Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. Criteria List for the Assessment of the Methodological Quality of the Studies

	Criterion	Scoring
Participation rate	1. Is the participation rate at baseline ≥70% or is the nonresponse nonselective?	Self-explanatory
Study attrition	2. Is the follow-up duration ≥12 months?	Positive, if duration of the study was ≥12 months
	3. Is the follow-up rate ≥70% of the number of participants at baseline?	Self-explanatory
	4. Are dropouts comparable with follow-up participants?	Self-explanatory
Data collection	5. Was the validity of the measure assessing physical activity reported?	Positive, if validity was assessed and reported to be adequate
	6. Was the validity of the measure assessing academic performance reported?	Positive, if validity was assessed and reported to be adequate
	7. Was the reliability of the measure assessing physical activity reported?	Positive, if reliability was assessed and reported to be adequate
	8. Was the reliability of the measure assessing academic performance reported?	Positive, if reliability was assessed and reported to be adequate
Data analyses	9. Does the analyzed sample consist of ≥500 participants?	Self-explanatory
	10. Are longitudinal data analyses methods used/stated?	Positive, if specific statistical methods, assessing change in outcome over ≥2 points, are mentioned by name
	11. Are socioeconomic confounders accounted for in the analyses?	Positive, if adjusting for socioeconomic confounders is specifically mentioned in the analyses (only applicable for observational studies)

eTable 2. Description of the Studies Reporting on the Relationship Between Physical Activity and Academic Performance in Children Structured by Type of Study and Methodological Quality

Source (Quality Score)[a]	Study Design/Country/Follow-up Duration	Characteristics of Study Sample at Baseline	Measure of Physical Activity	Measure of Academic Achievement	Main Results
Nelson and Gordon-Larsen,[17] 2006 (70%)	Observational US 1-2 y	7th-12th grade Age 12-18 y Both sexes[b] (n = 11 957)	Standard 7-day recall questionnaire; self-reported participation in PE (days/week), school-based sports and academic clubs (number per year), sports with parents, and their use of neighbourhood recreation centers (hours/week)	Self-reported score of A in math or English during the most recent grading period	Students in cluster 7 (ie, high participation in school activities, including team and individual sports, academic clubs, and PE) were more likely to earn high grades in math (RR, 1.20; 95% CI, 1.05-1.37) and English (RR, 1.21; 95% CI, 1.06-1.38). Students with ≥5 bouts per week MVPA were also more likely to achieve grades of A in math (RR, 1.08; 95% CI, 1.01-1.15) and science (RR, 1.06; 95% CI, 0.99-1.13)

Eitle and Eitle,[26] 2002 (60%)	Observational US 2 y	10th grade Age 15-16 y Only boys (n = 5018)	Self-report on basketball, football or "other sports" participation	Math and reading achievement test; self-report on grades earned for math, science, English, and history	White and black students who played football (β = −.53; SE, .22; *P* < .05) or basketball (β = −.80; SE, .25; *P* < .01) had significantly poorer math and reading test scores. No association was found between "other sports" and math and reading test scores. White male students who participated in "other sports" (β = −.36; SE, .14, *P* < .05) had significantly higher grades than white male students who played football and basketball and black male students who played football, basketball or "other sports"
Carlson et al,[18] 2008 (55%)	Observational US 5.5 y	Mean (SE) age 74.9 (0.1) mo 58.9% boys (n = 5316)	Report by classroom teachers on the number of times during the week and minutes per day that children participated in PE	Math and reading tests; based on these assessments, IRT scale scores were calculated	Boys and girls with medium exposure to PE demonstrated no significant academic benefits in reading or mathematics. Girls, not boys, with the highest exposure to PE demonstrated small significant academic benefits for reading (β = 2.4; 95% CI, 1.0-3.9) and mathematics (β = 1.5; 95% CI, 0.4-2.7)

Eitle,[27] 2005 (55%)	Observational US 2 y	8th grade Age 13-14 y 48.5% boys (n = 10 087)	Self-reported participation in baseball/softball, basketball, football, or "other team sports", and individual sports	Standardized test score for mathematics, science, reading, and history	Participating in "other team sports" or individual sports was generally associated with a significant positive effect on achievement domains for both boys and girls (β ranging from .95 to 1.45; *P* ranging from <.05 to <.001). Playing baseball/softball, football or basketball had no significant effect on academic test scores for girls but a significant negative effect on test scores for boys (β ranging from −1.56 to .95; *P* ranging from <.05 to <.01). Baseball/softball participation had a significant negative effect on mathematics test scores for black girls (β = −.95; SE, 1.92; *P* < .05), but not for white girls. Participating in "other team sports" had a significant positive effect on mathematics (β = −3.80; SE, 1.47; *P* < .05) and reading test scores (β = −3.97; SE, 1.45; *P* < .01) for white girls, but not for black girls. Participating in basketball had a significant negative effect on mathematics (β = −2.99; SE, 1.18; *P* < .05) and science test scores (β = −3.00; SE, 1.27; *P* < .05) for black males, but not for white males

