

PEDAGOGY

Effects of Common Core State Standards on Student Physical Activity Rates and Student and Teacher Perceptions in Physical Education

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Abstract

Since its development in 2010, the Common Core State Standards (CCSS) have been adopted in over 40 states. While the literature discussing the implications of this initiative is robust, the research examining its effect on K–12 physical education (PE) is limited. Moreover, there is little empirical data on the effect of the CCSS on student physical activity (PA) rates in PE. Thus, this study examined the effect of CCSS instructional integration into PE lessons on PA rates of sixth-grade students and on student and teacher perceptions in a public K–12 school. This study utilized a one-group within-subjects randomized design. Rates of PA were compared between PE classes that integrated the CCSS (i.e., CC+) and PE classes that did not integrate the CCSS (i.e., CC-). Student and teacher perceptions of the lessons were also studied.

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In addition, the feasibility (i.e., acceptability) of the use of an objective measure of PA intensity (accelerometer) was assessed. A linear mixed model analysis of percentage of time in moderate-to-vigorous PA (MVPA) produced a significant effect for condition, CC+ $M = 19.7\%$, $SD = 7.0$; CC- $M = 33.1\%$, $SD = 10.4$, $F(1, 24) = 182.82$, $p < .001$, $d = 1.46$, 95% CI [.88, 2.41]. The mixed-model analysis of total steps per minute also produced a significant difference by condition, CC+ $M = 20.99$, $SD = 9.46$; CC- $M = 32.76$, $SD = 9.46$, $F(1, 21) = 133.45$, $p < .001$, $d = 1.48$, 95% CI [.90, 2.15]. Linear mixed-model analysis of student and teacher perceptions showed no significant differences on any of the six items, indicating general agreement. Intraclass correlations of the student and teacher reports were 0.70 for the CC- items and 0.68 for the CC+ items, again demonstrating general agreement between students and the teacher. Students reported that the accelerometer was “easy to wear” (4.05 out of 5.0); the teacher report was slightly higher (4.83 out of 5.0). Large effect sizes on both PA dependent measures suggest that CCSS integration tasks may have a significant negative effect on PA levels. Student and teacher reports did not differ between CC+ and CC- lessons on a number of lesson attributes and also suggest that the use of accelerometers to measure PA is acceptable. More research needs to explore whether these results generalize to other settings, teachers, students, and activities and examine the overall effect of the CCSS on fitness across the school year. In addition, future research should examine whether certain types of CCSS integration tasks may be more successful with sustaining MVPA.

The Common Core State Standards (CCSS) were developed in 2010 to establish K–12 benchmarks for mathematics and English Language Arts (ELA) nationally while preparing each child for college, a career, and life pursuits (Common Core State Standards Initiative, n.d.-a). Recognizing the importance of other K–12 content in achievement of these goals, the CCSS have defined academic disciplines such as physical education (PE) as technical subjects and suggest that instructors in these content areas provide support for the attainment of the CCSS (Common Core State Standards Initiative, n.d.-b; James & Bullock, 2015). The CCSS do not include any specific provisions for K–12 PE, yet public school physical educators are being asked to integrate literacy skills (learned in English and mathematics classes) into their daily instruction in PE (James & Manson, 2015; James-Hassan, 2014a).

The literature on the broad implications of educational reform and the CCSS in K–12 education is extensive and highlights significant disagreement between proponents and critics (e.g., Au, 2013; AccountabilityWorks, 2012; Conley, 2011; Mathis, 2010; Mercier & Doolittle, 2013; Phillips, Mercier, & Doolittle, 2017; Saltman, 2014). However, the debate is largely uninformed by research examining the effects of the CCSS in PE. Available publications (James & Bullock, 2015; James-Hassan, 2014a, 2014b; Mercier, Whitley, & Manson, 2014) are generally devoted to prescriptive techniques from PE professionals to support the CCSS initiative and the potential role of PE. For example, James and Bullock (2015) provided suggestions for practitioners to integrate the CCSS in the PE setting. Examples include exit slips, in-and-outside class projects including homework, and summary paragraphs.

