

Physical Activity: Classroom-based Physically Active Lesson Interventions

Community Preventive Services Task Force Finding and Rationale Statement Ratified March 2021

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CPSTF Finding and Rationale Statement

Context

Physical activity among children is a public health priority (HHS 2008). The U.S. Department of Health and Human Services recommends that young people ages 6–17 years participate in at least 60 minutes of physical activity daily (HHS 2018). Regular physical activity in childhood and adolescence improves strength and endurance, helps build healthy bones and muscles, helps control weight, improves cognitive function, reduces risk of depression, and may improve cardiovascular health (HHS 2018). Most children in the United States, however, are not active enough to achieve health benefits (Child & Adolescent Health Measurement Initiative 2016; Merlo et al. 2020).

Schools have an important role in promoting and supporting daily and weekly physical activity among students. Adding short bouts of physical activity during classroom time adds a few minutes of physical activity to the school day and interrupts periods of sedentary behavior, and it may also enhance attention to educational content. Classroom-based physical activity interventions can be used to supplement other school programs and policies to promote physical activity among students such as physical education programs, recess breaks, and active travel to school interventions (CDC 2018).

Intervention Definition

Classroom-based physically active lesson interventions integrate bouts of physical activity into academic instruction. Teachers integrate physical activity into lessons taught inside or outside of classrooms. Physically active lessons aim to achieve moderate-to-vigorous intensity physical activity among students and typically last from 10 to 30 minutes. Lessons are taught one or more times per school day and up to five days each week. Interventions include training for teachers and may include access to integrated lesson plans or examples, and web or video resources designed to engage students in age- and classroom-appropriate exercises and dance routines.

CPSTF Finding (March 2021)

The Community Preventive Services Task Force recommends classroom-based physically active lesson interventions for students to increase physical activity and improve educational outcomes. Sufficient evidence of effectiveness shows these interventions, when delivered by trained classroom teachers, meaningfully increase the amount of time students engage in physical activity during the school day and improve educational outcomes in math and reading.

Rationale

Basis of Finding

CPSTF selects and evaluates recently published systematic reviews to provide program planners and decision-makers with effective intervention options. A team of specialists in systematic review methods and physical activity research, practice, and policy selected and evaluated the following published review:

Norris E, van Steen T, Direito A, Stamatakis E. Physically active lessons in schools and their impact on physical activity, educational, health and cognition outcomes: a systematic review and meta-analysis. *British Journal of Sports Medicine* 2020;54:826-38.

The team also abstracted information from the included studies and conducted additional analyses. The CPSTF finding is based on results from the published systematic review and meta-analyses, additional analyses of data from included studies, and expert input from team members and CPSTF.

The Norris et al. review included 42 studies (search period through April 2019), and 34 of these were examined in meta-analyses. Results of their analyses are summarized in Table 1.

Table 1. Intervention Effects on Student Physical Activity, Educational, Health, and Cognitive Outcomes

	Number of Studies	Standardized Mean Differences (P-value)	Direction of Effect	SMD Effect Size Estimate
Physical activity: overall	8	0.32 (p<0.0001)	Favors the intervention	Small
Physical activity: lesson time	16	2.33 (p<0.0001)	Favors the intervention	Large
Educational: overall	23	0.36 (p<0.01)	Favors the intervention	Small
Educational: lesson-time (time-on-task)	7	0.81 (p<0.0001)	Favors the intervention	Large
Health: body mass index (BMI), fitness	3	0.03 (p=0.45)	Inconsistent effects	Inconsistent
Cognitive: fluid intelligence, executive functions	3	0.01 (p=0.93)	Inconsistent effects	Inconsistent

SMD: Standardized mean difference

Norris et al. reported intervention effects on additional fitness and cognitive measures that were not included in their meta-analyses. Three studies assessed change in BMI and fitness outcomes (i.e., shuttle run, cardiovascular endurance run) and reported no significant differences between intervention and control groups. One study evaluated intervention effectiveness on short-term memory and found no significant differences between intervention and control groups.

The review team conducted additional analyses to evaluate the effect estimates Norris et al. reported for physical activity outcomes. The team calculated absolute mean differences in students' moderate-to-vigorous intensity physical activity in minutes per day (9 studies) and absolute mean differences in students' step counts in steps per school hour (3 studies). Results of these analyses are summarized in Table 2.

Table 2. Intervention Effect Estimates on Physical Activity

Physical Activity Outcome Measures	Number of Studies	Absolute Mean Difference: Median (IQI)	Direction of Effect
Student time spent in moderate-to-vigorous intensity physical activity	9	Increase of 2.9 minutes/day (IQI: 1.1 to 16.2) RD: 19.4% (IQT: 1.7 to 34.6)	Favors the intervention
Students' step counts	3	Increase of 529 steps/school hour (Range: 294, 782)	Favors the intervention

IQI: Interquartile interval

RD: Relative difference

To supplement the overall effect estimates for educational outcomes reported in the Norris et al. review, the team examined standardized mean differences for the subset of studies conducted in the United States. Results of these analyses are summarized in Table 3.

