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The Effect of Physical Education Climates on Elementary Students' Physical Activity Behaviors

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Abstract

BACKGROUND—With the growing need for children from underserved populations to be physically active it is imperative to create developmentally appropriate and enjoyable physical education programs that promote physical activity. The purpose of this study was to determine the effects of mastery and performance climates on physical activity during physical education.

METHODS—Children (N = 108) in grades K-2 from a rural southeastern elementary school in the US were randomly assigned to a mastery or performance oriented climate. The climates were implemented over 10 school days during regular scheduled physical education classes, and physical activity was measured with pedometers and SOFIT. Two experts in mastery motivational climates served as teachers for the study and were counterbalanced between conditions.

RESULTS—Results showed that steps/minute were significantly higher for the mastery condition and participants in the mastery condition spent significantly less time sitting ($p < .001$) and in management ($p < .001$) and more time in moderate-to-vigorous physical activity (MVPA; $p = .002$) and fitness activities ($p = .001$).

CONCLUSION—Results indicate that a mastery approach, which allows children the opportunity to drive their own physical activity, elicits higher step counts and more time spent in MVPA compared to a performance-oriented approach.

Keywords

mastery motivational climate; performance-oriented climate; pedometers; SOFIT

Current recommendations state that children, ages 5 to 18 years, should engage in a minimum of 60 minutes of daily, moderate-to-vigorous physical activity (MVPA) that incorporates the cardiorespiratory and musculoskeletal systems.[1] In Alabama, 70% of

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school-age children do not meet the daily recommendation for physical activity and only 33.3% have physical education on a daily basis.[2] In the United States, 31.7% of children are overweight and 16.8% are obese.[3] Furthermore, 34.5% of children living in the rural South are overweight, and 19.5% are obese.[4] Children who are overweight are at-risk of poor health and demonstrate a high prevalence of hypokinetic diseases that are commonly seen in adults (ie, heart disease, type II diabetes, stroke, several types of cancer, and osteoarthritis).[5] The exact etiology of childhood obesity is not evident, but physical activity is a major contributor to good health and is associated with weight control. With the growing need for children to be physically active, it is imperative to create developmentally appropriate, cost effective and motivating physical education programs that promote physical activity.

In response to this concern, researchers have investigated the effect of motivational climates on early childhood movement and physical education programs to understand the motivational process of student engagement.[6-10] Motivational climates reflect the salient features of an environment and define how an instructor incorporates and emphasizes various instructional strategies such as the delivery of feedback, rewards, and punishment.[11] Mastery-oriented climates are a specific type of motivational climate based on achievement motivation theory.The goal of a mastery-oriented climate is to create a motivating learning environment where effort is encouraged and the learning process is reinforced.[12-15] Mastery-oriented climates emphasize key environmental characteristics and instructional cues that are indicative of and lead to the adoption of mastery-oriented achievement goals. These key environmental characteristics and instructional cues, conceptualized by Ames,[12,13] are based on Epstein's[14,15] 6 dimensional TARGET structures (Table 1). The acronym TARGET stands for *Task, Authority, Recognition, Grouping, Evaluation*, and *Time*. A mastery-oriented motivational climate is characterized as autonomy supportive through the implementation of these 6 TARGET structures that allow the learner to navigate their own learning experience and physical engagement by placing the level, duration and type of task engagement in the hands of the student. Individuals invest more effort into a task in mastery oriented climates because they focus on demands and overcoming challenges that are autonomous or self-determined, subsequently increasing intrinsic motivation and perceptions of competence leading to greater effort.[16]

Researchers have found that children enrolled in mastery-oriented climate physical education and sport programs effectively engage in the lessons and self-management,[17] express enjoyment,[18,19] display positive attitudes toward physical activity,[20] and intend to be physically active.[19,21] As it relates specifically to children's physical activity, Parish et al[7,8] demonstrated that a mastery-oriented climate results in higher levels of MVPA during physical play sessions for toddlers and preschoolers compared to a performance climate. Furthermore, aspects of motivational climates, such as the need for autonomy have been linked to motivation to engage in leisure time physical activity outside of physical education[22] and autonomous motivation for physical education is linked to higher levels of self-reported leisure time physical activity in early adulthood.[23] However, studies have not manipulated nor implemented a mastery climate to assess the effect on physical activity accumulated during physical education.