James-Hassan (2014a, 2014b) also supported the integration of the CCSS in PE and recommended that all K–12 content areas address CCSS ELA and mathematics strands.

It can be argued that for the CCSS to achieve their intended impact, focus and support must be given to ensure that they are implemented and reinforced in all content areas. It is explicitly written that the common assessments and the curricula that support the standards recognize the importance of complex, challenging, nonroutine applications of knowledge. (James-Hassan, 2014a, p. 9)

From this perspective, “nonroutine” applies to academic content areas like PE where previously ELA and mathematics were not emphasized. Embracing this approach could help strengthen the reputation of the discipline within the school community and at the same time may improve standardized test scores in ELA and mathematics (James-Hassan 2014a). Mercier et al. (2014) agreed and connected the current CCSS initiative to past efforts by the PE profession to infuse literacy concepts into daily instruction. James and Manson (2015) also supported this position and suggested that interdisciplinary learning in PE is not a new concept to physical educators, identifying various studies that highlight its positive effects on motor and skill performance.

Similarly, in a review of integration literature in PE from 2004 to 2013, Marttinen, McLoughlin, Fredrick, and Novak (2017) encouraged the PE profession to embrace the integration of literacy in class to solidify the standing of PE in K–12 education. However, they warned that many of the integration studies involved mathematics and not ELA—an important distinction given the CCSS call for PE teachers to integrate the ELA standards.

Conversely, the potential negative effect of CCSS integration on K–12 PE also warrants discussion. Magnotta and Darst (2015) questioned the fit of PE within the framework of CCSS and argued that the research indicating the positive effects of physical activity (PA) on brain development may be overlooked under this structure. PE itself—through PA that creates conditions beneficial to cognitive functioning (without integrating the CCSS)—may enhance and promote academic performance (Magnotta & Darst, 2015; Seymour & Garrison, 2015). For example,

Students who obtain success in movement skills and fitness education concepts [in PE class] and develop an appreciation for healthy living practices can be stimulated to “want to learn” via different formats. Why cannot physical education stand on its own based on these principles? (Magnotta & Darst, 2015, p. 8)

At the same time, consistent PA and positive attitudes toward being physically active are strongly associated with a wide range of desirable physical, behavioral, cognitive, academic, emotional, and social outcomes (2018 Physical Activity Guidelines Advisory Committee, 2018; American Academy of Pediatrics & Council on School Health, 2013; Bailey, 2006; Datar & Sturm, 2004). Moreover, there is evidence that increasing PA specifically enhances performance on academic achievement tests while improving school attendance and classroom behavior (2018 Physical Activity Guidelines Advisory Committee, 2018; Centers for Disease Control and Prevention, 2010a; Michael, Merlo, Basch, Wentzel, & Wechsler, 2015; Ratey, 2008).

Given these stand-alone benefits, current educational reforms may be pressuring the PE profession to change its focus toward academic skills (Lounsbery & McKenzie, 2015; Mercier et al., 2014, Seymour & Garrison, 2015). For example, teacher evaluation

policies that focus on demonstration of growth in student performance scores may force physical educators to prioritize the cognitive domain at the expense of the psychomotor domain (Seymour & Garrison, 2015).

Despite the ongoing debate, there is a paucity of empirical studies and research needs to investigate the effect of the CCSS on public school K–12 PE. Specifically, studies need to examine the effect of the CCSS on student PA rates during PE classes, as well as on teacher and student perceptions of PE lessons. The purpose of this pilot study was to test whether student PA rates and teacher and student perceptions of lessons differed between PE classes that integrated the CCSS (i.e., CC+) and PE classes that did not integrate the CCSS (i.e., CC-). Given the pilot nature of the study, data were collected on the feasibility (i.e., acceptability) of the use of an objective measure of PA level (i.e., an accelerometer).

