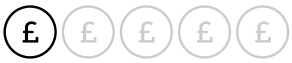
Physical activity

Low impact for very low cost based on moderate evidence

Physical activity refers to approaches that engage pupils in sports, dance, or any kind of physical exercise.

Implementation cost



Evidence strength

Impact (months)

+1 months

Subject breakdown

maths: 24
reading: 20
toolkit: 61

School phase breakdown

primary: 39
secondary: 13
toolkit: 61

Technical Appendix

The criteria used to judge the inclusion of studies in the Toolkit are:

- The population sampled involved early years and school age learners from 3-18 learning in their first language.
- The intervention or approach being tested was educational in nature, including named or clearly defined programmes and recognisable approaches classifiable according to the Toolkit strand definitions (e.g. peer tutoring or small group teaching). The intervention or approach is undertaken in a normal educational setting or environment for the learners involved, such as a nursery or school or a typical setting (e.g. an outdoor field centre or museum).
- A valid comparison was made between those receiving the educational intervention or approach and those not receiving it.
- Outcomes include the assessment of educational or cognitive achievement which reports quantitative results from testing of attainment or learning outcomes, such as by standardised tests or other appropriate curriculum assessments or school examinations or appropriate cognitive measures.
- The study design provided a quantitative estimate of the impact of the intervention or approach on the educational attainment of the sample, calculated or estimated in the form of an effect size (standardised mean difference) based on a counterfactual comparison.

Standardised mean differences and confidence intervals for the most appropriate estimates of the impact of the intervention or approach for the Toolkit were extracted from each included study, along with other study variables. These effect sizes were further synthesised into a single pooled effect using a random effects meta-analysis adopting a restricted maximum likelihood (REML) estimation methods.For the full details of the methodology see the Protocol and Analysis Plan (https://educationendowmentfoundation.org.uk/public/files/Toolkit/EEF_Evidence_Database_Protocol_and_Analysis_Plan_June2019.pdf) .

References (61)

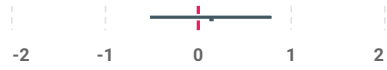
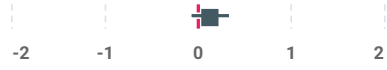
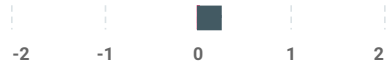
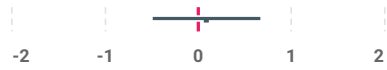
The forest plot below is a graphical representation of the results of all included studies in this Toolkit strand. It shows the effect size and confidence interval of each study, and whether the particular intervention in that study was more or less effective than standard practice or other alternative interventions that the study looked at.

Studies that show an effect size result on the right-hand side of the red vertical red indicate that the particular intervention studied was more effective than standard practice. Studies that show an effect size on the left-hand size of the red vertical indicate that the particular intervention studied was less effective than standard practice.

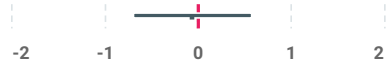
Author	Title	Effect Size	Effect Size (Graph)
McClelland (2014)	Enhanced academic performance using a novel classroom physical activity intervention to increase awareness, attention and self-control: Putting embodied cognition into practice *(Improving Schools)*	**Effect Size**: 0.86 **LCI**: -0.163 **UCI**: 1.883 **Weight**: 0.199 **Standard error**: 0.522	
Kirk (2016)	Sixty Minutes of Physical Activity per Day Included Within Preschool Academic Lessons Improves Early Literacy *(Journal of School Health)*	**Effect Size**: 0.656 **LCI**: 0.047 **UCI**: 1.265 **Weight**: 0.525 **Standard error**: 0.311	
Skolnick (1980)	The Effects of Physical Activities on Academic Achievement in Elementary School Children *(NA)*	**Effect Size**: 0.643 **LCI**: 0.104 **UCI**: 1.181 **Weight**: 0.654 **Standard error**: 0.275	
Mavilidi (2016)	Infusing Physical Activities Into the Classroom: Effects on Preschool Children's Geography Learning *(Mind, Brain, and Education)*	**Effect Size**: 0.608 **LCI**: 0.08 **UCI**: 1.135 **Weight**: 0.678 **Standard error**: 0.269	
Alesi (2016)	Improving children's coordinative skills and executive functions: The effects of a football exercise program *(Perceptual and Motor Skills)*	**Effect Size**: 0.546 **LCI**: -0.059 **UCI**: 1.151 **Weight**: 0.531 **Standard error**: 0.309	
Spitzer (2013)	Experimental observations of the effects of physical exercise on attention, academic and prosocial performance in school settings *(Trends in Neuroscience and Education)*	**Effect Size**: 0.482 **LCI**: 0.044 **UCI**: 0.919 **Weight**: 0.932 **Standard error**: 0.223	

