



## Intensity of commonly-reported classroom-based physical activity opportunities in public schools

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### ABSTRACT

The purpose of this study was to examine the intensity levels of PA opportunities offered in public school classrooms. Schools (N = 101) in school districts (N = 25) reported PA opportunities offered in classrooms using an online data collection tool over a two-year period (2014–2016). Using a randomized sampling technique, 20–30% of teachers in each school were selected each week to report PA in their classroom. These responses resulted in N = 18,210 usable responses. A researcher determined the intensity of PA opportunities using the 2011 Compendium of Physical Activities as a guideline; two additional researchers confirmed the coded categories. A descriptive analysis of PA opportunities was conducted to describe the proportion of opportunities whose intensity levels were light (LPA), moderate (MPA), vigorous (VPA), sedentary (SED), and those of unknown intensity. Chi-square analyses were utilized to examine differences between proportions of intensity levels offered by semester. Kruskal-Wallis tests were utilized to examine differences in proportion of physical activity opportunity intensity offered by grade level. Most PA opportunities were MPA (58.7%), followed by VPA (17.6%) and LPA (11.5%). Few responses were SED (0.5%), and 11.6% were of indeterminate intensity. A greater proportion of more physically intense activities reported during the fall versus spring semesters ( $p < 0.0001$ ). Differences in the intensity levels of PA offered by grade also differed, with a trend of decreasing intensity as grade level increased ( $p < 0.0001$ ). This study provides insight into the PA actually occurring in classrooms; a previously underexplored construct of school-based PA.

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### 1. Introduction

PA is crucial in maintaining a healthy lifestyle and can reduce the risk of early death, cardiovascular disease, diabetes, mental health issues, and other comorbid impacts in adults (Healthy People 2020, 2016). Moreover, PA can help maintain a healthy weight, which in turn may lead to the maintenance of greater overall health (Centers for Disease Control and Prevention [CDC], Physical Activity and Health, 2016a). In addition to the health impacts of an active lifestyle, there is a significant financial cost of inactivity to society. Recent estimates suggest that physical inactivity costs approximately \$117 to \$131 billion dollars per year for the adult population in the U.S. (Carlson et al., 2015). Thus, it is an important public health issue to encourage PA and reduce sedentary behaviors.

While adults are often the targets of PA interventions and programming, PA is particularly important for children and adolescents as they continue to grow and form lifelong habits. In children, regular PA can be beneficial for improving the health and strength of bones, increasing both respiratory and muscular fitness and strength, and improving mental health (Healthy People 2020, 2016). The U.S. Department of Health and Human Services (2008) Physical Activity Guidelines for Americans include recommendations for children to participate in at least 60 min of PA a day. The majority of this activity should be moderate or vigorous intensity aerobic activities; children should also participate in muscular fitness and bone-strengthening activities at least 3 days of the week (U.S. Department of Health and Human Services, 2008). However, >70% of adolescents are not physically active or do not participate in physical education on a daily basis (CDC, Youth Risk Behavior Survey Data, 2016b). Thus, researchers and practitioners have sought avenues for intervention and programming where children's PA can be increased. One such avenue is the incorporation of PA programming that occurs in schools.

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An estimated 50 million children in the United States are enrolled in public elementary and secondary education (Snyder et al., 2016). On average, a child in the United States will spend 6.64 h per day at school for each of the 180 school days per school year (National Center for Education Statistics, 2008). Because children will spend so much of their time in a school setting, schools may provide access and introduction to PA interventions and programming for the majority of children in the United States. This may represent an excellent opportunity to encourage children and adolescents to attain the recommended amount of PA by supplementing the total amount of PA accrued during the day with PA performed during school hours. However, much of time spent in school has traditionally contributed to physical inactivity in children and adolescents due to the sedentary nature of lectures, note taking, exams, and other traditional classroom activities. This provides plenty of room for improvements and interventions to increase PA.