Method

Participants

Participants in this study included a PE teacher and middle school students in a suburban public middle school in Western New York. To avoid bias in the administration of the PE lessons, four middle school teachers from the public school district were surveyed for their perceptions of the integration of CCSS into PE lessons (see Measures section for a description of the six-item survey). Results of the survey were used in the selection of the teacher whose responses represented a neutral view (neither positive nor negative) of the CCSS (the selected teacher's mean score was 3.33 on the 5-point scale that ranged from 1 to 5). This process resulted in the identification and selection of a certified PE teacher with 35 years of PE teaching experience. The teacher was a Caucasian female with a bachelor's degree in PE and a master's degree in educational foundations.

Once the teacher was identified and voluntarily agreed to participate, an individual PE class of sixth-grade students was selected for recruitment in the study. A primary factor in selection of this class was that it was scheduled in the middle of the day, which reduced potential conflicts with school assemblies and other events. Parents of the students in the targeted class were provided information about the study and only children whose parents provided written consent

were enrolled in the study. All of the 22 sets of parents of students in the class were approached for participation and 21 (95.5%) agreed and their children completed the study. The student participants were in the sixth grade and between ages 11 (17 or 81%) and 12 (4 or 19%), 12 (57%) being girls and 9 (43%) being boys. In addition, 16 students (76%) were Caucasian (9 females, 7 males) and five (24%) were African American (3 females, 2 males). There was no attrition following enrollment; however, there were four student absences across the six lessons (4/126, 3%); two students missed one class and one student missed two classes.

Measures

This study included individual measures for teacher selection and fidelity monitoring. The effects of the CCSS were assessed via two primary metrics of PA level (moderate-to-vigorous activity level and step counts) and a secondary rating scale survey assessing student and teacher perceptions of the PE lessons and use of the technology (accelerometer) to measure PA.

Physical educator selection survey. To minimize the potential of bias with the CCSS, an assessment of PE teachers' perspectives was conducted. As a result, a PE teacher with a neutral view regarding integration of CCSS into PE was selected. The survey used in the assessment of teachers' views consisted of six items drawn from a larger survey of PE teachers' perceptions of educational standards (Seymour & Garrison, 2016, 2017). Each item was rated on a 5-point Likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*, with a score of 3 indicating a neutral view (neither positive nor negative). In this study, the overall item mean was used in the identification and selection of the teacher to administer the lessons.

Fidelity checklist. Fidelity research regarding the accuracy of intervention implementation is limited and often underreported in PE (Stylianou, Kloeppe, Kulinna, & van der Mars, 2016). For this study, fidelity was assessed in each of the six PE lessons via a standardized fidelity checklist (Figure 1). The checklists were completed by research assistants (RAs) who were trained prior to initiation of the study lessons and observations. The RAs were taught to use the fidelity checklists by watching live and recorded lessons and interobserver agreement of 95.6% was established. The fidelity checklist was designed to assess for the presence of specific lesson components

Lesson: _____	Date: _____
Observer 1: _____	Observer 2: _____
Class Start Time: _____	Class End Time: _____

A warm-up or instant activity was included at the beginning of the lesson	YES	NO
An anticipatory set was utilized by the teacher to engage and capture the attention of students	YES	NO
An instructional episode introducing new content for the lesson was utilized by the teacher	YES	NO
A guided practice session was provided for students to rehearse main themes from the lesson	YES	NO
The lesson included a culminating activity for the students to practice lesson concepts more independently	YES	NO
A closure was implemented by the teacher to review lesson objectives and theme	YES	NO

Common Core State Standards Integration in PE:

Any reading, writing, listening, and speaking task or activity executed in PE class to support the Common Core State Standards in English Language Arts (“How Common Core,” n.d).

