

Evaluation Summary	
Age range	8-10
Number of pupils	720
Number of schools	5
Design	Pilot Study
Primary Outcome	Numeracy and Literacy

Lead applicant

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Co-applicants

- Aideen Gildea, Centre for Effective Education
- Seaneen Sloan, Centre for Effective Education
- Professor Allen Thurston, Director, Centre for Effective Education

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Background

SIGNIFICANCE

Previous research provides evidence to suggest that incorporating physical activity into school lessons can increase attainment (Donnelly, et al., 2009; Hollar, et al., 2010).

INTERVENTION

Specifically, a US based programme called Physical Activity Across the Curriculum (PAAC) has been shown to improve attainment in maths by an effect size of up to $d=0.5$. To establish whether similar effects could be achieved in a UK based sample the research team at Bristol University is adapting PAAC for a UK primary school context. The programme involves incorporating short bursts of physical activity into lessons with the aim of consolidating children's learning.

RESEARCH PLAN

Research questions

The purpose of the proposed evaluation is to determine the feasibility of adapting; implementing and, in the future, evaluating this intervention using a full scale randomised controlled trial design.

The role of the CEE evaluation team will be to work collaboratively with the Bristol University research team. We propose that the current feasibility study - to take place between October 2013 and June 2014 - will comprise both qualitative and quantitative data collection. The purpose of the study is twofold:

1. To explore the feasibility of programme adaptation and implementation, and
2. To explore the feasibility of a future, large-scale trial

The *implementation feasibility* element of the study will aim to:

- Inform and support the development and adaptation of the intervention for a UK context through independent observations of programme development, teacher training and programme implementation. These observations will be fed back to the Bristol research team through regular meetings with ourselves, the CEE.
- Explore the barriers and challenges associated with implementation and identify potential solutions through interviews with programme developers, teachers and principals.
- Determine whether the intervention is delivered with fidelity through observations of programme delivery and interviews with teachers.
- Explore whether the intervention can be taken to scale through interviews with programme developers, teachers and principals.
- Determine the acceptability of the intervention to all key actors through interviews and focus groups with pupils, teachers and principals.

The *trial feasibility* element of the study will aim to:

- Inform the selection of outcomes and measures through piloting the administration of potential educational and affective outcome measures. Specifically the ease of use and administration of digital versus paper tests to measure educational outcomes will be compared.
- In addition, the British Heart Foundation, who is recording the health outcome measurements, will be interviewed and observed collecting data to identify any challenges and barriers associated with administration of these particular tests.
- Determine the feasibility of the randomisation process i.e. allocating year groups within schools to the intervention and control groups, through interviews with principals and teachers.
- Provide initial quantitative outcome data on the efficacy of the programme through the analysis of the quantitative data collected on educational and affective outcomes at the end of the programme.
- Advise the Bristol research team on the requirements and process for undertaking a full scale RCT.

Design

Two year-groups in each of the six participating schools will take part in the study: Year 4 and Year 5. The unit of randomisation will be the year group, thus one year-group in each school will be allocated to the intervention group and the remaining year group will be part of the control group.

The children in the treatment group will receive the Physically Active Lessons (PAL) programme for two terms: between January and July 2014. The children in the control group will not receive the intervention and will represent 'business as usual'. The CEE evaluation team will undertake randomisation.

Participants

It is proposed that for the purposes of the current study, the programme is targeted at children in Years 4 (age 9) and 5 (age 10) and that six schools are recruited to participate. With potentially 30 children per class and two classes per year this would potentially yield a total sample of approximately 720 children; 360 in the intervention group and 360 in the control group. Since the primary aim of the study is not to test impact on outcomes, the same level of power is not required as if it were a full-scale trial.

Primary schools that meet the following criteria will be eligible for inclusion in the study:

1. Have at least one form entry
2. Willing to be randomly assigned to condition at the year group level
3. Willing to engage with the intervention and implement it with the Year 4 or 5 students
4. Willing to provide access to socio-economic and demographic data of students
5. Willing to allow the research team access to students in order to administer tests
6. Willing to provide end of Key Stage 2 assessment data for participating students at the end of Year 6

The Teacher Development Trust will be responsible for recruiting the six schools and will pass on the details of these schools to the CEE evaluation team for randomisation. Schools will be asked to agree to a Memorandum of Understanding so that they are aware of their responsibilities and rights in respect of the project. Additional parental consent (opt out) to participate in the study will be sought, through the schools, by the Bristol Research team.

