Environmental Characteristics and Student Physical Activity in PE Class: Findings From Two Large Urban Areas of Texas

Katherine A. Skala, **Andrew E. Springer**, **Shreela V. Sharma**, **Deanna M. Hoelscher**, and **Steven H. Kelder**

Abstract

Background—Physical education (PE) classes provide opportunities for children to be active. This study examined the associations between specific environmental characteristics (teacher characteristics; class size, duration and location; and lesson context) and elementary school-aged children's moderate-to-vigorous activity (MVPA) during PE.

Methods—Environmental characteristics and student activity levels were measured in 211 3rd, 4th and 5th grade PE classes in 74 Texas public schools using SOFIT direct observation.

Results—Students engaged in less than half their PE class time in MVPA (38%), while approximately 25% of class time was spent in classroom management. Percent time in MVPA was significantly higher in outdoor classes compared to indoors (41.4% vs. 36.1%, p=.037). Larger (p=.044) and longer (p=.001) classes were negatively associated with percentage of MVPA and positively correlated with time spent in management (p<.001).

Conclusions—Findings suggest that children's activity may be influenced by environmental factors such as class size, location, and lesson contexts. These findings hold important policy implications for PE class organization and the need for strategies that maximize children's MVPA. Further research is needed to test the causal association of these factors with student MVPA.

Keywords

physical education; health behavior; public health; physical activity; youth

INTRODUCTION

Physical education (PE) classes have been cited as one of the most important and available avenues for the promotion of physical activity (PA) among children at school [1]. Unfortunately, low levels of PA among children in PE classes have been reported in several studies [2-4]. Nader et al.[5] observed a sample of third grade PE classes from 684 U.S. elementary schools and found that the classes only accrued an average of 11.9 minutes of moderate-to-vigorous physical activity (MVPA) time (37% of class time). Results from other studies suggest a wide variability in the total percent of class time students spend in engage in MVPA during PE (8.5% to 43.9%)[4-6]. This variability in reported MVPA time during PE suggest the need to better understand both the pedagogy of PE as well as the environmental correlates of activity among children.

Ecological models of health behavior hold specific relevance for understanding children's PA behavior during school time given that children's PA may be less influenced by their individual motivations and more influenced by the context and content of time structured for PA. The four domains posited in the Ecological Model of Active Living [7], socio-cultural, built/physical, policy, and media/information, have relevant application to the PE setting. Evidence suggests that the extent to which teachers promote activity, demonstrate enthusiasm, and reward students may impact their level of activity [1, 8]. In addition, the role

of the built environment has demonstrated an impact on PA in terms of access to equipment and the location of the class [9]. Children's PA has been found to be positively associated with availability of PA-related equipment [9-11]. Location and facility of the class setting may also be important predictors of activity. Previous research indicates outdoor lessons are more active and indoor lessons involve more knowledge and sitting time [6, 10]. Finally, state and national level policies and guidelines have also affected PE by dictating frequency and duration of classes as well as class size, requiring specific curricula, teacher certifications and professional development[12], and setting standards for percent of class time student should be physically active [13].

One such guideline, The Healthy People 2010 report [13], includes as an objective that 50% of PE class time should be spent in MVPA. Little is currently known, however, about the proportion of classes that are currently meeting this objective, with the most recent report of activity levels of a large sample of US elementary children during PE conducted by McKenzie et al in 1995 [6]. Key changes have occurred in PE at the state, district, and school level over the past decade [12], and as a result, examining current activity levels of children during PE is important to understand the impact of these changes and inform future policy.

Furthermore, limited research has explored the association between environmental characteristics and percent of time spent in MVPA during PE of children in the US. While McKenzie et al[6] found the greatest energy was expended during fitness activities and the least was expended during knowledge-based activities, this study did not explore the bivariate associations between student activity and lesson context. To our knowledge, the only recent study that has explored this association was conducted by Chow et al[8] in Hong Kong among 4th-6th graders. Results from this study revealed that subject matter, proportion of time allocated to lesson content, and teacher behavior related to PA were all significant influences on students participation in MVPA[8]. This literature gap and the importance of understanding child PA through an ecological framework demonstrates the need to further examine the environmental characteristics that are directly associated with PA specifically among elementary physical education in the US.

The present study examined the associations between specific environmental characteristics (teacher characteristics, classroom characteristics, and lesson context) and MVPA in elementary school children during PE class. As a secondary aim, we explored the associations between teacher and classroom characteristics with lesson context.

METHODS

A secondary analysis was conducted on cross-sectional baseline data collected in fall 2006 from two coordinated school health intervention studies[14, 15] implemented in Houston and Austin, TX. At the onset of these studies, baseline data were collected from PE classes to measure PA and environmental characteristics within the school setting. Since both studies operated over the same time period and used similar study protocol and data collection methods, data from both studies were combined for the current study.