Check if any of the following English Language Arts literacy task(s) were integrated in the lesson:		
Station cards: During an activity that involves moving between several different stations, create station cards that offer in-depth written instructions for what to do next for critical thinking/comprehension practice (“How Common Core,” n.d).	<input type="checkbox"/>	Is at least one box checked? YES NO
Read-alouds: Also known as shared reading, read-alouds give students a chance to hear fluent reading. Provide handouts and read aloud while students follow along. They can then keep the handouts to peruse later or to reinforce your verbal (“How Common Core,” n.d).	<input type="checkbox"/>	
Bulletin boards: Provide a bulletin board that gives students instructions, gives tasks that must be accomplished, or provides a lesson that they must apply during class. Create a PE word wall that displays important vocabulary—movement words, health terms, names of muscle groups—that will be used throughout the day’s lesson (“How Common Core,” n.d).	<input type="checkbox"/>	
Supplemental texts: Post or distribute supplemental materials about the sport or skill you are currently covering. For instance, during a unit, post a short history of sport or activity, the basic rules, fun facts, and profiles of athletes (“How Common Core,” n.d).	<input type="checkbox"/>	
Setting goals: Have students write goals before an activity or at the start of the week. At the end of the activity or the week, have students provide a post-assessment of what they accomplished and what they could have done better (“How Common Core,” n.d).	<input type="checkbox"/>	
Create a new activity/game: Split students into groups and have them write the rules and directions for a new activity or game. They can then provide a quick demonstration of the new task and the best presentation can be chosen for use during the next class (“How Common Core,” n.d).	<input type="checkbox"/>	
Other: _____	<input type="checkbox"/>	

The Student Perceptions Survey was administered during the last 5 minutes of class	YES	NO
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Total # Yes	
Total # No	
Percentage	
Date Reviewed	

Figure 1. Fidelity checklist.

including warm-up, anticipatory set, instructional episode, guided practice, culminating activity, and closure. These elements were part of the manualized instructional protocol across conditions and the physical educator was required to include three or more of the six components during each lesson (Harvey et al., 2016). Manualization of these aspects of the lessons provided consistency across conditions and minimized the potential confounding of results by factors other than the CCSS elements. Results indicated that three or more components were exhibited in each of the six lessons (i.e., Lesson 1 = 5/6; Lesson 2 = 5/6; Lesson 3 = 4/6; Lesson 4 = 6/6; Lesson 5 = 3/6; Lesson 6 = 3/6). In addition to these common lesson components, the fidelity checklist in the assessment of whether the physical educator included any one of the CCSS ELA literacy tasks; this was used to establish whether the CC+ lessons included at least one CCSS ELA task and whether the CC- lessons did not include any CCSS ELA tasks. Results indicated that all of the CC+ lessons contained one or two CCSS ELA tasks ($M = 1.3$ ELA tasks) and that none of the CC- lessons contained any CCSS ELA tasks. Interobserver agreement among the RAs was also assessed during three randomly selected lessons (Lesson 1 CC-, Lesson 2 CC+, and Lesson 4 CC+) and results indicated 95.6% agreement.

Physical activity level (primary outcome measures). Levels of PA were measured during all six lessons via accelerometers. Accelerometry is a well-established objective measure of PA that removes the cognitive challenges commonly associated with subjective assessment of PA (e.g., inconsistent individual assessment of intensity, poor recall of activity level; Troiano, 2006; Troiano et al., 2008). Accelerometers allow for real-time data storage, recognize the intensity of movement, and can detect intermittent and incidental PA. A triaxial GT3X Actigraph accelerometer (Actigraph, n.d.) was used in this study. This device is small and unobtrusive to the wearer (27 g, $3.8 \times 3.7 \times 1.8$ cm) and in this study was fastened to an elastic band that was worn on the waist. With the accelerometer, higher counts indicate a greater level of PA. Studies have consistently supported the reliability and validity of the accelerometer for measuring PA (Crouter, Horton, & Bassett, 2012; Sasaki, John, & Freedson, 2011). In this study, PA was operationally defined as (1) the number of steps per minute and (2) the percentage of total minutes of moderate-to-

vigorous PA (MVPA; defined as activity intensity ≥ 4.00 metabolic equivalents; Freedson, Pober, & Janz, 2005). This PA calculation is the ratio of the metabolic rate during a specific activity to the resting metabolic rate. The number of steps per minute and the percentage of time in MVPA, rather than raw score totals, were used in the analyses because of some variability in the length of the lessons. The students wore the accelerometers for two class lessons prior to initiation of the study to reduce any possible “novelty effects” associated with wearing the accelerometers.