A performance-oriented climate is characterized by the teacher having more control over the learning environment as opposed to serving as a facilitator. Emphasis is placed on competition (eg, outperforming others) to achieve success. In this climate, the teacher drives learning and is responsible for making decisions about children's physical activity engagement. Performance-oriented climates are a traditional teacher-centered approach that is commonly used in physical education settings. Past research has shown that performance-oriented climates can promote motor skill development and learning in children.[9,24,25]

Previous studies in physical education have focused on motivational regulation such as perceived competence but have not established which motivational climates are effective in promoting sufficient physical activity during physical education.[16,18] This information is important because physical education contributes to children meeting physical activity guidelines and accounts for approximately 8.7%-23.7% and 11.4%-17.2% of daily steps for boys and girls respectively.[26] With the growing need for children to be more physically active and knowing that physical activity established early in life tracks into adulthood,[27] there is a need to optimize the physical education climate to promote physical activity participation to meet the recommendation that 50% of physical education class time be spent in MVPA.[28] Therefore, the aim of this study was to determine the effectiveness of mastery-oriented and performance-oriented climates on physical education physical activity participation in a sample of rural, children.

METHODS

Participants

This study was conducted in a small, rural, southeastern elementary school in Alabama. The school is comprised of 127 (48% males) students in K-2 and 97.4% of the school's population is African American with 98% enrolled in free or reduced lunch. Children enrolled in kindergarten, first and second grade, served as participants for this study. The 3 homeroom classes for each grade combine for one 45-minute physical education period, 5 days a week.

Recruitment letters and consent forms were distributed to the parents or guardians for each child enrolled in grades K-2. Parental or guardian consent and child assent were obtained in accordance with the project protocol approved by the Institutional Review Board for 113 children (89% response rate). After consent, children were randomly assigned to either a mastery-oriented (N = 56) or a performance-oriented (N = 57) physical education climate. Each participant met the following criteria for analysis: (1) participated in the acclimation period; and (2) participated in a minimum of 80% of data collection. Two children were absent during the acclimation period and 3 children did not participate in 80% of the data collection. The final sample size for this study was 108, with 53 participants in the mastery-oriented condition and 55 in the performance-oriented condition. The sample analyzed consisted of 33 kindergarteners, 40 first-graders, and 35 second-graders with an age range of 5-9 years and a ethnicity/race demographic of 77% Black, 17% Hispanic and 6% White. Participant demographics are provided in Table 2.

Conditions

In this study, the teacher implementing the mastery climate provided private recognition to students based on individual progress and evaluated students in reference to task mastery and individual improvement. Students were given the opportunity to make choices, involve themselves in leadership roles, participate in a variety of learning experiences and peer interactions (eg, cooperative and independent), and were allowed to choose the length of engagement necessary to master a skill (ie, based on his/her personal capabilities) in a variety of challenging and diverse tasks.

The performance-oriented climate focused on normative- and other-referenced criteria for judging student ability (ie, completing a certain number of laps or goals). [29] Descriptions of the physical education climates in reference to the TARGET[14,15] dimensions are provided in Table 1. A performance-oriented climate was the physical education instructional approach that was used in this school prior to this study.

Instruments

Pedometers—New Lifestyles Yamax NL-200 pedometers were used to measure steps for each participant. Prior to data collection, a 20-step field-based pedometer check was conducted to assess step count measurement accuracy for all pedometers. The check demonstrated that the pedometers accurately counted steps (error was +/− 1 step) for children in K-2. Previous reliability and validity testing of the pedometer showed that the Yamax accurately records the number of steps taken, has the most consistency between units, and is the most accurate at moderate activity levels.[30] The pedometer was secured to a pedometer belt that was placed around the participants' waist and adjusted so that the pedometer was located on the right side in midline with the quadriceps. The pedometer was closed and the students could not see the step count. At the end of each 30-minute physical activity portion of the class, the pedometers were removed and a research technician recorded the total count of accumulated steps.