Outcome measures

Student academic outcomes

To minimise cost and disruption and given that this is a feasibility study, it is proposed that only post-test data are collected and this will be undertaken in June/July 2014. The CEE will coordinate and be responsible for the post test data collection. To determine whether digital or paper tests are the most appropriate and/or practical method of data collection, both procedures will be piloted.

Primary outcomes

The primary outcomes are math and literacy.

For participating children in three of the six schools numeracy and literacy will be measured using the InCas assessments. Numeracy will be measured using a combined score for the following two InCas subscales: general mathematics and mental arithmetic. Similarly literacy will be measured using a combined score for the following two InCas subscales: word decoding and comprehension.

Participating children in the remaining three schools will undergo paper tests of literacy and numeracy using Progress in English and Progress in Maths.

Secondary outcomes

The secondary outcome is enjoyment of school. For those completing the digital tests this will be measured by the attitude subscale (namely enjoyment of school) of the InCas assessment. For those students completing the paper tests, they will also complete the Enjoyment of School scale developed by Pell and Jarvis (2001) and used in several previous RCT trials in education.

Follow up

To determine the potentially lasting impact of any observed improvements in academic outcomes 12-month follow-up data, in the form of end of Key Stage 2 assessments, could be assessed by linking to data held in the National Pupil Database.

Other student related variables

School attendance and background information including gender, age, ethnicity and Free School Meal entitlement will be collected from the school and/or National Pupil Database for students in both the control and intervention groups.

Health data will be collected by the British Heart Foundation at pre and post test. Time on task data will be collected by the Bristol University Research team.

Sample size calculation

Previous evaluations of the PAAC programme have reported effect sizes in the order of $d=0.5$ in favour of the intervention group in Maths. This may be an inflated estimate however due to the design and analysis of the study and the data on which it is based. It is estimated that the proposed sample size is sufficient to detect an effect size of $d=0.38$ with 80% power but only 45% powered to detect an effect size of $d=0.25$. This estimate has been calculated using Optimal Design (Version 3.01) and is based on a 2-level cluster design and the following assumptions:

- Significance level (α) = 0.05
- Number of students per class = 30
- Number of classes = 24
- Effect size (δ) = 0.25
- Estimated intraclass correlation coefficient (ρ) = 0.15
- Per cent of explained variation by Level 2 covariate (R^2) = 0.5

Analysis plan

The aim of this analysis will be to provide, ahead of the main, full-scale trial, some early indications of the impact of the programme on educational, health and affective outcomes. The initial characteristics of the intervention and control groups will be compared at baseline in relation to their core characteristics (gender, deprivation, ethnicity) and mean scores on the main outcomes.

The main effects of the intervention will be estimated using multilevel modelling to take account of the clustered nature of the data and a series of models will be estimated for each outcome measure. For each model, the relevant outcome measure at post test will form the dependent variable and a number of independent variables will be added including: a dummy variable representing whether the child was a member of the intervention or control group (coded '1' and '0' respectively); the students' baseline scores for the outcome

variable in question and a series of other covariates representing the students' core characteristics and baseline scores on any other outcome measures.

The main focus for the analysis will be the estimated coefficient associated with the dummy variable that represents the difference in mean scores on the respective outcome variable between the intervention and control groups, once baseline scores and other differences at baseline have been controlled for. This coefficient will then be used to estimate the effect size of the programme in relation to the respective outcome variable as the standardised mean difference between the two groups (Hedges' g).

In addition to the analysis of the main effects, an exploratory analysis will be conducted to examine any differential impact of the intervention i.e. whether it works better for particular groups such as boys and girls, children of different abilities at baseline, low-income children and minority ethnic children.

Process evaluation methods

Observations, interviews and focus groups will be conducted with principals, teachers and pupils in order to explore implementation feasibility and confirm the selection of outcomes, as outlined above. These data will be collected between November 2013 and June 2014 and will be transcribed and analysed to address the following, specific research questions:

- What are the barriers and challenges associated with programme training, support and implementation?
- Was the intervention delivered with fidelity? What factors influenced fidelity?
- Can the intervention be taken to scale for a full-scale trial? Including issues related to:
 - Perceptions and management of year group randomisation design
 - School, parent and child consent
 - Contamination between intervention and control classes
 - Feasibility of data collection and associated challenges i.e. digital vs paper tests; health data collection (by the British Heart Foundation); time on task data collection (by Bristol research team).
- How acceptable/enjoyable was the intervention for pupils, teachers and principals?