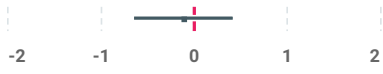
Author	Title	Effect Size	Effect Size (Graph)
Elofsson (2018)	Physical activity and music to support pre-school children's mathematics learning *(Education 3-13)*	**Effect Size**: 0.46 **LCI**: -0.087 **UCI**: 1.007 **Weight**: 0.636 **Standard error**: 0.279	
Branch (2003) SP	Extracurricular activities and academic achievement *(NA)*	**Effect Size**: 0.387 **LCI**: 0.246 **UCI**: 0.528 **Weight**: 3.599 **Standard error**: 0.072	
Budde (2008)	Acute coordinative exercise improves attentional performance in adolescents *(Neuroscience Letters)*	**Effect Size**: 0.369 **LCI**: -0.029 **UCI**: 0.767 **Weight**: 1.088 **Standard error**: 0.203	
Reed (2013)	Examining the impact of 45 minutes of daily physical education on cognitive ability, fitness performance, and body composition of African American youth *(Journal of Physical Activity and Health)*	**Effect Size**: 0.332 **LCI**: 0.129 **UCI**: 0.536 **Weight**: 2.651 **Standard error**: 0.104	
Callcott (2015)	The Synergistic Effect of Teaching a Combined Explicit Movement and Phonological Awareness Program to Preschool Aged Students *(Springer)*	**Effect Size**: 0.3 **LCI**: -0.032 **UCI**: 0.631 **Weight**: 1.442 **Standard error**: 0.169	
Mavilidi (2017)	Effects of Integrating Physical Activities Into a Science Lesson on Preschool Children's Learning and Enjoyment *(Applied Cognitive Psychology)*	**Effect Size**: 0.29 **LCI**: -0.237 **UCI**: 0.817 **Weight**: 0.679 **Standard error**: 0.269	
Morales (2011)	Physical activity, perceptual-motor performance, and academic learning in 9-to-16-years-old school children *(International Journal of Sport Psychology)*	**Effect Size**: 0.284 **LCI**: 0.031 **UCI**: 0.537 **Weight**: 2.075 **Standard error**: 0.129	
Altenburg (2016)	Effects of one versus two bouts of moderate intensity physical activity on selective attention during a school morning in Dutch primary schoolchildren: A randomized controlled trial *(Journal of Science and Medicine in Sport)*	**Effect Size**: 0.26 **LCI**: 0.002 **UCI**: 0.518 **Weight**: 2.024 **Standard error**: 0.132	
Bunketorp (2015)	Effects of a Curricular Physical Activity Intervention on Children's School Performance, Wellness, and Brain Development *(Journal of School Health)*	**Effect Size**: 0.259 **LCI**: -0.714 **UCI**: 1.231 **Weight**: 0.219 **Standard error**: 0.496	

