Project Based Learning
Evaluation report and executive summary
November 2016

Independent evaluators:

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The Education Endowment Foundation (EEF) is an independent grant-making charity dedicated to breaking the link between family income and educational achievement, ensuring that children from all backgrounds can fulfil their potential and make the most of their talents.

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About the evaluator

The project was independently evaluated by a team from Durham University: Victoria Menzies, Catherine Hewitt, Dimitra Kokotsaki, Clare Collyer and Andy Wiggins.

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Executive summary

The project

Project Based Learning (PBL) is a pedagogical approach that seeks to provide Year 7 pupils with independent and group learning skills to meet both the needs of the Year 7 curriculum as well as support their learning in future stages of their education. It particularly aims to improve their engagement in learning as well as practical literacy skills. This trial evaluates a specific type of PBL known as 'Learning through REAL Projects', developed by the Innovation Unit—an independent social enterprise that aims to improve public sector services.

A year long pilot project in 2013/2014 with eight schools (763 pupils) established the feasibility of a main trial. It provided the opportunity to develop the intervention and test the research procedures. The results contained in this report relate to a randomised controlled trial that took place between September 2014 and April 2016. Twelve intervention schools (2,101 pupils) and 12 control schools (1,973 pupils) were involved in the trial.

REAL projects was delivered by teachers, supported in many instances by teaching assistants (TAs), with further support from senior leadership colleagues. It was delivered for a year in the intervention schools with a relatively large proportion of timetabled teaching (varying between 20% and 50%). In almost all cases it was delivered to mixed-ability Year 7 classes.

The intervention used structured cross-subject 'REAL Projects' planned by the delivery teachers who were supported by Classroom Coaches from the Innovation Unit. Schools were also supported by Leadership Coaches. REAL Projects are driven by an *essential question* which has significant educational content. The projects encouraged pupils to create an 'excellent' product through drafting and redrafting and then to exhibit their work to an 'authentic' audience.

Visits were made to intervention schools at two time points and consisted of lesson observations, interviews, and focus groups with school leadership, project leads, class teachers, and pupils. Two case studies were also conducted in schools that it was agreed delivered the intervention well.

Key conclusions
1. Adopting PBL had no clear impact on either literacy (as measured by the Progress in English assessment) or student engagement with school and learning.
2. The impact evaluation indicated that PBL may have had a negative impact on the literacy attainment of pupils entitled to free school meals. However, as no negative impact was found for low-attaining pupils, considerable caution should be applied to this finding.
3. The amount of data lost from the project (schools dropping out and lost to follow-up) particularly from the intervention schools, as well as the adoption of PBL or similar approaches by a number of control group schools, further limits the strength of any impact finding.
4. From our observations and feedback from schools, we found that PBL was considered to be worthwhile and may enhance pupils' skills including oracy, communication, teamwork, and self-directed study skills.
5. PBL was generally delivered with fidelity but requires substantial management support and organisational change. The Innovation Unit training and support programme for teachers and school leadership was found to be effective in supporting this intervention.

How secure are the findings?

Overall, the findings have low security. The trial was designed as a two-armed randomised controlled trial with schools being allocated to intervention or control groups. It was set up as an efficacy trial which aimed to test if the intervention can succeed under ideal conditions. However, 47% of the pupils in the intervention and 16% in the control group were not included in the final analysis. Therefore there were some potentially important differences in characteristics between the intervention and control groups. This undermines the security of the result. The reason that so many pupils from schools implementing PBL are missing from the analysis is largely due to five of these schools leaving the trial before it finished. Many of the schools in this trial were experiencing challenging conditions, and some of the schools that dropped out had a change of leadership team during the trial. It may be that successful implementation of the PBL programme is difficult for schools in such circumstances. For some of these pupils without Year 7 outcome data, Year 11 data will be available in the future from national data sources. This will enable EEF to do a future analysis of the effectiveness of PBL which does not suffer from such high rates of data loss.

What are the findings?

The trial results did not find that the PBL programme had an impact either on the pupils' literacy performance (as measured by Progress in English 12 tests), engagement, or attendance. The analysis did find a statistically significant negative impact on students eligible for free school meals (FSM), however no negative impact was found for lower-attaining pupils more generally, which makes it difficult to hypothesise why PBL might negatively impact FSM pupils specifically. This adds to the uncertainty of the finding. Given the inherent design limitations, high attrition rate, and cross-over in terms of group allocation (with some control schools also involved in PBL) we should further limit the confidence we have in the above findings as bias in either direction could have been introduced.

The process evaluation, which was based on classroom observations and feedback from headteachers, project leads, teachers, and pupils in the schools, as well as the Innovation Unit delivery team, did provide evidence of positive benefits from doing PBL, in particular in terms of developing oracy, communication, team working, and research skills.

The existing international evidence on the effectiveness of PBL is relatively weak, and this research contributes to the evidence base from an English perspective. In summary, although PBL is unlikely to improve children's literacy outcomes or engagement, it may enhance the quality of children's learning, particularly improving some of the skills required for future learning and employment.

How much does it cost?

The cost per pupil is about £58 per year for the support package from the Innovation Unit. The main additional costs are teacher time for training which varied to some degree between schools. The Innovation Unit advised a minimum of three days each for three teachers (initial training) plus ongoing planning time as necessary including between one and three hours per week for the school PBL team.

Table 1: Summary of impact on primary outcome

Group	Number of schools	Effect size (95% confidence interval)	Estimated months' progress	EEF security rating	EEF cost rating
PBL vs. control	24	-0.13 (-0.31, 0.05)	-2	🔒🔒🔒🔒🔒	£ £ £ £
PBL (FSM-eligible) vs. control	24	-0.24 (-0.41, -0.06)	-3	NA	£ £ £ £

Introduction

Intervention

The Innovation Unit developed a Project Based Learning (PBL) intervention called 'Learning through REAL Projects'[1] based on three key principles:

1. that all pupils are capable of excellence regardless of prior attainment, needs, or background;
2. that student work should matter beyond grades and exams; and
3. that schools and classrooms are communities of learners and that teachers as well as pupils learn with and from each other.

Broadly speaking, the Learning through REAL Projects intervention involves teachers from different subjects designing and planning projects which enable pupils to produce a publicly-exhibited output such as a product, publication, or presentation. For example, in all schools the first REAL Project was to create and publish an A to Z book. Each school chose their own theme depending on the subjects involved (for example, A to Z of technology terms, A to Z of local heroes, A to Z of the school). The project involved pupils each researching the topic, writing and redrafting text and images, creating proofs, getting publishing quotes, getting a book published, and launching the book at a student-led book launch. Other projects varied from school to school and included:

- pupils learning about the environmental impact of rubbish, creating fashion pieces from recycled waste, and putting on a fashion show of these pieces for an audience;
- learning about local history and creating a museum exhibition within school for local primary school children; and
- a history project focusing on slavery and creating and marketing a music album to sell to support anti-slavery charities.

Projects are designed by teachers to be driven by an initial 'real world' question so as to allow pupils to cover pre-planned significant educational content. Each project leads to a student-created output which has a purpose and is displayed to an audience relevant to the project. The focus is on producing high quality work to answer the driving question, which has value to the pupils and relevance outside of school. Project work involves creating multiple drafts incorporating feedback and suggestions ('critique') from peers, teachers and others, such as community members, into the work. Projects also allow flexibility for student creativity and direction in creating outputs. Projects can still involve 'traditional' teaching of content where this fits into the knowledge the pupils need to know but this is focused towards supporting the project product.

The REAL Projects intervention provides schools with extensive professional development and support for both teachers and leadership staff from experienced teachers and school leaders. A similar intervention had been previously used in the U.K. in around eight schools.

The REAL Projects pedagogy is expected to increase pupils' deeper engagement with learning and with school through the direct relevance of projects to real-life issues or problems, along with the linking of different areas of learning (for example, marketing a product involves mathematical ideas, design work, communicating ideas, research skills, and literacy). Learning through REAL Projects also aims to support pupils in developing skills that are valued by employers in the current market and that

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[1] The term 'REAL projects' is used interchangeably with 'Learning through REAL Projects' and 'PBL' (unless stated otherwise) and specifically refers to the Innovation Unit version of PBL.

will be useful for pupils' future learning—described by the Innovation Unit as '21st Century Skills'. These include skills relating to team working, problem solving, communication (including oral presentation), leadership, interpersonal relationships, research and analysis, planning, organising, and prioritising. Within the pedagogy the development of these skills is assessed and valued alongside the academic knowledge learned. While not all skills can be assessed within each project, schools were encouraged to focus on one or two '21st Century Skills' to assess alongside relevant subject knowledge and the project outcome 'product'. Although the intervention is a pedagogical structure rather than a curriculum or skill-specific intervention, for the purposes of this study, the intervention specified that all projects must have a literacy component, primarily aimed at students producing high quality written work as part of their final product. It was also recommended that teams of teachers delivering the project include an English specialist.

The Innovation Unit's REAL Projects intervention specifies minimum requirements for schools including aspects of organisation, staffing and the curriculum, as well as classroom practices during REAL Projects lessons; all of these factors can vary with the existing school practice. The intervention involves all pupils in Year 7 in participating schools working in mixed-ability classes. Projects should be planned in conjunction with the English department and at least one other discipline so that links can be made between traditional instruction and PBL. There is also a requirement for a member of the school leadership team to be a part of the team leading the work in the school.

In addition, Learning through REAL Projects lessons should be timetabled to account for at least 20% of the Year 7 timetable (though 40% to 50% was recommended) and at least one project during the year should be an extended project accounting for a minimum of six full days learning time. Pupils should be taught in blocks lasting at least half a day. Teachers are required to plan projects from scratch or to adapt existing projects for their schools, with a recommended one to three hours of planning time per week for the team leading the work. This additional planning is required particularly as each project has to be planned from start to finish with deadlines for exhibition (for delivery of a number of lessons) and delivered in a similar way by different teachers—quite different to traditional lessons. Overall, intervention schools did try to meet these requirements although not all schools maintained mixed-ability classes throughout the year, and additional planning time specifically for the REAL Projects team could not always be provided. Further discussion of implementation can be found in the process evaluation section.

There were also expectations specified of the types of projects to be taught and the essential elements of REAL Projects that needed to be evident in those projects. Schools were required to start by adapting an existing project set by the Innovation Unit—publishing an A to Z book as described above—with the content selected by the school. During the year, schools were expected to adapt an additional two existing projects (from a bank of suggested project ideas) as well as create at least one original project planned by the teachers that would be teaching it. Each project had to include the essential components of:

- an essential question—driving the whole project;
- significant academic content built in;
- multiple drafts of work and critique on work provided by peers, teachers and others;
- a student-created final project;
- public exhibition of the work created; and
- an authentic audience to view and to comment on the work created.

Intervention schools were able to incorporate most of these aspects into the projects they planned (in particular, multiple drafts and critique were done well in all intervention schools), however the 'authentic audience' was often an issue and the public exhibition was sometimes challenging for schools to facilitate. Further discussion of implementation can be found in the process evaluation section.

Schools allocated to the intervention group were required to pay a contribution of £10,000 towards the intervention costs. For this (and additional funding provided by the EEF) schools were provided with:

- resources and materials—including a school handbook, printed training resources, access to online resources, a facilitated online REAL Projects community, as well as webinars supporting practice throughout the year;
- a school support package (nine days) over the two terms **before implementation** for planning and preparing to deliver REAL Projects that included—
    - three days of induction ('Quest') training (with other schools) that looked at project design, teaching, and assessment for the school's REAL Project team,
    - three days of individual school support from a Leadership Coach (an experienced headteacher with experience of changing school practice) for school senior leadership to help with planning and design,
    - three days of individual school support from a Classroom Coach (a qualified class teacher from an American PBL-based school with extensive experience of teaching through Project Based Learning) to support the REAL Projects teaching team with planning and project development, and
    - one day INSET for all staff in the school about Learning through REAL Projects; and
- an ongoing support package for schools **during the year of project delivery** (27 days) that included—
    - 18 days of Classroom Coach time (one visit per fortnight), and
    - nine days of Leadership Coach time (not always in person—regular telephone calls with school leaders were incorporated here along with occasional visits to assess progress with the full REAL Projects team).

The intervention was delivered to pupils during one full school year (September 2014 to July 2015) with training and support for schools and teachers starting in February 2014 to allow them to prepare for delivery the following school year.

Learning through REAL Projects is an intervention that involves a high degree of organisational setup, intensive initial training, a period of supported planning, and continued intensive support through the delivery of the intervention. For many schools it represents a significant change in practice, requiring commitment from both school leaders and classroom teachers—hence the level of support provided for the delivery of the intervention.

Background evidence

A literature review was conducted of the existing evidence for the effectiveness of Project Based Learning in primary and secondary schools, and of the factors that can facilitate the implementation of PBL. An abridged version is presented here with the fuller literature review included in Appendix B. It should be noted that Project Based Learning is different to *Problem* Based Learning (also sometimes shortened to PBL). While there are some similarities, Problem Based Learning concerns collaboratively solving an open-ended authentic problem, which is generally derived from professional practice, and is often used in medical schools and other post-secondary education. It does not tend to focus on creating an end product or exhibition, and due to the nature of the problem there is less relevance for an authentic audience.

Characteristics of Project Based Learning

Project based learning is a student-centred form of instruction based on three constructivist principles: learning is context-specific, learners are involved actively in the learning process, and they achieve their goals through social interactions and the sharing of knowledge and understanding (Cocco, 2006). It is considered to be a particular type of inquiry-based learning where the context of learning is provided through authentic questions and problems within real-world practices (Al-Balushi and Al-

Aamri, 2014) that lead to meaningful learning experiences (Wurdinger, Haar, Hugg and Bezon, 2007). The uniqueness of PBL is the construction of an end product, a 'concrete artefact' (Helle *et al.*, 2006) which represents pupils' new understandings, knowledge, and attitudes regarding the issue under investigation—often presented using videos, photographs, sketches, reports, models, and other collected artefacts (Holubova, 2008).

It is argued that the freedom and challenge that pupils experience as a result of solving the problems that arise in designing and building their projects result in high levels of student engagement (Wurdinger *et al.*, 2007). It is also said to foster self-regulated learning and promote pupils' conceptual knowledge within a systematic process of documenting and reflecting on learning (Barak, 2012). Within project based learning, pupils learn to be self-reliant through goal-setting, planning, and organisation; they develop collaboration skills through social learning; they also become intrinsically motivated by being encouraged to exercise an element of choice while learning at their own level (Bell, 2010).

Existing evidence

The existing evidence for a causal link between PBL and attainment outcomes seems to be weak. Most of the reviewed studies did not involve random allocation of participants to control and experimental groups and, as a result, a causal link between project based learning instruction and positive student outcomes has not been established. The majority of studies were based on a quasi-experimental pre-test/post-test design with some baseline equivalence established for the outcomes measured at the classroom level. Some studies with a less robust design for inferring causality were based on observations of pupils' behaviour, attitudes, and accomplishments in a project based learning environment without the presence of a comparator group (for example, Barak and Asad, 2012; ChanLin, 2008; Cuevas, Lee, Hart and Deaktor, 2005). Other studies have used state standardised test averages against which to compare the performance of pupils (Geier *et al.*, 2008).

Looking specifically at studies at secondary school level, a number of non-randomised studies demonstrated positive effects on content-specific learning through use of a project based learning curriculum—although these have usually been small pieces of research on short specific projects with very few U.K.-based studies. However, there appears to be no previous research which has established the effectiveness of PBL on literacy measures specifically; most papers focus on science, technology and history attainment outcomes.

Positive results have also been reported with primary age pupils although again most of the studies have been conducted in non-U.K. contexts and are small-scale pieces of research (for more detail regarding research findings in primary schools, see Appendix B).

In Oman, Al-Balushi and Al-Aamri (2014) conducted a small scale, two-class, quasi-experimental study with 62 11th-grade female pupils (equivalent to Year 12 in the U.K.) that explored the effect of environmental science projects on pupils' environmental knowledge and attitudes towards science. The findings were positive with the experimental group significantly outperforming the control group in an Environmental Knowledge Test and the Science Attitudes Survey. In history learning, Hernández-Ramos and De La Paz (2009) had eighth-grade pupils in the U.S. (equivalent to Year 9 in the U.K.) learn to create multimedia mini-documentaries in a six-week history unit. Compared to pupils who received traditional instruction (in a pre-test/post-test study), pupils that engaged in the project based learning curriculum demonstrated positive affective benefits and significant gains in content knowledge as well as historical thinking skills. However, again this was a weak study with only two classes with two different teachers which were not randomly allocated. Other quasi-experimental studies conducted in the U.S. (Hsu, Van Dyke, Chen and Smith, 2015; Geier *et al.*, 2008) looking at science education reported positive effects for the project based learning environment compared to a comparison group in teaching seventh- and eighth-grade pupils (Years 8 and 9 in the U.K.). They

found better development of argumentation skills and science knowledge and understanding, better process skills, and higher exam pass rates on a state-wide test.

Other small studies in Israel (Barak and Asad, 2012) and Taiwan (Lou, Liu, Shih and Tseng, 2011; ChanLin, 2008)—again focusing on project based learning in science—have indicated that a PBL environment led to higher learner motivation and increased interest in learning science, as well as increased enjoyment and engagement in learning STEM subjects. In ChanLin's (2008) qualitative study, PBL supported pupils in Taiwan in synthesising and elaborating knowledge in science exploration tasks.

Project based learning has been explored as a method of instruction with low-achieving pupils in Israel (Doppelt, 2003) and the U.S. (Cuevas *et al*., 2005), and with 'second chance' school pupils in Greece (Koutrouba and Karageorgou, 2013) with positive outcomes. Doppelt (2003) found—through a field research project with 54 fifteen- and sixteen-year-olds—that scientific-technological project based learning helped improve low-achieving pupils' motivation and self-image by allowing them to succeed early on in the process; this led to more pupils achieving college admittance requirements.

Some international studies have, however, shown mixed results. For example, in a quasi-experimental study with 13-year-old children taking computer courses in Greece, Boubouka and Papanikolaou (2013) found no significant effect of project based learning on student achievement but a statistically significant positive effect on self-perceived learning performances.

In the U.K. context, Boaler (1998) conducted a longitudinal study of mathematics instruction comparing an open, project-based environment to a traditional approach following two cohorts of pupils in two British secondary schools from Year 9 to Year 11. This study employed a closely-matched control group in terms of socioeconomic status, prior mathematics instruction, and attainment. A variety of instruments were used to measure pupils' skills, attitudes, and attainment. The main finding was that the two groups developed different forms of knowledge. The pupils learning mathematics in the project-based environment developed conceptual understanding which often required creative and deeper thinking in contrast to the procedural knowledge acquired by the traditional instruction group which was mainly based on information recall. In addition, more pupils at the project-based school succeeded in passing the General Certificate of Secondary Education (GCSE) at the end of the three-year study than those pupils receiving the traditional instruction.

Because of the transitional nature of pupils in Year 7 in this project, it is also relevant to look at some of the existing evidence for pupils in later primary school. Kaldi, Filappatou and Govaris (2011) conducted a quasi-experimental study in primary schools and from this argued that primary-age pupils can develop content knowledge and group work skills in addition to motivation and positive attitudes towards peers from a different ethnic background through project based learning instruction. Similarly, Karaçalli and Korur (2014) conducted a quasi-experimental study in Turkey with fourth-grade science pupils (equivalent to Year 5 in the U.K.) and found a statistically significant effect in terms of academic achievement and retention of knowledge for the PBL pupils. However, like many of the other studies included, this had a very weak design involving only pupils within one class volunteering to be part of the treatment, and had flaws to the analysis conducted.

Recommendations for implementing PBL

The literature was reviewed for the factors that facilitate the use of project based learning and how teachers can best support it. Six recommendations came from this search of the literature:

1. Student support: pupils need to be effectively guided and supported through the PBL process; emphasis should be given on effective time management and student self-management including making safe and productive use of technological resources.

2. Teacher support: regular support needs to be offered to teachers through regular networking and professional development opportunities. Support from the school senior management is crucial.
3. Effective group work: high quality group work will help ensure that pupils share equal levels of agency and participation.
4. Balancing didactic instruction with independent inquiry will ensure that pupils develop a certain level of knowledge and skills allowing them to comfortably engage in independent work.
5. Assessment emphasis on reflection, self, and peer evaluation: evidence of progress needs to be regularly monitored and recorded.
6. An element of student choice and autonomy throughout the PBL process will help pupils develop a sense of ownership and control over their learning.

The Learning through REAL Projects approach incorporates all these recommendations within the programme to some degree. There is particular focus on providing teachers with regular support throughout the year and on facilitating the relationship between senior management and REAL Projects teachers. Strategies (including suggested activities) for supporting pupils with becoming familiar with the PBL process and with managing group work are provided through the online community and by the Classroom Coaches. The programme also gives guidance and suggestions for assessing work and monitoring progress with suggested pro formas.

Rationale for the Current Project

Project Based Learning and similar approaches (such as the RSA's Open Minds project) have been advocated, developed to various degrees, and used in school teaching for many years. Currently, a few schools in the U.K. are using PBL as the basis of their whole curriculum including some academy schools and free schools from primary through to sixth-form level. A larger number of other schools are using the PBL approach for specific subjects, year groups, or for off-curriculum time, some of which have been using this approach for a number of years. PBL seeks to offer a way to engage pupils more deeply with learning, to interest them in areas they might not have thought about and to develop their skills for life beyond school. However, as demonstrated by the above review, very few impact evaluations have been carried out, particularly within the U.K. education system. This project therefore provides a timely opportunity to assess both the impact of a PBL intervention and its potential further adoption in schools.

