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Integration and Physical Education: A Review of Research

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ABSTRACT

The Common Core State Standards Initiative has placed an increased focus on mathematics and English language arts. A relationship between physical activity and academic achievement is evident, but research on integration of academic subjects with physical education is still unclear. This literature review examined databases for the years 2004–2013, focusing on physical education or physical activity and core academic subjects for school-aged youth. 23 studies were found that focused on integration and physical education that met the inclusion criteria. These were from 16 different publication outlets, ranging in research methods, country, and population. This review provides information on the status of integration and physical education. Since classroom teachers are increasingly being encouraged to incorporate core subjects with physical activity into their classes, it would be appropriate for physical educators to understand the desired outcomes of integration of core subjects before attempting its implementation.

KEYWORDS

Academic achievement; Common Core Standards; physical activity; physical education

Introduction

The beneficial effects of physical activity on academic achievement have been supported by numerous scholars (Booth et al., 2013; Castelli & Hillman, 2007; Ploughman, 2008). A recent review of children's physical activity and academic achievement (Howie & Pate, 2012) found 125 studies, prior to 2011, to support the positive association between physical activity and academic achievement. Overall, the findings from these investigations support that physical activity and academic achievement have a significant, positive relationship (Castelli & Hillman, 2007; Donnelly & Lambourne, 2011; Donnelly et al., 2009; Dwyer, Sallis, Blizzard, Lazarus, & Dean, 2001; Grissom, 2005). Despite this positive association, the prevalence of insufficient physical activity in the United States is increasing for children and youth, especially in the school environment (Fairclough, Beighle, Erwin, & Ridgers, 2012; Troiano et al., 2008).

Common Core State Standards (CCSS)

A recent shift in the American education system has introduced the CCSS Initiative, in which specific benchmarks are presented for grade level expectations for subjects such as math and English language arts (ELA; National Governors Association Center for Best Practices &

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Council of Chief State School Officers, 2015). As a result, many physical education teachers are encouraged to integrate their content with that of the common core in order to increase achievement on standardized test scores. According to Bronfenbrenner's (1977, 1979) ecological systems theory of child development, human development can be attributed to the interaction between an individual and his or her environment, and that there are many different levels of environmental influences that can affect a child's development, starting with learning environments. It might therefore be reasonable to assume that integration of two or more subject areas (i.e., physical education or physical activity into core curriculum) could help students learn and understand through different learning environments. This literature review aims to present the evidence for effective or ineffective integration of (a) common core into physical education and (b) integration of physical activity into the classroom or school day, not including physical education. This review will provide important information for physical educators, physical education teacher educators, and classroom teachers as to whether integration should be encouraged in the school environment.

Knowledge about integration

Education reform, most notably the 2001 No Child Left Behind (NCLB) Act, along with federal, state, and local legislative mandates have led to a greater emphasis on recognized core academic subjects such as math and ELA, and a de-emphasis on subjects such as music, art, and physical education. Most recently, the CCSS Initiative, a state-led effort coordinated by the National Governors Association (NGA) center and the Council of Chief State School Officers (CCSSO; CCSS Initiative, 2014a) has placed an increased focus on mathematics and ELA. The aims of this initiative are to define the knowledge and skills that students in grades K–12 should have to succeed in entry-level, credit-bearing, academic courses and in workforce training programs.

It is reasonable to assume that legislation makes integration of common core subjects a growing necessity. Since classroom teachers are increasingly being encouraged to incorporate physical activity into their classes, it may be appropriate for physical educators to reciprocate this integration of content as a means of encouraging collaboration and building overall school community. Integrating core academic subjects into a physical education setting could give physical education a more central and integral role in the school setting; however, this is merely hypothesized, as little evidence supports this notion. To date, no review of the literature on physical education and integration has been conducted. Accordingly, this literature review investigated the influences of integration of physical education into the classroom in the form of physical activity, and integration of core academic subjects into the physical education classroom setting.

Identifying research

To carry out this review, three databases (Web of Science, Education Resources Information Center (ERIC), and Sport Discus) were searched using the following phrases: physical education or physical activity and integration or interdisciplinary. For the purpose of this review, integration is defined as combining two or more subject areas to help students learn and understand through different modes (Pring, 1973).

The inclusion criteria for this review included studies: written in English, empirical research on school aged youth between the ages of 5 and 18, studies in the 10-year date range of 2004–2014 inclusive, research that included integration of physical activity or physical education with a core academic subject, as defined by the new CCSS (i.e. math, science, ELA, history), and studies published in peer reviewed sources. The authors included empirical research studies integrating physical activity in the classroom setting in this review, as the research team decided that the criteria should include all aspects of physical activity or physical education during the school day (excluding afterschool programs), regardless of it taking place during physical education class.