Table 3. Intervention Effects on Educational Outcomes: Subset of Studies from the United States

Educational Outcomes	Number of Studies	Standardized Mean Differences Median (IQI)	Direction of Effect	SMD Effect Size Estimate
Math achievement	7	0.16 (IQI: 0.03 to 1.65)	Favors the intervention	Small
Reading achievement	6	0.15 (IQI: 0.05 to 1.27)	Favors the intervention	Small
Writing/spelling achievement	1	0.14	Favors the intervention	Small
Science/social studies	2	0.18, 0.48	Favors the intervention	Small
Early literacy/language skills	2	0.01*	No effect	NA

IQI: Interquartile interval

SMD: Standardized mean difference

Applicability and Generalizability Issues

Intervention settings

The CPSTF finding is applicable to U.S. settings. Included studies were conducted in the United States (18 studies), Australia (7 studies), the United Kingdom (5 studies), the Netherlands (4 studies), and Denmark (2 studies), and one study each came from China, Croatia, Ireland, Israel, Portugal, and Sweden. Twelve of the U.S. studies reported setting. Studies were conducted in urban schools (3 studies), suburban schools (3 studies), rural schools (2 studies) and both urban and rural schools (4 studies).

Population characteristics

The CPSTF finding is applicable to primary school students (grades K-5), and likely children enrolled in preschool and daycare, in the United States. Included studies most often evaluated students in primary schools (29 studies), followed by students in preschools and daycare centers (10 studies). Students' median age was 7.6 years in studies conducted in the United States (18 studies), with an equal distribution of males and females, with a median of 50.0% for both groups.

There was limited information about students in higher grade levels (i.e., secondary school). One study from the United States reported results from primary and middle schools (grades K-8), and two studies (one from the United States) reported results from middle and high schools (grades 6-9).

U.S. studies that reported information about race and ethnicity included students who self-identified as Black or African American (median of 10.9% from 9 studies), Hispanic or Latino (median of 13.1% from 7 studies), and Asian (median of 4.6% from 4 studies). Only one study reported parents' education level, and three studies reported the percentage of participants who had an annual household income of less than \$40,000 (13.6%, 95.0%, 95.0%).

Seven studies reported information about students receiving free or reduced-price lunch. In five studies, the proportion of students receiving free or reduced-price lunch was less than 50%, with a median participation rate of 27.2%. In two studies, the majority of students received free or reduced-price lunch (89.0%, 94.0%). None of the included studies reported stratified analyses of outcomes based on these characteristics.

Intervention characteristics

The CPSTF finding is applicable to interventions implemented by teachers, independent of session frequency or active lesson time. Teachers were the primary implementers (32 studies), followed by researchers (7 studies). Interventions were implemented every day (18 studies), or from one to four days per week (21 studies). Most sessions were between 10 and 30 minutes each (32 studies). In 23 studies, students engaged in physically active lessons for more than 60 minutes per week.

Data Quality Issues

The CPSTF assessment adopted the data quality methods and findings from the Norris et al. review. The published systematic review included 27 group randomized trials, 14 controlled before-after studies, and 1 prospective cohort study. The authors evaluated the studies using a modified Cochrane risk of bias assessment tool (Higgins et al. 2017), which has five domain-specific assessments. The categories most commonly rated to have a high risk of bias were related to blinding, which included 2 different categories, participants and personnel (42 studies) and outcome assessment (15 studies), followed by random sequence generation (8 studies), incomplete outcome data (7 studies), allocation recruitment (2 studies), and other sources of bias (2 studies). No studies were excluded from analyses in either the published review or the CPSTF assessment based on assigned risk of bias rating. Twenty-four studies evaluated physical activity using an accelerometer or pedometer device (17 studies), an objective tool (System for Observing Fitness Instruction Time, or SOFIT; 5 studies), a self-report survey (2 studies).

Potential Additional Benefits

The Norris et al. review did not report on any additional benefits of classroom-based physically active lesson interventions. The included studies did not describe or evaluate any potential additional benefits. CPSTF did not postulate any additional benefits of physically active lesson interventions.

Potential Harms

The Norris et al. review did not report on the presence or absence of potential harms. None of the included studies reported harms associated with the interventions. CPSTF notes that depending on the activity, temporary adjustments to classroom desks and chairs might be necessary to ensure that physically active lessons are conducted safely and to accommodate children of all abilities.

Considerations for Implementation

The following considerations for implementation are drawn from studies included in the existing evidence review, the broader literature, and expert opinion from CPSTF, as noted below.