Coe et al,[22] 2006 (45%)	Observational US 1 school year (11 mo)	Mean (SD) age 11.5 (0.4) y Both sexes[b] (n = 214)	Self-reported 3-day physical activity recall	Individual grades in core classes (mathematics, science, English, and world studies); Terra Nova national standardized test scores	Students who performed vigorous physical activity at a level that met or exceeded the Healthy People 2010 guidelines achieved significant higher academic grades in the first (mean [SD], 35.9 [6.9]; $P < .01$) and second (35.1 [5.7]; $P < .05$) semester than students who did not No significant differences were found in academic achievement and Terra Nova scores as a function of activity level during either semester
Miller et al,[24] 2005 (45%)	Observational US 2 y	Mean age 14.4 y 45% boys (n = 586)	Self-reported participation in sports	Self-report (interview) of students on GPA over the year before the survey	Female athletes reported significant higher GPAs than female nonathletes (β = 0.21; $P < .01$). For boys, there was no significant association between athlete status and GPA
Crosnoe,[23] 2002 (36%)	Observational US 3 school years	Freshmen/sophomores (age 14-16 y) Both sexes[b] (n = 2651)	Self-report on the extracurricular activities at school they had been participating in during that school year	Self-report on GPA	Compared with male nonathletes, change in academic achievement was significantly less negative or even positive for male athletes (β = 0.05 [SE, 0.02]; $P < .05$), female athletes (β = 0.06 [SE, 0.02]; $P < .01$), and female nonathletes (β = 0.06 [SE, 0.02]; $P < .01$)

Stevens et al,[19] 2008 (36%)	Observational US 5 y	Kindergarten (age 5-6 y) Mathematics achievement analysis: 49.8% boys (n = 6482) Reading achievement analysis: 49.5% boys (n = 6393)	Report by parents on child's aerobic physical activity (frequency), exercise behavior (frequency), and participation in sports team or league Report by school administrators on the amount of physical education children participated in	Tests on mathematics and reading	PE had a significant negative effect on mathematics achievement in boys (β = −0.04) but not in girls. Participation in physical activity had a significant positive effect on mathematics achievement in both boys (β = 0.11) and girls (β = 0.11). PE was not significantly associated with reading achievement in both boys and girls. Physical activity had a significant positive effect on reading achievement in both boys (β = 0.14) and girls (β = 0.16)
Hanson and Kraus,[28] 1998 (30%)	Observational US 2 y	Sophomores (age 15-16 y) Both sexes[b] (n = 11 683)	Self-reported participation in sports or cheerleading/pep club	Self-report (interview) on their grades and (standardized) test scores	For both boys and girls there was no significant association between participating in sports and science achievement. For girls (β = −.11, SE = .04) there was a significant negative effect (P < .05) of participating in cheerleading/pep club on science achievement
Silliker and Quirk,[20] 1997 (22%)	Observational US approximately 4 mo	Freshmen to seniors (age 14-18 y) Both sexes[b] (n = 123)	Self-reported participation in extracurricular activity (i.e. soccer)	Self-report on first and second quarter grade point average	Students had significant (P<.05) higher grade point averages in in-season (mean [SD], 86.3 [6.7]), than in out-of-season (85.7 [7.8])

Donnelly et al,[21] 2009 (75%)	Cluster RCT US 3 school years	Mean (SD) age 8.2 (0.4) y 48.8% boys (n = 203)	Intervention: children spent an additional 90 min/wk in moderate to vigorous physically activity through the instruction of academic lessons that incorporated physical activity (eg, reciting multiplication tables while jumping to an "invisible" jump rope). The intervention continued for 3 years.	WIAT-II-A	Children in the experimental group significantly (P < .01) improved their academic achievement scores on composite, reading, math, and spelling compared with children in the control group
Ahamed et al,[15] 2007 (50%)	Cluster RCT Canada 16 mo	Mean (SD) age 10.2 (0.6) y 49.7% boys (n = 288)	Intervention: children in the "teachers in intervention" (INT) schools spent an additional 15 minutes in classroom-based activities for 5 days per week during a 16-month intervention. Activities included skipping, chair aerobics, dancing, playground circuits, and resistances exercises. Children in the INT schools as well as children in the usual practice schools (UP) participated in their regular PE.	CAT-3	Academic performance total test scores were not significantly different between treatment groups at the final measurements