Due to the complex nature of REAL Project and its implementation, it was decided by the EEF, Innovation Unit, and the evaluators to include a pilot year where the intervention would be piloted in a small number of schools and further developed. One of the aims of the pilot year was for the developers to decide on the right balance between support and cost. The Innovation Unit used feedback from schools and the research team to better refine and define the intervention. These changes were made prior to the full trial.

The Learning through REAL Projects intervention had not previously been tested in a research study, however the previous evidence indicated that the PBL approach showed promise. Therefore an efficacy trial testing the intervention when delivered in ideal conditions (with a high level of support provided by expert classroom teachers from an American PBL school) was chosen for this trial.

As well as exploring the impact of the intervention on attainment and engagement, this evaluation aimed to investigate the facilitators and barriers to English schools implementing and maintaining this intervention over a two-year period. The results of this project aimed to inform the feasibility of using the approach in schools, particularly within the Key Stage 3 curriculum, and suggest methods that could allow the intervention to be scaled up for more wider delivery if successful.

Evaluation objectives

Pilot development year questions

1. What is the existing evidence underpinning the PBL pedagogy?
2. How can the Learning through REAL Projects intervention be developed ready for a randomised controlled trial?
3. Do the planned trial research methods work when piloted?

Impact evaluation questions

1. What is the impact of the Learning through REAL Projects intervention on literacy when comparing pupils in intervention schools with those in control schools?
2. What is the impact of the Learning through REAL Projects intervention on engagement with school and learning for the participating pupils, compared to those in control schools?
3. Are there differential impacts of the Learning through REAL Projects intervention on different subgroups of pupils such as groups based on FSM status, prior attainment, and gender?

Process evaluation questions

1. What is the feedback from pupils on the Learning through REAL Projects intervention?
2. What is the feedback and professional assessment of the Learning through REAL Projects intervention from teachers and school leaders?
3. How effective and appropriate is the training and professional development provided?
4. What are the commitments and implications for schools adopting the programme?
5. What are the direct and indirect costs of delivering the programme?
6. What are the key success factors and barriers to successful implementation?
7. Are there any other areas of the programme that could be further developed (following the completion of the trial)?

Link to protocol:

https://educationendowmentfoundation.org.uk/public/files/Projects/EEF_Project_Protocol_ProjectBasedLearning.pdf

Ethical review

Ethical approval for the evaluation was obtained from the Board of Ethics in the School of Education, Durham University on 20 November 2012. This was updated on 25 March 2014 to accommodate changes to the research design. See Methodological section below for details of these changes.

Consent was given by the headteacher of each school involved to take part in the research. Control schools signed a memorandum of understanding with the Innovation Unit and intervention schools signed a services agreement agreeing to the requirements of the trial. Additional information sheets about the evaluation were also sent to all schools detailing the specifics of the research and how schools' data would be used. See Appendix C for examples of the school agreements, information sheets, and consent forms.

The intervention was delivered to all pupils as part of the curriculum but parents were given the opportunity to opt-out of their child's inclusion in the research through letters provided by the research team and sent by the schools to parents (also included in Appendix C).

Assessment at the end of the project was conducted across the full year groups; where parental opt-out had been received the papers were not collected or marked. One school required collecting opt-in consent to undertake the testing. In this case, as so few opt-in responses were received (30 out of 125), it was deemed unethical to run the assessment as the sample would be too small to be able to generalise results from this school.

Pupil focus groups were carried out in some schools as part of the process evaluation. Opt-in consent was obtained for these with information and consent forms sent home to parents and pupils assenting at the beginning of the focus groups. Teacher, headteacher, and developer interviews and focus groups were also conducted and oral consent was obtained to conduct these and to record them for research purposes before the interviews.

Project team

Innovation Unit (Developer)—responsible for programme development, recruitment to the project, and delivery of intervention:

Programme Lead: Louise Thomas.

Operations Manager: Kim Schilling.

Leadership Coaches: David Jackson, Chris Cotton, Angela Armytage, Jan McKenley-Simpson.

Classroom Coaches: John Bosselman, Cara Littlefield, Loni Bergqvist, Kay Flewelling.

Durham University (Evaluator)—overall responsibility for delivering the evaluation, including trial conduct, assessment collection, and process evaluation:

Principal Investigator: Dr Andy Wiggins.

Lead Researcher: Victoria Menzies.

Researcher (Literature review and process evaluation): Dr Dimitra Kokotsaki.

Advisor (Pedagogy and Literature review): Professor Joe Elliott.

Advisor (Assessment): Dr Christine Merrell.

Research Administrator: Clare Collyer.

York Trials Unit, University of York (Evaluator)—responsible for contributing to research design, conducting randomisation and analysis:

York project lead: Professor David Torgerson.

Lead Statistician: Professor Catherine Hewitt.

Trial registration

The trial was registered on the ISRCTN registry, study ID ISRCTN38596728.

Methods

Trial design

The evaluation project took place in two stages: an intervention development and research pilot stage during the first year of the project and a full randomised controlled trial following this.

Pilot/development phase

During the pilot/development stage, the intervention and support to be provided to schools was developed, refined and fully described by the Innovation Unit. This development was based on how the eight pilot schools (recruited by the Innovation Unit and having a range of previous experience of using PBL) used the programme, as well as independent feedback from the evaluation team about pedagogy, delivery, organisation, and support. During this period the evaluation team:

- conducted a literature review of the previous evidence for the effectiveness of Project Based Learning and the aspects that facilitate its delivery in schools;
- observed the initial three-day training programme and ongoing events provided for pilot schools;
- conducted phone interviews with the PBL lead in seven of the eight pilot schools;
- made visits to the three pilot schools most likely to be generalizable to the general population to observe PBL lessons, conduct interviews (with senior management and delivery staff), and to conduct a focus group with pupils; and
- provided feedback to the Innovation Unit on the delivery of the intervention (throughout the year with final date for feedback in June 2014).

During this stage of the project, the delivery of the primary outcome measure and newly developed engagement survey were piloted and feedback gathered from schools on the acceptability of the research processes. Interview and focus group schedules were also developed, piloted, and refined for the main project. This research piloting led to changes in the evaluation protocol for the main trial including an updated description of the intervention, and changes to secondary outcome measures and methods of delivering the assessment. The original protocol only included the academic outcome measures of literacy, maths and science. The piloting revealed that schools were not including maths as part of project based learning and that science was included only in one school. It was therefore decided to retain the literacy focus but to introduce an 'engagement' secondary outcome as this seemed more aligned with the intervention's aims. The original assessment delivery method was via a computerised assessment. The piloting also revealed that most schools did not have adequate facilities to deliver an IT assessment via computers for the full year group.

All aspects of this report hereafter refer to the Main Trial.

Main Trial

The main trial was a cluster two-armed randomised controlled trial with randomisation to the Learning through REAL Projects intervention group or to a 'business as usual' control group conducted at school level. The trial took place over the course of one year, although process evaluation data was collected for an additional year.

The original protocol stated that this would be a two-year trial with outcomes collected at the end of the second year. However, a decision was made by the EEF and the Innovation Unit not to fund the intervention for the second year as this would have required additional funding beyond the initial grant. It had been expected that the Innovation Unit might have been able to obtain additional funding for this second year, however this was not possible. The trial was therefore shortened to one year in a revised protocol agreed in January 2015 with outcomes collected after one year of delivery. Given the

organisational adjustments, staff commitments, and professional development involved for schools in delivering the intervention, a two-year trial would have allowed better embedding of REAL Projects and enabled schools to have become more independent with their delivery. It is also reasonable to assume that measuring outcomes after only one year might underestimate the effect of the intervention, however it was also necessary to take into account the additional cost to schools and the EEF of delivering the intervention.

Schools in the intervention group were asked to deliver the intervention throughout the year of the project, attend the required training, and comply with the minimum requirements as described above in the intervention section. Schools allocated to the intervention group were required to pay the Innovation Unit £10,000 towards the support and materials provided.

Schools in the control group were asked to continue with their usual practices of teaching at Year 7— 'business as usual'. No incentives were provided other than the option of purchasing the intervention for delivery after the project. Control schools were not given access to intervention materials (although limited materials were available on the Innovation Unit website) and were given no access to the support and professional development provided by the Innovation Unit between the start of the project and February/March 2015. From this time, if desired, control schools were able to pay for and access a reduced form of Learning through REAL Projects training and resources in order to plan for delivery in the 2015/2016 school year. Although this training took place before the post-testing in June and July 2015, control schools were committed not to implement REAL Projects until September 2015. The process evaluation revealed, however, that some control schools were doing a version of project based learning during the trial although this was without the direct support of the Innovation Unit and their coaches.

This two-armed cluster RCT design was chosen in order to provide robust estimates of the impact of the intervention. Although the trial was underpowered with only 24 schools, it was expected that the trial would give an indication of the potential impact and would also serve as a study of the feasibility of conducting an RCT of an intervention requiring substantial organisational change across schools.

Participant selection

Schools were eligible to participate in the project if they were a mainstream state secondary school in any area of England willing to be randomised to implementing the intervention (and pay a contribution of £10,000) or to be part of a business as usual control group. Schools had to be willing to undertake all research related procedures and to have the capacity to deliver the intervention (as assessed by the Innovation Unit). All pupils in Year 7 in participating schools were eligible to take part and schools were asked to include all Year 7 pupils.

Twenty-four schools were recruited by the Innovation Unit using their own networks of schools; recruitment also took place through a national media campaign with articles about the project in the TES magazine. Schools were asked to provide initial information on a registration form and were then contacted by the Innovation Unit. Each interested school was visited by a member of staff from the Innovation Unit in order to assess the school's capacity to deliver the intervention (for example, whether they would be able to make the required timetable changes and provide the required staffing). A recruitment conference was also held for interested schools to give details of what the intervention and research would involve. This was hosted by the Innovation Unit and the Evaluation Team.

Initially the Innovation Unit provided details of twenty-four schools for randomisation, however shortly after providing this list, and before randomisation, it informed the evaluation team that one school had withdrawn. This school was then replaced and randomisation took place in January 2014 with schools informed of their allocation shortly after. While schools had consented to be randomised, they did not sign a full agreement until after the randomisation had taken place. This was due to the nature of the

agreements being legally different, particularly with regard to the cost the intervention group was required to pay. Consent was given by the headteacher of each school to take part. Control schools signed a memorandum of understanding with the Innovation Unit and intervention schools signed a services agreement agreeing to the requirements of the trial and delivery of the intervention. An evaluation information sheet was provided to all schools separately to this. Parent opt-out consent was not sought until after the 2014/2015 school year had started as all pupils were joining a new school at that point. Opt-in consent was sought from parents for process evaluation student focus groups, as relevant, before these took place. Examples of the school information sheet, parental opt-out consent forms, and parental opt-in consent forms for student focus groups are included in Appendix C.

Outcomes measures

Primary outcome: literacy

The primary outcome was literacy attainment, as collected through the Progress in English 12 assessment (GL Assessment,1994, henceforth 'PiE'). Literacy was chosen as the primary outcome as the intervention has an explicit focus on literacy and requires the involvement of staff from the English department. Literacy is also particularly important as a progress measure to schools, especially at Key Stage 3, so it was important for the trial to investigate whether Learning through REAL Projects could be detrimental to pupils' literacy achievement.

The short form of the PiE 12 assessment was used as it is a standardised English and literacy assessment often used for summative assessment in school. It includes two reading comprehension passages (fiction and non-fiction) along with spelling and grammar exercises. It does not include any extended writing tasks. The overall raw score from the PiE 12 assessment was used in the primary outcome analysis.

Data from Key Stage 2 (KS2) SATS was obtained from the National Pupil Database (NPD) to use as a baseline assessment. Fine grade reading scores were chosen as the baseline outcome to use in the analyses as the correlation between Reading and PiE 12 was expected to be greater than other KS2 outcomes, giving the trial more power to detect an effect of the intervention should one exist.

Secondary outcomes: engagement

Secondary outcomes aimed to capture how actively engaged pupils were with school and learning. Engagement with school and learning was defined as feelings about, disposition to, and participation in, school, school life, and learning activities. These outcomes were chosen because a primary aim of the intervention was to increase pupils' engagement with the learning process and to give pupils the skills and motivation to continue learning beyond the classroom.

Measurement of engagement was done in two ways: through an 'Attitudes to School and Learning' survey that was developed to investigate pupils' self-reported engagement with school, and additionally through school attendance record data collected from the NPD. Collecting both survey data and attendance data therefore provided a way to investigate two aspects of this and to triangulate findings.

Attitudes to School and Learning survey

The 'Attitudes to School and Learning' survey was developed by the Durham University team to cover a broad concept of school engagement and learning in the classroom and beyond. The development of this measure began with a literature review of how 'engagement' was conceptualised and to review existing measures of engagement which used self-report data. The literature suggested engagement should be looked at in terms of behavioural/operative/doing elements, affective/emotional/feeling elements, and cognitive/intellectual/thinking elements.

Validated items from existing measures (which could be sourced), covering the above aspects of engagement, were collated into a database and categorised by engagement concept or theme. From these, the themes most relevant to the aims of the Learning through REAL Projects intervention were selected; items from these themes were then adapted to suit the U.K. context and, where necessary, made age-appropriate. The draft measure and items were shared and discussed with the Innovation Unit and their feedback incorporated.

For most items, student responses were given on a four point Likert scale to indicate how true the statement is. Items were not specific to individual lessons but to school and classes generally. The initial measure for piloting included sixty-three items looking at:

- identity with school;
- relationships with teachers and other pupils;
- motivation for learning;
- self-efficacy at school;
- involvement in the classroom;
- student learning behaviours (cognitive and metacognitive); and
- teacher behaviours in class.

The measure was piloted with 356 pupils in six schools. The data was subjected to factor analysis and scale reliability analyses. Following this, we removed items that did not work as intended (for example, that were not appropriate, did not fit with the scale, or reduced the reliability of the scale). The final attitudes measure used in the main trial (included in Appendix D) contained 53 items that principal components analysis revealed included seven subscales:

- active interest and enthusiasm;
- positive pupil ethos;
- pupil self-efficacy;
- motivation for learning;
- effort and behavioural engagement;
- attitudes towards teachers; and
- pupil agency in the classroom.

Cronbach's alpha of 0.95 was calculated for this measure, indicating a high level of internal consistency and therefore good reliability.

The total score on this measure, named the 'Attitudes to School and Learning questionnaire', was used as the secondary outcome.

School attendance data

Attendance at school was also used as a proxy measure for engagement. It was expected that pupils who were more engaged with school would have fewer absences than those who were less engaged. Data for this outcome was requested from the NPD. A percentage attendance score was calculated using the 'number of sessions possible' field and the 'number of sessions attended' field using data for the first two school terms of Year 7.

Outcome measure collection

Outcome measures were collected in June and July 2015 after schools had been implementing the intervention for three terms (with training taking place for teachers to prepare for delivery for two terms previously). The assessment and survey were delivered in one session lasting up to one and half hours under exam conditions and in most cases invigilated by a researcher independent of the schools and blind to the allocation of the school (and supported by school staff). In one case the

school administered the assessment with their own invigilators without supervision from the evaluation team due to difficulties with scheduling, and in one case a member of the research team not blinded to the school allocation administered the assessment. In two schools it was not possible to fit all pupils into one hall and the independent invigilator only assessed half the pupils while school staff assessed the remaining pupils. After sitting the assessments, the papers were sent directly to, and were marked by, GL Assessments and the data shared with the research team. The surveys were returned directly to the research team by the external invigilator (or in one case, by the school). The research team also returned the individualised results of the assessment and summary data of the attitudes survey to schools over the summer.

Changes from original protocol

In the original protocol, outcomes in literacy, maths, and science were expected to be collected using the CEM INSIGHT system. Due to the trial being shortened by a year, the INSIGHT system assessment was no longer appropriate for the age group and a decision to use the PiE measure was made instead. Maths and science outcomes were dropped from the revised protocol at this stage as the pilot project had revealed that schools were not consistently including maths or science in their REAL Projects. Feedback from schools about the time demands of additional assessments was also a factor in this decision, as it was in the decision not to also ask pupils to complete an additional measure of their future aspirations.

Sample size

The sample size was determined by the number of schools that the Innovation Unit could support with the funding they received from the EEF. This allowed for 12 intervention schools and a further 12 control schools which, assuming 125 pupils per year-group, gives a sample size of 3,000 pupils. We calculated the minimum effect size that a trial of this sample size would be able to detect by assuming a pre- and post-test correlation of 0.70 and an intra-cluster correlation coefficient of 0.19. The design effect would be 24.56, giving an effective sample size of 122. This is increased by the pre- and post-test correlation to give an 'effective' sample size of 240. This would allow us to detect, with 80% power, 5% two sided alpha and 20% attrition, an effect size of 0.40 ($p = 0.05$).

Randomisation

The Innovation Unit provided the Durham evaluation team with a list of schools that they had signed up to the project and information on the percentage of FSM students in each school and the size of the Year 7 group. Schools were coded, and names removed, and the list passed on to the York Trials Unit that developed the randomisation procedure and allocated schools. Schools involved in the pilot were not eligible to take part in the main trial to avoid contamination effects.

Once pupil baseline data was received, schools were allocated on a 1:1 basis to either receive the intervention for their incoming Year 7 cohort in 2014/2015 (the intervention school group) or to continue with 'business as usual' with the Year 7 cohort (the control group). The allocation was undertaken by an independent statistician using minimisation implemented in minimPy 0.3 (Saghaei and Saghaei, 2011). The independent statistician was not involved in the recruitment of schools and pupils, ensuring independent randomisation.

We chose to use minimisation, rather than simple randomisation or stratified randomisation using blocks, because this method of allocation allowed a better balance in terms of observable school-level characteristics compared with other allocation methods. This improves the credibility and statistical efficiency of a trial when the number of schools allocated is less than 100. The minimisation factors included the size of the Year 7 intake, the percentage of FSM pupils, whether the school was a free school or not, and whether the school stated on its website that it was already using PBL methods. Size of school seemed likely to be a factor affecting schools' ability to make teaching and timetable

changes. Similarly, free school status was included in the randomisation due to the perception that it would be easier to make timetable and teaching changes in a free school than in existing non-free school secondary schools (as seen in the pilot year). The IU was consulted about whether schools already using PBL methods (according to their websites) should be included in the sample: the IU was satisfied that no school was implementing the same model of PBL and it was therefore decided to include these schools in the sample and to control for this in the randomisation.

Naïve minimisation with base probability 1.0 (deterministic minimisation) was conducted using the following factors:

- number of pupils in Year 7 (two levels: less than 180 pupils and more than 180 pupils);
- percentage of pupils eligible for FSM (two levels: less than 36% and more than 36%);
- whether the school was a free school or not; and
- whether the school stated on its website or prospectus that it was using a form of Project Based Learning.

The variables 'percentage of free school meals' and 'size of the Year 7 intake' were continuous and therefore needed categorising. Cut-off values for levels were chosen based on baseline summary statistics. It was decided to split the two variables into two groups based on the median value. This was 36 for FSM proportion and 180 for size of Year 7 intakes.

Naïve minimisation was deemed to be sufficient as the allocations were conducted in a batch, rather than prospectively, meaning predictability was not a concern and hence a random element was not required. The school data was anonymised when received. The 24 schools were labelled a–x. Before being entered into the minimisation programme, the schools were randomly ordered in Stata v13. A random number from a Uniform [0,1] distribution was generated for each school using the seed 1556347. This variable was sorted in ascending order, and a consecutively numbered ID generated for the schools.

Analysis

Analyses were conducted in Stata® version 13 (Stata Corporation, College Station, Texas) using the principles of intention-to-treat, meaning that all schools and pupils were analysed in the group to which they were randomised, irrespective of whether or not they actually received the intervention throughout. Statistical significance was assessed at the 5% level unless otherwise stated; 95% confidence intervals are provided as appropriate. Model diagnostics were used to check model assumptions and transformations considered if assumptions did not hold.

Effect sizes are presented relating to analyses alongside 95% confidence intervals. In this report, effect size is defined as:

$$\Delta = \frac{\beta_{\text{intervention}}}{\sqrt{\sigma_\varepsilon + \sigma_s}}$$

where $\beta_{\text{intervention}}$ is the difference in mean scores between the intervention and control groups adjusting for KS2 reading fine grade scores and minimisation factors, σ_ε is the residual standard deviation, and σ_s is the standard deviation between schools.

Baseline data

School and pupil characteristics are presented by group to assess balance, however no formal statistical testing was conducted. As the randomisation process has been performed properly in this trial we know that the null hypothesis of no difference between treatment groups will be true. Hence any differences between groups that may be present would be due to chance alone. Undertaking

baseline testing would be uninformative and potentially misleading (Altman and Dore, 1990; Begg, 1990; Senn, 1994).

Descriptive analyses

Raw unadjusted outcome results are summarised by group. An estimate of the intra-cluster correlation coefficient (ICC) associated with school for the primary outcome of PiE is presented alongside a 95% CI. The correlation between the primary outcome of PiE scores and KS2 reading fine grade level was also estimated.

Primary analysis

The primary objective of this study was to investigate the impact of the intervention on literacy for the target pupils in the intervention schools compared to the control schools. The difference in literacy attainment between pupils in the intervention group and those in the control group was compared using a linear mixed model with PiE score as the response variable. Group allocation, KS2 reading level fine grading, FSM status, number of Year 7 pupils, whether free school or not, and currently advertised PBL (yes or no) were collected at baseline and were included as covariates in the model. The primary analysis needs to reflect the restrictions implied by the minimisation, hence FSM status, number of Year 7 pupils, whether free school or not, and currently advertised PBL (yes or no) were included as covariates in the model irrespective of their prognostic value (Committee for Medicinal Products for Human Use (CHMP), 2015). Adjustment was made for cluster randomisation through the inclusion of school as a random effect.