Approval for the original study upon which these data are based was obtained from the Committee for the Protection of Human Subjects at the University of Texas Health Science Center at Houston and participating school districts.

Sample

The study sample was based on 74 randomly selected public elementary schools located in two large metropolitan counties in Texas. Within the schools these Texas counties, 211 3rd, 4th, and 5th grade classes representing 6,740 students were measured.

Data collection Measures

PA levels and lesson context during PE class time were assessed using The System for Observing Fitness Instruction Time (SOFIT)[16]. SOFIT is a direct observation method that utilizes a momentary time sampling and interval recording system to assess PA levels and lesson context over a designated class period[16]. Three classes (3rd, 4th, and 5th grades) were observed at each school. Trained observers randomly select 4 students at the onset of the class to represent the activity of the entire class and code these students' activity over the entire class. SOFIT has been found to have strong evidence of inter-rater reliability and construct, concurrent, and discriminant validity for the measurement of MVPA and PE lesson context[16-20]. For the current study, data collectors were trained and certified in the SOFIT protocol[16], and reliability measures were taken in 10% of the classroom observations. Inter-rater agreement for all reliability measures exceeded 90%.

In addition to the direct observation of student activity, data collectors also recorded descriptive characteristics of the classroom, including grade level, gender of instructor, location of class (indoor, outdoor, or both), actual start and end time, total time observed, and number of students participating. Data on these variables were gathered via direct observation and structured interviews with PE instructor. Lastly, data on school-level ethnic composition and composition of economically disadvantaged students (determined by students who qualify for free or reduced price lunch) was obtained for the study schools from the Texas Education Agency (TEA)[21].

Study Variables

Two dependant variables were examined in this study: (1) minutes and percentage of class time spent in a specific lesson context (management, knowledge, skills, fitness, games and other/free-play based on the SOFIT method[16], and (2) minutes and percentage of class time children spent engaged in MVPA during their physical education classes.

Socio-demographic and contextual characteristics described above represented the independent variables under study. Lesson context is recorded simultaneously with the observation of activity levels of children as part of the SOFIT protocol[16] and is categorized into six categories: *management* (class time when students are not intended to be involved in physical education content), *knowledge* (class time when the primary focus is on knowledge related to any aspect of physical education rather than on activity itself), *fitness* (activity time devoted to activities whose major purpose is to alter the physical state of the individual in terms of cardiovascular endurance, strength, or flexibility), *skills* (activity time devoted to the practice of skills with the primary goal of skill development), *games (*activity time devoted to the application of skills in a game or competitive setting), and *other* (free play or recess periods when physical education instruction is not intended)[16]. Based on the lesson context data, additional variables entitled "sedentary lesson context" (combination of management and knowledge) and "active lesson context" (combination of fitness, skills, and games) were created.

Data Analysis

All analyses were conducted with SPSS version 16.0 (Chicago, Illinois). The unit of analysis in this study was the entire class. Descriptive analyses were first conducted to describe each metropolitan sample and the combined sample according to ethnicity, student economic disadvantage, class size, and duration of class (class length). In assessing the comparability of the two metropolitan samples for combining into one study sample, independent sample t-tests were conducted to assess differences in school and class characteristics such as ethnicity, socio-economic status and average class size and length. All subsequent analyses were conducted with the combined baseline datasets.

An analysis of means between groups was then conducted using independent sample t-tests and ANOVA to determine the mean difference of the student activity (mean minutes and percent total class time) and lesson context by teacher gender and indoor/outdoor class location. Pearson and Spearman correlation coefficients were computed to evaluate the bivariate relationship between additional characteristics (class length and class size) and student activity and lesson context variables. The percent of total class time variable was used rather than mean minutes when examining the bivariate relationships because it is more comparable between classes of different lengths. Additionally, Healthy People 2010 objective targets percent of classroom time in MVPA rather than total minutes.

The relationship between percent of classroom time in MVPA and each specific contextual characteristic was further examined using a linear regression model to determine the contextual characteristics that were significantly associated with % MVPA time. Percent time in MVPA was treated as the dependent or criterion variable, and the environmental characteristics were treated as the independent or predictor variable. We included environmental characteristic variables that were found to be significantly related to MVPA at the p .05 level based on the bivariate analyses. For these analyses, each variable was entered into a separate model. Models were adjusted for grade level and study site due to the significant differences observed between these two sites in ethnicity, class size, and class length.

RESULTS

Sample Characteristics

Hispanic students represented the highest ethnic composition of the total sample based on school-level data (62.2%) followed by African-American (22.0%), and Caucasian (14.19%). The student composition of the sample was predominantly low income, with 76.9% classified as economically disadvantaged.