Author	Title	Effect Size	Effect Size (Graph)
Zervas (1991)	Influence of physical exertion on mental performance with reference to training. *(Perceptual and Motor Skills)*	**Effect Size**: 0.244 **LCI**: -0.713 **UCI**: 1.2 **Weight**: 0.226 **Standard error**: 0.488	
Freitag (2005)	Promoting achievement through sports: An in-depth analysis on the impact of sports and other extracurricular activities on the development of youth *(NA)*	**Effect Size**: 0.229 **LCI**: -0.489 **UCI**: 0.947 **Weight**: 0.388 **Standard error**: 0.366	
Shore (2014)	Step-Count Promotion Through a School-Based Intervention *(Clinical Nursing Research)*	**Effect Size**: 0.224 **LCI**: -0.186 **UCI**: 0.634 **Weight**: 1.037 **Standard error**: 0.209	
Hulecki (1988)	The relationship between increased physical fitness and learning disabled children's self concept, anxiety, and academic achievement *(NA)*	**Effect Size**: 0.201 **LCI**: -0.473 **UCI**: 0.874 **Weight**: 0.437 **Standard error**: 0.344	
Beck (2016)	Motor-Enriched Learning Activities Can Improve Mathematical Performance in Preadolescent Children *(Frontiers in Human Neuroscience)*	**Effect Size**: 0.189 **LCI**: -0.204 **UCI**: 0.582 **Weight**: 1.11 **Standard error**: 0.2	
Hollar (2010)	Effect of a two-year obesity prevention intervention on percentile changes in body mass index and academic performance in low-income elementary school children *(American Journal of Public Health)*	**Effect Size**: 0.187 **LCI**: 0.035 **UCI**: 0.34 **Weight**: 3.403 **Standard error**: 0.078	
Mavilidi (2018)	Immediate and delayed effects of integrating physical activity into preschool children's learning of numeracy skills *(Journal of Experimental Child Psychology)*	**Effect Size**: 0.179 **LCI**: -0.328 **UCI**: 0.686 **Weight**: 0.726 **Standard error**: 0.259	
Donnelly (2017)	Physical activity and academic achievement across the curriculum: Results from a 3-year cluster-randomized trial *(Preventive Medicine)*	**Effect Size**: 0.153 **LCI**: -0.033 **UCI**: 0.339 **Weight**: 2.886 **Standard error**: 0.095	
Sallis (1999) 1_2	Effects of health-related physical education on academic achievement: Project spark *(Research Quarterly for Exercise and Sport)*	**Effect Size**: 0.148 **LCI**: -0.054 **UCI**: 0.351 **Weight**: 2.664 **Standard error**: 0.103	

Author	Title	Effect Size	Effect Size (Graph)
Have (2018)	Classroom-based physical activity improves children's math achievement – A randomized controlled trial *(PLOS ONE)*	**Effect Size**: 0.148 **LCI**: -0.028 **UCI**: 0.325 **Weight**: 3.021 **Standard error**: 0.09	
Kirk (2014)	Using Physical Activity to Teach Academic Content: A Study of the Effects on Literacy in Head Start Preschoolers *(Springer)*	**Effect Size**: 0.145 **LCI**: -0.363 **UCI**: 0.654 **Weight**: 0.722 **Standard error**: 0.26	
Reynolds (2007)	Follow-up of an exercise-based treatment for children with reading difficulties *(Dyslexia)*	**Effect Size**: 0.134 **LCI**: -0.529 **UCI**: 0.798 **Weight**: 0.449 **Standard error**: 0.339	
Lazroe (1968)	An Investigation of the Effects of Motor Training on the Reading Readiness of Kindergarten Children *(NA)*	**Effect Size**: 0.129 **LCI**: -0.082 **UCI**: 0.339 **Weight**: 2.552 **Standard error**: 0.108	
Booth (2014)	Associations between objectively measured physical activity and academic attainment in adolescents from a UK cohort *(British Journal of Sports Medicine)*	**Effect Size**: 0.129 **LCI**: 0.075 **UCI**: 0.183 **Weight**: 5.013 **Standard error**: 0.028	
Kvalø (2017)	Does increased physical activity in school affect children's executive function and aerobic fitness? *(Scandinavian Journal of Medicine & Science in Sports)*	**Effect Size**: 0.127 **LCI**: -0.004 **UCI**: 0.258 **Weight**: 3.769 **Standard error**: 0.067	
lisahunter (2014)	Active kids active minds: a physical activity intervention to promote learning? *(Asia-Pacific Journal of Health, Sport and Physical Education)*	**Effect Size**: 0.109 **LCI**: -0.27 **UCI**: 0.489 **Weight**: 1.173 **Standard error**: 0.194	
Schmidt (2016)	Classroom-based physical activity breaks and children's attention: Cognitive engagement works! *(Frontiers in Psychology)*	**Effect Size**: 0.089 **LCI**: -0.5 **UCI**: 0.677 **Weight**: 0.559 **Standard error**: 0.3	
Mead (2016)	The Impact of Stability Balls, Activity Breaks, and a Sedentary Classroom on Standardized Math Scores *(The Physical Educator)*	**Effect Size**: 0.052 **LCI**: -0.506 **UCI**: 0.611 **Weight**: 0.613 **Standard error**: 0.285	