Not only are PA interventions in the school setting beneficial for the health of children and adolescents, they have also been noted to increase academic performance. Implementing PA during the school day was shown to improve children's achievements in mathematics and reading (Fedewa et al., 2015; Mullender-Wijnsma et al., 2015), as well as improving performance on standardized testing (Donnelly and Lambourne, 2011). Incorporating PA into the classroom setting was also shown to be beneficial to increasing the amount of time students spent focusing on the academic tasks assigned them (Mullender-Wijnsma et al., 2015; Ma et al., 2014; Mahar et al., 2006; Mahar, 2011; Grieco et al., 2016). Students have also been reported to respond positively to exercise being implemented in the classroom (Howie et al., 2014; Finn and McInnis, 2014), which helps to improve enjoyment of school and the classroom environment.

This study will discuss PA commonly reported as occurring in classrooms or during the school day. The intensity levels of these activities, as well as how and when they occur in the classroom are also reported. The purpose of this study is to evaluate the types of PA teachers implemented in classrooms on a daily basis. It also illustrates what types of PA can be realistically and successfully implemented in classrooms and their intensity levels.

## 2. Methods

### 2.1. Design

The Kaiser Permanente Colorado *Thriving Schools* initiative seeks to create PA opportunities in PK-12 schools within the state of Colorado (USA). This study specifically examined the PA opportunities that classroom teachers reported in their classes. In total, these data represent a descriptive classification of the types of classroom-based PA opportunities that were offered in Colorado public schools as part of the program, collected over two academic years from 2014 to 2016. Specifically, this study consisted of a two-phased descriptive design. In the first phase researchers attempted to qualitatively determine the intensity of classroom PA opportunities. The second phase provides a descriptive analysis of classroom PA opportunities to describe the frequency, intensity, and duration of classroom-based PA opportunities.

### 2.2. Sample

This study utilized a randomized stratified sampling technique in which teachers in participating Colorado school districts who received funding from the Kaiser Permanente *Thriving Schools* initiative were asked to report PA opportunities that occurred in their classrooms (2014–15 AY N = 82 schools in 23 school districts; 2015–16 AY N = 101 schools in 25 school districts). Respondents taught in classrooms that ranged from pre-kindergarten to 12th grade. The schools reporting varied in rural, suburban, and urban locations, socioeconomic status of the area they serve, and size, see Table 1.

**Table 1**  
Descriptive statistics for schools and districts.

School level	
Elementary <sup>a</sup>	78
Middle <sup>a</sup>	11
High <sup>a</sup>	8
Mixed grade <sup>a</sup>	2
School setting	
Urban <sup>a</sup>	28
Suburban <sup>a</sup>	50
Rural <sup>a</sup>	22
District setting	
Urban <sup>a</sup>	33
Suburban <sup>a</sup>	50
Rural <sup>a</sup>	17
School characteristics	
School enrollment <sup>b</sup>	513.89 ± 328.96
District enrollment <sup>b</sup>	23,609.27 ± 21,406.85
School minority students <sup>c</sup>	42 ± 24
School FRL <sup>c</sup>	48 ± 27
District FRL <sup>c</sup>	42 ± 21

FRL = free and reduced cost lunches.

<sup>a</sup> %.

<sup>b</sup> Mean ± S.D.

<sup>c</sup> Mean % ± S.D.

### 2.3. Measures

Classroom teachers were asked to complete an online data collection tool. Data collected via this tool included the type of PA opportunity offered in the classroom (e.g., brain break, run in place, dancing, etc.), its duration, the number of students in the classroom, and the students' grade level. Moreover, characteristics of the school were automatically captured by the online system and allowed for more in-depth understanding of the individual responses. Additional details on the data collection method are described elsewhere (Kelly et al., 2016).