Descriptive Characteristics of the Class Lessons

A total of 211 lessons were observed across the 74 evaluation schools, which included 74 third grade lessons, 72 fourth grade lessons, and 65 fifth grade lessons (Table 1). Sixty lessons were taught by males (28.4%), and 148 were taught by females (70.1%). Most lessons took place indoors (68.7%). The mean class size among all three grades was 32.6 students (±18.4), and the mean class length across all grades was 43.6 minutes (±5.36)

Student activity and lesson context

MVPA was similar across grades, with a mean of 16.4 minutes (37.9%), and all grade levels spent a similar percent of class time being very active (Table 2). The greatest proportion of PE class time among the five activity levels across was spent standing (mean=36.8%), followed by sitting (mean=24.4%). For sedentary lesson contexts, classes spent an average of 23.2% in management and 14.8% in knowledge lesson contexts. When looking at the active contexts (fitness, skills, and games), the greatest proportion of class time across observations was spent in fitness activities (mean = 24.4%) followed by game activities (mean = 20.5%).

Teacher Gender

Overall, children stand more, exert less MVPA, and play more games in male-directed classes (Table 3). Children in male-led class spent 42.6% of class minutes standing compared to 34.3% in female-led classes (p .001). In contrast, male-directed classes spent less time walking (21.0% v. 24.7%, p .05) and engaged in MVPA (31.0% v. 39.2%, p .05) than female-directed classes. Compared to female led classes, male-directed classes spent

significantly less time in knowledge (11.5% v. 16.1%, p .001) and skill activity lesson contexts (6.9% v 16.0%, p .001). Male teachers spent almost double the amount time in games compared to the females (29.2% v. 17.2%, p .001).

Lesson Location

Indoor classes were more sedentary and focused more on skill development than outdoor classes (Table 4). Classes held indoors spent significantly more time sitting (26.8% v. 16.8%, p .001), engaged in knowledge (16.0% v. 11.6%, p .05), and engaged in skills (16.2% v. 8.1, p .05) compared to outdoor classes. In contrast, outdoor classes spent more time playing games (27.1% v. 18.0%, p .05).

Class Size

We found that as class size increases, the proportion of class time devoted to class management also significantly increases (p .001) (Table 5). Classes with less than 20 students averaged 19.5% of class time in management compared to classes with greater than 60 students that averaged 28.2%. (p .001). Smaller classes had a greater percentage of class time allocated to skills context (p .01), and classes with between 40-59 students displayed the greatest number of minutes devoted to game activities (27.4%, p .01) compared to other groups.

Lesson Context and Environmental Characteristics

Time spent in management context was positively correlated with the class size (r=.337; p<. 000) and class length (r=.197, p .01). In contrast, class length was negatively correlated with % time in MVPA (r=-.207; p .01). Additionally, a significant correlation was seen between class size and class length (r=.200; p .05).

Lesson Context and Student Activity

In general, sedentary lesson contexts (management and knowledge) were correlated with inactivity. Management and knowledge were positively correlated with sitting (r=.24 and .40 respectively; p .001) and negatively correlated MVPA (r=-.38 and -.25; p .001) (Table 6).

Alternatively, time spent in fitness was positively correlated with MVPA time (r=.274; p<. 001) and negatively correlated with standing (-.311, p .001). Games were positively correlated with sitting and standing (r=.141, .259; p<.040).

Contextual Predictors of MVPA

Results of the linear regression analysis reveal a significant relationship between percent time in MVPA and all environmental characteristics except teacher gender. MVPA was negatively associated with increased class time (β=-.612; p .001), sedentary lesson context (β=-.495; p .001), and class size (β=-.118; p .05). Positive associations were seen between MVPA and class location (β=5.538; p=.028), active lesson context (β=.203; p<.000).

DISCUSSION

The main findings of this study indicate that large class size, longer duration of class, indoor lesson location, and sedentary lesson contexts are predictors of decreased MVPA whereas active lesson context, fitness lesson context, and outdoor lessons are significant predictors of increased MVPA.

At the time this study was conducted, state legislation (Senate Bill19) required children participate in 135 minutes each week of physical activity, however, this bill did not mandate

class size, quality, accountability, or percent of class time students needed to participate in MVPA[22]. Only 19.4% of the classes observed (n=41) in this study met the Healthy People 2010[13] objective of 50% of class time spent in MVPA. On average, our study showed that 38% of class time was spent in MVPA, which is similar to findings reported by Nader and colleagues (37% MVPA) in their study of third grade children in the United States[5]. Our study also revealed that classes spent close to a quarter of class time sitting, which is consistent with prior research among Texas schoolchildren[6] and highlights the need for the integration of evidence based strategies and curricula to increase MVPA.

Although the average class time in our study (44 min) was markedly higher than reported in previous research from the United States[6,23], there was a significant negative association seen between class length and percent time in MVPA, suggesting longer classes may yield less activity. On the other hand, class length was positively associated with class size, suggesting that longer classes typically contain more students which could adversely affect activity time. This suggests it may be beneficial to schedule shorter PE classes more frequently during the week rather than longer classes less frequently to maximize activity time among students. Alternatively, different strategies may be needed to increase MVPA among classes of longer duration.