The definition of common core was taken from the CCSS Initiative (2014b). Articles that did not integrate a common core subject were excluded as they were outside the scope of this literature review. The CCSS Initiative website states that standards are being created for other subjects outside of ELA and math, however, for now, these subjects will comprise the inclusion criteria in order to assess efficacy of common core integration into physical education.

Physical education and integration research trends

The number of publications can be found in Figure 1. Along with each article, a brief description is given to explain the design and results. Articles were published in 16 different peer-reviewed journals. Elementary school students were the target population of 19 articles while two studies targeted pre-school students and one each focused on middle school and high school. Almost all of the research used in-service teachers (n = 21) to implement the integration. The two other studies employed the use of university researchers who assumed the role of teaching students in primary and secondary schools.

Overall, 19 of 23 articles used quantitative methods, two used qualitative methods, and two applied mixed methods. Eighteen studies (78.3%) were experimental, four were observational and one was a descriptive study. Only four studies used student interviews

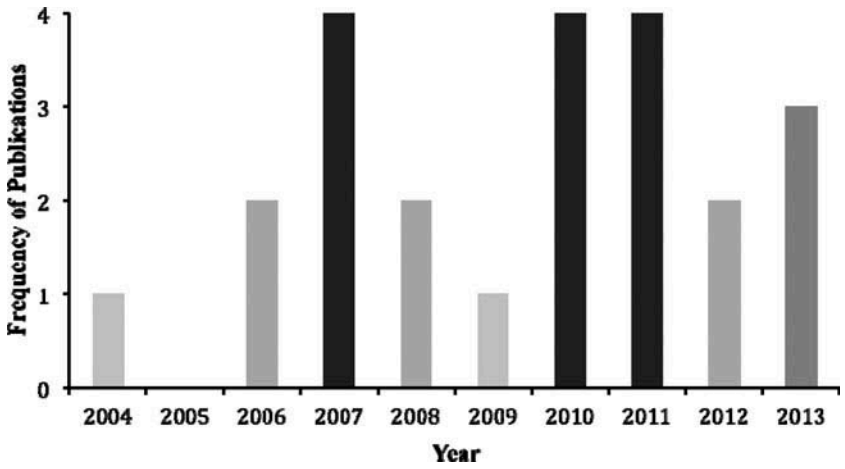

Figure 1. Article frequency by year from 2004–2013. Article range was between zero (2005) and four (2007, 2010, 2011) for the 10-year time frame.

as a method for data collection, and two used questionnaires, whereas 18 out of 23 studies used some other quantitative measurement (e.g., caloric expenditure, steps taken, physical activity monitoring devices, or tests for academic achievement). Of the subjects integrated, 11 of the studies focused solely on integrating physical activity into the classroom (see Table 1). Of those that looked at integration of the common core into physical education, math was integrated most often, with nine of the studies integrating math alone, or in conjunction with other subjects (see Table 2). Of the other core-subjects, English and science each were integrated in four studies while no studies integrated history. In total, 22 out of 23 studies claimed to be successful. In addition, 12 out of 23 studies had physical activity levels and academic achievement as the focus of the study, eight out of 23 studies focused solely on physical activity outcomes with no academic measure. The unit of analysis was the school or class in 17 out of 23 studies with six using students as the unit of analysis. Prevalence of research from different countries was vast with research coming from seven different countries, although the majority of research was conducted in the United States with 15 published articles.

Nineteen of the 21 studies that targeted K–12 students were conducted at the elementary school level. We feel it important to highlight that only one study in the last 10 years of peer reviewed research focused on secondary schools. Sallis (2000) noted that the highest level of physical activity decline occurs between the ages of 13–18 prompting beliefs that physical activity should actually be integrated more at the secondary level. Furthermore, the leading journals that published integration papers were *The Journal of School Health* and *Medicine and Science in Sports and Exercise*. The leading physical education pedagogy journals only published one article each on integration in the past 10 years. These pedagogy journals would seem the most logical outlets for this type of research, as physical educators are often spearheading the integration.

Core content integrated into physical education

Preliminary research to describe the challenging situations of common core integration in physical education was conducted by Thorburn and Collins (2003), in which an intervention was implemented over one academic year. The intervention consisted of a fully integrated curriculum with various academic subjects such as mathematics, English, and science. Data collection consisted of interviews with teachers, students, and administration. The findings of this study revealed that physical education teachers (N = 18) were often found to be in one of three situations. The first situation was within schools with short-term assessment pressures. This limited the capability of the teacher to deliver high quality instruction, termed by the authors as having a dichotomous theory/practical shift. The second situation, which also limited effectiveness of integration, involved teachers refining their teaching strategy into a specific style with a narrow focus, making it extremely difficult for them to adopt new practices, even when only a small to moderate change was required. Lastly, and more positively, schools in the third situation were successful in adopting integration as a regular aspect of their physical education program. This success was demonstrated by a high level of expertise for performance-led teaching environments, where feedback was often integrated into teaching (Thorburn & Collins, 2003).