Physical education teacher and student perceptions survey (secondary outcome measures). The PE teacher and student perceptions were assessed via a six-item survey, with each item rated on a 5-point scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. This survey assessed enjoyment of the activities, perceptions of PA level, perceptions of content learned, degree to which the activity was physically challenging, and degree to which the activity was mentally challenging. The final item was included to assess the ease of accelerometer use. The mean of each item across the two lesson types was used in the analyses.

Procedures

Following institutional review board approval, the study was conducted during the 2016–2017 academic school year. Written parental/guardian consent was obtained for all students in the study. For confidentiality, a unique code number was assigned to each student and no personally identifying information was included on any of the study forms/measures or in the database.

This study utilized a one-group within-subjects randomized design. The conditions (CC+ lessons and CC- lessons) were randomly assigned to six consecutive PE lessons involving the same sport, students, and teacher. Basketball was identified as an appropriate unit of instruction because it required relatively similar activity levels across all six class sessions and allows students to reach on average 48% MVPA in PE class (Hollis et al., 2017). As noted, the two study conditions consisted of PE lessons with CCSS ELA integration (CC+; three lessons) or PE lessons without CCSS integration (CC-; three lessons). The primary outcome measures (PA levels) data were collected during each lesson and the secondary rating scale data were collected at the end of each lesson. Before beginning each lesson,

RAs distributed the accelerometers and the students placed them around their waists. Subsequently, at the end of each lesson, the RAs gathered the accelerometers and distributed and then collected the completed surveys from the students and PE teacher. The RAs were not involved in the development or delivery of the lessons and were graduate students in the Department of Kinesiology at a college in the Northeastern United States.

Each lesson plan was devised collaboratively by the PE instructor and the researchers to ensure a clear distinction between the CC+ and CC- lessons. For the purpose of this study, a lesson that integrated the CCSS was operationalized as any ELA-related (reading, writing, listening, and speaking) task or activity that was included in the PE lesson to support the CCSS in ELA (“How Common Core,” n.d.). It is important to note that mathematics integration is not a requirement for PE teachers to align to the CCSS (Seymour & Finn, 2019); this fact, along with the lack of empirical studies on CCSS ELA integration in PE, resulted in ELA integration being tested in this study. The six ELA integration tasks included in this investigation were station cards, read-alouds, bulletin boards, supplemental texts, setting goals, and creating a new activity/game. Each task was operationally defined (per “How Common Core,” n.d.) to foster implementation accuracy and improve the precision of fidelity monitoring (Figure 1) during the six consecutive lessons used in the study (3 CC+ and 3 CC-). During the three CC+ days, the PE instructor integrated an ELA literacy task within each lesson. Conversely, ELA literacy tasks were excluded by the PE instructor during the three designated CC- lessons. To avoid a confound from the nature of the PE activity itself, the PE lessons all involved basketball activities. The randomly assigned lesson schedule was Lesson 1 CC-, Lesson 2 CC+, Lesson 3 CC+, Lesson 4 CC+, Lesson 5 CC-, and Lesson 6 CC-.

Overview of Data Analyses

Data analyses included examination of data integrity, descriptive statistics, inferential analyses, and calculation of effect sizes with confidence intervals. The data integrity review included examination of data accuracy, outliers, and missing data. Descriptive statistics (means and standard deviations) were calculated for each outcome measure. Inferential statistics included linear mixed models to test the effect of lesson type (CC+ vs. CC-) on PA levels. The models

included condition as a fixed effect and students as a repeated effect to account for the correlation within students across the six lessons. Student perceptions of the two lesson types (five items; CC+ vs. CC-) and ease of accelerometer use in each of the two lesson types (CC+ vs. CC-) were examined in a similar manner. Each of the six perception items was tested in a linear mixed model with a primary focus on the effect of condition. Teacher perception ratings were examined descriptively without hypothesis tests because there was a single teacher participant in the study. Intraclass correlations were calculated to estimate the consistency of student and teacher perceptions within each condition. Hypothesis tests of the primary outcomes were two tailed with alpha set to .05. Exact p values are reported, as well as effect sizes (Cohen's d) with 95% confidence intervals.