System for Observing Fitness Instruction Time (SOFIT)—*SOFIT* is an objective measure commonly used in physical education settings to determine the activity levels of students.[31] SOFIT uses momentary time sampling analysis (10-second observe, 10-second record) to quantify 3 aspects of physical education objectively: student physical activity levels, lesson context, and teacher behaviors. For this study, sedentary behaviors represent the time spent lying down, sitting, and standing, and MVPA represents the percentage of time spent walking and being very active.[32-34] The second dimension of SOFIT, focuses on the curricular lesson context decision that is coded as management, knowledge content, fitness, skill practice, game play, or other. The third dimension of the SOFIT instrument provides frequencies of teacher prompts for in-class and out-of-class physical activity. SOFIT was analyzed via videotape. Video cameras were placed at opposite corners of the physical education setting. After pedometers were attached, participants for SOFIT analysis were randomly selected (every third child) from each climate, with equal representation by sex. Videotapes were analyzed and coded by one trained observer who was unfamiliar with the purpose of the study and the experimental conditions. The SOFIT technician achieved an inter-rater reliability of .92 prior to data analysis and was trained by an expert observer, the SOFIT training manual, and a video.[34] Reliability was checked on 25% of the 60 classes (8 mastery, 7 performance classes over all lesson plans) against a trained SOFIT observer, and all observation checks ranged from .92 to .98.

A manipulation check was conducted to ensure that the 2 climates were delivered according to the TARGET structures and that delivery of the climate did not differ by teacher. A trained observer who was unfamiliar with the intent of the study completed the manipulation check. The observer completed the analysis by observing and listening to videotapes of all 60 sessions to determine which criteria of the TARGET structure was being implemented (high autonomy, low-autonomy or neither). There was 100% agreement between the trained observer and the proposed climate implemented for the TARGET structures within the instructional climates. In addition, an equal number of reinforcement cues were tallied and did not differ by teacher within each condition.

Procedure

Following randomization, students participated in a 5-day acclimation period to become familiar with the procedures (ie, group assignment, climate, and placement of pedometers). During the acclimation period, the children participated in their respective climates, had access to the physical education equipment, wore the pedometers, and were observed with video cameras. Lesson plans and stations used in the acclimation period were similar to those used during data collection. Previous research supports that a 5-day acclimation period is sufficient for children to become familiar with the physical education climate, teachers,

wearing a pedometer, testing protocol and procedures, equipment, and setting.[9,35,36] Upon completion of the acclimation period, data were collected for 10 consecutive physical education classes. To ensure that the motivational climate was manipulating the students' physical activity behaviors during physical education, the lesson plan and objective for each physical education session was identical for both climates; the only difference was the motivational mastery- or performance-based approach. All lessons consisted of: (1) a 5-minute introduction to the lesson, (2) 30-minutes of physical education instruction, practice, and engagement; and (3) a 5-minute closure and cool-down. Five additional minutes of class time during the physical education period was used as transition time to and from the classrooms. During the introduction, the children reviewed the rules for engagement, the pedometers were attached, and video recording for SOFIT analysis began. Children were given brief demonstrations of the physical activity stations incorporated into the daily lesson. Children participated in the stations during the 30-minutes of physical education instruction. Each class period consisted of 5 activity stations designed to emphasize MVPA when performing fundamental motor skill activities. The activity stations were identical for both climates; however, the type of engagement at the stations was dictated by the climate. For example, a child exposed to the mastery climate chose the station at which to play, the length of time to play at a station, with whom they played, and the type of activity at the station. In contrast, in the performance climate the instructor grouped the students, dictated time at each station, and directed the type of activity at each station. The closing consisted of cool-down activities, while pedometers were removed from each child. The physical education climates were implemented by 2 of the investigators who have experience in early childhood motor development and physical activity, and have had extensive experience in implementing each climate. To minimize teacher effects, the teachers were counterbalanced between the 2 climates (ie, each teacher implemented and instructed 5 mastery- and 5 performance-oriented physical education classes). There were 5 lesson plans and each teacher implemented each lesson plan once for each climate. The school's physical education teacher and teaching assistant were present, but did not provide instruction. The climates were implemented in a gymnasium that was divided by a curtain, so that participants could not see the other condition.