Table 1. Description of all studies found that integrated physical activity in the classroom.

Physical activity integration in the classroom				
Author(s) (year), country	Sample	Subject integrated	Study design	Length of study
Ahamed et al. (2007), Canada	Grades 4 and 5, 288 students	Physical Activity in the classroom	Longitudinal, quantitative	16 months
Chen et al. (2011), USA	Two classes, grade 2, 35 students	Math and Physical Activity in the classroom	Cross-sectional, qualitative	Not reported
Donnelly et al. (2009), USA	Twenty-four schools, grades 2–5, 1,410 students	Physical Activity in the classroom	Longitudinal, quantitative	Over 3 years
Erwin et al. (2011), USA	Two schools, grades 3–5, 106 students	Physical Activity in the classroom	Cross-sectional, quantitative	8 months
Gibson et al. (2008), USA	Grades 2–5, 4,905 students	Physical Activity in the classroom	Quasi experimental mixed methods	1 year
Holt et al. (2013), USA	Four schools, grades K–5, 1,284 students	Physical Activity in the classroom	Cross-sectional, quantitative	6 months
Honas et al. (2008), USA	Three schools, grades 2–5, 38 students	Physical Activity in the classroom	Cross-sectional, quantitative	Not reported
Katz et al. (2010), USA	Three schools, grades 2–4, 1,214 students	Physical Activity in the classroom	Cross-sectional, quantitative	8 months
Knox et al. (2012), U.K.	One school, grades 7 and 9, 115 students	Physical Activity in the classroom	Quasi experimental, quantitative	18 weeks
Liu et al. (2007), China	Two schools, grades 1–5, 753 students	Physical Activity in the classroom	Longitudinal, quantitative	Two semesters
Mahar et al. (2006), USA	Fifteen classes, grades K–4, 243 students	Physical Activity in the classroom	Cross-sectional, quantitative	12 weeks
Murtagh et al. (2013), Ireland	Four schools, grades 2–6, 90 students	Physical Activity in the classroom	Cross-sectional, quantitative	3 months
Palmer et al. (2013), USA	One class, preschool, 16 students	Physical Activity in the classroom	Cross-sectional, quantitative	One time
Reed et al. (2010), USA	Six classes, grade 3, 155 students	Physical Activity in the classroom	Cross-sectional, quantitative	4 months
Stewart et al. (2004), USA	Three classes, grades 1, 3 and 5, 71 students	Physical Activity in the classroom	Cross-sectional, quantitative	One semester
Vazou et al. (2012), Greece	Fifteen classes, grades 4–6, 147 students	Math, English, and Physical Activity in the classroom	Cross-sectional, quantitative	2 weeks

Table 2. Description of all studies found that integrated core subjects in physical education.

Core content integrated into physical education				
Author(s) (year), country	Sample	Subject integrated	Study design	Length of study
Bartholomew and Jowers (2011), USA	Grades K–5	Math, Science, and English in the gymnasium	Longitudinal, quantitative	Ongoing
Chen, Cone, et al. (2007), USA	Two classes, grade 2, 35 students	Math in the gymnasium	Cross-sectional, qualitative	Not reported
A. Chen et al. (2007), USA	Twenty-seven classes, grades 4–5, 162 students	Science in the gymnasium	Quasi experimental, quantitative	Not reported
Derri et al. (2010), Greece	Two schools, preschool, 67 students	English in the gymnasium	Cross-sectional, quantitative	5 weeks
Lee and DuMont (2010), USA	One class, grades 9–12, four students	Math in the gymnasium	Cross-sectional, mixed methods	1 week
Oliver et al. (2006), New Zealand	Three classes, grades 5 and 6, 78 students	Math and English in the gymnasium	Cross-sectional, qualitative	Over 4 weeks
O'Hara et al. (2011)	Two groups, 6–10-year-olds, 140 students	Science in the gymnasium	Cross-sectional, quantitative	Not reported

It is suggested that integration of one or more subject areas could help students learn and understand through different learning environments (Derri, Kourtessis, Goti-Douma, & Kyrgiridis, 2010; Lee & DuMont, 2010; O'Hara, Reis, Esteves, Brais, & Branco, 2011).

