .998 | 1.000 | .995 |
| 6 | A | 1.000 | 1.000 | .999 |
| | B | .998 | .999 | .995 |

Note. All values were significant at the $p < .001$ level.

Pearson product correlation coefficient table for the six physical activity sessions of the MC condition

| Session | | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 2 | *r* | .876 | x | | | |
| 3 | *r* | .897 | .996 | x | | |
| 4 | *r* | .928 | .991 | .997 | x | |
| 5 | *r* | .895 | .996 | .998 | .996 | x |
| 6 | *r* | .897 | .994 | .998 | .996 | .997 |

Note. All values were significant at the $p < .001$ level.

Pearson product correlation coefficient table for the six physical activity sessions of the PC condition.

| Session | | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 2 | *r* | .991 | x | | | |
| 3 | *r* | .997 | .997 | x | | |
| 4 | *r* | .999 | .995 | .999 | x | |
| 5 | *r* | .994 | .995 | .999 | .998 | x |
| 6 | *r* | .977 | .985 | .990 | .984 | .994 |

Note. All values were significant at the $p < .001$ level.

Pearson product correlation coefficient table for the six physical activity sessions of the FP condition

| Session | | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 2 | *r* | .995 | x | | | |
| 3 | *r* | .997 | .994 | x | | |
| 4 | *r* | .996 | .997 | .998 | x | |
| 5 | *r* | .996 | .996 | .994 | .996 | x |
| 6 | *r* | .999 | .998 | .998 | .999 | .998 |

Note. All values were significant at the $p < .001$ level.

Means and standard deviations for the three physical activity conditions; and F-values, degrees of freedom and p-values for the 16 BEST keys

| BEST key codes | | MC | PC | FP | *F* | df |
|---|---|---|---|---|---|---|
| Adapt Task | *M* | 1378.87[ab] | .04[ac] | 22.99[bc] | 655.70 | 2, 46 |
| (seconds) | *SD* | 261.54 | .20 | 34.47 | | |
| Kids Decis | *M* | 1630.35[ab] | .54[ac] | 93.17[bc] | 755.84 | 2, 46 |
| (seconds) | *SD* | 270.93 | 2.01 | 64.13 | | |
| Imprv Rec | *M* | 5.66[b] | 7.68[c] | .77[bc] | 12.14 | 2, 46 |
| (frequency) | *SD* | 5.65 | 6.65 | 1.00 | | |
| Kids Grp | *M* | 1142.71[ab] | 34.22[ac] | 74.65[bc] | 63.91 | 2, 46 |
| (seconds) | *SD* | 654.88 | 40.02 | 72.88 | | |
| Prev Cmpr | *M* | 1.18[b] | .75[c] | .00[bc] | 9.27 | 2, 46 |
| (frequency) | *SD* | 1.42 | .93 | .00 | | |
| Flex Time | *M* | 1358.60[ab] | .00[ac] | 2.44[bc] | 692.76 | 2, 46 |
| (seconds) | *SD* | 255.76 | .00 | 4.21 | | |
| Inflex Task | *M* | 440.53[ab] | 1029.5[ac] | 93.89[bc] | 13.52 | 2, 46 |
| (seconds) | *SD* | 256.74 | 1116.06 | 44.18 | | |
| Tchr Decis | *M* | 1.62[ab] | 1028.95[ac] | 17.88[bc] | 19.93 | 2, 46 |
| (seconds) | *SD* | 5.94 | 1115.49 | 29.02 | | |

| BEST key codes | | MC | PC | FP | *F* | df |
|---|---|---|---|---|---|---|
| Win Luck | *M* | .06 [b] | 7.82 [c] | .00 [bc] | 46.15 | 2, 46 |
| (frequency) | *SD* | .20 | 5.61 | .00 | | |
| Tchr Grp | *M* | .17 [a] | 1472.48 [ac] | .63 [c] | 42.11 | 2, 46 |
| (seconds) | *SD* | .59 | 1110.93 | 2.10 | | |
| Other Cmpr | *M* | .11 [a] | 8.72 [ac] | .10 [c] | 46.76 | 2, 46 |
| (frequency) | *SD* | .28 | 6.15 | .28 | | |
| Inflex Time | *M* | 499.30 [ab] | 2323.90 [ac] | 107.58 [bc] | 13.26 | 2, 46 |
| (seconds) | *SD* | 244.35 | 210.39 | 58.56 | | |
| Free Play | *M* | .09 [b] | .06 [c] | 1572.80 [bc] | 6077.85 | 2, 46 |
| (seconds) | *SD* | .31 | .28 | 98.79 | | |
| Gen Rec | *M* | 13.32 [b] | 13.72 [c] | 2.26 [bc] | 12.00 | 2, 46 |
| (frequency) | *SD* | 12.30 | 8.09 | 2.32 | | |
| Class Manage | *M* | 306.43 [a] | 865.28 [ac] | 259.29 [c] | 76.71 | 2, 46 |
| (seconds) | *SD* | 113.04 | 326.89 | 133.66 | | |
| Instruct | *M* | 201.8 [ab] | 284.09 [ac] | 6.13 [bc] | 172.75 | 2, 46 |
| (seconds) | *SD* | 61.99 | 73.97 | 12.60 | | |

Note. [a] denotes a significant mean difference between the MC and PC at the $p < .05$ level.

[b] denotes a significant mean difference between the MC and FP at the $p < .05$ level.

[c] denotes a significant mean difference between the PC and FP at the $p < .05$ level.