- What affective or attitudinal outcomes were identified as relevant and potential additional outcomes?

The following methods of data collection will be undertaken to address the above questions:

Teacher training observation

The CEE evaluation team will attend and observe the teacher training that will be conducted by the Teacher Development Trust in November 2013. At this initial contact point the research team will also provide teachers with a description of the study and obtain their contact details.

Documentation and observation of on-going teacher support

The Teacher Development Trust will be providing on-going support for teachers throughout the duration of the implementation. This will be in the form of teacher led collaborative enquiry and the CEE research team will document and observe this element of the programme.

Teacher interviews

Teachers will be interviewed on completion of the training to explore their initial perceptions of the programme (January 2014); one month into implementation (February 2014), and; finally at the end of the study (June 2014). The initial interviews will be relatively short and will take place over the telephone. The final interview will be in person and will take between 30 and 40 minutes. Teachers in the control group will also be interviewed to explore any potential contamination issues between control and intervention classrooms.

School visits

The CEE research team will visit each participating school once by to collect process data towards the end of the study period (May/June). During this school visit the researcher will conduct the final interviews with teachers (as mentioned above) and principals, undertake a lesson observation and conduct a focus group with 6 to 8 children who have taken part in the programme.

The findings arising from the analysis of these observations, interviews and focus group data will be reported alongside the findings from the outcome data in the final evaluators report to the EEF.

Personnel

As Director of the Centre for Effective Education *Professor Allen Thurston* will have overall responsibility for the direction and delivery of the project. He will also provide appropriate support and advice throughout the study. Professor Thurston is a former primary school teacher who now undertakes large scale randomised controlled trials in education. He has held numerous research grants including recent grants from ESRC and EEF.

Dr Sarah Miller is the Principal Investigator and will have responsibility for overseeing all aspects of the design, randomisation and the analysis and write up of the data. She is a Deputy Director of the Centre for Effective Education and a psychologist with a strong quantitative and statistical background comprising considerable experience conducting complex multivariate analyses (including hierarchical linear modelling). Her experience of supervising and conducting research projects spans cluster randomised controlled trials, systematic reviews and large-scale surveys. Currently she is Principal or Co-Investigator on three large-scale randomised controlled trials in Education and is undertaking a number of systematic reviews in related areas.

Dr Miller will be supported by Seaneen Sloan and Aideen Gildea who have considerable experience in the conduct of CRCT's, multi-level modelling and process evaluations in relation to RCT's.

Aideen Gildea is a Researcher in the Centre for Effective Education. Aideen's work over the last decade has involved undertaking high quality quantitative and qualitative research on a range of RCTs but her expertise lies primarily in qualitative methods; specifically process evaluations that are designed to run alongside RCTs. She is particularly experienced in designing and carrying out process evaluation work including observation studies for fidelity alongside the main impact study. Aideen is a qualified health visitor, and worked for many years with parents and families in the community. She is currently the lead qualitative researcher on a trial of a school based social and emotional learning programme.

Seaneen Sloan is a researcher in the Centre for Effective Education. She is currently responsible for the day-to-day running of a large-scale (>60 schools) cluster randomised controlled trial of a social and emotional learning programme. Having ten years' experience

in research, she is skilled in recruitment and retention of schools in evaluations with long-term follow-up, training fieldwork staff and ensuring all data collection targets are met, liaising with school personnel and programme developers, administering tests on both one-to-one and whole-class basis, as well as data management, analysis (including multi-level modelling), and report writing.

Risks

A risk analysis of School of Education and CEE activity has been undertaken. This is presented below by means of establishing the potential risks to the funder and the controls and contingency measures that are in place to minimise these risks. One of the major benefits of EEF funding this proposed evaluation are the extensive and strong controls and contingency measures that Queen's University Belfast will be able to provide. This adds security to the funding body and peace of mind that the proposal will be delivered on specification and on time.