The integration of core subjects in physical education settings could be effective in developing language skills, understanding math, and acquiring knowledge by adopting movements to solve various problems (Bartholomew & Jowers, 2011; Derri et al., 2010; Lee & DuMont, 2010; O'Hara et al., 2011). Developing language skills, for example, was observed in a study where the intervention group outperformed the control group in their written and oral language skills when a program was implemented to integrate a language program into a physical education class (Derri et al., 2010). This study followed preschool children through a 5-week intervention and measured knowledge with a pre- and post-test. An example of math integration comes from a study by Lee and DuMont (2010) in which students used physical activity monitors to collect their own movement data and the researchers then analyzed the students' mathematical thinking. Other researchers (O'Hara et al., 2011) have also used electronic devices to measure individual students' movement to help them interact with meaningful data and integrate learning into a physical education environment.

An integrated approach to physical education satisfied the needs of students' physical activity levels in studies by Oliver, Schofield, and McEvoy (2006) as well as Chen, Martin, Sun, and Ennis (2007). In the study by Oliver et al. (2006), a comprehensive, stand-alone primary (elementary) school unit for grades 5–6 was developed in collaboration with primary school teachers. The unit was developed to correspond with the New Zealand national curriculum and assessment guidelines. A thematic approach was taken, whereby all disciplines were linked by a common topic of conducting a "virtual" walk around New Zealand. Subjects incorporated were English, social studies, mathematics, statistics, and physical education. Lesson plans required student participation in physical activity, explored physical activity themes, or involved "walking" to various cities in New Zealand in order to integrate core content. This intervention significantly increased student physical activity as measured by accelerometers. In addition, A. Chen et al. (2007) accomplished a significant increase in objectively measured physical activity by having students calculate stride length by measuring distance walked and number steps taken in a physical education unit. The intervention was deemed successful from an integration standpoint, however no academic achievement measures were assessed, nor transferability into the classroom.

Based on these findings, it may be appropriate for physical educators to integrate core academic subjects into physical education settings in order to give physical education more of a central and integral role. Chen, Cone, and Cone (2007) identified ways that a physical education teacher could collaborate with a classroom teacher in order to successfully integrate core content into physical education. This interdisciplinary planning and teaching process resulted in a mutually beneficial outcome for both the physical education and classroom teacher. By sharing their leadership roles they formed and assembled each lesson's focus, scope, sequence, and teaching strategies based on the students' skills and knowledge in both subjects. The research indicated that developing such partnerships does not sacrifice high quality instruction (W. Chen et al., 2007).

Although it appears that physical education has the potential to serve as an effective conduit for integration, due to the limited number of empirical studies that have been conducted to date, the results of the aforementioned studies should be treated with caution. There is potential for physical education as a host for common core integration into physical education, but the results from studies mentioned here must be treated with

caution. The most common subject to be incorporated into physical education was math, therefore efficacy of integrating other common core subjects is not clear as only a few other studies included ELA into their intervention. Through successful integration of academic subjects into the physical education curricula, researchers have shown that students can improve their language skills, improve on their mathematical thinking skills, increase their physical activity levels, and have the ability to analyze and relate to meaningful data that they produce through activity monitors. The primary purpose of integration is to increase academic achievement via measurable outcomes such as time on-task, standardized testing, and formative assessment. Unfortunately much of the research has not measured these crucial aspects and further study in this area is warranted.

Physical activity integration in the classroom

Physical activity integration in the classroom has received considerable media and anecdotal attention in the last 10 years. Several intervention studies have attempted to integrate daily physical activity breaks into the classroom to increase physical activity levels in students by implementing a new physical activity unit (Ahmed et al., 2007; Honas, Washburn, Smith, Green, & Donnelly, 2008; Murtagh, Mulvihill, & Markey, 2013; Stewart, Dennison, Kohl, & Doyle, 2004). In general, these studies attempted to evaluate the effect of a classroom-based short activity break on in-school step counts of primary (elementary) school children. All studies found a significant increase in the change in daily steps between baseline to follow-up between groups. Children in these studies who participated in a short activity break achieved a higher amount of physical activity during school hours than students who did not (Ahamed et al., 2007; Honas et al., 2008; Murtagh et al., 2013; Stewart et al., 2004).

In another example, Erwin, Beighle, Morgan, and Noland (2011) encouraged intervention teachers within their study to include at least one 5–10-minute classroom physical activity break each day in addition to students' regularly scheduled physical activities (i.e., recess, movement during morning announcements, physical education). The results indicated that students in a physical activity intervention group recorded on average significantly more school steps per day compared to the control groups at both the follow-up and the post follow-up monitoring periods. Based on these findings it is reasonable to assume that this intervention was effective in increasing the number of steps per day in the classroom.