Author	Title	Effect Size	Effect Size (Graph)
Leandro (2018)	Interdisciplinary working practices: can creative dance improve math? *(Research in Dance Education)*	**Effect Size**: 0.05 **LCI**: -0.321 **UCI**: 0.421 **Weight**: 1.215 **Standard error**: 0.189	
Coe (2006)	Effect of physical education and activity levels on academic achievement in children *(Medicine and Science in Sports and Exercise)*	**Effect Size**: 0.041 **LCI**: -0.228 **UCI**: 0.309 **Weight**: 1.924 **Standard error**: 0.137	
Tarp (2016)	Effectiveness of a School-Based Physical Activity Intervention on Cognitive Performance in Danish Adolescents: LCoMotion—Learning, Cognition and Motion – A Cluster Randomized Controlled Trial *(PLOS ONE)*	**Effect Size**: 0.04 **LCI**: -0.132 **UCI**: 0.211 **Weight**: 3.11 **Standard error**: 0.087	
Gallotta (2015)	Impacts of coordinative training on normal weight and overweight/obese children's attentional performance *(Frontiers in Human Neuroscience)*	**Effect Size**: 0.033 **LCI**: -0.366 **UCI**: 0.431 **Weight**: 1.086 **Standard error**: 0.203	
Sjöwall (2017)	No Long-Term Effect of Physical Activity Intervention on Working Memory or Arithmetic in Preadolescents *(Frontiers in Psychology)*	**Effect Size**: 0.021 **LCI**: -0.16 **UCI**: 0.201 **Weight**: 2.966 **Standard error**: 0.092	
Puder (2011)	Effect of multidimensional lifestyle intervention on fitness and adiposity in predominantly migrant preschool children (Ballabeina): Cluster randomised controlled trial *(BMJ (Online))*	**Effect Size**: 0.019 **LCI**: -0.138 **UCI**: 0.176 **Weight**: 3.33 **Standard error**: 0.08	
Butzer (2015)	Yoga may mitigate decreases in high school grades *(Evidence-based Complementary and Alternative Medicine)*	**Effect Size**: 0.013 **LCI**: -0.391 **UCI**: 0.416 **Weight**: 1.065 **Standard error**: 0.206	
Fedewa (2015)	A randomized controlled design investigating the effects of classroom-based physical activity on children's fluid intelligence and achievement *(School Psychology International)*	**Effect Size**: 0.011 **LCI**: -0.186 **UCI**: 0.209 **Weight**: 2.727 **Standard error**: 0.101	
Riley (2016)	Findings from the EASY minds cluster randomized controlled trial: Evaluation of a physical activity integration program for mathematics in primary schools *(Journal of Physical Activity and Health)*	**Effect Size**: -0.005 **LCI**: -0.263 **UCI**: 0.252 **Weight**: 2.03 **Standard error**: 0.131	

Author	Title	Effect Size	Effect Size (Graph)
Yin (2004)	Re-Examining the Role of Interscholastic Sport Participation in Education *(Psychological Reports)*	**Effect Size**: -0.005 **LCI**: -0.034 **UCI**: 0.024 **Weight**: 5.266 **Standard error**: 0.015	
Miller (2015)	Physically Active Lessons Evaluation report and Executive summary Independent evaluators *(Education Endowment Foundation)*	**Effect Size**: -0.02 **LCI**: -0.224 **UCI**: 0.184 **Weight**: 2.638 **Standard error**: 0.104	
Mullender-Wijnsma (2015)	Improving Academic Performance of School-Age Children by Physical Activity in the Classroom: 1-Year Program Evaluation *(Journal of School Health)*	**Effect Size**: -0.021 **LCI**: -0.392 **UCI**: 0.349 **Weight**: 1.217 **Standard error**: 0.189	
Mullender-Wijnsma (2016)	Physically active math and language lessons improve academic achievement: A cluster randomized controlled trial *(Pediatrics)*	**Effect Size**: -0.029 **LCI**: -0.21 **UCI**: 0.152 **Weight**: 2.963 **Standard error**: 0.092	
de Greeff (2016)	Long-term effects of physically active academic lessons on physical fitness and executive functions in primary school children *(Health Education Research)*	**Effect Size**: -0.034 **LCI**: -0.209 **UCI**: 0.141 **Weight**: 3.048 **Standard error**: 0.089	
Crist (1994)	The effects of aerobic exercise and free-play time on the self-concept and classroom performance of sixth-grade students *(NA)*	**Effect Size**: -0.038 **LCI**: -0.297 **UCI**: 0.221 **Weight**: 2.013 **Standard error**: 0.132	
Gao (2013)	Video game-based exercise, Latino children's physical health, and academic achievement *(American Journal of Preventive Medicine)*	**Effect Size**: -0.044 **LCI**: -0.371 **UCI**: 0.283 **Weight**: 1.47 **Standard error**: 0.167	
Costigan (2016)	High-Intensity Interval Training for Cognitive and Mental Health in Adolescents *(Medicine & Science in Sports & Exercise)*	**Effect Size**: -0.062 **LCI**: -0.698 **UCI**: 0.574 **Weight**: 0.486 **Standard error**: 0.324	
Shoval (2018)	The Effect of Integrating Movement into the Learning Environment of Kindergarten Children on their Academic Achievements *(Early Childhood Education Journal)*	**Effect Size**: -0.067 **LCI**: -0.463 **UCI**: 0.329 **Weight**: 1.098 **Standard error**: 0.202	