Secondary analyses

A repetition of the primary analysis with an additional adjustment for gender was included in the model. This was the only additional factor pre-specified in the protocol that was not included as a minimisation factor and thus in line with the EEF statistical guidance. An analogous approach to the primary analysis was also used to assess for difference between the intervention and control pupils in terms of the secondary outcomes of the attitudinal survey total scores and attendance data; the same adjustments as the primary analysis were undertaken. Model assumptions were checked for each analysis by visual inspection of normal plots to assess deviations from normality and plots of residuals against predicted values to assess uniform variance. The underlying assumptions of normality for the analysis were in doubt for attendance data with the residuals showing clear skew as the points deviated from the central line. When the assumption of normality is in question, then we can often transform the data to another scale where the assumption of normality is reasonable. A transformation applies the same mathematical function (here arcsine) to each data point. Hence the outcome was transformed prior to analysis. Given the skew of the data and type of outcome data, an arcsine transformation was utilised.

Subgroup analysis

Three pre-specified subgroup analyses (FSM status, gender, and prior attainment) were explored. The effect of the intervention on pupils on each of the predefined variables was assessed by including an interaction term between each baseline variable of interest and group allocation in a repetition of the primary analysis. An additional analysis repeated the primary analysis for the subgroup of pupils eligible for FSM to be in line with the funder's requirements. At the request of a reviewer, a further exploratory subgroup analysis (FSM status) was also undertaken for the secondary outcome of attitudinal total scores.

Missing data

The impact of missing data on the primary analysis was assessed using multiple imputation by chained equations with 20 imputations. Missing values were replaced by plausible substitutes based

on the distribution of observed data (rather than a single estimate such as the mean) also including randomness to reflect uncertainty; this was repeated 20 times to create 20 datasets which were combined to give estimates and 95% confidence intervals (Royston and White, 2011; Azur, 2011). Baseline characteristics and PiE scores were both imputed using the same covariates (PiE12, KS2 reading, minimisation factors, and group).

Implementation and process evaluation

Due to the multifaceted and complex nature of the intervention and the implications of this for schools in terms of adopting PBL, the process evaluation was quite extensive. It included:

- observations of initial training for schools;
- cross-sectional visits to intervention schools collecting observation and interview/focus group data from school leadership, class teachers, and pupils;
- interviews with control schools about their teaching and PD practice;
- separate focus groups with Leadership Coaches and Classroom Coaches;
- interviews with the Innovation Unit programme leaders;
- intervention teacher survey at the end of the intervention year: and
- case studies of how two schools used the Learning through REAL Projects intervention.

The methods for each aspect are detailed below.

Observations of initial training for schools

At least one researcher attended a day of training for headteachers and REAL Project Leads in April 2014 and two of the three days of Quest training for the teaching team that would be involved in delivering the intervention in May 2014. These sessions were for all intervention schools together and took place in London. Observations were conducted to familiarise the evaluation team with the requirements on schools of delivering the intervention and to allow the team to understand how training had been delivered to schools so as to explore this as a topic in interviews. Open notes were taken during these observations and informal conversations were held during these days with those participating and those leading the training.

Cross-sectional visits to intervention schools collecting observation and interview/focus group data from school leadership, class teachers and pupils

Six out of the twelve intervention schools were chosen at random for two school visits. At the time of arranging visits, one of the six pulled out from the project and from delivering the intervention and was unwilling for a visit to be made. Five schools therefore remained in the sample. Structured visits were made by two researchers to all five schools between April 2015 and June 2015. Visits, where possible, included observations of REAL Projects lessons (using an observation schedule with headings and free form responses), an interview with the headteacher (or nominated senior leader), an interview with the Learning through REAL Projects lead, a focus group involving three to five class teachers delivering the REAL Projects lessons, and a focus group with a group of pupils in the school. All interviews and focus groups used a semi-structured schedule covering themes (depending on the relevance to participants) including: organisation of REAL Projects, staffing, training and support, project delivery and fidelity, impact, and barriers and facilitators to delivery.

s conducted.

Table 2 below shows which of these aspects were conducted in each school and the total number of observations, interviews, and focus groups conducted.

Table 2: Number of interviews and observations across process evaluation schools (conducted during first year/conducted in second year)

	Case study school	Headteacher	Other SLT	PBL lead	Teacher/s, other staff	Pupil focus group	Lesson observation
School A		1/0	0/1	1/1	1/1	1/0	1/0
School B		1/0	1/1	1/1	1/1	1/0	1/0
School C		1/1	0/0	1/1	0/0	0/1	0/1
School D		1/0	0/0	1/0	1/0	1/0	1/0
School E*	1	1		1	1		1
School F	1	1/1		1/1	1/0	1/0	1/0
Total	2	8	3	10	7	5	6

*School E was a case study school only and as such was only visited once

Following the first year of intervention delivery it was intended to visit all five schools again in order to look at the continued implementation of the intervention beyond the required delivery time (after the trial's post-testing). Contact was made with all five schools regarding visits. One school that had been visited previously had had a change of headteacher and had stopped delivering the intervention; it was unwilling to talk to the research team. Visits were made between November and April 2016 to the four remaining schools which included an interview with the headteacher or a member of senior leadership (where possible), an interview with the Learning through REAL Projects lead, and a pupil focus group and observation if it hadn't been possible on the previous visit. These interviews explored themes brought up by the school on the previous visits as well as questions about sustainability of the intervention in the school.

Control school practice

Telephone interviews with seven control schools were conducted by one researcher in April 2015 to investigate what these schools had been doing through the project. These interviews used a semi-structured interview schedule to explore: motivation for signing up to the project, previous experience with PBL, current Year 7 teaching including any PBL practice, any plans or training to do PBL the next school year, other innovative practice going on in the school, and staff professional development.

A member of staff from the Innovation Unit was also interviewed regarding which control schools were receiving training from the Innovation Unit for the following year (beginning February 2015) and what they knew of the PBL practice in the remaining control schools.

Teacher survey

An online teacher survey was sent electronically in July 2015 to all intervention teachers involved in REAL Projects as provided by the Innovation Unit. This explored teacher views of the intervention, how well they were able to implement the intervention, impact on pupils and teaching practice, and

views on the support and training provided. Nineteen teachers from six intervention schools responded to the survey. This was used to inform understanding of implementation fidelity as well the process evaluation findings generally. However, it is worth noting that responses were only received from 50% of schools originally allocated to the intervention and this may bias results.

Developer and intervention delivery team interviews

Innovation Unit project lead

A semi-structured interview (with flexibility to explore other topics) was conducted with the two Innovation Unit project leads in July 2015 at the end of the intervention delivery by two project researchers. This interview discussed: what went well, delivery of the intervention (and variations in delivery), perceived impact, assessment of REAL Projects, the accountability framework, and control schools' practices and plans for the future development and delivery of REAL Projects.

Classroom Coaches

A focus group with all four Classroom Coaches (employed by the IU to provide a high level of support to teachers implementing the intervention) took place in March 2015 to discuss how schools were implementing the intervention, the training and support provided, the barriers teachers face, and the Classroom Coach role in the project. This was undertaken by two researchers and used a semi-structured guide.

Leadership Coaches

A focus group was held with all four Leadership Coaches (employed by the IU to support school leaders in implementing the intervention) and the Innovation Unit project leads during March 2015. This focused on the role of the Leadership Coach and how this supports schools, the barriers/difficulties facing school leaders in delivering PBL, how well they perceive schools have implemented the intervention, how the intervention had developed during the project, and the sustainability of the intervention in schools.

Case studies

At the end of the year of intervention delivery, two schools were identified by the Innovation Unit project leads where the intervention had been perceived as particularly successful, and those schools were invited to contribute to in-depth case studies. Two researchers visited these schools in November 2015 to explore practice and to look in more depth at the organisation and delivery of REAL Projects. During these visits interviews took place with the headteacher and with the schools' REAL Project lead. Where the visit was the first to a school (as the school was not already part of the cross-sectional design) an observation of lesson practice and discussion with teachers delivering the intervention also took place. The focus of the case study visits was to look more at the schools' specific REAL Projects practice and to explore in more depth the projects they delivered. The two full case studies are included in Appendix E and the findings from these incorporated into the Process Evaluation results.

Fidelity

Implementation fidelity data was collected through the visits to schools (including observations of lessons and interviews with staff), teacher surveys and interviews, and focus groups with those supporting schools in implementing REAL Projects. A qualitative description of implementation fidelity from across the sample is included in the process evaluation results section. Data on implementation was not collected systematically from all schools (five randomly selected schools were visited and teachers from six schools responded to the teacher survey), however interviews with the coaches and Innovation Unit explored delivery in all schools.

The questions and issues explored relating to implementation fidelity were:

- Did the school meet the minimum implementation criteria? (Data from school visits.) Those criteria were that:
    - at least 20% of the Year 7 timetable should be devoted to the programme;
    - mixed-ability classes were involved in REAL Projects;
    - the English department should be involved in planning projects; and
    - planning time should be provided for the REAL Projects team in addition to normal planning time.
- Were schools able to implement the different aspects of a REAL Project? (Data from school visits, teacher surveys, and Classroom Coach and Leadership Coach interviews.) Key elements were:
    - an essential question;
    - significant content;
    - redrafting and critique;
    - a student-created final product;
    - an exhibition; and
    - an authentic audience.
- Did schools receive support as described in the model? Did the support include:
    - attendance at initial Quest training;
    - support from a Classroom Coach during the year: and
    - support from Leadership Coach during the year?

Costs

A specific cost questionnaire was sent to the Innovation Unit which was responded to in detail. In addition, more specific cost categories (for example, direct, indirect, in kind, and opportunity) were discussed with headteachers and REAL Projects Leads, as a result of which we decided to only report the necessary costs to implement and deliver the programme. There was a large degree of variation between schools in both how they defined and attributed PBL costs and what they reported spending in practice. In some instances schools spent no more—apart from the £10,000 fee to the Innovation Unit and additional travel costs—than they would have done had they not done PBL, whereas in others there was additional spending on, for example, residential trips for Year 7 pupils. Much of the justification for extra expenses did not relate entirely to REAL Projects, but to more general benefits such as supporting the transition from primary school. It should be noted that PBL is a whole-class intervention and should not necessarily incur any extra costs (for example, to support pupils with special educational needs), however each school would need to evaluate whether there were any cost implications for its specific circumstances and take the appropriate decisions.

Most of the training and related costs are 'up front', therefore as per the EEF guidance we have spread these over a three-year period, however we have not included an inflator as this would probably only be 1% or 2% with the main item being professional fees, and other unknown costs such as travel would be very variable depending on location and so on.

An estimation of the time costs for staff attending the initial training is also provided and the recommended time for staff planning each week is also provided. However, the actual planning time given varied significantly (from no additional time to up to three hours a week) between the schools visited for the process evaluation, therefore, it was not possible to give an estimate of the planning time necessary to deliver the intervention.

Timeline

The timeline for the evaluation is outlined in Table 3 below.

Table 3: Timeline for the evaluation

Date	Activity
January 2013	Project start
April 2013	School recruitment conference for pilot year
July 2013	Pilot/development training period
September 2013	Pilot schools begin using Learning through REAL Projects
November 2013	Telephone interviews, pilot schools
October 2013–January 2014	School recruitment, main trial
January 2014	Randomisation, main trial
March/June 2014	Observations of main trial training
May–June 2014	Observation visits and interviews take place, pilot trial
July 2014	Piloting outcome measure, pilot trial
September 2014	Main trial delivery begins
April 2015	Control school telephone interviews
April–June 2015	School interviews and observation visits 1
June–July 2015	Outcomes testing, main trial
November 2015–March 2016	School interviews and observation visits 2
June 2016	Final report

Impact evaluation

Participants

The flow of participants through the evaluation is shown in Figure 1 below. As the recruitment drive was directed at all schools across England it is not known how many schools were initially identified and approached. Twenty-four schools were initially recruited, however one school withdrew before randomisation (it declined to comment on the reason for this), and was replaced by a backup school. These twenty-four schools, which did not include any of the pilot schools, were then randomised in January 2014. Two intervention group schools withdrew from the project after randomisation, after having received some of the initial training but before the start of the new school year. These were schools that were under pressure from Ofsted, had undergone leadership changes, and declined to respond and engage with the Innovation Unit or the evaluation team. It was not possible to gather any data from these schools despite our attempts to contact them.

Two intervention schools asked to withdraw from the research aspects of the trial when approached about outcome assessment. One was academised during the year and the Principal and senior leadership team left. The new Executive Principal made the decision not to continue with REAL Projects as described and was unwilling for pupils in the school to complete any assessments or to be evaluated on the way they were implementing the project. The other school disengaged from the evaluation before the assessment, although when contacted further they agreed to complete the attitudinal survey secondary outcome. They said they were unhappy with the change to the intervention only being supported for one year rather than two.

One intervention school which remained part of the trial asked for opt-in consent from parents to undertake the testing. Only a small number of forms were returned to the school (30 out of 125 pupils) consequently the evaluation team took the decision that it was not ethical or cost efficient to carry out the primary outcome testing in this school. Fifty-five pupils completed the attitudinal survey.

In total 7 out of 12 intervention schools (1,133 of 2,101 pupils) and all 12 control schools (1,717 of 1,973 pupils) completed the primary outcome assessment; and 9 out of 12 intervention schools (1,328 of 2,101 pupils) and all 12 control schools (1,516 of 1,973 pupils) completed the attitudinal survey.

Issues that arose during the assessment period included schools reluctant to share pupil UPN data with the evaluation team (resolved) and schools experiencing restructures and conversion to academy status making it challenging to secure their continued involvement in the evaluation.

Outcome testing was conducted on a single day in each school and pupils who were absent on the day of testing were lost.

Figure 1: Participant flow through trial
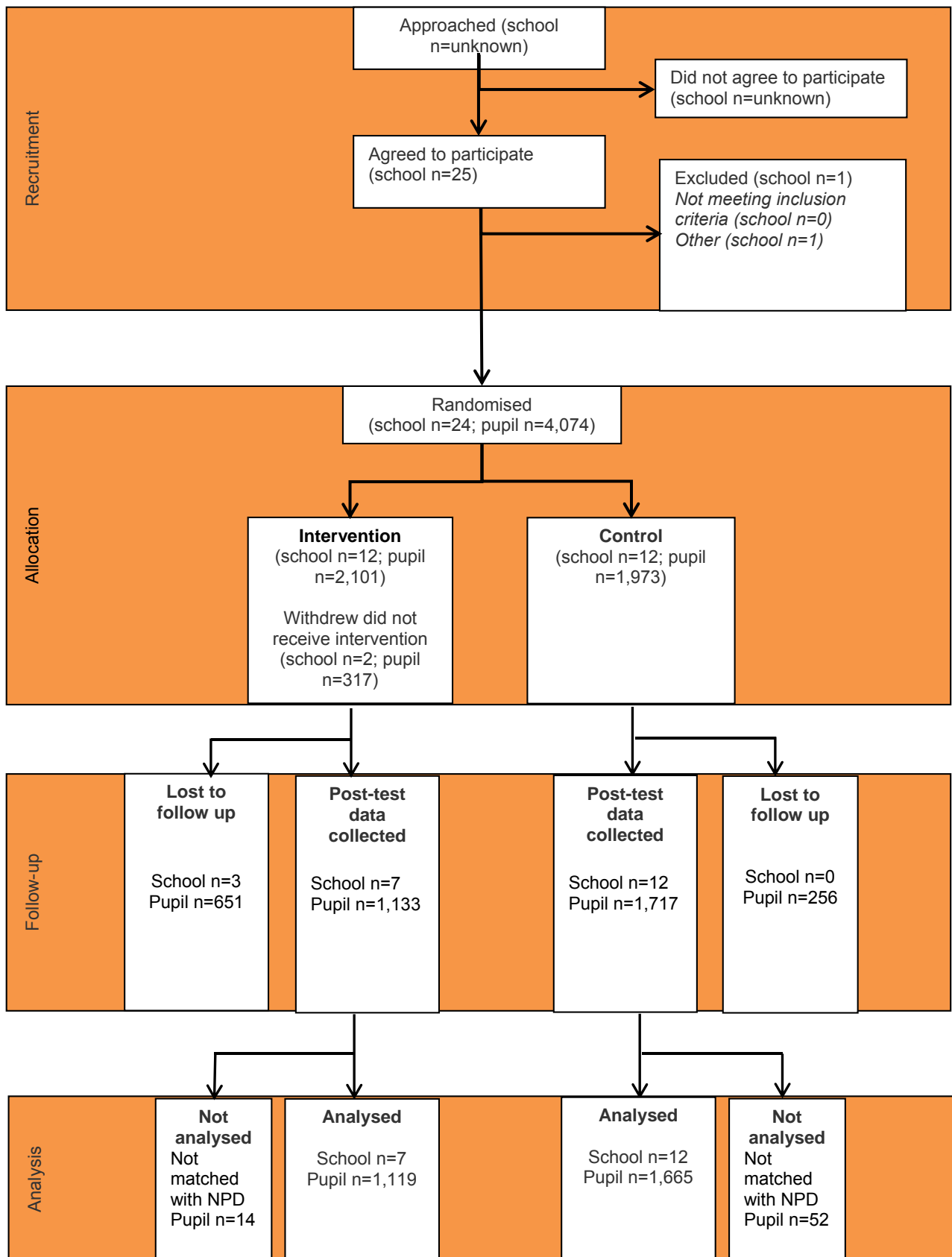
As requested by the EEF, a calculation of the actual minimum detectable effect size was conducted for different stages of the trial (Table 4). At the analysis stage, using the observed correlation of 0.71, the observed ICC of 0.09 (as opposed to the assumed 0.19), the number of individuals included in the primary analysis (2,784; 1,119: 1,665), and the average cluster size of 166 gives an effective sample size of approximately 2,784 pupils meaning that for this trial we had the ability to detect an effect size of 0.36 with 80% power.

Table 4: Minimum detectable effect size at different stages

Stage	N [schools/pupils] (n = intervention; n = control)	Correlation between pre-test and post-test	ICC	Average cluster size	Power/Alpha	Attrition	Minimum detectable effect size (MDES)
Protocol	24 (12; 12) 3,000 (1,500; 1,500)	0.70	0.19	125	80% 0.05	20%	0.40
Randomisation	24 (12; 12) 4,074 (2,101; 1,973)	0.70	0.19	125	80% 0.05	20%	0.35
Analysis (i.e. available pre- and post-test)	19 (7; 12) 2,784 (1,119; 1,665)	0.71	0.09	166	80% 0.05	32%	0.36

Pupil characteristics

School characteristics

Baseline characteristics of the 24 randomised schools are presented in Table 5; characteristics were similar in both allocated groups apart from Ofsted ratings. Ten out of the 12 control schools were rated as outstanding or good, whereas 4 of the 12 intervention schools achieved these ratings.

Table 5: Baseline school characteristics

Variable	Intervention group		Control group	
School-level (categorical)	n/N (missing)	Percentage	n/N (missing)	Percentage
Current PBL	1/12 (0)	8.3%	1/12 (0)	8.3%
Ofsted rating Outstanding Good Requires improvement Inadequate None	11/12 (1) 0/11 (0) 4/11 (0) 5/11 (0) 1/11 (0) 1/11 (0)	 0% 36.4% 45.5% 9.1% 9.1%	12/12 (0) 2/12 (0) 8/12 (0) 1/12 (0) 1/12 (0) 0/12 (0)	 16.7% 66.7% 8.3% 8.3% 0%
Free school	1/12 (0)	8.3%	1/12 (0)	8.3%
Selection Comprehensive Modern	 12/12 (0) 0/12 (0)	 100% 0%	 10/12 (0) 2/12 (0)	 83.3% 16.7%
Type of school Academy converter mainstream Academy sponsor-led Community Foundation school Free school mainstream	 1/12 (0) 4/12 (0) 2/12(0) 3/12(0) 2/12 (0)	 8.3% 33.3% 16.7% 25.0% 16.7%	 4/12 (0) 4/12 (0) 2/12 (0) 2/12 (0) 0/12 (0)	 33.3% 33.3% 16.7% 16.7% 0%
School-level (continuous)	n (missing)	Mean (SD)	n (missing)	Mean (SD) or Median (min, max)
Number of Y7 pupils	12 (0)	172.5 (43.0)	12 (0)	171.0 (52.8)
Percentage of pupils eligible for FSM	12 (0)	38.5 (25.1, 77.8)	12 (0)	31.5 (18.3, 56.6)
Percentage of pupils with English as additional language	11 (1)	7.3 (1.1, 37.8)	11 (1)	6.6 (1.0, 68.2)
Percentage of pupils with special education needs	11 (1)	10.5 (3.3)	12 (0)	10.8 (6.9)
Percentage boys	11 (1)	50.3 (46.8, 63.9)	12 (0)	52.2 (48.7, 98.7)

N.B: SD = Standard deviation, min = minimum, max = maximum

According to their websites, two schools described themselves as already undertaking some project based learning: one was allocated to the intervention and the other to the control group. The Ofsted ratings were lower in the intervention group compared to the control group, with ten intervention schools rated as 'requiring improvement' or 'inadequate' and only two control schools in the same categories. Most of the control schools were rated as 'good' or 'outstanding'. The mean school size was around 170 pupils in both groups. The median percentage of pupils eligible for FSM was slightly higher in the intervention group (38.5) compared to the control group (31.5); this is higher than the national average of pupils known to be eligible for and claiming free school meals in state-funded secondary schools which was 13.9% in January 2015 (Department for Education, 2015). The median percentage of pupils with English as an additional language was slightly higher in the intervention group (7.3) compared to the control (6.6). The percentage of pupils with SEN was approximately 11% in both the intervention and control groups. The median percentage of boys was similar in both groups at just over 50%.