Data Analysis

Descriptive statistics were generated to describe the sample. Over the course of the study, 5 students checked out of physical education early; therefore, pedometer output of steps was transformed into steps/minute by dividing the number of steps taken during the physical activity engagement period by the amount of time the pedometer was worn (ie, 30 minutes). Because the manipulation check indicated that 2 separate climates were successfully implemented, the steps/minute for each day were combined for an overall mean step/minute. A 2 (condition) × 2 (sex) ANOVA was used to determine differences in steps/minute between the 2 climates. A MANOVA was used to determine differences between the climates in SOFIT outcomes [physical activity (time spent lying, sitting, standing, and MVPA), lesson context (time spent in management, knowledge, fitness, skill, game, and other) and number of physical activity prompts over the 10 days. Alpha level was set at .05 *a priori* and data were analyzed using SPSS version 17.

RESULTS

Descriptive results can be found in Table 2. In terms of the pedometer analysis the ANOVA revealed a significant main effect for condition ($F = 7.02$, $p < .001$), and no effect for sex ($p = .936$) or a Condition × Sex interaction ($p = .378$). Children in the mastery-oriented physical education climate accumulated an average of 11 more steps per minute than the children in the performance-oriented physical education classes. The MANOVA results

showed that participants in the mastery condition spent significantly less time sitting ($p < .001$) and in management ($p < .001$) and more time in MVPA ($p = .002$) and fitness activities ($p = .001$). There were no differences for additional SOFIT categories (Table 3).

DISCUSSION

This study investigated the influence of mastery- and performance-oriented physical education climates on physical activity (ie, pedometer step count and MVPA measured through SOFIT observation) in children in grades K-2. The mastery-oriented climate resulted in higher levels of physical activity compared to a performance-oriented climate. Students in the mastery climate had the opportunity to select tasks and perform the task at their own comfort level. Students also were given the opportunity to make choices, involve themselves in leadership roles, participate in a variety of learning experiences and peer interactions (eg, cooperative and independent), and were allowed to choose the length of practice time necessary to master a skill. These findings show that physical activity participation for children in grades K-2 is positively affected when the instructional climate for their physical education program emphasizes a mastery-climate and implements the 6 TARGET structures.[13]

It is recommended that a minimum of 33.3% and a preference level of 50% of physical education time be devoted to MVPA.[28] According to Scruggs,[32] 10 minutes of MVPA in a 30-minute physical education class (ie, representing approximately 33.3% of class time in MVPA) equates to 60-63 steps/minutes for first and second grade children. The participants in the mastery condition met this steps/minute recommendation, whereas, participants in the performance climate did not. These differences occurred, even though children received approximately an equal number of prompts to be physically active (mastery average number of prompts = 48, performance average number of prompts = 49). Furthermore, the SOFIT results showed that children spent 20% more of the lesson in MVPA during the mastery condition compared to the performance condition. However, the SOFIT results showed that both climates engaged in MVPA for at least 33.3% of the class time, but mastery participants engaged in significantly more MVPA. It is important to note that the step count recommendation was derived from first and second grade students, and this study sample included kindergarten students. Difference in height and stride length may account for differences between meeting steps/minute recommendations.