Results

Physical Activity Levels (Primary Analyses)

The two primary measures of PA, obtained from the accelerometers, were percentage of time in MVPA and steps per minute (see Table 1 for descriptive statistics). The overall mean for MVPA in the CC+ condition for all three lessons was 19.7% ($SD = 7.0$); the three-lesson mean MVPA in the CC- condition was 33.1% ($SD = 10.4$). The linear mixed model test of condition was significant, $F(1, 24) = 182.82$, $p < .001$, $d = 1.46$, 95% CI [.88, 2.14]. The overall mean for steps per minute in the CC+ condition was 20.99 ($SD = 9.46$); the mean for the CC- condition was 32.76 ($SD = 9.46$). The linear mixed model test of condition was significant, $F(1, 21) = 133.45$, $p < .001$, $d = 1.48$, 95% CI [.90, 2.15].

Student and Teacher Perceptions Survey (Secondary Analyses)

Table 2 presents the student and teacher perceptions survey results (five items assessing perceptions of aspects of the lessons and one item assessing ease of accelerometer use across the two lesson types). Linear mixed model tests of student ratings by lesson type (CC+ vs. CC-) showed no significant difference on any of the six items. Intraclass correlations of the student and teacher reports were 0.70 for the CC- items and 0.68 for the CC+ items, demonstrating general agreement between students and the teacher. The students expressed greatest agreement with the items related to enjoyment

Table 1

Descriptive Statistics for Moderate-to-Vigorous Physical Activity (MVPA) Level and Step Count by Lesson and Condition

Lesson (<i>n</i>)	Condition	MVPA%	Steps per minute
		<i>M (SD)</i>	<i>M (SD)</i>
1 (21)	CC-	23.27 (6.80)	23.59 (4.08)
2 (20)	CC+	20.32 (6.84)	22.37 (5.19)
3 (19)	CC+	17.11 (6.34)	17.92 (4.78)
4 (21)	CC+	21.43 (7.27)	22.47 (4.85)
5 (21)	CC-	35.04 (6.10)	34.15 (6.11)
6 (20)	CC-	41.38 (8.62)	40.97 (9.68)
All lessons		26.50 (11.01)	26.97 (9.68)

Note. MVPA% = percentage of time in moderate-to-vigorous physical activity; CC- = PE lesson with no common core integration; CC+ = PE lesson with Common Core integration.

Table 2

Descriptive Statistics for Student and Teacher Perceptions of Lessons and Accelerometer Use

Item	Condition	Students	Teacher
		(<i>N</i> = 21) <i>M (SD)</i>	(<i>N</i> = 1) <i>M (SD)</i>
Enjoyment of activity	CC-	3.97 (1.01)	3.67 (0.58)
	CC+	4.00 (1.02)	3.67 (1.15)
Physically Active \geq 50% ^a	CC-	4.42 (0.95)	4.67 (0.58)
	CC+	4.32 (1.08)	4.00 (1.00)
Students Learned	CC-	3.36 (1.27)	3.67 (0.58)
	CC+	3.06 (1.21)	3.33 (1.15)
Physically Challenging	CC-	2.70 (1.44)	4.33 (0.58)
	CC+	2.41 (1.35)	4.00 (1.00)
Mentally Challenging	CC-	2.29 (1.29)	4.00 (1.00)
	CC+	2.23 (1.27)	4.00 (1.00)
Accelerometer Easy to Wear	CC-	4.15 (1.24)	4.67 (0.58)
	CC+	3.95 (1.30)	5.00 (0.00)

Note. CC- = PE lesson with no Common Core integration; CC+ = PE lesson with Common Core integration. Scale ratings: 5 = *strongly agree*; 4 = *agree*; 3 = *neutral*; 2 = *disagree*; 1 = *strongly disagree*.