Pupil characteristics

Characteristics of 3,483 pupils from participating secondary schools are presented in Table 6. As this was a cluster randomised trial, randomisation aimed to balance the trial arms with regard to cluster-level characteristics rather than individual-level characteristics. The mean KS2 scores were similar between intervention and control groups across all components in both the randomised and 'as analysed' samples. There was a slightly higher percentage of males in both the randomised and 'as analysed' samples, and a slightly lower percentage of FSM pupils in the control group compared to the intervention group in the randomised sample and the reverse for the 'as analysed' sample. There were disproportionate amounts of missing data for the KS2 baseline measures between the intervention and control groups, 35% and 7% respectively. This was in part related to the withdrawal of two intervention schools and 317 associated pupils prior to commencement of the intervention. Given schools were randomised before pupils were attending the secondary school it was not possible to identify pupils baseline characteristics prior to the withdrawal.

Table 6: Baseline pupil characteristics

Pupil-level (categorical)	Intervention		Control	
	n/N (missing)	Percentage	n/N (missing)	Percentage
As randomised				
Eligible for FSM	666/1,549 (552)	43.0%	688/1,847 (126)	37.3%
Gender Female Male	776/1,582 (519) 806/1,582 (519)	49.1% 51.0%	808/1,891 (82) 1,083/1,891 (82)	42.7% 57.3%
As analysed				
Eligible for FSM	385/1,119 (982)	34.4%	595/1,665 (308)	35.7%
Gender Female Male	553/1,119 (982) 566/1,119 (982)	49.4% 50.6%	736/1,665 (308) 929/1,665 (308)	44.2% 55.8%
Pupil-level (continuous)	**n (missing)**	**Mean (SD)**	**n (missing)**	**Mean (SD)**
As randomised				
KS2 Reading (pre score)	1,548 (553)	28.1 (4.6)	1,836 (137)	28.1 (4.4)
KS2 Mathematics	1,548 (553)	28.4 (5.0)	1,836 (137)	28.3 (4.9)
KS2 Average point score	1,548 (553)	28.1 (4.3)	1,836 (137)	28.1 (4.2)
As analysed				
KS2 Reading (pre score)	1,119 (982)	28.6 (4.1)	1,665 (308)	28.3 (4.3)
KS2 Mathematics	1,119 (982)	28.9 (4.6)	1,665 (308)	28.5 (4.7)
KS2 Average point score	1,119 (982)	28.6 (3.9)	1,663 (310)	28.3 (4.1)

Pupil-level (categorical)	n/N (missing)	Percentage	n/N (missing)	Percentage	Effect Size
Eligible for FSM	666/1,549 (552)	43.0%	688/1,847 (126)	37.3%	-0.04
Gender Female Male	776/1,582 (519) 806/1,582 (519)	49.1% 51.0%	808/1,891 (82) 1083/1,891 (82)	42.7% 57.3%	0.03
Pupil-level (continuous)	**n (missing)**	**Mean (SD)**	**n (missing)**	**Mean (SD)**	
KS2 Reading (pre score)	1,548 (553)	28.1 (4.6)	1,836 (137)	28.1 (4.4)	0.09
KS2 Mathematics	1,548 (553)	28.4 (5.0)	1,836 (137)	28.3 (4.9)	0.01
KS2 Average point score	1,548 (553)	28.1 (4.3)	1,836 (137)	28.1 (4.2)	0.0006

Outcomes and analysis

Summary of raw outcomes

Raw unadjusted means of PiE scores are presented in Table 7 by intervention and control groups. Mean PiE scores were similar in both allocated groups at 24.2 (SD 11.2) in the control group and 24.5 (SD 10.8) in the intervention group. Proportions of individuals with missing data on PiE12 scores and/or covariates included in the analysis were 16% and 47% in the control and intervention groups respectively. The 47% attrition rate in the intervention group is unusually high and could be seen to indicate a biased drop out due to the intervention. However, from the five schools for which data was missing, two schools withdrew before starting the intervention due to a change in leadership and school priorities which was not related to the intervention, while an additional school did not provide follow up data due to a lack of parental consent to conduct the assessment, again unrelated to the intervention. The final two schools did implement PBL during the year. One of these schools refused

to sit the tests because they did not think an effect would be evident after one year. In the other school, the whole leadership team was replaced by a new one under an academy sponsor. The secondary outcomes of attitudinal survey total scores and attendance were also similar in the two groups.

Table 7: Raw summary statistics for outcome scores

| Outcome | Raw means | | | |
| | Intervention group | | Control group | |
	n (missing)	Mean (SD)	n (missing)	Mean (SD)
Progress in English 12	1,133 (968)	24.5 (10.8)	1,717 (256)	24.2 (11.2)
Attitudinal survey total scores	1,124 (977)	164.3 (21.5)	1,262 (711)	163.7 (22.7)
Attendance	1,573 (528)	0.96 (0.05)	1,899 (74)	0.96 (0.05)

Intra-cluster correlation coefficients (ICCs) and correlation

An intra-cluster correlation coefficient (ICC) was estimated in relation to the primary outcome of PiE scores and found to be 0.06 (95% CI: 0.02 to 0.09) for 2,850 pupils. The correlation between the primary outcome of PiE and KS2 reading fine grade scores (pre-test) based on 2,784 pupils was estimated to be 0.71 which was as anticipated in the sample size calculation.

Regression model results

Table 8 and Table 9 show summary results for primary and secondary regression analyses. No significant differences were found between the two randomised groups in any of the primary or secondary analyses. Results are discussed in more detail in the following sections.

Table 8: Primary analysis

Outcome	Score difference (95% CI)	n in model (intervention; control)	Effect size (95% CI)	p-value
Progress in English 12	-1.00 (-2.38, 0.37)	2,784 (1,119; 1,665)	-0.13 (-0.31, 0.05)	0.15

Table 9: Secondary analyses

Outcome	Score difference (95% CI)	n in model (intervention; control)	Effect size (95% CI)	p-value
Repetition of primary analysis adjusting for gender	-1.05 (-2.36, 0.26)	2,784 (1,119; 1,665)	-0.14 (-0.32, 0.04)	0.12
Attitudinal survey total scores	0.28 (-3.12, 3.68)	2,338 (1,108; 1,230)	0.01 (-0.15, 0.17)	0.87
Attendance (transformed)	-0.012 (-0.04, 0.02)	3,381 (1,546; 1,835)	-0.08 (-0.29, 0.13)	0.46

Primary analysis

The primary analysis was adjusted for baseline KS2 reading fine grade score, FSM status, number of Year 7 pupils, whether a free school or not, and whether the school advertised using a form of Project Based Learning prior to trial. After exclusions for missing data relating to any of these variables or the response, analysis was conducted on 2,784 pupils (1,119 in the intervention and 1,665 in the control group). There was little or no evidence of a difference in PiE scores, with a non-significant decrease of 1.00 point for those in the intervention group compared with those in the control group (p = 0.15, 95% CI: -2.38 to 0.37). This relates to an effect size of -0.13 (95% CI: -0.31 to 0.05).

Secondary analyses

Repetition of the primary analysis with an additional adjustment for gender

This analysis was conducted on the same 2,784 pupils as those for the primary analysis. There was little or no evidence of a difference in PiE scores, with a non-significant decrease of 1.05 points for those in the intervention group compared with those in the control group (p = 0.12, 95% CI: -2.36 to 0.26). This relates to an effect size of -0.14 (95% CI: -0.32 to 0.04).

Attitudinal survey total scores

This analysis was conducted on 2,338 pupils (1,108 in the intervention group and 1,230 in the control group). There was little or no evidence of a difference in the attitudinal total scores, with a non-significant increase of 0.28 points for those in the intervention group compared to the control group (p = 0.87, 95% CI: -3.12 to 3.68). This relates to an effect size of 0.01 (95% CI: -0.15 to 0.18).

Attendance data

This analysis was conducted on 3,381 pupils (1,546 in the intervention group and 1,835 in the control). This data was requested and supplied from the NPD. After investigation of model assumptions it was identified that the normality assumption was in question and the residuals were highly skewed. Given the nature of the outcome variable and the type of skewness observed, the data was transformed using an arcsine transformation. Model assumptions were repeated after including the transformed variable in the analysis. The resulting distribution of the residuals was closer to normality so the transformed variable was used in the analysis in order that the confidence intervals and p-values could be interpreted with more confidence. There was little or no evidence of a

difference in the attendance, with a non-significant decrease of 0.012 points in the transformed variable for those in the intervention group compared to the control group (p = 0.46, 95% CI: -0.04 to 0.02). This relates to an effect size of -0.08 (95% CI: -0.29 to 0.13).

Subgroup analyses

Three pre-specified subgroup analyses (FSM status, gender, and KS2 reading fine grade scores) included an interaction term between each baseline variable of interest and group allocation for the primary outcome only (Table 10). There was no evidence of a statistically significant interaction between allocated group and gender (p = 0.49; 95% CI: -1.54 to 0.74) in terms of PiE12 scores, nor allocated group and prior attainment (p = 0.39; 95% CI: -0.08 to 0.20), suggesting the intervention did not have a differential effect dependent on these two variables.

There was a statistically significant interaction in PiE between allocated group and FSM status (p = 0.02; 95% CI: -2.77 to -0.30) suggesting the intervention had differential effects dependent on FSM status. This relates to an effect size of -0.38 (95% CI: -0.38 to -0.02). As requested by the funder, the primary analysis was repeated using data only from pupils eligible for FSM as a subgroup analysis. There was evidence of a difference between allocated groups in PiE between those eligible for FSM randomised to the intervention and control groups with a significant decrease of 1.85 for pupils in the intervention group when compared with those in the control group (p = 0.009; 95% CI: -3.25 to -0.46). This relates to a statistically significant effect size of -0.24 (-0.41 to -0.06).

Table 10: Subgroup analyses

Subgroup	Effect size (95% CI)	p-value
FSM status interaction	-0.38 (-0.38 to -0.02)	0.02
FSM status subgroup	-0.24 (-0.41 to -0.06)	0.009
Gender	-0.05 (-0.23 to 0.12)	0.49
KS2 reading fine grade scores	0.01 (-0.17 to 0.19)	0.39

An exploratory subgroup analysis for FSM status for the secondary outcome attitudinal total scores was also undertaken. There was no evidence of a statistically significant interaction between allocated group and FSM status in terms of attitudinal total scores (p = 0.69; 95% CI: -2.92 to 4.44).

Missing data analysis

Given the proportion of missing data, both at baseline and at post-test PiE12 scores (n = 1,290) we conducted a sensitivity analysis using multiple imputation by chained equations to include all schools and pupils randomised (Royston and White, 2011; Azur, 2011). The results from the sensitivity analysis were similar to those from the primary analysis (

Table 11). There was little or no evidence of a difference in PiE scores, with a non-significant decrease of 0.88 point for those in the intervention group compared with those in the control group (p = 0.10, 95% CI: -1.95 to 0.18). This relates to an effect size of -0.11 (-0.24 to 0.02).

Table 11: Missing data analysis for the primary outcome

Progress in English 12	Score difference (95% CI)	n in model (intervention; control)	Effect size (95% CI)	p-value
Primary	-1.00 (-2.38, 0.37)	2,784 (1,119; 1,665)	-0.13 (-0.31, 0.05)	0.15
Imputed	-0.88 (-1.95, 0.18)	4,074 (2,101; 1,973)	-0.11 (-0.24 to 0.02)	0.10

Cost

For the calculation we have assumed a six form entry school, and that PBL is delivered to all of the pupils in Year 7 over the three-year period and continues into the following year.

Participating Pupils			
	Year 1	Year 2	Year 3	Total
Y7	180	180	180	540
Y8		180	180	360
				900

The first year cost per school is £22,950 (reduced to £10,000 for the trial schools). The Innovation Unit has advised that following years would be £10,000. Travel costs by the Classroom and Leadership Coaches would be in addition. These were capped at £3,000 for the trial and we have also used this figure for future years. This element is highly variable depending on the location of the school and number and location of coaches.

Costs					
	Year 1	Year 2	Year 3	School Total	Cost per pupil
Actual	25,950	13,000	13,000	51,950	**£58**
Subsidised	13,000	13,000	13,000	39,000	**£43**

The figures do not include VAT which the Innovation Unit charges, and schools would have to provide cover for teachers attending the QUEST training. Assuming 3 teachers attending, this would require nine days of cover, as well as travel and accommodation costs. The intervention also specifies a requirement for additional planning time for the team delivering REAL Projects which is recommended to be between one and three hours per week. In practice this planning time varied hugely between no specific time and up to two hours per week.

In summary, we have therefore assumed the cost per pupil to be £58 (+VAT), with additional school costs associated with nine days of cover. The additional time in schools for planning and meetings related to PBL have not been included due to the variation between schools and it being reasonable to assume that additional time would be needed for *any* new initiative or ongoing development. Whether such additional costs are considered part of the PBL budget would, of course, be a decision that each school would have to make in light of its own circumstances.

Process evaluation

Fidelity

Intervention Group

Implementation fidelity was assessed for the ten intervention schools that delivered the intervention (the two other intervention schools withdrew from the project after receiving some initial training but did not deliver any of the intervention). Fidelity to the REAL Projects intervention was reasonably high considering the necessary variation and adaptations to the different school contexts. Schools delivered between four and six projects to Year 7 pupils during the year with all projects covering more than one subject area.

In terms of minimum organisational elements, all of these schools started the year delivering at least 20% of their Year 7 curriculum using REAL Projects as required. One school, following a change of leadership in February, reduced this to below 20% (changing staffing and planning time for projects at the same time). All schools, apart from one, began the year with mixed ability REAL Projects classes. That one school, however, which started out using sets subsequently switched to mixed ability REAL Projects classes, whereas two other schools reverted to setting after their first project. The English department was involved in planning projects in all schools, but the extent of the involvement varied from advising on assessment for already-planned projects without involvement in teaching, to being involved in the full planning process and teaching REAL Projects. Not all schools were able to give the required amount of additional planning time to REAL Projects teachers: two intervention schools gave no additional regular planning time, and half of the schools (who responded to the teacher survey) only provided up to 30 minutes a week. All schools sent teachers to attend the initial Quest training, however some teachers that attended this training had left the school by the start of the delivery year. New teachers were trained by the Classroom Coach instead (from the support time allocated to the school). Support from the Leadership Coaches and Classroom Coaches was provided as described in the model.

Delivery of the REAL Projects generally included the key elements specified, although the Classroom Coaches and our school visits showed that the quality of these elements varied between schools. All schools were using an essential question to drive the content of a project and were strong on using critique and redrafting with particular focus on peer critique. All schools delivered projects which included rigorous content, based either on the curriculum for that subject or on the project topic, however the level of rigour varied from project to project; Classroom Coaches indicated that sometimes the rigorous content was taught as an add-on to the project rather than through the project. All schools had planned to have a student-created final product, however on some projects in a few schools this was not possible (for example, publishing a finished book) due to budget constraints or other organisational factors. Schools did generally deliver an exhibition at the end of each project but in most cases this was for parents or other pupils in the school rather than a public exhibition with a truly 'authentic audience'. There were, however, a few strong examples—such as art displayed in a local art gallery and a local artist invited to provide feedback—but these were the minority. Schools reported this to be a difficult aspect to get right due to the need to make connections outside of school and the time taken to set it up.

Control Group Activity

A number of schools in the control group were delivering some aspects of project based learning during the year of the trial. Four schools in the control group were delivering more than 20% of their Year 7 curriculum through PBL, and two of these four schools paid to have external professional development and support from other organisations: one paid for staff to visit and learn from High Tech High (a PBL-based school in the U.S.) and for support from EOS Education (a PBL teaching alliance).

Five control schools signed up to deliver REAL Projects the following year and therefore worked with the Innovation Unit to plan for this and to receive training from January/February 2015 as agreed, however two of these schools also implemented one or two small trial projects towards the end of the year with Year 7 pupils. Six control schools did not deliver any aspect of PBL during the trial year (except the training for the following year).

It is worth highlighting that during an interview with a control school the senior leader explained that the school had signed up to the RCT because it was interested in delivering the intervention. It had therefore been willing to pay the £10,000 required as part of the trial because it was felt that it was the best way to support pupils in the school. Although the school had signed an MoU for the project committing it *not* to deliver PBL, it felt the needs of its pupils came first and would be best supported by delivering PBL, despite the MoU agreement.

Interviews with Innovation Unit staff revealed that it was unlikely that the control schools were delivering PBL in the way that REAL Projects prescribed (with the exception of one school with significant paid support) and even schools paying for some support would not be receiving the extent of support provided by the Innovation Unit.

However, this control group activity limits the conclusions we can make from the trial given that a third of the control group were delivering some aspects of PBL for 20% of the Year 7 curriculum while another two control schools delivered some aspects of project based learning towards the end of the year.

Implementation

The following sections look at issues of implementation, barriers to delivery, outcomes, and formative findings across five schools. We consider insights gained from two case-studies carried out at two schools where it was agreed—by both the Innovation Unit, as developer and delivery partner, and the evaluation team—that the implementation of REAL projects had been effective. Both schools also agreed that their implementation had been effective. Importantly, while there are quite substantial similarities between the schools, the implementations were nonetheless different in a number of respects—supporting the notion that there is no simple 'one size fits all' version or implementation of PBL. Some background information on these two case studies is presented next.

Case studies: background to the schools

Both schools are larger than average, well established, and draw the majority of their pupils from nearby communities on the outskirts of large conurbations. There were relatively small differences in their last Ofsted ratings—2 ('good') for School E, and 3 ('requires improvement') for School F, with one having gone up and the other down—but nonetheless both were judged to be reasonably effective with good leadership. In both instances, English teaching at KS3 was identified as an area that could be improved—the primary outcome for the trial. Attitudes to learning and support from parents were judged to be good, as was attendance and relationships between pupils and teachers. It can therefore be reasonably assumed that from an Ofsted perspective both schools were in a good position to implement and manage the necessary organisational changes required for PBL.

School E

The starting point for school E was an ongoing internal review of their curriculum and wider school development, and an identified need to improve KS3 teaching. Some elements of 'project work' and student-led or independent learning were already being undertaken and the school as a whole was keen to encourage similar initiatives. In such circumstances it was not surprising that the offer to be included in the trial, in particular the intervention arm, was enthusiastically accepted. The headteacher emphasised that the school was looking for something like PBL to provide more structure and rigour to their plans and aspirations for KS3.

School F

School F was motivated to do REAL Projects in order to holistically improve educational outcomes for pupils leaving secondary school, both in terms of exam outcomes but also promoting skills required for employment and further or higher education (including in particular STEM subjects) as well as local needs. It felt the architecture for improvement was largely already in place, but that the curriculum, both nationally and how it was being interpreted locally, was not able to support the outcomes it desired. The school had a long term interest in initiatives such as the CBI '21st Century Skills' and the more recent RSA 'Opening Minds' competencies framework, which mesh well with the underlying philosophy and principles of PBL. As the head and PBL lead emphasised, pupils come from primary schools with a passion to learn and it is essential they put in place a way for that passion to continue and thrive in secondary school.

The necessary conditions for the success of the intervention

Belief in PBL principles

A major enabler for the success of the intervention was the schools' desire to take project based learning on board and a deep belief in the principles underlying this type of learning. Schools believed that pupils needed to be actively involved in their learning and develop a passion for learning—skills essential for developing learning and competences throughout life that would adequately meet 21st century workplace requirements. All five schools held a deep-seated belief that education needed to change to incorporate higher quality learning able to enhance pupils' ability to be critical thinkers and allow them to be creative in an environment where learning is relevant and has a real purpose. The quotations that follow illustrate the schools' belief in the project-based learning principles which drove its desire to sign up for the initiative:

> '…I was crying out for something that would formalise the way that we were doing competence-based learning and give our teachers the pedagogical framework for enabling what we wanted. The core things that I wanted were basically a toolkit, and a lexicon around 'learning to learn' (School F, headteacher).

> '…they need to be lifelong learners because what they need to know and understand now, and what they'll need to be able to know and understand and the skills they'll need to apply in 2, 3 years' time, will be completely different' (School B, PBL lead).

> 'We wanted to be outstanding for attitudes to learning here, [and] for behaviour. One of the reasons that we thought REAL would be good was pupils' involvement in their learning… so they would be active learners rather than just kids sitting quietly in a classroom' (School A, headteacher).

> 'I really do believe in the real learning opportunities that this presents for the pupils—for all the pupils to engage—because I think engagement is critical… I also think that [in addition to] the projects giving the relevance to their learning, it actually helps pupils to engage; and if you've engaged pupils and got them motivated then you're halfway there to getting them to achieve, and so I am absolutely an advocate of REAL Projects' (School C, headteacher).

Strong team, collaboration, and time given for PBL

All schools agreed that a strong team of staff would be essential for the success of project based learning and this was an area that would be within the control of the school. A good leader supported by senior management, and an open-minded team of teachers who believe in the principles of project based learning and are determined to see it working, were seen to be key factors in facilitating the implementation of the intervention.