Fredericks et al,[16] 2006 (43%)	RCT South-Africa 8 wk	1st grade (age 6-7 y) 56.6% boys (n = 53)	Intervention: children participated in a 10-wk developmental movement programme. Children followed a daily program focusing on perceptual-motor and sensory-motor skills with a duration of 20 min	ASB, reading age test, maths age test, and the DAP	All groups (play, toy, control and experimental group) performed significantly better in the academic achievement tests after the intervention period. The experimental group performed significantly better on spatial (P < .001), reading (P < .01) and mathematical skills (P < .001) than the play, toy and control group after the 10-week programme

Sallis et al,[25] 1999 (38%)	RCT US 2 y	Mean (SD) age 9.5 (0.4) y 52.2% boys (n = 754)	Intervention: children spent an additional 30 minutes in health-fitness and skill-fitness activities during a 36-week intervention (Physical Education Programme SPARK). Health-fitness activities included aerobic dance, running games, and jump rope. Skill-fitness activities included soccer, basketball, Frisbee games, softball, and kickball. A standard SPARK lesson lasts 30 minutes: 15 minutes of health-fitness activity and 15 minutes of skill-fitness activity	MAT6 and MAT7, providing scores for reading, mathematics, language, and a composite score known as the Basic Battery	Cohort 1: Children in the "trained teacher" condition had significantly less decline (*P*<.05) on their language score (mean [SD], -1.5 [18.8]) compared with children in the control condition. Reading scores significantly increased (*P*<.05) in the "specialist" condition (4.9 [21.6]), whereas scores of the control children (-3.7 [17.6]) declined There were no significant effects of the SPARK programme on mathematics and basic battery scores Cohort 2: Children in the trained teacher condition had significantly less decline (*P*<.01) on their reading (-16.3 [22.0]) and basic battery scores (-9.0 [18.6]), compared with children in the specialist condition and control condition. Children in the specialist condition had significantly more decline (*P*<.01) in their language scores (-18.0 [21.0]), compared with children in the trained teacher and control conditions

Abbreviations: ASB, Aptitude Test for School Beginners; ß, regression coefficient; CAT-3, Canadian Achievement Test; DAP, Draw-a-Person Test; GPA, grade point average; IRT, item response theory; MAT6/MAT7, Metropolitan Achievement Tests, 6th and 7th Editions; MVPA, moderate to vigorous physical activity; PE, physical education; RCT, randomized controlled trial; RR, relative risk; US, United States; WIAT-II-A, Wechsler Individual Achievement Test–Second Edition.

[a] Reference numbers correspond to the reference list in the main article.

[b] No further descriptive data were available on baseline sample.

eTable 3. Overall Scores of the Methodological Quality of the Included Studies

	Source[a]	Criterion											No. Applicable	Score, %
		1	2	3	4	5	6	7	8	9	10	11		
Observational studies	Nelson and Gordon-Larsen,[17] 2006	+	+	+	?	+	−	+	−	+	NA	+	10	70
	Eitle and Eitle,[26] 2002	−	+	+	?	−	+	−	+	+	NA	+	10	60
	Carlson et al,[18] 2008	−	+	−	?	−	+	−	+	+	+	+	11	55
	Eitle,[27] 2005	−	+	+	?	−	+	−	+	+	−	+	11	55
	Coe et al,[22] 2006	−	−	+	+	+	−	+	−	−	+	−	11	45
	Miller et al,[24] 2005	+	+	+	−	−	−	−	−	+	−	+	11	45
	Crosnoe,[23] 2002	?	+	?	−	−	−	−	−	+	+	+	11	36
	Stevens et al,[19] 2008	−	+	−	?	−	+	−	+	+	−	−	11	36
	Hanson and Kraus,[28] 1998	+	+	−	?	−	−	−	−	+	NA	−	10	30
	Silliker and Quirk,[20] 1997	+	−	+	NA	−	−	−	−	−	NA	−	9	22
Intervention studies	Donnelly et al,[21] 2009	+	+	+	?	NA	+	NA	+	−	+	NA	8	75
	Ahamed et al,[15] 2007	−	−	+	+	NA	−	NA	+	−	+	NA	8	50
	Fredericks et al,[16] 2006	+	−	+	NA	NA	−	NA	−	−	+	NA	7	43
	Sallis et al,[25] 1999	+	+	−	−	NA	−	NA	−	−	+	NA	8	38
All studies	**Total score**	**50**	**71**	**64**	**14**	**14**	**36**	**14**	**43**	**57**	**50**	**43**		

Abbreviations: NA, not applicable; −, the publication provided an informative description, but an inadequate performance; +, the publication provided an informative description of the criterion at issue and met the quality criterion; ?, the publication provided no or insufficient information.

[a] Reference numbers correspond to the reference list in the main article.