Ethics

All research will be conducted according to the School of Education at Queen's University ethical guidelines. Ethical approval will be obtained from the School of Education's Research and Ethics Committee prior to any data collection to be undertaken by the CEE evaluation team. Informed consent will be obtained from participants and data will be anonymised and held securely on a password-protected computer.

Data protection statement

Data will be processed on password protected Windows 7 machines with bit locker encryption. For those using Apple Macs, these machines will also all be password protected and the data will be stored in a separate password-protected encrypted folder as a disk image (.dmg) file.

The stored location is a high security Data Centre, with fire and intrusion alarms, using relevant sensors as well as CCTV monitored 24 x 7 by security personnel. The rooms have dual entry card and pin code access doors. Access to media devices is by authorised staff only and media removed off site is to high security safes.

The Centre for Effective Education data protection policy is that no NPD can be printed, written in hard copy or written to removable media.

The Centre for Effective Education data protection policy is that NPD data cannot be shared via email. Users can only access the data via the corporate SharePoint or Novell systems which only permit access to those authorised to do so.

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Risk	Assessment	Countermeasures and contingency plan
<p>1. Schools decide they no longer want to participate following randomisation</p>	<p><i>Likelihood: Low</i> <i>Impact: Low</i></p>	<p>A Memorandum of Understanding will be established between schools and the research team prior to participation making clear the responsibilities and rights of schools.</p>
<p>2. Bristol University and CEE have differences of opinion on trial design, measures or approach to analysis</p>	<p><i>Likelihood: Medium</i> <i>Impact: Medium</i></p>	<p>Early project initiation meetings with the research and evaluation teams to finalise project design and agree measures.</p> <p>CEE staff have experience of working closely with programme developers in a flexible way while maintaining the robustness of the study design and independence of evaluation.</p>
<p>3. Failure of schools to administer assessments at the required time</p>	<p><i>Likelihood: Low</i> <i>Impact: High</i></p>	<p>Evaluation team will both oversee and personally administering the tests both digital and paper.</p>

Risk	Assessment	Countermeasures and contingency plan
4. Differential Pupil Attrition from control and intervention groups	<p><i>Likelihood: Low</i></p> <p><i>Impact: Low</i></p>	<p>Outcome data will be collected directly from schools. With a well-designed trial of this nature we would expect some attrition but with this sample size and the proposed data collection methods, this should be evenly matched between control and intervention schools.</p> <p>Imputation methods will be used if required.</p>
5. Lack of study power	<p><i>Likelihood: Low</i></p> <p><i>Impact: Low</i></p>	<p>Some smaller observed effect sizes may not be significant.</p> <p>This will be dealt with in the interpretation of the impact results, however this is primarily a feasibility study rather than an impact study.</p>
6. Data protection and ethics	<p><i>Likelihood: Low</i></p> <p><i>Impact: High</i></p>	<p>Robust data protection and ethical procedures are in place at CEE. Data sharing protocols will be established.</p>
7. Staffing issues: staff leaving or unavailable over extended duration of project	<p><i>Likelihood: Medium</i></p> <p><i>Impact: High</i></p>	<p>Staff turnover in the CEE is generally low however succession planning has been built into team roles. Large CEE team can absorb problems in the short-term. Sufficient numbers of experienced staff in senior roles to cover others in the team.</p>

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Timescales

	2013					
	Sept-Oct	Nov-Dec	Jan-Feb	Mar-Apr	May-Jun	July-Aug
1. Evaluation planning						
Study design						
Recruitment of schools						
Ethical approval						
Randomisation						
2. Impact evaluation						
Collection of Reading and Maths data via InCas, PiE and PiM						
Collation of other data from the NPD						
Data processing						
Analysis						
3. Process evaluation						
Attend and observe teacher training						
Interviews with						

teachers and school management team						
Observations						
Focus groups with students						
Analysis						
4. Reporting						

References

Donnelly, J. E., (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.

Hollar, D. (2010) Effects of a Two-Year Obesity Prevention Intervention on Percentile Changes in Body Mass Index and Academic Performance on Low-Income Elementary School Children. *American Journal of Public Health, 100*, 646–653.

Pell, T., & Jarvis, T. (2001). Developing attitudes to science scales for use with children of ages from five to eleven years. *International Journal of Science Education, 23*(8), 847–862.