Another study conducted by Holt, Bartee, and Heelan (2013) evaluated a school-level policy to integrate bursts of daily physical activity into the classroom, which meant all students had to be provided with at least 20 minutes of physical activity throughout the day outside of recess and physical education. Results of this study showed students in the curriculum-based lessons or walk/run period intervention groups significantly increased school day moderate-to-vigorous physical activity (MVPA) compared with students in no additional activity groups. In a similar study, Liu et al. (2007) evaluated the effect of a classroom-based physical activity integration program in Beijing, China. They showed that the average energy expenditure and duration of total physical activity per day among students in the intervention school increased significantly from the baseline when using safe and age- and space-appropriate physical activity classroom activities. This provides

rationale to suggest that children expend more energy when involved in a physical activity-based intervention.

While direct measures of activity such as step counts and accelerometer data are beneficial in order to justify the efficacy of integration, it is also imperative to consider health outcomes of children. Other intervention studies attempted to integrate daily physical activity breaks into the classroom to specifically improve students' health outcomes and overall fitness. Knox et al. (2012) investigated cardiovascular disease risk factor response in adolescents following a physical activity intervention in the classroom (3,200 m of brisk walking during a 60-minute subject classroom-based lesson, two times per week). Results from this study suggest that brisk walking has a positive physiological impact on children. Katz et al. (2010) evaluated the effects of a physical activity program in the elementary school classroom on health outcomes and fitness. The physical activity component incorporated brief bursts of activity in the classroom throughout the day at the discretion of the teacher; two comparable schools acted as controls for this study. This study showed improvements in measures of health and fitness during 1 school year. Utilizing tests from the FitnessGram® assessment tool, fitness measures of upper body strength, abdominal strength, and trunk extensor strength were improved compared to baseline (Katz et al., 2010).

It is noteworthy that only a small number of studies in the last 10 years focused both on student physical activity levels and academic achievement. The findings from these investigations, however, support the idea that physical activity and academic achievement are related (Donnelly & Lambourne, 2011; Hillman et al., 2009). In regard to academic achievement, it is important to mention research conducted by Mahar et al. (2006) that evaluated the effects of a classroom-based physical activity program on children's in-school physical activity levels and on-task behavior during academic instruction following the physical activity intervention. Results demonstrated that students in the intervention group took significantly more steps than the control group and that there was success at increasing on-task behavior during academic instruction. A similar study by Donnelly et al. (2009) investigated the effect of a school-based physical activity intervention on increasing academic achievement scores in elementary school children. Intervention schools had significantly greater increases in daily physical activity levels and academic achievement scores than control schools over the 3-year intervention. Further, two studies examined the effects of school-based physical activity interventions on students' cognitive functions (i.e., better ability to sustain attention [concentration] and fluid intelligence) and both showed that cognitive functions are ameliorated with exercise (Palmer, Miller, & Robinson, 2013; Reed et al., 2010).

Attitudes toward physical activity integration

Through research it is understood that students' attitudes, experience, and motivation play an influential role in educational settings. A few studies were found investigating students' attitude, experience, and motivation in integration studies published in the last 10 years (Chen, Cone, & Cone, 2011; Gibson et al., 2008; Vazou, Gavrliou, Mamalaki, Papanastasiou, & Sioumala, 2012). These studies focused specifically on situational motivation, achievement goal orientation, personal goals, and effort/persistence during classes that integrated physical activity. It is suggested, therefore, that class climate and goal

setting practice plays a role in students' perceptions of and their motivation to participate in physical activity (Gibson et al., 2008). From these findings it can be assumed that a supportive environment and high levels of expectancy-related beliefs and subjective task values are positively related to motivation in physical education (Chen et al., 2011). One study in particular showed that intrinsic motivation, perceived competence, and effort significantly improved as a result of the integrated school-based physical activity intervention (Vazou et al., 2012). Furthermore, lessons integrating physical activity were perceived as more enjoyable and more interesting compared to traditional lessons. These studies indicate that increasing school time physical activity by introducing physical activity into core subject lessons may potentially have a positive impact on children's cognitive performance and academic achievement, physical activity levels throughout the day, motivation, enjoyment, or confidence and on several risk factors associated with cardiovascular disease.

Discussion

The main purpose of this review was to assess the degree to which integration of core content into physical education or integration of physical activity into the classroom is successful. The Ecological Systems Theory states that a person is directly and indirectly impacted by various environmental entities, such as home, school, work, community, and society. Bronfenbrenner (1977, 1979) contended that there are multiple layers: the micro, meso-, exo-, and macrosystems, that impact individual behavior. In this literature review, it would be reasonable to assume that the school environment acts as the mesosystem, however this is shaped and influenced by influences such as policy, external governing bodies and other factors whose influences reside in other areas of the system (Bronfenbrenner, 1977, 1979).