### 2.4. Procedures

The data collection system randomly selected teachers 2–3 times a semester and queried them to report classroom PA occurring in their classroom during a one-week period. The selected teachers received an email on Friday morning with a link to the online system to record classroom PA opportunities, as well as a paper form they could use throughout the week before uploading all activity data to the online system. This email served as a notification that the teacher would need to report on classroom PA opportunities during the following week. The teachers were sent an additional email reminder midweek, as well as a final email reminder at the end of their reporting week. Weekly sampling of teachers used a stratified random sampling approach where 20–30% of each school's teaching population was selected to participate, allowing researchers to collect data without undue participant burden. These responses resulted in N = 18,445 possible classroom-based PA opportunities reported.

### 2.5. Data analysis

Data reduction included a two-phased approach in which all responses were first coded for PA intensity, and second where all resulting responses from phase 1 were descriptively examined.

#### 2.5.1. Phase 1

All responses were initially examined for outliers and unreasonable values. For example, because teachers were allowed to list anything in

the response box, there were nonsensical values such as numbers and non-readable entries. Once these responses were cleaned the remaining PA opportunities (N = 18,210) were examined for content. A researcher determined the intensity of each PA opportunity reported using the 2011 Compendium of Physical Activities (Ainsworth et al., 2011) as a guideline. In cases where the activity was not reported in such a way that the PA intensity was easily identifiable (i.e., “Go Noodle”, etc.), the researcher conducted an online search of literature databases to determine the PA intensity level. MET values were then used to create code categories of sedentary (SED), light (LPA), moderate (MPA), vigorous (VPA), and unknown (UNK) PA opportunities. Concurrently, a second researcher conducted an identical process. A third researcher then examined the coded categories assigned for accuracy, as well as resolved any disagreements in assignment between the first two researchers (Creswell, 1998). This process allowed researchers to distill all of the classroom PA opportunity responses into manageable categories. In total, 18,210 responses were assigned an activity code (see Fig. 1).

2.5.2. Phase 2

Descriptive statistics were calculated for all coded classroom PA opportunities (SED, LPA, MPA, VPA, UNK), and other variables of interest. Chi-square analyses were utilized to examine differences between proportion of intensity levels offered during the school day by semester and year. Kruskal-Wallis tests were utilized to examine differences in proportion of PA intensity levels offered and grade level (defined as elementary school [grades PK-5], middle school [grades 6–8], high school [grades 9–12], and events that happened at a school-level with mixed grades. All data reduction and statistical analyses were conducted using the SAS statistical package (version 14; Cary, NC) with  $\alpha = 0.05$ .

3. Results

Respondents in the final dataset represented 101 schools in 25 school districts in Colorado (USA), and contributed N = 18,210 responses that were reported. Results indicated that most (58.7%) classroom-based PA opportunities were MPA, followed by VPA (17.6%) and LPA (11.5%). Few of the responses were coded as SED (0.5%), and 11.6% were of indeterminate PA intensity (Fig. 1).

Examples of the most commonly reported classroom LPA include charades or stretching. For MPA walking or yoga are examples of commonly-reported activities, while running or dancing are examples of commonly-reported VPA. When examining SED activities, notes or testing were commonly reported examples. Of those that were of indeterminate intensity, movement or free choice were commonly-reported

examples. Additional commonly reported examples of the types of activities recorded by intensity are found in Table 2.

There was a significant difference in the intensity of classroom-based PA opportunities by semester, with a greater proportion of more physically intense activities reported during the fall versus spring semesters ( $p < 0.0001$ ). When examined by school level (i.e., elementary school; junior high school; high school; “whole school”, or mixed grades) there were significant differences ( $p < 0.0001$ ) in the proportion of PA opportunities by intensity (Table 3), with a general trend of decreasing intensity of PA opportunities as grade increased.

4. Discussion

The purpose of this study was to provide a detailed description of the types and intensities of commonly-reported PA opportunities that occurred in classroom-based PA as part of a program to increase PA in schools. Findings herein suggest that most classroom-based PA was offered at the MPA to VPA intensity level, though some were still offered at lesser intensities. Additionally, there appears to be a seasonal effect, with more intense activities offered during the fall semester. Moreover, differences exist by level of school, with a general decrease in PA intensity observed from elementary to high school. In total, these findings are unique because this study represents to our knowledge the first of its kind to attempt to quantify classroom-based PA opportunities that are implemented in classrooms on a daily basis.