Author	Title	Effect Size	Effect Size (Graph)
Sibley (2004)	The effects of an acute bout of exercise on inhibition and cognitive performance *(NA)*	**Effect Size**: -0.08 **LCI**: -0.64 **UCI**: 0.48 **Weight**: 0.611 **Standard error**: 0.286	
Williams (1968)	The Effects of Individualized Programs of Physical Education on Normal Children Who Have Reading Difficulties *(NA)*	**Effect Size**: -0.09 **LCI**: -0.408 **UCI**: 0.228 **Weight**: 1.529 **Standard error**: 0.162	
Ahamed (2007)	School-based physical activity does not compromise children's academic performance *(Medicine and Science in Sports and Exercise)*	**Effect Size**: -0.095 **LCI**: -0.359 **UCI**: 0.17 **Weight**: 1.962 **Standard error**: 0.135	
Helgeson (2013)	The Impact of Physical Activity on Academics in English Classes at the Junior High School Level - ProQuest *(NA)*	**Effect Size**: -0.096 **LCI**: -0.46 **UCI**: 0.267 **Weight**: 1.253 **Standard error**: 0.186	
Ardoy (2014)	A Physical Education trial improves adolescents' cognitive performance and academic achievement: the EDUFIT study *(Scandinavian Journal of Medicine & Science in Sports)*	**Effect Size**: -0.117 **LCI**: -0.658 **UCI**: 0.423 **Weight**: 0.65 **Standard error**: 0.276	
Emmons (1968)	A comparison of selected gross-motor activities of the Getman-Kane and the Kephart perceptual-motor training programs and their effects upon certain readiness skills of first-grade Negro children. *(NA)*	**Effect Size**: -0.125 **LCI**: -0.572 **UCI**: 0.322 **Weight**: 0.899 **Standard error**: 0.228	
Hraste (2018)	When mathematics meets physical activity in the school-aged child: The effect of an integrated motor and cognitive approach to learning geometry *(PLOS ONE)*	**Effect Size**: -0.156 **LCI**: -0.811 **UCI**: 0.5 **Weight**: 0.46 **Standard error**: 0.334	
Vazou (2017)	Intervention integrating physical activity with math: Math performance, perceived competence, and need satisfaction *(International Journal of Sport and Exercise Psychology)*	**Effect Size**: -0.233 **LCI**: -0.472 **UCI**: 0.007 **Weight**: 2.21 **Standard error**: 0.122	
Resaland (2016)	Effects of physical activity on schoolchildren's academic performance: The Active Smarter Kids (ASK) cluster-randomized controlled trial *(Preventive Medicine)*	**Effect Size**: -0.3 **LCI**: -1.539 **UCI**: 0.939 **Weight**: 0.137 **Standard error**: 0.632	

Author	Title	Effect Size	Effect Size (Graph)
Hillman (2014)	Effects of the FITKids Randomized controlled trial on executive control and brain function *(Pediatrics)*	**Effect Size**: -0.328 **LCI**: -0.594 **UCI**: -0.063 **Weight**: 1.951 **Standard error**: 0.136