Mastery climates are designed to encourage the learner to manage their engagement in a task, whereas, a performance climate is designed to dictate task participation. Based on these results, the constraints of the performance-oriented climate required the teachers to spend 20% more time in class management, resulting in 16% more time spent sitting and less time in MVPA. In contrast, the mastery climate required considerably less management by the teacher (3% of the lesson). This finding is important because school time constraints are reducing time in physical education; therefore, implementing instructional approaches that maximize children's activity time are necessary to help children meet physical activity recommendations. Although not measured in this study, it must be noted that differences in MVPA between the conditions may be attributed to increases in intrinsic motivation that are associated with TARGET structures implemented within the mastery-oriented condition. A mastery climate provides choice and autonomy by emphasizing self-determined criteria for success. Further, because of its focus on improvement, learning, and self-development at achievement tasks, a mastery climate may facilitate a sense of enjoyment. Performance climates are more controlling and provide extrinsic criteria for success which leads to less positive psychological outcomes.[37] Nicholls[38] and Ames[12,13] consider a mastery approach to be linked intimately to intrinsic motivation and positive affect. Being intrinsically motivated drives an individual, and is a prerequisite for effort and persistence to sustain

physical activity engagement.[12,16] Future studies need to investigate changes in physical activity, motivation, and affect that result from mastery climates.

In addition to higher levels of physical activity, mastery climates have been shown to be effective in promoting higher perceptions of physical competence[9,39] and motor competence.[9,35,39] These factors are critically important with respect to children's achievement motivation.[38] Specifically, as young learners become more proficient in performing a task they also experience higher perceptions of physical competence that increases their motivation to learn how to move. In contrast, young learners who are unsuccessful in learning their skills have low perceptions of motor skill competence. In a mastery climate, effort and ability are less clearly differentiated as causes of achievement, thereby allowing success to be dictated by the learner. On the other hand, a performance climate enhances the differentiation between ability and effort, because normative ability is rewarded, and success with low effort could be seen as indicative of even greater ability.[40]

Significant differences in physical activity between girls and boys were not present. This finding is similar to other studies examining physical activity of elementary[32] and middle[41] school students during structured physical activity contexts. Specifically, boys and girls demonstrated similar physical activity levels regardless of the climate condition. In unstructured activity contexts, such as recess, children as young as preschool- and kindergarten-age demonstrate sex differences in activity level with boys demonstrating higher levels.[42] These sex disparities in unstructured activities underscore the need for structured physical activity opportunities for young children, particularly for girls.

Limitations

This study had several limitations. First, trained researchers, not physical education teachers, delivered the conditions. More research is necessary to determine if physical education teachers can apply a mastery motivational climate to enhance physical activity participation. Second, this is a small sample of elementary school children from one geographic location, primarily of African American descent. Results cannot be generalized to K-2 children from other locations and racial/ethnic groups. However, we suspect that the findings will be similar regardless of location and racial/ethnic groups. In addition, the small sample size limited our ability to examine grade and race differences. Third, although the manipulation check identified that 2 separate climates were implemented, this study did not measure how the children perceived the physical education climate nor changes in their intrinsic motivation or affect. Existing climate perception measures exclude young children because they require a child to read. Additional pictorial scales which measure children's perception of the climate need to be developed and validated. Fourth, this study did not examine the impact of the physical education climates on school day or out-of-school physical activity, nor did it investigate intrinsic motivation. According to the literature, physical education class only accounts for 8.7%-23.7% in boys and 11.4%-17.2% in girls, of total recommended daily steps.[26] Although, physical education alone cannot meet daily physical activity recommendations, participation during physical education does contribute to meeting 60 minutes of daily MVPA. However, the ability for physical education to influence out-of-school physical activity is not evident.[43] The strengths of this study are that we employed randomization and showed that a mastery climate increased physical activity participation using 2 objective measures. Future studies should investigate if certain physical education climates can increase physical activity participation outside of physical education and determine the duration of the effect. To gain a better understanding of the overall effects of mastery climates on physical activity behaviors, future interventions should investigate changes in participants' intrinsic motivation along with their perceptions of physical competence and physical activity outcomes. It also would be beneficial to see if the results could be replicated in more diverse populations and with physical education teachers.