Overall, teachers spent close to a quarter of total class time in the management context which is also consistent with previous research and may be a direct result of classes that are too large[6,8,23]. The National Association for Sport and Physical Education (NASPE) suggests large classes inhibit the amount of MVPA for each student and recommends classes be no larger than 25 students per teacher [24,25]. Only 49% of the classes in this study met this recommendation. These findings reinforce the notion that large class size inhibits the quality of the class by decreasing the amount of MVPA and increasing the amount time devoted to classroom management.

Our finding that lesson location is associated with student activity is consistent with prior research that suggests that outdoor lessons generate increased student activity, while indoor lessons offered more sitting time and knowledge context[6]. In our study, indoor classes were less active and more focused on knowledge and skills activities, while outdoor classes were more active and focused on games and fitness. While the indoor setting may be more conducive to teaching knowledge and skills due to its closed environment, it appears that the outdoor setting lends itself more to games and fitness, suggesting that teachers should consider using a mixture of both outdoor and indoor lessons to maximize all domains of physical education. These findings also suggest the need for strategies to increase MVPA while students are indoors such as providing knowledge or management information while students are engaged in activity. Strategies to increase MVPA in PE classes have been documented in coordinated school health programs such as CATCH[26] and SPARK[27].

In contrast to previous research by McKenzie et al[6], our study found significant differences in classes by teacher gender for MVPA time and various lesson contexts. The emphasis on games among the male-led classes creates some concern in that if students are not afforded enough time in other contexts to develop competence in their skills or fitness, they are less likely to participate in PA outside of the school setting[28]. Future research is needed to elucidate the reason for the differences between male and female-led classes.

The association between game context and sitting down is likely due in large part to the common inclusion of elimination-type games in current PE classrooms by which students are instructed to sit down or wait when they are 'out' of the game. Recent research has found that non-elimination games provide more MVPA compared with elimination games, although elimination games may be more enjoyable[29]. Evidence-based curricula such as

SPARK[27] and CATCH[26] that incorporate activity promoting strategies have been found to increase student MVPA. Additionally, state and district level professional development opportunities should be provided for practicing teachers to equip them with methods and strategies to minimize sitting and standing in PE class.

Strengths and Limitations

This study provides a detailed understanding of the environmental characteristics of PE class and their relationship to PA among elementary school children in Texas. This study contributes to a limited body of literature on classroom context and student activity levels amongst elementary-aged children in the United States. Additionally, this study includes observations from multiple sites across Texas representing a diverse, low income population of over 6,500 students from multiple grades in 12 school districts. These strengths notwithstanding, specific limitations merit mention. First, because these data are cross-sectional, we cannot conclude causality. Second, even though teachers were instructed to behave normally while their classrooms were being observed, it is possible that they may have made changes or adjustments to their classes while they were being observed. Additionally, our data are drawn from an urban sample which may not be generalizable to more rural or suburban schools. Finally, we acknowledge that this study does not explore all potential predictors of student MVPA such as access to facilities or resources for PA. As reported by Chow et al[8], teachers behaviors that promote physical activity such as enthusiasm and rewards may also be important predictors of MVPA. Future research is needed to explore the potential influence of these behaviors in conjunction with contextual predictors on student MVPA.

IMPLICATIONS

Given that less than 20% of classes examined in this large sample of elementary school PE class observations met the Healthy People 2010 objectives[13], significant changes are necessary to modify elementary school PE to have the maximum impact on cardiovascular health and obesity prevention. Findings from this study first and foremost identify a continued need for the incorporation of strategies to maximize the amount of time elementary school children engage in MVPA during PE class. Secondly, our findings provide further justification for the current recommendations on limiting class size to no larger than 25 students per PE class[24,25].

In terms of pedagogical practice, specific attention should be paid to the lesson context. Since classes are spending over one -third of their class in management and knowledge, it will be important for teachers to integrate strategies recommended by organizations such as NASPE to increase activity during management and knowledge time.

Given the range of benefits for physical activity in children[30], it is critical that we take an aggressive approach towards improving the delivery of PE classes to increase student activity and physical fitness. Supporting an environment conducive to maximum engagement in PA, providing appropriate and sufficient teacher training and professional development opportunities, and instituting policy to ensure the consistency and quality of these classes are critical considerations for both engaging children in recommended levels of PA as well as preparing children for a lifetime of enjoyable PA.

Acknowledgments

REFERENCES

1. McKenzie TL, Marshall SJ, Sallis JF, Conway TL. Student activity levels, lesson context, and teacher behavior during middle school physical education. Res Q Exercise Sport. 2000; 71:249–259.