Organizations such as the Society for Health and Physical Educators America (SHAPE America) have attempted to bridge the gap between physical education and the common core for teachers with their push for webinars of integration (SHAPE America, 2013). However, based on this review only seven studies have examined the effectiveness of the integration of core academic subjects in physical education, thus it is not clear what strategies are deemed effective for teachers to adopt.

There is a big push for Science, Technology, Engineering, and Math (STEM) education in the western world, and maybe this is an ideal avenue to deliver more math and science education to students through physical education integration. Of the 23 studies included in this literature review, nine focused primarily on mathematics integration with either physical education or physical activity, as well as several science-based integration interventions. This raises the question of why math is the leading subject to be integrated into classrooms and physical education. It may be that this subject is the most logical to integrate into physical education and classrooms due to the fact that teachers constantly give directions involving numbers and sequences. Furthermore, the sustainability of these interventions and papers reviewing integration needs to be considered when making suggestions. Without examining the long-term efficacy of integration it is not reasonable to assume that reciprocal benefits exist.

When we examine physical activity integration in the classroom, it is clear that there are more studies published about the integration of physical activity into the classroom than of

common core subjects into physical education. When integrating physical activity into core subjects, mixed success has been indicated. While there was a trend observed suggesting activity breaks increase overall school MVPA, most of the studies were based solely on physical activity outcomes without academic measures. This might lead researchers and practitioners to believe that there is a missed opportunity of true integration, and to question whether integrating physical activity into the classroom will remain a sustainable option for teachers. The same argument could be made for physical education. That is, physical educators may feel that class time is not wisely spent focusing on academics instead of exclusively on physical education and physical activity. How long will teachers incorporate physical activity breaks into their classrooms when they are not sure if this is merely taking time away from academics? Empirically deduced benefits of physical activity integration into the classroom consist of getting children more on-task, more accumulated physical activity throughout the day, and improving motivation, enjoyment, and confidence (Ahamed et al., 2007; Gibson et al., 2008; Holt et al., 2013; Liu et al., 2007; Stewart et al., 2004; Vazou et al., 2012). Worthwhile benefits of physical activity integration programs are also found to elicit several health outcomes such as physical fitness, cardiovascular health, and BMI reduction (Honas et al., 2008; Katz et al., 2010; Knox et al., 2012). However, these data must be treated with caution; insufficient amounts of empirical research are available to make conclusions of how to most effectively integrate academic subjects into physical education, and how to also integrate physical activity into the classroom setting. It is important to note that only research that investigated common core subjects was considered for this review, as that is the growing trend in the U.S. education field. Therefore, studies including other subjects (e.g., folk dancing, technology) were not considered.

Implications

It is important for researchers in this field to continue to conduct research on subject integration and to understand what place it has in the school environment, as physical education settings may hold great potential to integrate different academic subjects. Researchers should focus on conducting more research in the area of integration as it is being suggested for practitioners as a credible and important approach to education. As this review suggests, however, integration has not been extensively examined and many studies did not take into account academic measures. Instead researchers have chosen to measure the effects of physical activity into the classroom as activity breaks without an academic goal. Further research on effective methods of integrating common core subjects into physical education could help strengthen the evidence of the link of academic achievement and physical education, as well as ensuring the relevance of physical education in schools amid growing concerns of budget cuts. Integrating academic subjects into physical education could place this subject at the heart of the school instead of the peripherals as it often is seen.

Conclusion

This review contributes a unique summary of the literature for integration of core curricular content in physical education as well as physical activity integration in the classroom. Our review brings to light that the pressure from many organizations to integrate core content into their classes is not as evidence-based as it appears. Empirical

research needs to thoroughly investigate what makes this integration successful or not in order to effectively guide teachers to enhance their curricula. Through this literature review, researchers in the field of physical education are provided with a clear understanding of the empirical research conducted on integration and physical education in the last 10 years. It is important to know what has been investigated in order to plan future research and to answer questions that arise from prior studies. In order for physical education to stay relevant in the current neoliberal global context (Macdonald, 2011) it is important to increase the perceived value of physical education to administrators and policy makers. One avenue to increasing this perceived value may be to further push the link between physical education and academic achievement, but more extensive research is warranted.