^aPhysically Active \geq 50% = Physically active for at least 50% of the activity.

of the activity, being physically active at least 50% of the activity, and ease of wearing the accelerometer and somewhat less agreement with items related to physical and mental challenge of the activity. The rating of the item on student learning was near the neutral, or midpoint, of the scale. The teacher ratings were similar to the students' with the exception of the mental and physical challenge ratings; the teacher provided a higher level of agreement that the lessons were mentally and physically challenging in CC+ and CC- conditions. Statistical tests of the differences between student and teacher ratings were not conducted, because comparison of a single teacher with the entire class was not appropriate.

Discussion

The purpose of this pilot study was to assess the effects of CCSS integration (ELA tasks/activities) into PE lessons on student PA rates and on student and teacher perceptions of the PE lessons. Findings indicated that integration of the CCSS tasks into the PE lessons significantly negatively affected student PA levels. Specifically, results from both of the objective primary measures (MVPA and steps per minute measured via the accelerometers) indicated significantly lower PA levels when the physical educator integrated ELA tasks (CC+) compared to lessons without CCSS integration (CC-). In fact, the magnitude of the overall differences was quite large (MVPA, $d = 1.46$; steps per minute counts, $d = 1.48$). This is an important finding that suggests that while PE teachers may have had prior success with interdisciplinary learning (James & Manson, 2015), integration of CCSS ELA tasks/activities may be detrimental to PA levels and is worthy of additional consideration (Marttinen et al., 2017). Given the pilot nature of this investigation, replication studies using objective outcomes are needed and will strengthen the knowledge base. For example, average PA levels for the teacher and the class prior to the study may reveal more about the specific effect of CC+ versus CC- lessons.

These results also raise other potential considerations. For example, if physical educators are being asked to integrate the CCSS into daily instruction, the training of PE teachers regarding best practices and implementation of ELA tasks/activities into their lessons must be more closely examined (Seymour & Finn, 2019). Specifically, professional development that provides guidance to physical educators

about how to achieve optimal student levels of MVPA while integrating the CCSS would be helpful. It may be that physical educators who are trained to integrate CCSS into PE class while mindful of maximizing PA levels could reduce potential negative effects. It is interesting to note that the recommended levels for MVPA in PE class is 50% (Centers for Disease Control and Prevention, 2010b; Society of Health and Physical Educators, 2014), yet under both conditions in this study (CC+ and CC-) MVPA levels were well below the standard. This suggests that other factors such as teacher training and lesson content may play a role in this discussion.

Another factor for consideration involves the type of CCSS integration task, as different tasks may have differential effects on PA levels. A larger investigation testing the individual effects of certain types of tasks on PA levels may yield critical information on which serve to increase or hinder PA levels. As mentioned, the literature addressing the effects of the CCSS on PE is largely prescriptive with limited objective data. This study suggested that the integration of CCSS ELA tasks/activities (at least those included in this investigation) reduced PA levels during those PE lessons.

In addition to the objective measures, this study included secondary measures (surveys) assessing student and teacher perceptions regarding different facets of the lessons and the feasibility of accelerometer use for the CC+ and CC- lessons. Results revealed no significant effect of the CCSS integration on student ratings of their lessons or in the ease of accelerometer use during the lessons compared to the non-CCSS lessons. The teacher's ratings regarding the effect of the CCSS ELA tasks/activities on PE lessons and use of the accelerometer in most cases mirrored student agreement rankings. It is interesting to note that an intraclass correlational analysis of the student and teacher reports yielded values of 0.70 for the CC- items and 0.68 for the CC+ items, demonstrating general agreement between groups. The findings from the surveys are interesting and suggest that should the CCSS initiative continue to be a requirement for physical educators, student perceptions of their PE lessons/classes may not be substantially affected. Taken together, the results from the primary and secondary measures suggest that the integration of the CCSS ELA tasks/activities may not have a negative effect on student and teacher perceptions but do appear to

have a significant and detrimental effect on PA level. This seems to have meaningful applied practice implications if PA (and potentially physical health) is a central focus and targeted outcome for PE lessons/classes. When considered from the non-CCSS perspective, the findings suggested that students' and the teacher's views of the PE lessons were not negatively affected by the significantly higher PA rates within those lessons.