'I couldn't have been luckier with the team as the person leading it… [the team] have been incredibly enthusiastic, and because they've got different specialism, it's made it a lot easier, especially having the Art specialist, because a lot of the projects have creative outcomes' (School C, PBL lead)*.*

Keeping the lines of communication open and exhibiting a real team spirit can create a 'cohesive team' that shares the same teaching and learning aims as well as sharing expertise and subject knowledge:

'It's a very supported curriculum in terms of project handbook, team training… a lot of emphasis on us working together and reflecting, reviewing and that' (School F, follow-up meeting, headteacher).

Having planning time was one of the challenges raised by staff, particularly during the first year of the project. In most cases, schools had found ways to address this in the second year of the project and had managed to protect some time to be spent solely on PBL planning. Planning time was seen as important for the success of REAL Projects in schools, particularly as this gave a chance for teams from across different departments to work together and for organising resources, such as setting dates for key events and booking rooms.

'Towards the end of last year we were given four days off timetable where we had a core team of five of us that went off-site. We sat there and planned the projects and that was brilliant because then it meant you could start this year with every single exhibition date on the calendar' (School B, follow-up visit, PBL lead).

Last but not least, it was felt that an important part of the PBL process was for schools to reflect on the success of each project delivered and to look at the modifications and alterations that they could make to improve it for the future:

'It has been a journey we've been on since the beginning. The second project didn't work as well as the first project and then we learnt from that, and there was much more of the learning diaries and the learning logs and the progress logs which made a real difference' (School A headteacher).

Importance of the PBL process and product

The essential elements of drafting, redrafting, and critiquing as part of the process to a final product and exhibition with audience were seen to be very important. The process was described as a very creative one where pupils were involved in an iterative and dynamic process of exploring, thinking, reflecting, reconsidering actions, and making decisions before the final product could be constructed and presented in public.

It was also important for the reflection and critique to be captured and assessed. This was an aspect of pupils' learning that lent itself to making clear connections with literacy work. This writing process had a two-fold purpose. First, it served as a tangible document that pupils could use to reflect on, draft and redraft throughout the project and, second, it was a useful assessment tool that could be used to demonstrate the progress that the pupils were making in writing.

'…having that critique and constantly coming back and saying, is this good enough? How could we improve it? What else do we need to do to add to it? That's what keeps driving it forward' (School A headteacher).

Within the context of exhibiting pupils' work, it was felt that the expectation that the final product should be of high quality needed to be cultivated and taught. Some schools recognised that they needed to provide support to help pupils develop these high expectations:

'I've still got some work to do with some of my teachers in valuing excellence in terms of outcome, that actually that is a really important thing to model: it's not just about learning, it's about creating something with excellence and that breeds pride in pupils which they don't necessarily have' (School D headteacher).

For pupils to fully benefit from the REAL Projects model, it was felt that the final outcome needed to be valued and judged by an 'authentic audience'. Schools generally stated that involvement of parents and members of the community can help create this audience which is essential for the successful completion of the project. Schools recognised this and put extra measures in place to engage more parents in these exhibition events in the second year of the project.

Training and support

The good training and constant support provided by the Innovation Unit was very much appreciated and recognised by all schools. The initial training was very informative and offered a number of inspiring project ideas. The coach's support and guidance were essential for the projects to take off, and coaches provided an important source of advice at times when difficulties were encountered along the way. Further training was being planned for members of staff who did not get the chance to attend the initial training. This was usually being done in schools either by trained and experienced staff or by the Classroom Coach.

Training and Innovation Unit support in School E

The school was impressed with, and highly valued, the support from the Innovation Unit and the Leadership and Classroom Coaches, although in different ways. The Classroom Coaches were found to be very approachable and knowledgeable, and importantly were happy to work alongside the teachers. The Leadership Coach needed to adopt a role 'sympathetic' to the needs of the headteacher and leadership team, and this school felt that this had been achieved.

In addition to two of the staff attending the QUEST training in London, the Classroom Coach replicated the programme in the school for most of the REAL Projects teaching team. This took place over a two-day period and was found to be highly productive and beneficial. Importantly, this helped bring the staff together for PBL in a way that having just one or two teachers reporting back to the rest of the staff would not have done.

It was felt that the Classroom Coach had unique skills and experience that were unlikely to be available currently in U.K. based trainers. However, the Leadership Coach skills were viewed as more generic, and could therefore be 'bought in' locally or regionally. It was also suggested that some of the school's PBL staff would be able, in time, to fulfil a coaching role by sharing their PBL skills and expertise with other schools.

Training and Innovation Unit support in School F

Two teachers from School F and one member of the senior leadership team attended the QUEST training in London. This was found to be very helpful and in particular helped the school to identify ways in which their educational aspirations could be realised as well as training them to effectively implement REAL Projects. The cost of attending this, both time and expenses, were described by the headteacher as significant 'front loaded' costs which it was not possible to continue funding beyond the first year of the project (despite continuing with PBL). Therefore, the following year the QUEST training was done in the school by the Classroom Coach and the PBL lead. This approach helped the school to tailor the project and training more to local needs although while still retaining the essential elements of PBL.

The input of both the Leadership and Classroom Coach was very much valued by the school and PBL team. Both worked mainly with the PBL lead as the role of the Leadership Coach, which was normally

to support the head to establish the right structure and conditions for PBL to work, was not really necessary given what the school was already doing. Moving forwards, the school would be happy to purchase support as required, but not necessarily the whole package.

At quite an early stage the school was encouraged by the Innovation Unit to help other schools adopt the programme given their positive experience. However, they took a cautious approach to this, concerned that the particular expertise of the Classroom Coaches would not be that easy to replicate, and also wary of not paying enough attention to their own needs. The PBL lead has since gone on to do some support and consultancy work with another school, but is still able to support the project in her own school, and has benefited professionally from this.

Barriers to delivery

Assessment

Uncertainty around assessment and how it fits with project based learning was evident in all five schools. One of the major challenges for school staff was demonstrating that pupils could make measurable progress within an educational culture of testing and accountability to a level that would satisfy governmental expectations. As a result, assessment created a tension for the schools which sometimes led to having to compromise innovative ideas about assessment in order to satisfy perceived Ofsted requirements. This was a major concern that was voiced in all schools.

> *'We need to make sure there's data, we need to show progress, we need to show that the kids are improving their literacy and we are meeting the Ofsted criteria because otherwise we haven't got a leg to stand on and we will be slashed very quickly'* (School B, PBL lead).

> *'We just want to get past Ofsted. That's a shame because it stops things moving forward, but we just need to do that first'* (School C headteacher).

The assessment of pupils was perceived as needing to be aligned to the nature of project based learning but also needing to conform to traditional notions of testing and measuring progress. One school tried to achieve this by taking a 'holistic approach' to assessment where projects would be marked as a whole without compartmentalising different subject areas.

A desire to establish consistent and rigorous assessment systems was common, and different ideas emerged across schools for doing this, however more time and development was still needed for these to be purposefully applied. A common view was that appropriate assessment would lead learners to be more independent, more critical of their own and others' work, and guide learners to make improvements in their work. There was also a perceived tension between the evident positive outcomes regarding pupils' communication and presentation skills and the schools' perceived difficulty in quantifying this systematic progress in learning—to demonstrate a 'tangible learning experience' (School B, Deputy Head). Assessment of project based learning was, therefore, an area in which all schools were trying hard to improve as the following comments illustrates:

> *'But there is no clear assessment from the outset and we are developing it… wishy-washy is the wrong word but it's... not solid, it's not shown to kids as I'd like to, and parents haven't got a clue. So assessment does need looking at. We have started'* (School B teacher).

Many schools were using essay-writing to provide a tangible assessed product for every project. Schools were trying to establish assessment criteria for this written project-related work within the context of general assessment practices in the school. Even though-essay writing seemed to be one way forward in assessing PBL, concerns were raised about the challenges in marking essays and the importance of doing this 'properly'. Furthermore, essay-writing as the only option in demonstrating rigour in assessing PBL was questioned. These points are illustrated below:

'There does seem to be a bit of a link with rigour and writing essays [but] that's not the only way to demonstrate something is rigorous. There's obviously lots of different opinions being thrown into the pot and that is one gripe of mine at the moment—I don't think rigorous education needs to just be essay-writing. I don't think they need to do it in every single project' (School C, PBL lead).

Because of these challenges around assessment, schools were keen to attend relevant assessment forums in London where ideas about good practice and success stories would be shared. Headteachers expressed the desire to allow members of staff to attend these forums to bring back innovative assessment ideas which could be considered for implementation in their school.

Practical limitations

Limited ICT resources was another hurdle mentioned in the interviews that made the initial stages of PBL implementation quite difficult. Problems were encountered when there were not enough ICT classrooms available or when the iPads or iPhones that some pupils had did not have the necessary resources installed for purposeful PBL work to take place. The limited resources would limit the quality of the work that the pupils could produce.

'For us in our first half term where it was the first project that came from the Innovation Unit we had to do a book. We just did not have the IT resources—it was an absolute nightmare. It was a trial. The way it was implemented did not work for us at all, the way we'd done it—not the way they'd done it. Logistically—because we didn't have the ICT facilities—how were we supported to produce a professional-looking book?' (School D teachers).

Other challenges, such as having suitable space for project-based work and for the public exhibition, time pressures to organise meetings, having enough time as a team to plan appropriate work, preparation time, timetabling, and financial constraints were all mentioned as organisational issues that limited the extent that PBL could be optimally delivered. Moreover, specific issues within schools to do with time pressures, and the expectation that teachers should successfully fulfil a number of different roles, meant that, occasionally, some suggestions given by the trainers about how to run a project in an efficient way could not always be realistically implemented.

Staff perceptions in the rest of the school

In a few schools, staff involved in teaching and leading REAL Projects felt that there was resistance to PBL from other teachers in the school and a lack of understanding of the principles of PBL. This meant that it was difficult to get the principles embedded in other areas of the school and sometimes led to the REAL Projects team feeling isolated, especially when the majority of their teaching time was in REAL Projects.

'I think one of the mistakes we've made is not managing to make it as clear to other staff as it could be what it's about and spreading it throughout, so I think it would be fair to say there's a lack of understanding from staff not involved directly in PBL. We've managed to get some involvement from the Directors of Maths and Science, so there's elements of PBL coming through other areas of the curriculum, but I would say there's not a whole-academy understanding really of what PBL is and that's something that we need to tackle in the coming year' (School B, PBL lead).

'If we were to have had this year again I think we would have done more CPD work with the whole staff, so that the whole staff's understanding was better… so I think we're probably much more knowledgeable now to do it with the whole staff next year' (School A head-teacher).

Schools were therefore aiming to tackle this in the second year of delivery and were putting more emphasis on a whole-school approach where more members of staff, even those not directly involved in PBL, would become familiarised with aspects of it. They hoped that PBL principles would permeate the whole school ethos.

Organisation and challenges in School E

In School E, both the headteacher and the PBL lead, as well as several of the teachers we spoke to, reported that one of the biggest challenges of doing the PBL project was the very tight timescale. In practice this amounted to signing up in February with training taking place in May or June and starting to deliver REAL Projects the following September. This was necessary for the timing of the trial, but there was a consensus that at least a term or two is needed to plan for the necessary organisational changes, and that ideally a year is needed to effectively prepare to implement REAL Projects. It follows that quite a few schools would be unable to undertake the necessary preparatory work in this short time-period; that this school was able to is a reflection on the school, and should be considered when generalising. The school felt in a secure position internally and externally to address the challenges of a major new initiative such as PBL.

A major perceived challenge identified early in the planning phase was getting the necessary 'buy-in' and support from three departments not used to working together. They found that the departments were able to work well together, but they emphasised that it was important to ensure that all three were equally valued and that time taken for REAL Projects from subject teaching was proportionate. Once the project was underway, most concerns centred on logistical issues. While it was felt that better forward planning would have helped, in practice it was felt that any major organisational change would have presented similar challenges. It was also emphasised that many staff needed additional support when working outside of their 'comfort zone'—such as having to work in a cross-curricular way, cope with new subjects, or use ICT more intensively. Noting that Year 7 pupils are generally enthusiastic about their new secondary school experience, it was emphasised that the 'student voice' survey showed particular enthusiasm for project-working (comparison was made to the previous year as well as other non-PBL subjects).

An important commitment was made at an early stage of planning that the curriculum needed to drive the timetable, even when this might have knock-on effects on other subjects. In practice, the REAL Projects curriculum was not found to constrain wider school working significantly. The pupils did PBL twice a week for 150 minutes at a time (triple 50-minute lessons). One session was humanities-focused and the other business and ICT. This was found to be a good and effective arrangement which fitted well with the wider school organisation and will continue for future years.

The staff we spoke to emphasised the value and importance of headteacher, senior staff, and governor buy-in to the pedagogy. Again, this largely reflects the nature and values of the school and importantly was identified by everyone we spoke to at the school as an essential prerequisite for effective PBL. There was quite considerable emphasis on the need for planning and meeting time, in particularly as there were up to 12 teachers delivering PBL. The school also placed considerable importance on the role of teaching assistants (TAs) to support the pupils generally as well as individually for those with specific needs. Indeed, we saw one lesson where the pupils had reading ages ranging from 6 to 15 years, as well as EAL pupils, and in such circumstances TAs played a very important role.

Organisation and challenges in School F

In School F, in addition to having much of the organisational structure in place for PBL, at the time when the Innovation Unit approached the school to join the trial the PBL lead had recently completed a Masters degree focusing on how STEM could be effectively taught at the school through PBL. This, combined with support from the governors, made it relatively straightforward (compared to other

schools) to implement PBL. However, they were aware that it did not really fit clearly with government policy in practice, or with 'playing safe' with Ofsted. They suggested that the uncertainty relating to PBL was a perception that there was a lack of empirical evidence supporting it as an educational approach. However, this is also the case with a lot of educational approaches, for example, those concerned to address the issue of white working-class boys performing below their peers.

The school benefited from good community links and at that time teachers were organised on a faculty basis, rather than along strict subject lines. Both of these factors helped with the organisation and implementation. Although PBL was a high-profile project, the school sought to play this down internally so as to reduce the chance of some element of resentment. The PBL teachers were organised on a small team basis, with most of their teaching being PBL. Overall the school sought to 'grow' the teachers in to their role, and had great success with new or NQT teachers in the PBL team who were able to get support from the lead staff and the PBL processes. Although much of this was likely down to the skills and abilities of the PBL lead, it shows the potential value of team-working for staff support and development.

For Year 7, about 50% of the timetable was assigned to PBL and this reduced in Year 8. PBL included ICT, science, design and technology, and humanities, as well as an element of English. The PBL team did not, however, possess the whole range of subject expertise, and where necessary the specific departments and teachers from elsewhere in the school contributed to the planning and design of the REAL Projects and materials. The team were very cohesive which helped with joint planning, and this was helped by having a period when the full team could meet each week on Friday afternoons.

Outcomes

Perceived outcomes of the intervention

The pupils' perspective

The pupils interviewed talked with enthusiasm about a variety of projects they had worked on, developed, and presented to an external audience, including projects about the environment and recycling issues, the Romans, health and social care, school improvement issues, reflections on inspirational people, and history heroes—among many other topics.

Pupils thought that PBL work was more relaxing and fun than subjects taught in a more traditional, didactic way. They felt they could learn useful knowledge and develop skills that would be valuable in real life situations, in career choices, and in their development in life later on. This view is illustrated in comments such as:

> 'You feel proud of yourself, it determines you more and more, then one day you're probably going to have the passion to be a historian or someone who knows a lot about geography, so it really helps for future' (School C pupil).

The PBL environment was also perceived as encouraging all pupils to participate in tasks through team working and appropriately differentiated work. Some pupils felt that it helped them develop the tools to evaluate their own work and the work of others while developing a better awareness of areas that they could improve on. Others mentioned with pride that they developed creativity skills, the ability to listen to and accept their peers' critique and feedback, as well as enhanced research skills and an ability to understand and remember the material covered because they found it more 'connected', 'interesting' and 'fun'.

> 'In REAL Projects, [learning is] connected, it's building up your skills so that you can use them in real life situations' (School F pupils).

'[Feedback from peers] was helpful for us so we know what to do next… the first time people wrote like good handwriting or good use of punctuation, but we needed more depth. Because we then had more capability we started to actually write something that would be useful for the person' (School C pupils).

Pupils also mentioned that they appreciated their artistic involvement in projects and engagement with technology which made their learning more interesting and engaging. Very often their enthusiasm motivated them to work more at home.

'I sometimes do work at home… it gives me more knowledge in what I am learning about. The projects actually motivate us to do more research cause we're really determined so we want to make it the best and so we go home and maybe one person in the group will write the script even though Miss said you didn't need to do this but it will make us really better' (School C pupils).

The perspective of teachers and PBL leads

There were a number of success stories that teachers and senior members of staff were keen to share in the interviews. All of these related to the confidence the pupils developed through their project-based work which was demonstrated through significant improvements in their oracy skills—their ability to express themselves fluently and confidently in front of an audience. Oracy skills and confidence in communicating were seen as particularly important for the future workplace.

'We have a child here [who was] very, very withdrawn, couldn't make friends easily… but she actually [performed] in assembly in front of all the kids. You can't measure that. And that just made such a difference to all of us and even if you've had the week from hell, you get in there and you celebrate the achievement with the kids and they're all applauding each other. When you see that, you come out thinking "I'm ready for next week now", and it does uplift you' (School F teachers).

'I've noticed an improvement in confidence. With lots of them they have become a lot more confident in their own ability, but also in taking the initiative a bit more. We've had quite a few pupils now making speeches at the exhibitions and that's really good for confidence and public speaking' (School C, PBL lead).

'She's always been a very high-achieving student and she's very top set, but I think the thing she's got from PBL is her oracy—she's much more confident now to speak and to express her opinions' (School B follow-up visit, deputy head).

Some teachers also expressed views that special educational needs pupils had particularly benefited from PBL. SEN pupils had been observed to engage quickly within the PBL environment because of the connected information they were presented with. This meant that there was less room for disruption in the classroom.

'We work with a lot of autistic and ADHD children and it was perfect for them. They weren't having what they would see as random information given to them. It was completely aligned so they were heading along one path of journey of discovery which was perfect for autistic children' (School D headteacher).

Teachers felt that the major outcomes of PBL for the pupils were increased engagement and more positive attitudes to learning, which were evident in the classroom but also came through in their responses in student voice reviews. A key factor that contributed to pupils' engagement, according to the teachers, was their ability to see the purpose of what they were doing and take ownership of their learning within an environment that recognised the diverse areas in which pupils can excel.

'The pupils are incredibly positive about their learning, they feel rewarded, they feel like their talents are recognised. They feel like they have an opportunity to succeed in a range of different areas rather than the very narrow metrics that we use ordinarily. They are much more confident, they are noisy but actually incredibly well organised, and have a great attitude to learning' (School F headteacher).

Improvement in literacy was another outcome mentioned by school staff, particularly in the improved quality of pupils' writing. Moreover, in preparation for the new school year, the desire to implement PBL effectively often led to special attention being given to facilitate a smooth transition for pupils to the secondary school environment through stronger cooperation with the feeder primary schools. This helped secondary schools to be better prepared to meet the learning needs of all pupils:

'We REALLY know our pupils in PBL, we really know them back to front and I think they do feel a bit safer I suppose, and with a high proportion of statemented kids here, it's nice and it does help that transition I think, give them a bit of consistency' (School C, PBL lead).

Furthermore, staff stated that parents' feedback was very positive about PBL as pupils' enthusiasm with their learning and increased involvement in PBL activities were noticed and appreciated at home:

'We had parents' evening last week and it was quite interesting, a lot of the parents were saying how much the kids were enjoying doing it and it was actually feeding back into their home lives where you're not sure an English lesson or Chaucer would have had that same kind of effect, and I think cause it's in smaller chunks, the pace of what you are delivering is quite intense but we moved on quite quickly and I think that's been huge' (School D teacher).

Schools often used PBL as an opportunity to engage more parents in the school. One school set up a system where text messages would be sent to parents to inform them about PBL key events and gave pupils the opportunity to continue their PBL work at home by allowing them outside access to Google documents. Another school set up Learning Blogs for pupils for them to reflect on their PBL work which could be accessed by parents. As a result, some parents felt more engaged with their child's learning. Furthermore, all schools took extra steps to establish stronger home-school links in order to encourage more parents to attend public exhibitions as this was perceived particularly valuable.

'I'm getting dates in the diary for the exhibition a lot earlier than I was last year… We can let parents know sooner and we can put it in the parent bulletin—one thing that's really helped I think, especially for the performance is that we've now got a facility in the office to text parents and the office text every single Year 7 parent the day before and said don't forget about the performance tomorrow night and I think that really helped' (follow-up visit, PBL lead).

Perceived benefits and pupil progress in School E

In School E, PBL was seen to help departments to think and work together and therefore had positive benefits in other subjects and areas of the school, potentially leading to benefits for pupils beyond Years 7 and 8.

It was also found that REAL Projects supported existing primary/secondary transition activities, as well as fostering wider local contacts and educational opportunities. For instance, the school had worked with a local museum and local designers in some of the projects. Likewise, a number of staff visited other PBL schools, both locally and further afield, which, they suggested, helped bring in new ideas. More generally, working in a team was found to help many staff reflect on their own practice and skills and it was thought it would therefore support staff development more generally. For the pupils' progress through the school it was felt that the PBL approach to learning instilled valuable learning skills, such as research skills, as well as giving them an introduction to subject- or department-organised teaching, which they would not have been familiar with from primary school.