2. Sallis JF, McKenzie TL. Physical education's role in public health. Res Q Exercise Sport. 1991; 62:124–137.

3. Sarkin JA, McKenzie TL, Sallis JF. Gender differences in physical activity during fifth-grade physical education and recess periods. J Teach Phys Educ. 1997; 17:99–106.

4. Simons-Morton B, Taylor W, Snider S, Huang I. The physical activity of fifth-grade students during physical education classes. Am J Public Health. 1993; 83:262. [PubMed: 8427337]

5. Nader PR. Frequency and intensity of activity of third-grade children in physical education. Arch Pediatr Adolesc Med. 2003; 157:185–190. [PubMed: 12580690]

6. McKenzie TL, Feldman H, Woods SE, et al. Children's activity levels and lesson context during third-grade physical education. Res Q Exerc Sport. 1995; 66:184–193. [PubMed: 7481079]

7. Sallis JF, Cervero RB, Ascher W, Henderson KA, Kraft MK, Kerr J. An ecological approach to creating active living communities. Annu Rev Public Health. 2006; 27:297–322. [PubMed: 16533119]

8. Chow BC, McKenzie TL, Louie L. Children's physical activity and environmental influences during elementary school physical education. J Teach Phys Educ. 2008; 27:38–50.

9. Sallis JF, Conway TL, Prochaska JJ, McKenzie TL, Marshall SJ, Brown M. The association of school environments with youth physical activity. Am J Public Health. 2001; 91:618–620. [PubMed: 11291375]

10. Hastie P, Sanders J. Effects of class size and equipment availability on student involvement in physical education. J Exp Educ. 1991; 59:211–224.

11. Verstraete SJM, Cardon GM, Clercq DLR, DeBourdeaudhuij IMM. Increasing children's physical activity levels during recess periods in elementary schools: The effects of providing game equipment. Eur J Public Health. 2006; 16:415–419. [PubMed: 16431866]

12. Lee SM, Burgeson CR, Fulton JE, Spain CG. Physical education and physical activity: Results from the school health policies and programs study 2006. J Sch Health. 2007; 77:435. [PubMed: 17908102]

13. U.S. Department of Health and Human Services. Healthy people 2010: Objectives for improving health. U.S. Department of Health and Human Services; Washington, D.C.: 2000.

14. Kelder, S.; Hoelscher, D.; Cuccia, M., et al. Evaluation report: Steps consortium coordinated approach to child health (CATCH) project: Dissemination in harris county public elementary schools. Univesity of Texas School of Public Health; Houston, TX: 2008.

15. Hoelscher DM, Springer AE, Kelder SH, et al. Reductions in child obesity among disadvantaged elementary school children in schools with community outreach; interim results from the dell coordinated approach to child health (CATCH) community trial. Obesity. In Press.

16. McKenzie TL, Sallis JF, Nader PR. SOFIT: System for observing fitness instruction time. J Teach Phys Educ. 1991; 11:195–205.

17. Keating XD, Kulinna PH, Silverman S. 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. 1999; 3:207.

18. Pope RP, Coleman KJ, Gonzalez, Barron F, Health EM. Validating SOFIT during physical education in a predominantly hispanic community. Med Sci Sport Exer. 2000; 32:S328.

19. Rowe P, Mars H, Schuldheisz J, Fox S. Measuring students' physical activity levels: Validating SOFIT for use with high-school students. J Teach Phys Educ. 2004; 23:235–251.

20. Scruggs PW, Beveridge SK, Eisenman PA, Watson DL, Shultz BB, Ransdell LB. Quantifying physical activity via pedometry in elementary physical education. Med Sci Sport Exer. 2003; 35:1065.

21. Texas Education Agency. [December 19, 2009] Texas Education Agency. Available at: www.tea.state.tx.us/.

22. Kelder SH, Springer AE, Barroso CS, Smith CL, Sanchez E, Ranjit N, Hoelscher DM. Implementation of Texas Senate Bill 19 to Increase Physical Activity in Elementary Schools. J Public Health Pol. 2009; 30:S221.

23. McKenzie TL, Stone EJ, Feldman HA, et al. Effects of the CATCH physical education intervention: Teacher type and lesson location. Am J Prev Med. 2001; 21:101–109. [PubMed: 11457629]

24. National Association for Sport and Physical Education & American Heart Association. 2006 Shape of the Nation Report: Status of Physical Education in the USA. National Association for Sport and Physical Education; Reston, VA: 2006.

25. National Association for Sport and Physical Education. Appropriate class length for elementary physical education [position paper]. American Alliance for Health, Physical Education, Recreation, and Dance; Reston, VA: 2008.