A final note is warranted regarding the findings involving the feasibility of the use of accelerometers to collect PA data. As noted, results indicated that students and the teacher considered the accelerometers to be an easily used instrument to collect PA data and there was no difference in ratings when used with or without the integration of the CCSS ELA tasks/activities. This was considered a promising finding, as the accelerometers constitute an objective measure of PA that is not susceptible to the characteristic problems associated with subjective assessment of PA. As such, researchers can capture empirical data to test the effects of CCSS integration on PA, with surveys to supplement the primary physical data if desired.

Although this was the first study to objectively test the effect of CCSS ELA task/activity integration on PA levels in PE and it had many strengths (e.g., measurement of PA via an objective measure, randomization of the sequence of lessons, manualized lesson plan structure, comprehensive assessment of fidelity and monitoring for the presences of CCSS tasks/activities by RAs uninvolved with lesson delivery, statistical accounting for the effects of correlated/clustered data), several limitations warrant mention. One limitation involved the small sample size (both student participants and a single teacher), which restricts broader generalizations regarding the findings. Another limitation involved the manner in which the sequencing of the lessons may have influenced the outcomes. For example, a basketball lesson at the beginning of the unit may be more instructional than at the end of the unit. Although this is a potential limitation, the primary PA measures were adjusted to account for such differences (i.e., use of percentage of time in MVPA and steps per minute). Future studies may want to use a randomized two-group within-subjects counterbalanced design to control for potential order effects (i.e., randomization of students to one of two order groups and testing the effects of the CCSS integration

in the two groups in counterbalanced order of delivery). The study also only tested the effect of the CCSS ELA tasks/activities and as such does not provide insight into the possible effect of other CCSS content on PA levels. Relatedly, this study only examined the effects of the CCSS ELA tasks/activities during a basketball unit and it is unknown whether other PE units of instruction would be similarly affected. Given these limitations, future studies should include larger samples of students and PE teachers and test the effects of different CCSS content tasks/activities on a broader range of PE units of instruction. This will help in the determination of whether CCSS integration has uniform or differential effects on PA levels based on the CCSS content integrated and/or PE unit of instruction.

Overall, this preliminary investigation yielded important information that can be used in the expansion of this line of research. As noted, the literature review yielded no empirical studies of the effect of CCSS ELA tasks/activities integration on PE lessons and/or that included an objective measure of PA. Another point for consideration is that the CCSS policy initiative defines PE as a technical subject and suggests that PE teachers support ELA literacy. Nevertheless, the research examining the effects of CCSS integration in PE class is predominant in mathematics with nine studies that either independently or in conjunction with other subjects analyze this practice (Marttinen et al., 2017; Seymour & Finn, 2019). Given the belief that integrating mathematics in PE may be effective for students, this may be counterintuitive for physical educators (Marttinen et al., 2017; Scrabis-Fletcher, 2016; Wade, 2016).

It is clear from this study that integration of some types of CCSS ELA tasks/activities (at least those included in this study) may reduce PA during PE lessons; however, more extensive and controlled testing needs to include different types of ELA tasks/activities. Assuming the need for ongoing integration of the CCSS into PE lessons, researchers should develop and test specific ELA and/or mathematics tasks/activities that can be easily integrated into PE lessons and do not reduce PA levels. At the same time, future studies that control for teacher experience and integration tasks that sustain PA levels may reveal more about the objective effects of CCSS ELA integration in PE. This in turn may ensure that policy makers and administrators

recognize PE as contributing to the academic, as well as physical, development of students in this era of educational accountability.

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