As with many of the other schools there were some challenges in assessing impact. It was found that the approach in the first year of delivery lacked consistency making it difficult to draw firm conclusions about progress. However, in the second year, the systems were more aligned and integrated with the whole-school approach allowing direct comparisons to be made, both year on year and between subjects. The school emphasised that consistency in assessment and the ability to compare progress was important for maximising the returns from PBL, as well as giving wider credibility to the approach.

In general, feedback from the various departments suggested that the Year 7 group as a whole had made more progress than previous years. It was also felt that PBL encouraged deeper leaning of particular topics and increased the breadth of content that could be explored by going beyond the national curriculum. Specifically, it was felt PBL helped the development of a wide range of skills for the future which would be useful throughout the pupils' education, such as research, team work, and presentational skills. The school had also found the PBL approach more suited to low-ability learners and was able to point to instances of far more progress being made by such learning than would have been expected. However, it did recognise this was not in itself a solution for all such pupils and that more planning and adaption of lessons needed to be done.

Overall, this school was very enthusiastic about PBL and felt that it was of substantial benefit to its teaching and learning. It was also positive about the potential benefits to other schools, however it did point to the need for the school to be in a 'secure' position, both internally and externally. From its experience, a great deal of commitment had to be made to properly implement the project, and to reap the benefits for pupils.

Perceived benefits and pupil progress in School F

For School F, the most important tangible benefit was improved engagement in the learning process, for both pupils and their parents. With regards to parents, we were told that far more were attending parents evenings than had previously and more were also accessing on-line reports.

The school did not yet have the data to directly assign academic impacts to PBL, however it felt that by improving engagement—even in just one target group, such as white working-class boys—it was likely to improve academic performance. The school also pointed to future learning benefits, including life-long learning and skills valued by employers. It was felt that embedding these skills at this early stage would have the benefit of encouraging more pupils to continue their education by doing IBs or more vocational courses. We were told of improvements in terms of PBL directly supporting the primary/secondary transition as well as the longer-term integration of the Year 7 pupils into the school.

We were also told that the programme is likely to go on to help support local employment needs, for example in the area of STEM and progression to Higher Education. It was also evident that the programme was playing a valuable role in terms of staff training and support, in particular through team working, and, more generally, for the school to help meet its broad educational aims.

Formative findings

How the intervention can be improved

The following suggestions refer to process evaluation findings that might be considered by the Innovation Unit and addressed in their training with the schools. The training and support offered was perceived to be excellent with ample help and support offered along the way. However, if schools are aware of the suggestions that follow, there will be greater potential for the intervention to be delivered more effectively. For example, if schools are actively encouraged to share best practice with other schools from the beginning of the project and are able to build this into their timetable, then better decisions might be made regarding its implementation. Likewise, if schools are alerted to the danger of project-based work being occasionally approached on a more superficial level by pupils, this would raise understanding about the importance of closely supporting and monitoring pupils' work and

progress. Last but not least, embedding PBL across the school seems to be a useful target for schools to be aiming towards.

Student choice, but ensuring depth of learning

The student interviews revealed that students would like more of a say in what projects were undertaken, and it was felt that this would lead to a higher level of participation and engagement. This suggestion was welcomed by some schools, however more student choice does not mean that teachers would not need to monitor pupils' decisions in order to challenge and extend them. On the contrary, they would need to work closely with the pupils to ensure that they are engaged into a reflective, deeper approach to learning rather than getting side-tracked into the more superficial or presentational aspects of the project, as illustrated in the quote that follows:

'I think it's that depth now that we really need to be looking at. For example, I have one girl that worked extremely hard at the last 'Trashion Show' project, bearing in mind the whole scheme of learning was about 6Rs, sustainability, consumerism, the effects that consumerism is having on the planet and then she made this product that was tennis balls that held things… she'd done a good job of getting donated tennis balls but it was like a useless item, I felt that she's missed the point of the project and I tried in lots of occasions to give a critique to move her forward but she was adamant this was what she wanted to do. …it's that depth and in her evaluation she has picked up on it but to the point that the penny's dropped' (School F, follow-up meeting, PBL lead).

Embedding PBL across the school

When this deeper learning becomes better embedded within the PBL environment, and the organisational challenges fully addressed, then it will be more feasible for schools to develop a more holistic vision about the potential benefits of this type of learning. For example, teachers not already involved in PBL may start to see benefits of PBL on pupils moving up through the school, especially in terms of confidence and skills, and their deeper knowledge. Encouraging teachers not involved in PBL to observe learning in PBL classrooms might also help them to see how it could work for them. A 'cultural change' might then start to take place in schools such that more teachers adopt project-based learning elements in their teaching. If this change occurs, schools may move towards more of a common shared vision and more interdisciplinary working. Comments that reflect the need for such a school-wide interaction include:

'Within the next year, we aim to introduce [PBL to] more subjects, we do need some structure to create that cultural change; it's got to work holistically, so it will need that structure at the early stages' (School B, follow-up visit, deputy head).

'It's the investment with staff—if we could roll it out to every curriculum area, to every group, I think it would be different and that would be the long term goal' (School A headteacher).

'She's working with Maths and Science team, so it's trying to roll out our core ethos into other areas so it's not as directed from the REAL team, it's how it fits into the rest of the school' (School F, follow-up meeting, PBL lead).

Sharing best practice across schools

Sharing ideas with other local schools and becoming familiar with best practice in schools where PBL has been implemented successfully was perceived as being a useful mechanism for continuous professional development and as a source of inspiration. In addition, resource-sharing through the online community—through websites and Google handouts—facilitated communication and the development of ideas around PBL. It was also mentioned that the enhanced communication among schools could be even more valuable in the long run than the initial support from the Innovation Unit.

However, many schools found it difficult to engage with other schools (even locally) due to time pressures in everyday school life or because of extra demands placed upon teachers higher up the school.

> *'I think we would have loved to have gone to the exhibitions of some of the other school projects… [but] everything becomes so busy doesn't it'* (School A headteacher).

> *'I think if we've got a team of schools around us that are all working towards the same thing… that's probably more important than it is having somebody come from the Innovation Unit individually. […] I work with colleagues from other schools around here and we share ideas and we work together, so I'd kind of want that relationship moving forward'* (School D, PBL lead).

Conclusion

Key conclusions
1. Adopting PBL had no clear impact on either literacy (as measured by the Progress in English assessment) or student engagement with school and learning.
2. The impact evaluation indicated that PBL may have had a negative impact on the literacy attainment of pupils entitled to free school meals. However, as no negative impact was found for low-attaining pupils, considerable caution should be applied to this finding.
3. The amount of data lost from the project (schools dropping out and loss to follow-up) particularly from the intervention schools, as well as the adoption of PBL or similar approaches by a number of control group schools, further limits the strength of any impact finding.
4. From our observations and feedback from schools, we found that PBL was considered to be worthwhile and may enhance pupils' skills including oracy, communication, teamwork, and self-directed study skills.
5. PBL was generally delivered with fidelity but requires substantial management support and organisational change. The Innovation Unit training and support programme for teachers and school leadership was found to be effective in supporting this intervention.

Interpretation

The impact evaluation indicates that the Learning through REAL Projects intervention does not improve literacy or engagement outcomes for participants overall, in the intervention group compared to the control group, and may have had a negative impact on pupils eligible for FSM, however major limitations to the trial add uncertainty as to the validity of these results. In this interpretation we discuss how the impact findings should be interpreted, as well as some of the broader issues arising from this project. In addition we highlight the useful lessons from this project for evaluating complex interventions requiring large-scale school-level change.

We summarise and consider the interpretation under five headings, including: academic impact, impact on engagement, process, and large-school change interventions.

Academic impact

Overall the project did not find that PBL had an impact on literacy for all of the pupils in the intervention group compared to those in the control group. The analysis did show a statistically significant negative finding for FSM pupils in the intervention group (in other words, which suggested they did worse as a result of doing PBL). However, these findings should be interpreted with caution. This particularly so in regards to the comparison group—what the counterfactual to schools doing PBL was, the group imbalance after randomisation, and the level of attrition from the intervention group (47%) (see limitation section below) as well as the fact that it included a reasonably small number of schools and therefore was lacking power.

In terms of the counterfactual, a number of the control schools were actively using PBL approaches. Related to this, it is important to be aware that schools were recruited on the basis that they had the ability and capacity to make the substantial organisational changes required to implement PBL, as well as the incentive and desire to make improvements in how they delivered the KS3 curriculum. In addition, all schools recruited were willing to pay £10,000 towards professional development to support the implementation and delivery of PBL. It seems reasonable therefore that the control schools were not simply passive (or engaged in 'business as usual') during the trial period, but rather sought other ways to improve their KS3 teaching (including using PBL). The process evaluation found that some control schools delivered some project based learning and that four control schools used a

variation of PBL to teach at least 20% of their Year 7 curriculum, sometimes with bought-in additional support. This makes it difficult to assess the impact of Learning through REAL Projects over and above the impact of the PBL interventions delivered by the control schools.

It would also seem credible that reducing the trial period from two years to one year limited the time available for the intervention to become embedded in a school, therefore reducing the ability to demonstrate an impact.

The significant negative finding on literacy outcomes for FSM pupils is, however, of concern. It is particularly difficult to interpret given that the same negative impact was not found for low-achieving pupils. It is possible that the Learning through REAL Projects intervention is not as accessible to FSM pupils as for other pupils. The autonomy provided by projects and the requirement for more independent self-directed study may require skills that are less developed by these pupils, or it may be that access to resources (such as computer or internet access) is not as available outside of school for disadvantaged pupils. The process evaluation, however, did not provide any evidence to support this hypothesis. This element of the evaluation was based on classroom observations and feedback from headteachers, project leads, teachers, and pupils in the schools. It found that PBL was well received and considered to be of benefit in terms of developing oracy, communication, team working, and research skills. The intervention was also perceived as being of benefit to low-attaining pupils more generally.

It is worth noting that although literacy attainment was chosen as the primary outcome for this study—given the primary purpose of the EEF—it was not the principal aim of the Learning through REAL Projects intervention. Its key aims were to promote deeper learning of topics, learning skills, and skills relevant to future work and study, as well as interest and engagement in learning more generally; literacy skills only formed a part of the picture. Nonetheless, there was a clear rationale as to why there could have been a positive impact on literacy, and accordingly the funder, developer, and evaluator were keen to investigate whether a PBL curriculum can be implemented which can promote literacy attainment to at least the same extent as a more traditional teaching approach. However, the conclusion from this trial has to be that adopting PBL had no clear impact on either literacy (as measured by the Progress in English assessment) or student engagement with school and learning.

Impact on engagement

As with the academic outcomes, we did not find any evidence that the intervention impacted either positively or negatively on engagement with school or learning from the attitudes survey or the attendance data. However, the research limitations regarding the control group and attrition, described above for the academic outcomes, also apply to these outcomes and limit the conclusions that can be drawn from the data.

It should, though, be noted that the underlying aims of this PBL intervention are long-term benefits in terms of softer secondary outcomes—such as engagement with learning as well as skills for work and later study—and it may be the case that there would be differences between the two groups at a later date, such as when accessing further and higher education or employment. It may, however, be that our measures of these softer skills of engagement and school attendance were not the most appropriate measures to use in this study and that measures of the skills valued by employers and those which support further learning, as well as later outcomes, should be the focus of future study. This trial was only able to measure impact after one year of implementation when schools were just beginning to understand how to develop effective projects and getting used to a new way of teaching. A longer time for this practice to embed in schools may also lead to more positive outcomes.

Implementation and large school change interventions

The process evaluation tells a much more positive story compared to the impact evaluation findings. There was a great deal of enthusiasm for PBL from the intervention schools that completed the first year, as well as for those that continued into the second year. Almost without exception, those schools reported finding positive benefits from the programme in terms of attainment, confidence, learning skills, and engagement in class. While there was a high level of attrition from the intervention group schools, this was not generally due to schools having difficulty with implementing the intervention but to other factors in the school including leadership changes and academisation (with the exception of two schools where the intervention affected their decision to continue).

We found from our observation visits, and feedback from the Innovation Unit coaches, that the intervention was implemented with a high degree of fidelity over the one year research period. The level of support provided by the Innovation Unit model, both from Classroom and Leadership Coaches, was described as essential to supporting this fidelity and for successful delivery of the intervention in schools. Support from school leadership and a strong REAL Projects team who are bought-in to the principles of PBL are also key to successfully implementing this intervention. Almost all schools reported that assessment of REAL Projects, in a way that could be used to show progress for accountability purposes, was a major challenge to its implementation.

Effectively implementing PBL at a whole school or cohort level is challenging due to the necessary degree of organisational change. It should of course be noted that all of the schools which implemented PBL were both willing and generally had the capacity for such change. We found, however, that the Innovation Unit's Learning through REAL Projects implementation processes were particularly effective for the target (that is, willing and with the capacity) schools, and the feedback from those schools was almost entirely positive.

The key elements were to support both the classroom practice with expert coaches, as well as provide support to the heads and leadership teams. The latter varied considerably, largely depending on the particular contexts of the schools, and is therefore difficult to describe in a generalised way. The Leadership Coach worked on a case-by-case basis providing support as was necessary at different levels depending on the requirements of the school. However, such a skill is largely generic and it may be possible for this to be provided in other ways than a specific PBL coach. The Classroom Coaches on the other hand had to have very specific skills and be experienced in the delivery of projects in the classroom, and their knowledge had to be imparted in a fairly consistent way across a wide range of schools.

The implementation was also effectively supported through high quality initial and centralised training (QUEST) which besides providing schools with the necessary skills and materials, allowed schools to feedback and discuss their own situations and potential issues with both the Innovation Unit team and colleagues from other schools. This was a two-way learning process which was particularly evident from the improvements made between the pilot QUEST and subsequent first round QUEST training, a process essential for the implementation of a complex intervention such as PBL. In addition, the ongoing support through newsletters, online community pages, and blogs also helped with the implementation.

Limitations

The key design limitations were the validity of the counterfactual, moderately high levels of missing data, imbalance between intervention and control groups at the pupil level after attrition, and the limited time the intervention was given to embed in schools.

The issue of the validity of the counterfactual occurred through not being able to isolate the intervention and control groups as a third of control group schools were doing a variation of PBL.

The level of buy-in required from schools signing up to the project, including the monetary commitment, led to only schools very motivated to implement PBL signing up to the project. However, for some that did not get allocated to the intervention group, faithfully adopting the control condition was seen as being detrimental to their pupils' learning and therefore some of these schools chose to implement a version of PBL anyway. This creates a substantial challenge for an RCT design with such an intervention and consideration could be given to alternative designs such as time-series for future similar evaluations.

There was also a high level of attrition in collecting the assessment data during the project, particularly from intervention group schools as well as issues with missing baseline data. It was not possible to collect data from five intervention schools in this project with two withdrawing after randomisation (due to no longer wishing to do the intervention) but before any intervention implementation, two withdrawing towards the end of the project (due to their perceptions of the intervention) and one being unable to secure parental consent for the assessment. The analysis on an intention-to-treat basis will therefore be biased to some degree, with a large chunk of data missing, not at random, from the intervention group. Those that withdrew were less likely to have implemented the intervention and therefore the analysis may be positively skewed if the intervention does have an impact, however the level of missing data introduces unknown bias and reduces the power of the study to detect an effect.

We also need to be aware of the limitations of what was being measured, and whether the measures were likely to be affected by doing the intervention. Literacy as assessed by the PiE assessment was chosen as the primary outcome because it was judged to be the EEF academic assessment most closely aligned with what PBL was seeking to do: improving the pupils' literacy skills. The assessment chosen, however, only measured a select set of literacy outcomes and in particular did not include any extended writing tasks which might have been more affected by the intervention. As mentioned above, literacy was not the primary aim of the Learning through REAL Projects intervention and therefore it is possible that a different assessment looking at other factors more aligned to the intervention would have found a significant effect (positive or negative).

Related to the above is the time scale or period allowed for the intervention to have an impact, in practice the time between the intervention starting and the outcome being tested (as well as the time delay before the control group can access the intervention). The reduction from a two year trial to a one year trial could have reduced the impact that could be detected and if we had measured outcomes after two years we may have been more likely to see a difference in outcomes between the control and intervention group. Also, some of the predicted outcomes for PBL relate to future education phases and life-long learning, the effects of which cannot be seen until later, and therefore not possible to measure in this project.

Given that it is not possible to conclude with any confidence that PBL had a positive or negative impact on literacy outcomes we are limited in what we can say about the generalizability of using PBL to improve literacy and engagement more widely in other schools. The feedback from the process evaluation may be relevant for most schools seeking to broaden their curriculum, however, in terms of the messages about the organisational change required to implement PBL, the learning can only be really generalized to those schools that are willing and that have the capacity to manage the change process. We cannot say anything about the likely impact if such an intervention were to be imposed on a school.

Future research and publications

The need for improving skills appropriate for further study and those valued by employers in the modern workplace (a central aim of PBL) has not diminished, but probably increased. This study picked up the value of these skills to pupils' learning and future potential through the process evaluation, but was not able to measure these skills as an outcome. Further research should be

commissioned as to the ways in which these skills can be measured, and to how schools can play their part in providing young people with such skills and ways in which they can be measured.

For future evaluations of similar interventions involving significant investment from schools and large scale organisational changes, careful consideration needs to be made about whether randomised controlled trial designs are appropriate to assess effectiveness in light of the difficulties faced during this project. Other rigorous research designs may be better suited to this style of evaluation and particularly those that allow a longer term (five- to ten-year) view to be taken.

The research team do intend to publish a number of papers from this evaluation and currently an extended version of the literature review is due to be published shortly in a journal. In addition, the team are advising the KATA foundation in Denmark on a PBL project that will promote STEM subjects and the impact will be assessed over a long period of time (up to ten years).

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Appendix A: EEF cost rating

Cost ratings are based on the approximate cost per pupil per year of implementing the intervention over three years. More information about the EEF's approach to cost evaluation can be found here. Cost ratings are awarded as follows:

Cost rating	Description
£ £ £ £ £	*Very low:* less than £80 per pupil per year.
£ £ £ £ £	*Low:* up to about £200 per pupil per year.
£ £ £ £ £	*Moderate:* up to about £700 per pupil per year.
£ £ £ £ £	*High:* up to £1,200 per pupil per year.
£ £ £ £ £	*Very high:* over £1,200 per pupil per year.

Appendix B: Project-based learning: a review of the literature

Defining characteristics of project-based learning

Project-based learning is a student-centred form of instruction which is based on three constructivist principles: learning is context-specific, learners are involved actively in the learning process and they achieve their goals through social interactions and the sharing of knowledge and understanding (Cocco, 2006). It is considered to be a particular type of inquiry-based learning where the context of learning is provided through authentic questions and problems within real-world practices (Al-Balushi and Al-Aamri, 2014) that lead to meaningful learning experiences (Wurdinger, Haar, Hugg and Bezon, 2007). Blumenfeld, Fishman, Krajcik, Marx and Soloway (2000), for example, described the process of project-based science as follows:

> *'The presumption is that students need opportunities to construct knowledge by solving real problems through asking and refining questions, designing and conducting investigations, gathering, analysing, and interpreting information and data, drawing conclusions, and reporting findings' (p.150).*

It has been argued that the freedom and challenge that pupils experience as a result of solving the problems that arise in designing and building their projects result in high levels of student engagement (Wurdinger *et al*, 2007) due to the cognitive challenge as well as the strong affective, ethical and aesthetic dimensions that form part of a well-designed project (Wrigley, 2007). Thomas (2000) identified five essential characteristics of projects: 1. Centrality, 2. Driving question, 3. Constructive investigations, 4. Autonomy and 5. Realism, with the importance of student collaboration, reflection, redrafting, and presentations emphasised in other publications (Kwon, Warderip and Gomez, 2014; Patton, 2012). The uniqueness of project-based learning is the construction of an end product, a 'concrete artefact' (Helle *et al*., 2006) which represents pupils' new understandings, knowledge and attitudes regarding the issue under investigation often presented using videos, photographs, sketches, reports, models and other collected artefacts (Holubova, 2008).

It is argued that it can help foster self-regulated learning and can promote pupils' conceptual knowledge within a systematic process of documenting and reflecting on learning (Barak, 2012). Pupils learn to be self-reliant through goal-setting, planning and organisation, they develop collaboration skills through social learning and become intrinsically motivated by being encouraged to exercise an element of choice while learning at their own level (Bell, 2010). Project-based learning has been explored in various contexts and in different phases of schooling ranging from the early stages of education through primary and secondary school to higher education.

Overview of the evidence for the effectiveness of project-based learning

Most of the reviewed studies did not involve random allocation of participants to control and experimental groups and, as a result, a causal link between project-based learning instruction and positive student outcomes cannot be established with certainty. The majority of these studies were based on a quasi-experimental pretest-posttest design with some baseline equivalence established for the outcomes measured at the classroom level. Some studies of weaker quality were based on observations of pupils' behaviour, attitudes and accomplishments in a project-based learning environment without the presence of a comparator group (for example, Barak and Asad, 2012; ChanLin, 2008; Cuevas, Lee, Hart and Deaktor, 2005; Morales, Bang and Andre, 2013). Other studies have used state standardised test averages against which to compare the performance of 7th/8th grade pupils (Geier *et al*., 2008) and 12th grade students (Schneider, Krajcik, Marx and Soloway, 2002).

Sweller, Kirschner and Clark (2007) have emphasised the importance of randomised controlled experimental studies of different instructional procedures to provide stronger and more reliable evidence on the effectiveness of project-based learning.