References

Ahamed, Y., Macdonald, H., Reed, K., Naylor, P., Liu-Ambrose, T., & McKay, H. (2007). School-based physical activity does not compromise children's academic performance. *Medicine & Science in Sports & Exercise*, *39*, 371–376. doi:10.1249/01.mss.0000241654.45500.8e

Bartholomew, J. B., & Jowers, E. M. (2011). Physically active academic lessons in elementary children. *Preventive Medicine*, *52*(1), 51–54. doi:10.1016/j.ypmed.2011.01.017

Booth, J. N., Leary, S. D., Joinson, C., Ness, A. R., Tomporowski, P. D., Boyle, J. M., & Reilly, J. J. (2013). Associations between objectively measured physical activity and academic attainment in adolescents from a UK cohort. *British Journal of Sports Medicine*, *48*, 265–270. doi:10.1136/bjsports-2013-092334

Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *The American Psychologist*, *32*, 513–531. doi:10.1037/0003-066X.32.7.513

Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press.

Castelli, D. M., & Hillman, C. H. (2007). Physical education performance outcomes and cognitive function. *Strategies: A Journal for Physical and Sport Educators*, *21*, 26–30. doi:10.1080/08924562.2007.10590756

Chen, A., Martin, R., Sun, H., & Ennis, C. D. (2007). Is in-class physical activity at risk in constructivist physical education? *Research Quarterly for Exercise & Sport*, *78*, 500–509. doi:10.1080/02701367.2007.10599449

Chen, W., Cone, T. P., & Cone, S. L. (2007). A collaborative approach to developing an interdisciplinary unit. *Journal of Teaching in Physical Education*, *26*, 103–124.

Chen, W., Cone, T. P., & Cone, S. L. (2011). Students' voices and learning experiences in an integrated unit. *Physical Education and Sport Pedagogy*, *16*, 49–65. doi:10.1080/17408989.2010.491818

Common Core State Standards (CCCS) Initiative. (2014a). *State standards: About the standards*. Retrieved from http://www.corestandards.org/about-the-standards/

Common Core State Standards (CCCS) Initiative. (2014b). *State standards: Development process*. Retrieved from http://www.corestandards.org/about-the-standards/development-process/

Derri, V., Kourtessis, T., Goti-Douma, E., & Kyrgiridis, P. (2010). Physical education and language integration: Effects on oral and written speech of pre-school children. *The Physical Educator*, *64*, 178–186.

Donnelly, J. E., Greene, J. L., Gibson, C. A., Smith, B. K., Washburn, R. A., Sullivan, D. K., & Williams, S. L. (2009). Physical Activity Across the Curriculum (PAAC): A randomized controlled trial to promote physical activity and diminish overweight and obesity in elementary school children. *Preventive Medicine*, *49*, 336–341. doi:10.1016/j.ypmed.2009.07.022

Donnelly, J. E., & Lambourne, K. (2011). Classroom-based physical activity, cognition, and academic achievement. *Preventive Medicine*, *52*, 36–42. doi:10.1016/j.ypmed.2011.01.021

Dwyer, T., Sallis, J. F., Blizzard, L., Lazarus, R., & Dean, K. (2001). Relation of academic performance to physical activity and fitness in children. *Pediatric Exercise Science*, *13*, 225–238.

Erwin, H. E., Beighle, A., Morgan, C. F., & Noland, M. (2011). Effects of a low-cost, teacher-directed classroom intervention on elementary students' physical activity. *Journal of School Health*, *81*, 455–461. doi:10.1111/j.1746-1561.2011.00614.x

Fairclough, S. J., Beighle, A., Erwin, H., & Ridgers, N. D. (2012). School day segmented physical activity patterns of high and low active children. *BMC Public Health*, *12*, 406. doi:10.1186/1471-2458-12-406

Gibson, C. A., Smith, B. K., DuBose, K. D., Greene, J. L., Bailey, B. W., Williams, S. L., … Donnelly, J. E. (2008). Physical activity across the curriculum: Year one process evaluation results. *International Journal of Behavioral Nutrition and Physical Activity*, *5*, 1–11. doi:10.1186/1479-5868-5-36

Grissom, J. B. (2005). Physical fitness and academic achievement. *Pediatric Exercise Physiology*, *8*, 11–25.

Hillman, C. H., Pontifex, M. B., Raine, L. B., Castelli, D. M., Hall, E. E., & Kramer, A. F. (2009). The effect of acute treadmill walking on cognitive control and academic achievement in preadolescent children. *Neuroscience*, *159*, 1044–1054. doi:10.1016/j.neuroscience.2009.01.057

Holt, E., Bartee, T., & Heelan, K. (2013). Evaluation of a policy to integrate physical activity into the school day. *Journal of Physical Activity and Health*, *10*, 480–487.

Honas, J. J., Washburn, R. A., Smith, B. K., Green, J. L., & Donnelly, J. E. (2008). Energy expenditure of the physical activity across the curriculum intervention. *Medicine & Science in Sport & Exercise*, *40*, 1501–1505. doi:10.1249/MSS.0b013e31816d6591

Howie, E. K., & Pate, R. P. (2012). Physical activity and academic achievement in children: A historical perspective. *Journal of Sport and Health Science*, *1*, 160–169.