26. Kelder SH, Mitchell PD, McKenzie TL, et al. Long-term implementation of the CATCH physical education program. Health Educ Behav. 2003; 30:463. [PubMed: 12929897]

27. Sallis JF, McKenzie TL, Alcaraz JE, Kolody B, Faucette N, Hovell MF. The effects of a 2- year physical education program (SPARK) on physical activity and fitness in elementary school students. sports, play and active recreation for kids. Am J Public Health. 1997; 87:1328. [PubMed: 9279269]

28. Sallis JF, Prochaska JJ, Taylor WC. A review of correlates of physical activity of children and adolescents. Med Sci Sport Exer. 2000; 32:963.

29. Foster KE, Behrens TK, Jager AL, Dzewaltowski DA. Effect of elimination games on physical activity and psychosocial responses in children. J Phys Act Health. 2010; 7:475–483. [PubMed: 20683089]

30. Koplan, JP.; Liverman, CT.; Kraak, VA. Prevention of childhood obesity: Health in balance. Institute of Medicine (U.S.)., Committee on Prevention of Obesity in Children and Youth, Food and Nutrition Board, Board on Health Promotion and Disease Prevention. , editor. National Academies Press; Washington, D.C.: 2005.

Table 1

Descriptive Characteristics of Participating Schools

	Total (n=211)		3rd Grade (n=74)		4th Grade (n=72)		5th Grade (n=65)	
	Total	%	Total	%	Total	%	Total	%
Teacher Gender								
Male	60	28.4	23	31.1	22	30.6	15	23.1
Female	148	70.1	50	67.6	50	69.4	48	73.8
Both	2	0.9	1	1.4	0	0	1	9.2
Lesson Location								
Indoor	145	68.7	49	66.2	51	70.8	45	69.2
Outdoor	32	15.2	13	17.6	10	13.9	9	13.8
Both	32	15.2	11	14.9	11	15.3	10	15.4
Class Size								
<20	47	22.3	15	20.3	15	20.8	17	26.2
20-39	93	44.1	35	47.3	33	45.8	25	38.5
40-59	49	23.2	17	23	15	20.8	17	26.2
>60	19	9	7	9.5	9	12.5	3	4.6
Lesson Length								
0-19 min.	0	0	0	0	1	1.4	0	0
20-29 min.	1	0.5	0	0	10	13.9	0	0
30-39 min.	39	18.5	17	23	51	70.8	12	18.5
40-49 min.	148	70.1	50	67.6	9	12.5	47	72.3
50-59 min.	22	10.4	7	9.5	1	1.4	6	9.2
> 60 min.	1	0.5	0	0	0	0	0	0
Teacher Type								
PE Specialist	208	98.6	72	97.3	72	100	64	98.5
Other	2	0.9	2	2.7	0	0	0	0

	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Lesson Length	43.61	5.37	43.19	5.29	44.14	5.65	43.52	5.15

Table 2

Mean Minutes of Lesson Time and Percent Lesson Time for Student Activity and Lesson Context by Grade Level

Student Activity	All Classes (n=211)				3rd (n=74)				4th (n=72)				5th (n=65)			
	Mean Min.	SD	Mean %	SD	Mean Min.	SD	Mean %	SD	Mean Min.	SD	Mean %	SD	Mean Min.	SD	Mean %	SD
Lying Down	0.36	0.73	0.84	1.74	0.43	0.81	1.02	2.05	0.38	0.76	0.86	1.7	0.27	0.60	0.61	1.34
Sitting	10.90	7.1	24.44	14.72	10.86	7.06	24.54	14.69	11.91	7.38	26.32	14.66	9.88	6.76	22.24	14.73
Standing	15.97	5.8	36.8	13.3	16.31	5.71	38.02	13.23	15.73	6.05	35.87	13.86	15.83	5.68	36.44	12.81
Walking	10.19	4.68	23.66	11.11	9.25	4.41	21.74	10.36	9.94	4.53	22.89	11.08	11.52	4.91	26.71	11.49
Very Active	6.18	3.28	14.26	7.59	6.34	3.29	14.69	7.35	6.17	3.53	14.05	7.58	6.01	3.23	13.99	7.95
MVPA	16.37	5.69	37.92	13.69	15.59	5.68	36.43	13.35	16.12	5.63	36.94	13.68	17.54	5.67	40.7	13.88
Lesson Context																
Management	10.25	5.79	24.16	11.9	10.12	5.58	22.73	13.47	9.98	5.46	22.63	11.54				
Knowledge	6.47	3.95	14.97	7.98	7.07	3.64	16.01	9.52	5.74	3.88	13.26	9.05				
Fitness	10.49	9.64	23.81	21.58	10.05	9.06	23.2	22.35	11.24	10.71	25.82	24.42				
Skill	5.86	8.97	12.43	20.57	6.12	8.96	13.93	19.4	6.13	9.69	14.36	22.8				
Game	9.00	9.88	21.3	22.93	9.17	10.42	20.37	22.05	8.64	10.12	19.83	23.28				
Free Play	1.54	6.01	3.31	13.18	1.59	5.65	3.74	14.17	1.79	7.00	4.09	15.79				