Pre-school and primary school

Implementation of a project-based concept mapping developmental programme to facilitate children's experiential reasoning and comprehension of relations (Habok, 2015) reported positive results for the experimental group that attended one of the two kindergartens in Hungary. In particular, even though the experimental group started with a disadvantage in achievement, there was a significant increase in this group's development compared to the control group. Habok concluded that the use of concept maps in school practice holds promise as a visual expression tool in promoting understanding of connections and causalities. Another study with pre-school science teachers in Sweden (Ljung-Djärf, Magnusson and Peterson, 2014) argued that a learning study project model (a kind of action research that combines variation theory with the concept of lesson study) has the potential to promote pre-school science.

In their quasi-experimental study on the effectiveness of project-based learning in primary school in Greece, Kaldi, Filippatou and Govaris (2011) argued that primary age pupils can develop content knowledge and group work skills in addition to motivation and positive attitudes towards peers from a different ethnic background through project based-learning instruction. Similarly, Karaçalli and Korur (2014) conducted a quasi-experimental study in Turkey with fourth-grade science pupils (equivalent to Year 5 in the U.K.) and found a statistically significant effect in terms of academic achievement and retention of knowledge for the project-based learning pupils. A U.S. study that explored the effectiveness of a project-based approach in 2nd grade (equivalent to Year 1 in the U.K.) social studies and content area literacy (Halvorsen, Duke, Brugar, Berka and Brown, 2012) reported positive outcomes for low-SES pupils and claimed that the project-based learning approach has the potential to help narrow the gap between low and high-SES pupils in social studies and literacy for 2nd grade pupils. The study employed a 'design or formative experiment approach' (p.10) where six teachers and a subset of their pupils participated in the study. Two teachers were from high-SES schools and four teachers from low-SES schools. The teachers in the low-SES schools implemented project-based units in their teaching which were developed by the researchers. In addition to student assessments, data were also collected through classroom observations and teacher interviews. The study had a number of limitations, such as a small sample size (N=10-12 from each class with 43 children in low-SES and 20 children in high-SES classrooms), lack of a control group and researcher designed assessment measures that may be less reliable and valid in comparison to other published standardised measures.

Secondary school

Al-Balushi and Al-Aamri (2014) conducted a quasi-experimental study with 62 11th grade female pupils (equivalent to Year 12 in the U.K.) in Oman that explored the effect of environmental science projects on pupils' environmental knowledge and attitudes towards science. Two classes were randomly assigned into an experimental group and a control group. The findings were positive with the experimental group significantly outperforming the control group in the Environmental Knowledge Test and the Science Attitudes Survey. The authors acknowledged, however, that a novelty effect could not be ruled out as pupils' enthusiasm in the experimental group in using new technology to design their products could have led to the more positive results in the post-tests.

In history learning, Hernández-Ramos and De La Paz (2009) had eighth grade pupils in the U.S. (equivalent to Year 9 in the U.K.) learn to create multimedia mini-documentaries in a six-week history unit. Compared to pupils who received traditional instruction, pupils that engaged in the project-based learning curriculum demonstrated positive affective benefits and significant gains in content knowledge as well as historical thinking skills. This was a quasi-experimental study using a pretest-

postttest design and there was no random allocation of pupils or teachers to control and experimental conditions. Therefore, it cannot be inferred with certainty that the knowledge gains are necessarily the result of technology-enhanced project-based learning at the intervention school as other teaching and learning activities could have contributed to the positive results.

Another quasi-experimental study carried out in the U.S. (Hsu, Van Dyke, Chen and Smith, 2015) explored seventh graders' (equivalent to Year 8 in the U.K.) development of argumentation skills and construction of science knowledge in a graph-oriented computer-assisted project-based learning environment. A significant difference in science knowledge, counterargument and rebuttal skills was found in favour of the treatment condition. In another U.S. study, Geier *et al*. (2008) reported that 7th and 8th grade pupils that participated in project-based inquiry science units showed increased science content understanding, better process skills and significantly higher pass rates on the statewide test over the remainder of the district population.

Boaler (1998) conducted a longitudinal study of mathematics instruction comparing an open, project-based environment to a traditional approach and it followed two cohorts of pupils in two British secondary schools from Year 9 to Year 11. Even though this study did not involve the random allocation of participants, it employed a closely-matched control group in terms of socioeconomic status, prior mathematics instruction and attainment. A variety of instruments were used to measure pupils' skills, attitudes and attainment. The main finding was that the two groups developed different forms of knowledge. The pupils learning mathematics in the project-based environment developed conceptual understanding which often required creative and deeper thinking in contrast to the procedural knowledge acquired by the traditional instruction group which was mainly based on information recall. In addition, more pupils at the project-based school succeeded in passing the General Certificate of Secondary Education (GCSE) at the end of the three-year study than those pupils receiving the traditional instruction.

Other studies have shown higher learner motivation in a project-based learning environment with fourteen and fifteen year old girls in Israel showing increased interest in learning scientific-technological subjects (Barak and Asad, 2012). Project-based learning as related to STEM (science, technology, engineering and mathematics) curriculum design for female senior high school pupils in Taiwan led to gains in terms of enjoyment, engagement with the project and the ability to combine theory and practice effectively (Lou, Innovation Unit, Shih and Tseng, 2011). This study was an in-depth investigation of 84 pupils' cognition, behavioural intentions and attitudes in the project-based STEM environment and involved text analysis and questionnaire survey as the main data collection tools.

The 10-11 year old pupils in ChanLin's (2008) qualitative study in Taiwan developed skills in synthesising and elaborating knowledge and in engaging in scientific exploratory tasks with the use of technology. Project-based learning has also been explored as a method of instruction with low-achieving pupils in Israel (Doppelt, 2003) and the U.S. (Cuevas *et al*., 2005), and with second chance school pupils in Greece (Koutrouba and Karageorgou, 2013) with positive outcomes. Doppelt (2003) found that scientific-technological project-based learning helped improve low-achieving pupils' motivation and self-image by allowing pupils to succeed early on in the process and led to more pupils achieving the college admittance requirements. Doppelt's study was a field research project that used qualitative and quantitative tools (portfolio analysis, observations, interviews, matriculation examination results and assessment of pupils' projects) with a sample of 54 10th to 12th grade pupils (fifteen to eighteen years old).

Encouraging results were also reported with high school high achievers in Israel where 60 pupils from three experimental classes in comprehensive high schools exhibited a significant increase in formal technological knowledge and skills and more positive attitudes towards technology in comparison to the pupils in the three control classes which were drawn from technological high schools (Mioduser and Betzer, 2007). However, the different type of schools involved suggests differences in student

take-up and characteristics, and indicate an unequal student comparison which limits the strength of the findings. Some studies have shown mixed results. For example, in their quasi-experimental study with 13 year old children (grade 8) taking computer courses in Greece, Boubouka and Papanikolaou (2013) found no significant effect of project-based learning on student achievement but a statistically positive effect on self-perceived learning performances.

Project-based learning studies in higher education and in pre-service teacher training

A number of studies have explored the effectiveness of project-based learning in higher education in different countries. Most of these studies have focussed on engineering education. For example, Ruikar and Demian (2013) made links with industry engagement through multimedia podcasting in the U.K., Hassan and his colleagues (2008) adopted an integrated, multicourse, project-based learning methodology in electronic engineering in Spain and Fernandes *et al*. (2014) followed the project-led education model developed by Powell and Weenk (2003), to engage pupils in learning at a University in Portugal. In Australia, Stewart (2007) investigated the link between self-directed learning readiness and project-based learning outcomes in a postgraduate management course and found that self-directed learning readiness, such as having high self-management skills, was a key enabler for achievement learning outcomes from project-based learning. Another study (Gibbes and Carson, 2014) investigated project-based language learning using Activity Theory in a university language programme in Ireland. This study reported mixed results in learning outcomes for the study participants because of contradictions found in the activity system (e.g. inequitable divisions of labour, perceived lack of time due to community obligations or opposition to the rules governing the activity in the modules).

Some studies have applied the principles of project-based learning with pre-service teachers and claimed that student-teachers can become better problem-solvers (Mettas and Constantinou, 2008), can gain benefits from formative assessment (Frank and Barzilai, 2002) and become more aware of the object of learning which can then lead to enhanced learning among pre-school children (Ljung-Djärf, Magnusson and Peterson, 2014).

The review of the literature indicated certain factors that can help facilitate the adoption of project-based teaching instruction in the classroom. These are summarised in the section that follows.

Facilitating factors in the implementation of project-based learning instruction

On the basis of their study and findings, Al-Balushi and Al-Aamri (2014) concluded that project-based instruction is not more demanding than traditional instruction in terms of resources and time and can be implemented with few resources, inside the school building and within the time allocated for the study of particular topics.

Modern digital technology is a major enabler for pupils to comfortably engage with the process of designing and developing their project as they can document the whole process and easily share their creations in a digital format (Patton, 2012). Effective use of technology as an integrated part of the pedagogical processes has been found to help both weakly and strongly performing pupils construct knowledge in the project-based learning environment (Erstad, 2002). However, Bell (2010) points out that children need to be guided and supported in using technology safely and effectively to gain the creativity affordances that technological involvement can offer.

Furthermore, group processes of high quality (conceptualised as group members showing positive interdependence, individual accountability, equal participation and social skills) have been found to play a pivotal role to the success of collaboration in project-based learning (Cheng, Lam and Chan, 2008). High quality group work becomes even more important when challenges associated with social class differences, gender and attainment hierarchies have been found to affect power relations among

some pupils in the project-based learning group leading to unequal learning possibilities with some pupils enjoying more agency than others (Crossouard, 2012). Crossouard argues that teachers need to be better supported, both within initial teacher education and continuing professional development, to develop more sensitivity towards the social and gendered hierarchies that can often be implicit in pupils' discourse, particularly in relation to peer assessment interactions. Issues of social equity can thus become part of the pedagogic focus and the language used in the classroom in order to explore social relations.

The successful implementation of project-based learning in the classroom lies on the teacher's ability to effectively scaffold pupils' learning, motivate, support and guide them along the way. Effective scaffolded instruction within high-quality experiences will help reduce pupils' 'cognitive load' (Hmelo-Silver, Duncan and Chinn, 2007), will enable them to make small successful steps and ultimately achieve 'cognitive growth just beyond their reach' (Bell, 2010, p.41). Leaving scope for learner control of the learning process is crucial with teachers and pupils having to work together to reflect upon the purpose of the project, set clear and realistic goals, and make decisions regarding the pace, sequencing and content of learning (Helle *et al*., 2006). In scaffolding pupils' learning, teachers may need to give pupils insight into the content of the desired response in project-based learning in order to allow them to recognise and take up the learning opportunities afforded in the classroom (Gresalfi, Barnes and Cross, 2012). Based on their case study findings in the U.S., Grant and Branch (2005) concluded that the exploration of cross-disciplinary units and team teaching should be emphasised so that pupils can understand how their abilities can be used across domains and avoid the fragmentation of skills and knowledge.

The level of support that teachers get from the school's senior management (Erstad, 2002) and from other colleagues is of particular importance. Lam, Cheng and Choy (2010) concluded that when teachers felt well supported by their schools in terms of their competence and autonomy, they were more motivated to implement and persist in using project-based learning.

The use of a two-phase project-based approach has been put forth in the literature as an effective approach to first help the pupils become sufficiently competent by developing the knowledge and skills needed to then be able to design and make products independently in the second phase (see, for example, Drain, 2010; Good and Jarvenin, 2007). Drain (2010) used the Cognitive Apprenticeship framework which, on the basis of situated cognition theory, claims that learning is maximised when it occurs in real life contexts and pupils engage with authentic problems. This was a case study of a primary school class (Year 5) in New Zealand and their teacher during a technology unit. The first part of the unit aimed to help pupils develop knowledge of technological concepts and procedures through appropriate activities while the second half enabled pupils to be creative and exercise initiative in designing and creating their projects. The importance of balancing didactic instruction with in-depth inquiry methods has also been emphasised by Grant and Branch (2005). Student assessment needs to be aligned to the unique features of the project-based learning process and outcomes with teachers identifying suitable assessment moments where they can first generate 'teachable moments' (Lehman, George, Buchanan and Rush, 2006) and then create formative scaffolds to guide and support their pupils along the project process (Hmelo-Silver *et al*., 2007). Assessment in project-based learning has been described as 'authentic' (Bell, 2010, p.43) which, in addition to measuring a child's performance via rubrics, it primarily focuses on reflection, self and peer evaluation. Self-assessment skills can help pupils learn to regulate their own learning and acquire ownership of the learning process (Ertmer and Simons, 2005).

How teachers can support project-based learning in the classroom – what the evidence shows

Mergendoller and Thomas (2005) interviewed twelve expert teachers in project-based learning in the U.S. to elicit the teachers' strategies for implementing and managing the project, and maximizing its success. These teachers were recognised as experts within the national PBL community, they had

trained other teachers and had made presentations on project-based learning at various professional conferences and workshops. Forty three questions formed part of the semi-structured interview schedule and covered aspects of overall planning and project planning, carrying out the project and the future of project work in the classroom. The interview transcripts were coded into narrative segments that led to themes about aspects of project implementation such as time management, getting started and managing student groups. This analysis revealed a number of successful techniques employed by expert teachers in project-based learning and were grouped around seven overarching themes and 18 sub-themes. Each sub-theme comprised a number of principles or guidelines which aim to provide practical advice to teachers and are summarised below under each theme.

1. Time management – This theme relates to scheduling projects effectively by coordinating project schedules with other teachers, for example, or use block scheduling to increase flexibility, and be able to hold to timelines by building in a 20% overrun when planning a project or learning when to enforce and when to extend a time line.
2. Getting started – This theme is about orienting pupils, i.e. getting them think about the project well before they begin, giving them a rubric that clearly explains what they are expected to search for and try to accomplish and jointly agreeing on grading criteria before the start of the project. The 'getting started' theme is also about encouraging thoughtful work early on in the project in developing a research plan and a suitable research question while facilitating a sense of mission.
3. Establishing a culture that stresses student self-management – Here, responsibility is shifted from the teacher to pupils where pupils are involved in project design, they make decisions for themselves and they are encouraged to learn how to learn.
4. Managing student groups – The emphasis is on establishing the appropriate grouping pattern, promoting full participation and keeping track of each group's progress through discussion, monitoring and recording evidence of progress.
5. Working with others outside the classroom, such as other teachers, parents and people from the community in order to work out the feasibility and nature of external partnerships.
6. Getting the most out of technological resources, such as judging the suitability of using technology for the project, making efficient use of the internet by being encouraged to make informed choices in exploring relevant web sites and developing critical thinking skills.
7. Assessing pupils and evaluating projects – This final theme refers, firstly, to the importance of grading pupils by using a variety of assessment methods, including individual and group grades and giving emphasis to individual over group performance and, secondly, to adequately debriefing projects by demonstrating reflection strategies and collecting formative evaluation information from pupils about the project and how it might be improved.

Starting from the premise that project-based teaching assumes significant changes in classroom practices, Krajcik, Blumenfled, Mars and Soloway (1994) described how teachers can learn to address the new challenges presented through the dynamic interplay of three elements in middle school science teaching: teachers' *collaboration* with consultants and university personnel to share and critique ideas, plans and teaching activities; *classroom enactment* where teachers plan and carry out new practices in the classroom in an attempt to construct and generate understandings about what is possible in their classroom, modify their thinking and adopt the most appropriate teaching strategies; teachers' *reflection* on their teaching via journals, case reports or videotapes of classroom implementation to develop the knowledge that will help promote student learning.

Recommendations made on the basis of the evidence

On the basis of the literature review, the following six key recommendations can be made which are considered to be essential for the successful adoption of a project-based learning approach in the mainstream school setting.

1. *Student support*: pupils need to be effectively guided and supported; emphasis should be given on effective time management and student self-management including making safe and productive use of technological resources.
2. *Teacher support*: regular support needs to be offered to teachers through regular networking and professional development opportunities. The support from the school senior management is crucial.
3. *Effective group work*: high quality group work will help ensure that pupils share equal levels of agency and participation.
4. *Balance between didactic instruction with independent inquiry method* work will ensure that pupils develop a certain level of knowledge and skills before being comfortably engaged in independent work.
5. *Assessment emphasis on reflection, self and peer evaluation*: evidence of progress needs to be regularly monitored and recorded.
6. An element of *student choice and autonomy* throughout the project-based learning process will help pupils develop a sense of ownership and control over their learning.

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Appendix C: Consent and Information Sheet Examples

Innovation Unit's Memorandum of Understanding with Control Schools

Innovation Unit

Memorandum of Understanding (MoU) between
The Innovation Unit Limited and
_____ School ('the Parties')

Parties

- **The Innovation Unit Limited** (company registration number 05997039 and registered address of CAN Mezzanine, 49-51 East Road, London, N1 6AH)
- _____ **School,** a school based at

1. Purpose and Scope

This MoU describes the framework within which _____ and **The Innovation Unit** will work together on _Learning through REAL Projects;_

Project description
Innovation Unit has received a grant from the Education Endowment Foundation to run a Randomised Controlled Trial of Project Based Learning (which we call _Learning through REAL Projects_). This programme aims to raise attainment by engaging students more deeply in their learning. There is evidence of benefits of this approach from the US, but it has yet to be rigorously tested in the UK. A pilot of the support package is being run with 8 schools during the academic year 2013-14.

The aim of this programme is to evaluate the impact of _Learning through REAL Projects_ on students' literacy and engagement outcomes. The results of the research will contribute to our understanding of what works in raising pupils' attainment and will be widely disseminated to schools in England. Ultimately we hope that the evaluation will equip school staff with the skills to better design great learning to support and engage all students.

The research design
To find out what the impact is, Innovation Unit will compare a group of schools who implement _Learning through REAL Projects_ against those that do not.

24 Trial Schools have been randomly allocated into two groups of 12 (Group A and Group B) by evaluators at Durham University and the University of York.

The process of randomly allocating schools into one of two groups is critical to the research design. Randomisation helps ensure that the two groups to be compared are as similar as possible, thereby reducing any possible bias in findings.

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Selection to be one of the 24 Trial Schools was based on a number of factors including school capacity and commitment to high quality implementation of *Learning through REAL Projects*. From the perspective of the programme, schools in Group A and Group B are considered to be equal in every respect apart from the implementation (or not) of *Learning through REAL Projects*.

Should any school decide not to participate in the programme once randomization has occurred, it will not be possible to replace that school, and this could jeopardize the research.

Group A schools will form a control group for the duration of the trial and Group B schools will prepare for and then implement *Learning through REAL Projects* from 2014.

2. Responsibilities

_____ as a school allocated to the Control Group (Group A), will be responsible for the following;

- *Not* introducing *Learning through REAL Projects* practice with Innovation Unit support from September 2014 to July 2015. This is to ensure that there is sufficient distinction between the practice of the two groups of schools for meaningful conclusions to be drawn from the evaluation.
- Allowing evaluators to conduct online or paper assessment tests with students at the end of academic year 2014/15.
- Providing evaluators with additional information about the school and practice as requested.

Use of Data
A condition of funding by the EEF is that schools pass on their Unique Pupil Numbers (UPNs) to the evaluation team to allow the long term impact of the programme to be assessed. This is for all students in the Trial Schools taking part, from Group A and Group B. Parents and carers will however have the option to opt-out of their child's data (including UPNs) being used for any part of the evaluation.

Pupils' test responses and any other pupil data will be treated with the strictest confidence. The responses will be collected by the evaluators, Durham University and the University of York. Named data will be matched with the National Pupil Database and shared with the EEF. No individual school or pupil will be identified in any report arising from the research.

What _____ as a school allocated to the Control Group (Group A) will receive from Innovation Unit in terms of support:

- Designation as an EEF Research Partner School.

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- Regular updates on the progress of the trial.
- Data on student progress towards the end of Year 7 for all cohorts in the trial, provided by the independent evaluators, Durham University and the University of York.
- Innovation Unit, REAL Projects and Education Endowment Foundation logos for inclusion on school websites and other promotional material.
- There is **no payment commitment** for schools selected to Group A for the duration of the trial (*see note on funding below*).
- Schools in Group A will additionally receive a stipend to cover the costs incurred as a result of submitting students for assessment purposes, not to exceed £1,000 per school (*see attached Purchase Order*).
- Innovation Unit will keep Control Group schools informed of international study visits and relevant programmes and events.

3. Term

- The start date of this agreement is 24 February, 2014.
- The term of this MoU is for a period of 1 year and 5 months*, from the start date of this agreement until 31 July, 2015.

*Important note on funding and the duration of the Trial
Innovation Unit may secure funding for a second year of trial, and will contact Group A schools towards the end of academic year 2014/15 to let them know whether the trial will continue to academic year 2015/16.

If it does, schools in Group A must continue to *not* introduce *Learning through REAL Projects* practise in academic year 2015/16.

At this time, Group A schools may also decide to begin work with Innovation Unit to train staff and design projects from September 2015, in preparation for implementation from September 2016. This being the case, a new contract for services would be issued at this time.

If the trial runs to two years, Group A schools also commit to allowing evaluators to conduct online or paper assessment tests with Year 7 *and* Year 8 students at the end of academic year 2015/16.

Data on student progress for all cohorts in the trial, will be provided by the independent evaluators, Durham University and the University of York.

4. Contracting and Financial Arrangements

See attached Purchase Order.

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5. Revisions

Changes to this MoU can be made at any time if agreed by all the Parties and documented in writing.