Katz, D. L., Cushman, D., Reynolds, J., Njike, V., Treu, J. A., Walker, J., … Katz, C. (2010). Putting physical activity where it fits in the school day: Preliminary results of the ABC (activity bursts in the classroom) for fitness program. *Preventing Chronic Disease*, *7*(4), 1–10.

Knox, G. J., Baker, J. S., Davies, B., Rees, A., Morgan, K., Cooper, S., … Thomas, N. E. (2012). Effects of a novel school-based cross-curricular physical activity intervention on cardiovascular disease risk factors in 11- to 14-year-olds: The activity knowledge circuit. *American Journal of Health Promotion*, *27*, 75–83.

Lee, V. C., & DuMont, M. (2010). An exploration into how physical activity data-recording devices could be used in computer-supported data investigations. *International Journal of Computers for Mathematical Learning*, *15*, 167–189.

Liu, A., Hu, X., Ma, G., Cui, Z., Pan, Y., Chang, S., … Chen, C. (2007). Report on childhood obesity in China: Evaluation of a classroom-based physical activity promotion program. *Biomedical and Environmental Sciences*, *20*, 19–23.

Macdonald, D. (2011). Like a fish in water: Physical education policy and practice in the era of neoliberal globalization. *Quest*, *63*, 36–45.

Mahar, M. T., Murphy, S. K., Rowe, D. A., Golden, J., Shields, A. T., & Raedeke, T. D. (2006). Effects of a classroom-based program on physical activity and on-task behavior. *Medicine & Science in Sport & Exercise*, *38*, 2086–2094.

Murtagh, E., Mulvihill, M., & Markey, O. (2013). Bizzy break! The effect of a classroom-based activity break on in-school physical activity levels of primary school children. *Pediatric Exercise Science*, *25*, 300–307.

National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010). *Common Core State Standards*. Washington, DC: National Governors Association Center for Best Practices & Council of Chief State School Officers.

O'Hara, K., Reis, P., Esteves, D., Brais, R., & Branco, L. (2011). Science, sport and technology—a contribution to educational challenges. *The Electronic Journal of Elearning*, *9*, 87–97.

Oliver, M., Schofield, G., & McEvoy, E. (2006). An integrated curriculum approach to increasing habitual physical activity in children: A feasibility study. *Journal of School Health*, *76*, 74–79.

Palmer, K. M., Miller, M. W., & Robinson, L. E. (2013). Acute exercise enhances preschoolers' ability to sustain attention. *Journal of Sport & Exercise Psychology*, *35*, 433–437.

Ploughman, M. (2008). Exercise is brain food: The effects of physical activity on cognitive function. *Developmental Neurorehabilitation*, *11*, 236–240.

Pring, R. (1973). Curriculum integration. In R. S. Peters (Ed.), *The philosophy of education* (pp. 123–149). London, UK: Oxford University Press.

Reed, J. A., Einstein, G., Hahn, E., Hooker, S. P., Gross, V. P., & Kravitz, J. (2010). Examining the impact of integrating physical activity on fluid intelligence and academic performance in an elementary school setting: A preliminary investigation. *Journal of Physical Activity and Health*, *7*, 343–351.

Sallis, J. F. (2000). Age-related decline in physical activity: A synthesis of human and animal studies. *Medicine and Science in Sports and Exercise*, *32*, 1598–1600.

Society of Health and Physical Educators (SHAPE) America. (2013). *Introduction to the Common Core State Standards*. Retrieved from http://iweb.shapeamerica.org/iweb/Purchase/ProductDetail.aspx?Product_code=304-RW031

Stewart, J. A., Dennison, D. A., Kohl, H. W., & Doyle, J. A. (2004). Exercise level and energy expenditure in the TAKE10! In-class physical activity program. *Journal of School Health*, *74*, 397–400.

Thorburn, M., & Collins, D. (2003). Integrated curriculum models and their effects on teachers' pedagogy practices. *European Physical Education Review*, *9*, 185–209.

Troiano, R. P., Berrigan, D., Dodd, K. W., Masse, L. C., Tilert, T., & McDowell, M. (2008). Physical activity in the United States measured by accelerometer. *Medicine & Science in Sports & Exercise*, *40*, 181–188.

Vazou, S., Gavrliou, P., Mamalaki, E., Papanastasiou, A., & Sioumala, N. (2012). Does integrating physical activity in the classroom influence academic motivation? *International Journal of Sport and Exercise Psychology*, *10*, 251–263.