Conclusions

In summary, these results demonstrate that school-age children accumulated higher step counts and MVPA when participating in a mastery-oriented physical education program compared to a performance-oriented climate. Some of the primary objectives in elementary physical education programs are to promote physical activity engagement, motor skill development, physical competence, and positive physical self-perceptions.[9,28] Previous studies suggest that a mastery-oriented approach enhances gross motor skill development and perceived physical competence. This study suggests that a mastery approach elicits more physical activity and creates an effective physical education climate for children in grades K-2 in a rural school setting.

IMPLICATIONS FOR SCHOOL HEALTH

Mastery-climate is an instructional approach that does not require additional resources to implement such as other curriculum-based physical education programs. Physical education policies might benefit from defining and implementing high autonomy instructional approaches in elementary physical education. Specifically, teachers should aim to provide a variety of challenging and diverse tasks, allow children to select their own tasks, perform the task at their comfort level, and allow the student to determine the length of time at a task, while providing task-specific feedback to the students. As with any instructional approaches there are challenges and obstacles to effective implementation. With respect to mastery climates, teachers may experience difficulty in developing fun and challenging activities that meet the range of skill levels among the learners, and deviating from a more structured approach (ie, students participate in specific stations for a set amount of time before rotating to a second station). Another adjustment is the shift in the teacher's role within the classroom. In a mastery climate, students are driving their own learning, while the teacher is now the facilitator. At first this is a difficult shift in control to accept and the students must learn to "self-manage," but with time, both the teacher and students will see that the autonomy supportive environment created within a mastery climate is an effective approach for physical education instruction.

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Table 1

Descriptions of the MMCPEP and LAPEP Conditions in Reference to the TARGET Structure

Target Structure	MMCPEP	LAPEP
Task	Student works on a variety of tasks and activities at his/her own ability level and is encouraged and/or helped to set realistic, short-term, self-referenced goals.	Tasks are common for all participants in a competitive environment, where success is based on ability comparisons.
Authority	Students are allowed to make decisions about their lessons (eg, choosing a task from a variety of options).	The teacher makes all the decisions such that the responsibility within the learning environment lies with the teacher.
Recognition	Recognition and feedback are focused on individual effort, knowledge, and skill development and feedback and rewards are distributed privately.	Recognition and feedback are based on individual ability/knowledge comparing individuals against others, or comparing one group to another.
Grouping	Participants work in small groups or alone and use flexible, heterogeneous grouping arrangements (which limit ability comparisons).	The teacher organizes the participants into groups based on ability and teacher preference (allows for more obvious social comparisons).
Evaluation	Evaluation is self-referenced,and incorporates an individualized criterion of progress, improvement, and task.	Evaluation is based on normative ability comparison in public, which in turn facilitates social comparison.
Time	Student driven	Teacher Driven

Table 2

Descriptive Data for the MMCPEP and LAPEP Conditions

	MMCPEP (N = 53)	**LAPEP (N = 55)**
Boys	29	32
Girls	24	23
Height (inches)	48.95(±3.42)	49.03(±2.59)
Weight (pounds)	56.93(±12.20)	61.14(±20.11)
Steps/Min Overall*	60(±16)	49(±11)
Steps/Min Boys	60(±14)	49(±14)
Steps/Min Girls	59(±15)	48(±11)

Note: Significant differences between climates; $p < .05$.

Table 3

SOFIT Results for the MMCPEP and LAPEP Conditions

	MMCPEP (N = 53)	LAPEP (N = 55)
Physical Activity		
Lying down	1 min.	1 min.
Sitting*	3 min.	8 min.
Standing	7 min.	9 min.
MVPA*	19 minute	12 min.
Lesson Context		
Management*	1 min.	7 min.
Knowledge	2 min.	2 min.
Fitness*	10 min.	5 min.
Skill	12 min.	12 min.
Games	0 min.	0 min.
Other	5 min.	4 min.
Teacher Behavior		
In class prompts	48	49
Out of class prompts	0	0

Note: Significant differences between climates; $p < .05$.