Table 3

Mean Minutes and Percent Lesson Time for Student Activity and Lesson Context by Teacher Gender

Student Activity	Mean Minutes					% Time				
	Male (n=60)		Female (n=148)			Male (n=60)		Female (n=148)		
	Mean Min.	SD	Mean Min.	SD	Mean dif.	Mean %	SD	Mean %	SD	Mean dif.
Lying Down	0.31	0.84	0.37	0.69	-.587	0.73	2.00	0.86	1.64	-0.128
Sitting	9.61	6.04	11.48	7.45	-1.871	21.62	12.70	25.67	15.35	-4.049
Standing	18.47	5.9	14.87	5.4	3.611 ***	42.63	13.02	34.29	12.64	8.347 ***
Walking	8.9	4.6	10.66	4.66	-1.757 *	21.03	11.29	24.67	10.99	-3.630 *
Very Active	5.97	3.06	6.33	3.37	-.356	13.98	7.37	14.52	7.69	-0.540
MVPA	14.88	5.83	16.99	5.59	-2.115 *	35.01	14.69	39.18	13.24	-4.170 *
Lesson Context										
Management	11.15	6.86	9.83	5.31	1.32	25.46	14.88	22.18	11.12	3.28
Knowledge	5.02	4.11	7.04	3.77	-2.02 ***	11.51	9.12	16.08	8.56	-4.571 ***
Fitness	9.46	10.1	11	9.49	-1.54	22.32	24.87	25.21	21.85	-2.884
Skill	3.06	6.08	6.86	9.62	-3.80 ***	6.92	13.79	15.96	22.47	-9.033 ***
Game	12.7	10.58	7.55	9.28	5.140 ***	29.17	24.72	17.16	20.99	12.014 ***
Other	1.9	6.51	1.42	5.86	.470	4.60	15.79	3.40	13.86	1.197

** mean difference is significant at the .01 level

* mean difference is significant at the .05 level

*** mean difference is significant at the .001 level

Table 4

Mean and Percent Lesson Time for Student Activity and Lesson Context by Lesson Location

	Indoor (n=145)		Outdoor (n=32)			Indoor (n=145)		Outdoor (n=32)		
Student Activity	Mean Min.	SD	Mean Min.	SD	Mean dif*	Mean %	SD	Mean %	SD	Mean dif
Lying Down	0.44	0.82	0.19	0.4	0.25*	1.01	1.97	0.41	0.86	0.61**
Sitting	12.14	6.79	7.36	6.91	4.78***	26.81	13.52	16.76	14.83	10.05***
Standing	15.94	5.50	17.40	5.58	-1.46	36.04	12.26	41.40	13.98	-5.36*
Walking	9.70	4.09	11.35	6.21	-1.64	22.18	9.73	26.60	14.23	-4.42*
Very Active	6.21	3.37	6.12	3.2	0.09	13.96	7.46	14.83	8.04	-0.87
MVPA	15.92	5.13	17.47	6.91	-1.54	36.13	11.93	41.42	16.75	-5.29
Lesson Context										
Management	10.21	6.04	9.47	5.22	.74	22.19	11.74	22.59	12.58	0.41
Knowledge	7.06	3.90	5.08	4.38	1.98*	11.55	9.33	16.01	8.91	4.45*
Fitness	10.1	9.92	11.24	10.35	-1.13	26.40	25.21	22.89	22.81	-3.51
Skill	6.96	9.61	3.38	7.0	3.13*	8.10	14.60	16.21	22.48	8.10*
Game	8.26	10.13	11.0	10.33	-2.74	27.17	26.29	17.95	22.04	-9.23*
Free Play	1.84	6.71	1.78	5.64	0.06	4.58	14.79	4.35	15.74	-0.23

*
mean difference is significant at the .05 level

**
mean difference is significant at the .01 level

***
mean difference is significant at the .001 level

Table 5

Mean and Percent Lesson Time for Student Activity and Lesson Context by and Class Size

Student Activity	Total (n=211) Mean min.	SD	<20 (n=47) Mean min.	SD	20-39 (n=93) Mean min.	SD	40-59 (n=49) Mean min.	SD	>60 (n=19) Mean min.	SD	p	<20 (n=47) Mean %	SD	20-39 (n=93) Mean %	SD	40-59 (n=49) Mean %	SD	<60 (n=19) Mean %	SD	p
Lying Down	0.64	0.72	0.38	0.72	0.39	0.8	0.30	0.61	0.35	0.76	.789	0.88	1.69	0.94	1.98	0.62	1.29	0.79	1.74	.645
Sitting	18.68	5.99	8.86	5.99	9.96	6.49	13.21	7.70	15.62	7.8	.005	20.68	13.93	23.28	14.51	27.26	13.70	33.75	15.93	.053
Standing	28.13	5.4	17.51	5.4	15.03	5.87	16.41	6.02	15.31	4.91	.645	41.55	12.95	35.33	12.9	36.06	14.61	33.46	9.60	.190
Walking	18.08	5.01	10.10	5.01	10.98	4.44	9.83	4.29	7.67	5.50	.403	23.9	11.61	26.25	10.75	21.32	9.62	16.98	12.52	.114
Very Active	10.90	2.96	5.44	2.96	5.94	3.02	6.90	3.44	6.74	3.72	.044	12.97	7.44	14.19	7.30	14.74	7.15	15.02	8.35	.356
MVPA	28.98	5.62	15.54	5.62	16.92	5.43	16.73	5.55	14.41	6.9	.447	36.87	13.47	40.44	13.60	36.06	12.04	32.00	15.9	.521