We found no other studies that report on the difference in PA between the fall and spring semester. Our research indicates that more PA was reported in the fall semester versus in the spring semester. Further research should be conducted to determine if this finding is consistent throughout a longer time span, or with additional schools. One possible explanation theorized for this is that standardized testing occurs in the spring semester (Colorado Department of Education, 2016), which requires children to remain sedentary while preparing for the test and while testing. For this reason, teachers may be less willing to utilize classroom time for PA as testing approaches, particularly after new legislation was passed that allows teachers to lose tenure and be dismissed due to poor evaluations based on test scores (Ramirez et al., 2014).

PA intensity levels were also shown to decrease as children aged and moved through the school system. In elementary and middle school, classroom activities included many YouTube videos and activities, “brain breaks”, and short activities. In higher grade levels, these activities were almost nonexistent. Fewer incidents of PA in high schools may reflect teachers’ beliefs that students participate in PA through

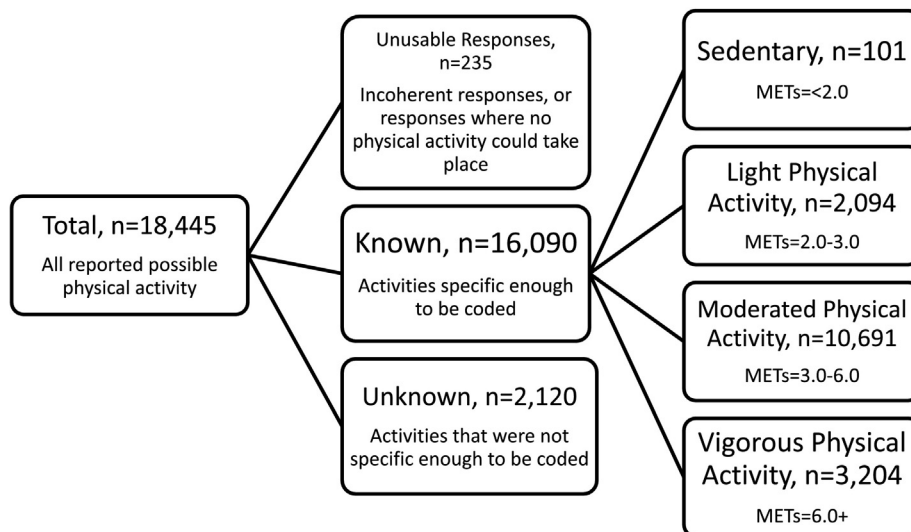


Fig. 1. Process of assigning intensity levels to each reported activity.

**Table 2**  
Examples of the most commonly reported physical activities by intensity level.

Intensity level	Examples
LPA	Ball or beanbag toss, charades, look for books, mindful breathing, presentations, Simon says, singing, stretching
MPA	Hacky sack, hula hoops, juggling, lunges, marching, recess, walking, yoga
VPA	Running, tag, jumping jacks, dancing, various sports, zumba
SED	Reading, discussion, review, notes, testing
UNK	Movement, physical activity, exercise, Youtube, game, free choice, energizer, group/classroom activity, warm up, fitness break

after school activities (i.e., sports), making classroom PA unnecessary. High school teachers also may be unwilling to “forfeit” classroom time for activities not directly relevant to the subjects being taught, particularly given increased emphasis on making students “college-ready” as they near high school graduation. We found no other studies that report on the differences in offered activities for different grade levels throughout school; additional research needs to be done to verify that this finding is consistent. However, this finding is consistent with other studies that report PA in adolescents decreases with age (Sallis et al., 2000).