This CPSTF recommendation and the CPSTF recommendation for classroom-based [physical activity breaks](https://www.thecommunityguide.org/findings/physical-activity-classroom-based-physical-activity-break-interventions) [https://www.thecommunityguide.org/findings/physical-activity-classroom-based-physical-activity-break-interventions], provide two evidence-based options to modestly increase students' physical activity during the school day, interrupt stretches of sedentary time, and improve some measures of student attention to lessons. Additional minutes of moderate-to-vigorous intensity physical activity accumulated through these strategies may also help students achieve the recommended 60 minutes of daily physical activity. Classroom-based physical activity interventions should be used to supplement, not replace, other school programs and policies to promote physical activity among students. These may include recess breaks and the following CPSTF-recommended interventions:

- [Interventions to increase active travel to school](https://www.thecommunityguide.org/findings/physical-activity-interventions-increase-active-travel-school) [https://www.thecommunityguide.org/findings/physical-activity-interventions-increase-active-travel-school] (2016)
- [Enhanced school-based physical education](https://www.thecommunityguide.org/findings/physical-activity-enhanced-school-based-physical-education) [https://www.thecommunityguide.org/findings/physical-activity-enhanced-school-based-physical-education] (2013)
- [Combined nutrition and physical activity interventions in schools](https://www.thecommunityguide.org/content/summary-cpstf-findings-evidence-intervention-approaches-prevent-control-obesity-schools) [https://www.thecommunityguide.org/content/summary-cpstf-findings-evidence-intervention-approaches-prevent-control-obesity-schools] (2018)

CPSTF recommendations support the priorities of [CDC's Healthy Schools Guidance and Comprehensive School Physical Activity Program Framework](https://www.cdc.gov/healthyschools/physicalactivity/index.htm) [https://www.cdc.gov/healthyschools/physicalactivity/index.htm]. CDC provides the following program and intervention guidance:

- [Increasing Physical Education and Physical Activity: A Framework for Schools](https://www.cdc.gov/healthyschools/physicalactivity/pdf/2019_04_25_PE-PA-Framework_508tagged.pdf) [https://www.cdc.gov/healthyschools/physicalactivity/pdf/2019_04_25_PE-PA-Framework_508tagged.pdf] (2017)
- [Strategies for Classroom Physical Activity in Schools](https://www.cdc.gov/healthyschools/physicalactivity/pdf/ClassroomPAstrategies_508.pdf) [https://www.cdc.gov/healthyschools/physicalactivity/pdf/ClassroomPAstrategies_508.pdf] (2018)

Most of the included studies evaluated interventions implemented by teachers. The interventions provided training for teachers, and most also provided resources such as integrated lesson plans, and videos or web links to classroom appropriate exercises and dance routines.

Investigators in included studies noted several advantages of physically active lesson interventions including retention of classroom time for instruction, teacher flexibility to fit active lessons into the classroom schedule, and modest resource requirements. CPSTF notes that scalability may depend on development of, or access to, integrated lessons and activities that support daily or regular use.

Identified factors related to implementation and sustained use of physically activity lesson interventions include:

- Teacher time required to integrate activity into lesson plans on a regular basis (particularly when there are not packaged active lessons)
- The support that teachers receive from school administrators
- The level of buy-in and comfort level from the school system
- Resources, time, and spaces available
- Goals of individual classes or courses

This review identified several free, publicly available resources that provide guidance on the implementation of physically active lessons in the classroom:

- [Classroom Energizers \(Eat Smart Move More\)](https://www.eatsmartmovemorenc.com/resource/energizers-for-schools/) [https://www.eatsmartmovemorenc.com/resource/energizers-for-schools/] is a resource guide from North Carolina public schools that instructs on classroom-based physical activity integrated with academic concepts.
- [Move for Thought](https://educateiowa.gov/sites/files/ed/documents/1213_np_lt_MoveforThought_0.pdf) [https://educateiowa.gov/sites/files/ed/documents/1213_np_lt_MoveforThought_0.pdf] is an integrated physical activity strategy for learning in primary school classrooms.
- [Active Academics](https://activeacademics.org/?pid=20&homepage)[®] [https://activeacademics.org/?pid=20&homepage] offers classroom teachers practical physical activity ideas that can be integrated into regular classroom content areas.
- [Springboard to Active Schools](https://schoolspringboard.org/classroomphysicalactivity/) [https://schoolspringboard.org/classroomphysicalactivity/] provides professional development, technical assistance, and tools and resources for promoting physical activity in the classroom.
- [Active Schools](http://www.activeschoolsus.org/) [http://www.activeschoolsus.org/] provides information on implementing physical activity in the classroom, including links to activity ideas and webinars and trainings for classroom teachers.

Evidence Gaps

CPSTF and Norris et al. identified several areas that have limited information. Additional research and evaluation could help answer the following questions and fill existing gaps in the evidence base.

- How do intervention effects vary by participant characteristics, including household income, parents' level of education, and race/ethnicity in U.S. populations?
- How do intervention effects vary based on duration and frequency of physically active lessons during the school day?
- Do physically active lessons help more students meet recommendations for 60 minutes per day of moderate-to-vigorous intensity physical activity?
- What is the impact of classroom-based physically active lesson interventions on the following outcomes?
 - Cognitive functions
 - Physical fitness, including aerobic fitness, muscle strength and endurance, flexibility, and body composition
 - Other student health outcomes
- Are these interventions effective for students in middle and high school settings?
- What are barriers to teacher and school adoption and sustained implementation, and what are solutions to address them?
- How might physical activity breaks be tailored so they are developmentally appropriate, culturally relevant, and inclusive of students with disabilities?

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Disclaimer

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