Lesson Context	Total (n=211) Mean min.	SD	<20 (n=47) Mean min.	SD	20-39 (n=93) Mean min.	SD	40-59 (n=49) Mean min.	SD	>60 (n=19) Mean min.	SD	p	<20 (n=47) Mean %	SD	20-39 (n=93) Mean %	SD	40-59 (n=49) Mean %	SD	<60 (n=19) Mean %	SD	p
Management	17.73	8.17	9.12	4.9	5.24	5.55	13.08	7.01	13.4			19.44	11.14	11.57	21.27	28.08	11.99	28.77	13.82	.000
Knowledge	11.31	6.65	6.67	4.53	3.86	3.85	5.97	3.56	6.51			15.49	10.54	9.06	15.87	12.55	7.40	14.01	7.14	.032
Fitness	18.52	11.27	10.28	11.29	9.07	8.78	9.12	10.86	12.33			26.65	27.3	22.11	24.61	18.83	16.97	28.21	26.12	.412
Skill	10.35	6.82	7.29	9.69	9.79	5.61	2.75	8.73	4.28			15.63	22.41	22.99	17.05	6.27	12.69	9.40	19.17	.006
Game	15.7	9.34	7.43	9.74	9.35	10.72	12.81	8.85	7.04			22.7	24.59	21.78	17.44	27.43	22.87	14.78	18.61	.003
Free Play	2.83	0.04	1.51	0.18	5.31	8.20	2.91	9.25	2.12			0.09	0.44	13.33	3.76	6.82	19.10	4.82	21.03	.225

Table 6

Correlation between Percent Time in Lesson Context and Percent Time in Student Activity

	Lying	Sitting	Standing	Walking	Very Active	MVPA
Management	-.112	.240 ***	.137 *	-.302 ***	-.235 ***	-.376 ***
Knowledge	.116	.402 ***	-.199 **	-.216 **	-.141 *	-.254 ***
Physical Fitness	.073	.018	-.311 ***	.105	.341 ***	.274 ***
Skills	.082	-.154 *	.122	.194 **	-.219 ***	.036
Games	-.151 *	.141 *	.259 ***	-.139 *	.058	-.081
Free Play	.030	-.038	-.088	.166 *	-.023	.122
Sedentary Lesson Context[A]	-.026	.477 ***	-.007	-.412 ***	-.303 ***	-.503 ***
Active Lesson Context[B]	-.004	-.325 ***	.073	.178 **	.243 ***	.279 ***

[A] Sedentary Lesson Context refers to the combination of management time and knowledge time

[B] Active Lesson Context refers to the combination of fitness time, skills time, and games time

*
correlation is significant at the p .05 level

**
correlation is significant at the p .01 level

***
correlation is significant at the p .001 level

Table 7

Association between Environmental Characteristics and % of Class Time in MVPA Based on Independent Linear Regression Models

Environmental Characteristic[A] (Predictor)	Unstandardized Coefficient β	Standard Error	*p*	95% Confidence Interval
Total Class Time	-.620	.178	.001	[-.972, -.269]
Number of Students	-.151	.055	.007	[-.260, -.042]
Location of Class[B]	5.794	2.817	.041	[.233, 11.354]
Teacher Gender[C]	3.244	2.037	.113	[-.771, 7.20]
Sedentary Lesson Context[D]	-.498	.060	.000	[-.616, -.304]
Active Lesson Context[E]	.201	.049	.000	[.104, .299]
Fitness Lesson Context	.163	.040	.000	[.084, .242]
Management Lesson Context	-.416	.073	.000	[-.559, -.272]
Knoweldge Lesson Context	-.462	.108	.000	[-.677, -.249]

[A] Separate regression models were conducted for each individual variable adjusting for grade level and site location in each model

[B] Dummy variables for class location : indoor classes= 1 and outdoor classes =2; classes in both location were excluded from this sample

[C] Dummy variables for teacher gender: male teachers= 1 and female teachers =2

[D] Sedentary Lesson Context refers to the combination of % time in management and knowledge contexts

[E] Active lesson context refers to the combination of % time in games, fitness, and skills