The reduction in PA in the spring semester and in higher grades may actually be harmful to academic performance. Previous research suggests that PA in classrooms can actually improve performance on standardized testing (Donnelly and Lambourne, 2011), as well as improve understanding in the areas of math and reading (Fedewa et al., 2015; Mullender-Wijnsma et al., 2015). This study suggests that less PA occurs in the classroom as testing nears in the spring, and as children grow older. Therefore, it is possible that standardized test scores could actually improve by either increasing or maintaining the amount of PA offered in the spring semester compared to the fall semester, as well as maintaining PA levels as children grow older and learn more advanced material. More research should be conducted on whether interventions that increase PA around testing time could improve scores on standardized tests.

Possible limitations of this study could include the open-ended responses from classroom instructors. Although this approach allowed the educators to input unique activities, it also allowed for many responses that were either too vague or too specific to be used in the study. Another limitation may be measurement errors, where teachers did not accurately report the PA that they offered in their classrooms, either because they felt pressured to report that they were offering more PA than they actually were or because they did not keep accurate measures of the PA offered. To improve this measurement precision, the design of the entire study would need to be shifted to observations of the

**Table 3**  
Proportion of PA intensity level by grade and semester.

Grade level	LPA	MPA	VPA	SED
Elementary (n = 13,390)				
Fall	790 (10.01%)	5568 (70.55%)	1528 (19.36%)	6 (0.08%)
Spring	466 (8.48%)	3884 (70.64%)	1135 (20.64%)	13 (0.24%)
Total	1256 (9.38%)	9452 (70.59%)	2663 (19.89%)	19 (0.14%)
Junior high (n = 1273)				
Fall	211 (32.31%)	267 (40.89%)	171 (26.19%)	4 (0.61%)
Spring	132 (21.29%)	312 (50.32%)	173 (27.90%)	3 (0.48%)
Total	343 (26.94%)	579 (45.48%)	344 (27.02%)	7 (0.55%)
High school (n = 1181)				
Fall	363 (43.68%)	333 (40.07%)	76 (9.15%)	59 (7.10%)
Spring	104 (29.71%)	183 (52.29%)	59 (16.86%)	4 (1.14%)
Total	467 (39.54%)	516 (43.69%)	135 (11.43%)	63 (5.33%)
All school activity (n = 85)				
Fall	2 (2.70%)	33 (44.59%)	37 (50.00%)	2 (2.70%)
Spring	4 (36.36%)	0 (0.00%)	2 (18.18%)	5 (45.45%)
Total	6 (7.06%)	33 (38.82%)	39 (45.88%)	7 (8.24%)

classrooms instead of self-reported data; however, it would not be realistic to collect such a large amount of data and observations using a purely observational method, so the design of this study is justified. Lastly, the qualitative sorting of the reported activities into intensity categories could have introduced error into the data set.

District coordinators reported additional anecdotal evidence about how instructors grew weary of reporting PA as they were chosen to do it several times a semester. It is unclear if the dissatisfaction with the surveys had any effect on the data reported, as there was no measurement for this. This could possibly be remedied by asking teachers to report less, perhaps only once a semester. Another issue reported by teachers was the difficulty in reporting because movement was a built-in part of their daily classroom activities. Asking teachers to report less may also improve the quality of reporting, as they may be more willing to report in detail if it is not required of them so often.

Overall, to our knowledge, this study is the first to record and evaluate PA offered on a daily basis in classrooms. Many studies show the benefits of PA in the classroom (Fedewa et al., 2015; Mullender-Wijnsma et al., 2015; Donnelly and Lambourne, 2011; Grieco et al., 2016; Ma et al., 2014; Mahar et al., 2006; Mahar, 2011; Finn and McInnis, 2014; Howie et al., 2014), but there is a gap in the research when it comes to evaluating the reality of PA implemented in classrooms. More research should be conducted to expand what is known about PA in the classroom and whether classrooms in other geographic locations are meeting the recommendations. Our study is also useful in providing classroom educators with suggestions of PA that can realistically and successfully be implemented in a classroom setting. Additional research will be necessary in order to assemble a more complete compendium of PA to be used in the classroom setting.

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