6. Indemnification

Each Party agrees to defend, indemnify and hold harmless the other Parties, their officers, directors, employees, and agents from and against any and all claims, demands, actions, causes of action, penalties, judgments and liabilities (including court costs and reasonable legal fees) based upon or arising out of any act, omission, negligence, misconduct, or breach of any material condition of this agreement by the other party, its subcontractors, or their respective employees, representatives, servants, agents, invitees, licensees or contractors.

7. Intellectual Property

7.1   All Background Intellectual Property in Background Information used in connection with the Project shall remain the property of the party introducing the same (or their licensor) and such Background Information shall be clearly identified in writing to the other party. It should be noted for the purposes of this MoU that all materials, techniques and know how related to Project Based learning used by the project Based Learning Coaches are regarded as Background Intellectual Property.

7.2   Each Party authorizes the other party to utilize relevant Background Intellectual Property, on a non-exclusive, royalty free basis, in order to develop the Foreground Intellectual Property.

7.3   Under the terms of the Grant Agreement between Innovation Unit and The Education Endowment Foundation (EEF) – the main funders of this project - and the terms of the grant EEF received from the UK's Department for Education, Intellectual Property Rights directly associated with grant funding from EEF are to be vested in the Crown. The Parties therefore irrevocably assign all Foreground Intellectual Property Rights by way of present assignment of present and future rights with full title guarantee to EEF.

8. Disputes

In the event of a dispute, the Parties shall attempt to work together in good faith to resolve such dispute, and failing that, each Party shall retain any rights they may have under existing, applicable law.

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9. Confirmation of Agreement

On behalf of

Name:

Signature:

Position: Headteacher

Date:

On behalf of The Innovation Unit

Name: Gareth Wynne

Signature:

Position: Company Secretary

Date: 24 February, 2014

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Innovation Unit's Service Agreement with Intervention Schools

SERVICES AGREEMENT

between

THE INNOVATION UNIT LIMITED

and

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THIS AGREEMENT IS DATED   **10 FEBRUARY 2014**

BETWEEN:

The Parties

(1)   **THE INNOVATION UNIT LIMITED** a private company limited by
       guarantee, registered in England and Wales with company number
       05997039 and whose registered office is at CAN Mezzanine, 49-51 East
       Road, London N1 6AH (the "**Innovation Unit**") and

(2)   a school based at

This Agreement sets out the terms and conditions under which Innovation Unit will
carry out the services as set out in Schedule 1 ("**the Services**").

1   Definitions

1.1   In this Agreement the following expressions shall bear the following meanings:

Background Information	any information, know-how, methodologies or other materials introduced into, and used for the benefit of, the Project, by a party;
Background Intellectual Property	Any Intellectual Property already in existence and held by either Party before this agreement commenced;
Business Day	means a day (other than a Saturday or a Sunday) on which commercial banks are open for general business in London;
Effective Date	means the date of this Agreement;
Fees	means the sums due on successful completion of each of the milestones set out in Schedule 1 totalling £10,000 plus reasonable travel expenses plus VAT (at the prevailing rate);

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FOI Legislation	means the Freedom of Information Act 2000 (FOIA), all regulations made under it and the Environmental Information Regulations 2004 (EIR) and any amendment or re-enactment of any of them; and any guidance issued by the Information Commissioner, the Department for Constitutional Affairs, or the Department for Environment Food and Rural Affairs (including in each case its successors or assigns) in relation to such legislation;
Foreground Intellectual Property	any Intellectual Property that arises or is obtained, licenced to or developed by either Party in connection with the Project, including without limitation any Intellectual Property in the associated deliverables set out in Schedule 1 and the Proposal;
Milestone	means the point at which the deliverables specified in Schedule 1 are to be completed;
Intellectual Property	any patents, rights to inventions, copyright and related rights, trade marks, trade names and domain names, rights in designs, rights in computer software, database rights, rights in confidential information (including know-how and trade secrets) and any other intellectual property rights, in each case whether registered or unregistered and all similar or equivalent rights or forms of protection existing anywhere in the world which subsist or will subsist, now or in the future;
Project	means the project detailed in Schedule 1;
Request for Information	shall have the meaning set out in the FOIA or EIR as relevant; and

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Term the duration of the provision of the Services commencing on 10 February 2014 and ending on 31 July 2015.

1.2   The headings of the clauses and schedules of this Agreement are used for convenience only and shall not affect the construction of this Agreement. The schedules form part of this Agreement.

1.3   If there is an inconsistency between any of the provisions of this Agreement and the Proposal, the provisions of this Agreement shall prevail.

2   Consideration

2.1   In consideration of Innovation Unit performing the Services and subject to it performing its obligations under this Agreement and the provision of associated deliverables set out in Schedule 1,   shall pay the Fees to Innovation Unit according to the payment schedule and timetable set out in Schedule 1.

3   Innovation Unit's Obligations

3.1   Innovation Unit warrants and undertakes that it will, and will procure that any sub-contractor will:

3.1.1 perform the Services during the Term in accordance with this Agreement and the Proposal and according to the timescales and conditions set out therein;

3.1.2 at all times act in good faith towards   and any other third parties;

3.1.3 supply to   , at such times as   shall reasonably request, any information howsoever relating to the Services that   may require from time to time ("**Information Request**");

3.1.4 for each Information Request, provide such further information as is reasonably requested by   ;

3.1.5 perform the Services according to the highest professional standards expected of a competent supplier of services identical or similar to the Services and in a diligent, competent and co-operative manner and ensure that any reports provided are of high quality.

3.1.6 keep   informed as to the progress of the Services, or any problems experienced and to inform   promptly of any new developments or of any potential opportunities that Innovation Unit may identify from time to time;

3.1.7 on Customer's request, return any equipment given by Customer to Innovation Unit and treat such equipment with reasonable care and only use such equipment for business purposes relating to the provision of the

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Services;

3.1.8 perform the Services in accordance with all applicable laws, rules and regulations;

3.1.9 perform the Services in an ethical and trustworthy manner in all respects and in particular (but without limitation), Innovation Unit will:

3.1.9.1   behave honestly and courteously to any persons Innovation Unit may come into contact with whilst performing the Services;

3.1.9.2   update   on a regular basis, including being honest and open about any difficulties that it may have encountered;

3.1.9.3   provide any or all information required by   for the purposes of   effective monitoring of the progress and quality of the Services being provided;

3.1.9.4   meet with   or its nominated representatives at such reasonable intervals as   shall request, to discuss the performance of the Services and their progress;

3.1.9.5   nominate Louise Thomas(the "**Project Director**") to oversee the provision of the Services and act as   's key contact. The Project Directors shall have all necessary expertise and have authority to make decisions on Innovation Unit's behalf with regard to the Services. Innovation Unit agrees that in the event that Louise Thomas cannot for any reason continue as Project Director it will agree a suitable replacement with   ;

3.1.9.6   ensure that the persons appointed to provide the Services are suitably qualified and are able to dedicate sufficient time and attention to allow the Project to progress in line with the timescales set out in the Schedule 1 and the Proposal;

3.1.9.7   allow such staff from   or any agents of   to contribute to, assist with or participate in the provision of the Services as   deems at its sole discretion necessary.

4   's Obligations

4.1   shall give clear and timely instructions and information to Innovation Unit to enable Innovation Unit to provide the Services.

4.2   agrees to implement learning through real projects as per Schedule 1.

4.3   will be responsible for ensuring participating staff are released for appropriate time on the agreed days including the training session for teachers.

5   Fees

5.1   All sums payable to Innovation Unit under this Agreement are exclusive of VAT which shall, where applicable, be payable on submission of an appropriate VAT invoice at the prevailing rate.

5.2   The Fees shall be inclusive of all expenses incurred by Innovation Unit in

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connection with the Services, and Innovation Unit shall be responsible for all costs and expenses incurred in this respect.

5.3   will settle invoices approved by it within 30 days of receipt, provided always that such invoices are submitted in accordance with the Milestones.

5.4   No refunds will be offered in the event that   chooses to withdraw from being a Implementation School and the full fees will still be due on milestone dates.

6   Warranties

6.1   Innovation Unit hereby warrants and agrees that:

6.1.1 it has or will obtain all rights, licenses, consents, approvals, permissions, permits, tests and other certificates and authorities (whether public or private) necessary to perform the Services;

6.1.2 any materials produced in performing the Services or developing the Project will not infringe the intellectual property rights (or any other rights) of any third party;

6.1.3 it has not licensed or assigned any rights in the Background Intellectual Property or the Foreground Intellectual Property to any third party in any part of the world;

6.1.4 it has the appropriate time, skills, experience and resources to perform and deliver the Services in accordance with this Agreement;

6.1.5 all information, data and materials provided at any time by or on its behalf to   is true and accurate;

6.1.6 it has full power and authority under its constitution and has taken all necessary actions to execute and perform this Agreement;

6.1.7 it and any sub-contractors engaged in accordance with clause 14.1 do not have any actual or potential conflict of interest with   (including its trustees, officers or employees) in entering into and carrying out its obligations in accordance with the terms of this Agreement and Innovation Unit will immediately inform   if Innovation Unit becomes aware of any actual or potential conflict of interest, whereupon it will be at   's discretion whether or not to continue the arrangements as set out in this Agreement.

7   Publicity

7.1   Innovation Unit will comply with   's publicity requirements from time to time.

7.2   will comply with EEF's publicity requirements from time to time.

8   Duration

8.1   The terms of this Agreement shall become effective on the Effective Date and,

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subject to this clause 8, shall continue in effect for the duration of the Services.

8.2   Either party may terminate this Agreement immediately by giving the other notice in writing if the other has committed a material or persistent breach of its obligations or ceases for any reason to carry on business, or is unable to pay its debts as they fall due, or has a receiver, manager, administrator administrative receiver or liquidator appointed in relation to its assets.

8.3   Termination of this Agreement shall not prejudice the accrued rights and obligations of either party. The following paragraphs shall continue in force following termination: 6-22 inclusive.

9   Indemnity and Limitation of Liability

9.1   's total liability to Innovation Unit, whether in contract, tort (including negligence) or otherwise in connection with this Agreement shall in no circumstances exceed a sum equal to the Fees paid or payable, provided always that nothing in this Agreement shall limit the liability of either party for death or personal injury caused by its negligence, for fraudulent misrepresentation, or for breach of any of the obligations under the Sale of Goods Act 1979 or the Supply of Goods and Services Act 1982 which may not be excluded by contract.

10   Rights of Third Parties

10.1   A person who is not a party to this Agreement may not rely upon it or enforce any rights pursuant to the Contract (Rights of Third Parties) Act 1999.

11   Provision of Information and Freedom of Information

11.1   In the event that   is subject to the provisions of Freedom of Information Act, Innovation Unit will, on written request from   , provide   with any information relating to the Services as   may reasonably require.

12   Intellectual Property

12.1   All Background Intellectual Property in Background Information used in connection with the Project shall remain the property of the party introducing the same (or their licensor) and such Background Information shall be clearly identified in writing to the other party. It should be noted for the purposes of this contract that all materials, techniques and know how related to Project Based learning used by the project Based Learning Coaches are regarded as Background Intellectual Property.

12.2   Each Party authorizes the other party to utilize relevant Background Intellectual Property, on a non-exclusive, royalty free basis, in order to develop the Foreground Intellectual Property.

12.3   Under the terms of the Grant Agreement between Innovation Unit and The Education Endowment Foundation (EEF) – the main funders of this project - and the terms of the grant EEF received from the UK's Department for Education,

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Intellectual Property Rights directly associated with grant funding from EEF are to be vested in the Crown. The Parties therefore irrevocably assign all Foreground Intellectual Property Rights by way of present assignment of present and future rights with full title guarantee to EEF.

13   Confidentiality

13.1   Innovation Unit agrees at all times to keep strictly secret and confidential all information and materials (in whatever form) disclosed to Innovation Unit by or on behalf of   ("**Confidential Information**"), and not at any time for any reason whatsoever (whether before or after termination or expiry of this Agreement) disclose the Confidential Information to any third party and only use it for the purposes of performing the Services.

13.2   Innovation Unit shall procure that all of its employees, agents, sub-contractors and professional advisors having access to any of the Confidential Information shall be subject to the same confidentiality obligations as set out in this clause 13.

13.3   The obligations of confidence referred to in this Agreement shall not apply to any information which:

13.3.1 is required to be disclosed by law; or

13.3.2 is already lawfully in the public domain; or

13.3.3 Innovation Unit can prove by documentary evidence was already in its possession; or

13.3.4 is disclosed by Innovation Unit with the express written consent of

14   Assignment and Variation

14.1   Innovation Unit may not assign or sub-contract any of its obligations set out in this Agreement, without   's prior written consent.

14.2   Any amendment to the terms of this Agreement must be agreed in writing by both parties.

15   Disrepute

15.1   Innovation Unit will not, either by act of neglect or default, do anything which is or may reasonably be expected to be injurious to the interests or reputation of

16   Legal relationships

16.1   Nothing in this Agreement creates a partnership, a joint venture, the relationship of employer and employee, or establishes a relationship of principal and agent or other fiduciary relationship between the parties to this Agreement, and neither   nor Innovation Unit will hold itself out as having any authority to incur any obligation of any nature whether express or implied on the other's behalf.

17   Further Assurance

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17.1 Innovation Unit shall support   to obtain the full benefit of this Agreement, whether in connection with any registration of title or other similar right or otherwise.

18   Prevention of Corruption

18.1 Innovation Unit shall at all times and shall procure that any sub-contractors engaged in accordance with clause 14.1 shall at all times:

18.1.1 act lawfully, ethically and in good faith in its dealings with and comply fully with the Prevention of Corruption Acts 1889 to 1916, the Bribery Act 2010 and any related regulations rules, procedures or like legislation; and

18.1.2 report promptly to   any fraud, theft and/or corruption of which Innovation Unit becomes aware or suspect to have occurred in relation to the provision of the Services.

18.2 Innovation Unit shall ensure that, at any time when its employees or sub-contractors are on   's premises, they comply in full with   's policies and procedures relating to health, safety and security and any instructions given to Innovation Unit by   or its officers in that regard.

19   Entire Agreement

19.1 This Agreement, constitutes the whole agreement between ourselves relating to its subject matter and supersedes and extinguishes any prior drafts, agreements, undertakings, representations, warranties and arrangements of any nature, whether in writing or oral, relating to such subject matter provided that this paragraph 19.1 shall not operate to exclude either party's liability to the other for fraudulent misrepresentation. In the event of any inconsistency between the terms of this Agreement and the Proposal, the terms of this Agreement shall prevail.

20   Waiver

20.1 Failure or neglect by either party to enforce at any time any of the provisions of this Agreement shall not be construed nor shall it be deemed to be a waiver of our respective rights hereunder, nor in any way affect the validity of the whole or any part of this Agreement, nor prejudice our respective rights to take subsequent action.

21   Force Majeure

21.1 Innovation Unit shall not be liable to   in respect of anything which, apart from this provision, may constitute a breach of this Agreement arising by reason of circumstances outside of Innovation Unit's reasonable control ("**Force Majeure**").

21.2 Innovation Unit shall give to   notice as soon as practicable upon becoming aware of an event of Force Majeure which prevents performance of its respective obligations under this Agreement, and of the cessation of the said event.

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21.3 If the Force Majeure event prevails for a continuous period of more than one month,   may terminate this Agreement by giving 14 days' written notice to Innovation Unit. On the expiry of this notice period, this Agreement will terminate. Such termination shall be without prejudice to the rights of the parties in respect of any breach of this Agreement occurring prior to such termination.

22   Governing Law and Jurisdiction

22.1 Both parties agree that this Agreement shall be governed by and interpreted in accordance with English Law, and hereby submit to the exclusive jurisdiction of the English Courts.

Signed by Gareth Wynne
Company Secretary
For and on behalf of Innovation Unit

Dated   10 February 2014

Signed by

For and on behalf of   ....

Dated: ....

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Schedule 1

<u>**The Project**</u>

Learning through REAL Projects
Trial School Contract Schedule
for schools allocated to Implementation Group (Group B)

Project description

Innovation Unit has received a grant from the Education Endowment Foundation to run a Randomised Controlled Trial of Project Based Learning (which we call *Learning through REAL Projects*). This programme aims to raise attainment by engaging students more deeply in their learning. There is evidence of benefits of this approach from the US, but it has yet to be rigorously tested in the UK. A pilot of the support package is being run with 8 schools during the academic year 2013-14.

The aim of this programme is to evaluate the impact of *Learning through REAL Projects* on students' literacy and engagement outcomes. The results of the research will contribute to our understanding of what works in raising pupils' attainment and will be widely disseminated to schools in England. Ultimately we hope that the evaluation will equip school staff with the skills to better design great learning to support and engage all students.

The research design

To find out what the impact is, we will compare a group of schools who implement *Learning through REAL Projects* against those that do not.

24 Trial Schools have been randomly allocated into two groups of 12 (Group A and Group B) by evaluators at Durham University and the University of York.

The process of randomly allocating schools into one of two groups is critical to the research design. Randomisation helps ensure that the two groups to be compared are as similar as possible, thereby reducing any possible bias in findings.

Selection to be one of the 24 Trial Schools was based on a number of factors including school capacity and commitment to high quality implementation of *Learning through REAL Projects*. From the perspective of the programme, schools in Group A and Group B are considered to be equal in every respect apart from the implementation (or not) of *Learning through REAL Projects*.

Should any school decide not to participate in the programme once randomization has occurred, it will not be possible to replace that school, and this could jeopardize the research.

11

Group B will prepare for and then implement *Learning through REAL Projects* from 2014, with Group A forming a control group.

What schools allocated to the Implementation Group (Group B) will receive from Innovation Unit in terms of support

All 24 Trial Schools will receive:
- Designation as an EEF Research Partner School
- Regular updates on the progress of the trial
- Data on student progress towards the end of Year 7 for all cohorts in the trial, provided by the independent evaluators, Durham University and the University of York
- Innovation Unit, REAL Projects and Education Endowment Foundation logos for inclusion on school websites and other promotional material.

In addition, schools allocated to Group B will receive support from Innovation Unit to implement *Learning through REAL Projects* as follows:

Preparation support package (Jan-Jul 2014):
- 3 day residential induction training on *Learning through REAL Projects* for up to 8 members of staff.
- One day whole staff INSET (subject to availability of coaches).
- 3 days leadership support from expert coaches and former headteachers.
- 3 days *Learning through REAL Projects* support from expert coaches from High Tech High.
- Opportunity to meet other schools in Group B through events and online collaboration.
- Visits to Innovation Unit Developer Schools already implementing *Learning through REAL Projects.*

Implementation support package (from Sept 2014):
- 18 days support by High Tech High coaches in academic year 2014/15 (one day per school per fortnight); (12 days in academic year 2015/16*).
- Up to 9 days of leadership support (3 per term) in academic year 2014/15; (4 days in academic year 2015/16*).
- Access to online and face-to-face opportunities to network with other schools.
- Tools and resources.

What schools allocated to the Implementation Group (Group B) contribute to the costs of the programme

Schools randomized to Group B commit to:

- A period of preparation and a minimum of 1* year of implementation at a cost of £10,000 + VAT plus reasonable travel expenses incurred by coaches.

- Covering staff travel and accommodation expenses and any supply cover to enable staff participation in the programme.

12

What schools allocated to the Implementation Group (Group B) commit to delivering as part of the programme

Schools randomized to Group B commit to:

- Delivering *Learning through REAL Projects* to Year 7 cohort starting in September 2014 (moving to incoming Y7 and Y8 from 2015*) (see 'Definition' of REAL Project Based Learning outlined in the *Learning through REAL Projects - Handbook for Trial Schools*).

- Implementing changes to staffing and timetable structures according to the 'Minimum Implementation Commitments' detailed in the *Learning through REAL Projects - Handbook for Trial Schools*.

- Releasing all relevant staff for at least 6 days training during the spring and summer terms 2014 (3 days formal induction training plus 3 days school based project design work).

- Allowing coaches from High Tech High and Innovation Unit to work with leaders, teachers and students to develop outstanding REAL Project Based Learning practice.

- Allowing evaluators to conduct online and paper assessment tests with students at the end of academic year 2014/15 (and academic year 2015/16*).

- Providing evaluators with additional information about the school and practice as requested.

*Important note on funding and the duration of the Trial

Innovation Unit may secure funding for a second year of trial, and will contact Group B schools towards the end of academic year 2014/15 to let them know whether the trial will continue to academic year 2015/16.

If it does, schools in Group B will continue to receive the support above in academic year 2015/16.

If the trial runs to two years, Group B schools also commit to allowing evaluators to conduct online or paper assessment tests with Year 7 *and* Year 8 students at the end of academic year 2015/16.

Data on student progress for all cohorts in the trial, will be provided by the independent evaluators, Durham University and the University of York.

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Use of Data

A condition of funding by the EEF is that schools pass on their Unique Pupil Numbers (UPNs) to the evaluation team to allow the long term impact of the programme to be assessed. This is for all students in the Trial Schools taking part, from Group A and Group B. Parents and carers will however have the option to opt-out of their child's data (including UPNs) being used for any part of the evaluation.

Pupils' test responses and any other pupil data will be treated with the strictest confidence. The responses will be collected by the evaluators, Durham University and the University of York. Named data will be matched with the National Pupil Database and shared with the EEF. No individual school or pupil will be identified in any report arising from the research.

Milestones and invoicing schedule

The Fees will be payable upon delivery of the deliverables outlined above by the Milestone dates set out below and in accordance with the terms of this Agreement.

Milestone Number	Associated Payment Amount	Description	Due Date
1	£5,000 + VAT	On signature of contract by customer.	By 28 February 2014
2	£5,000 + travel expenses + VAT	On completion of services	1 July 2015
Total	**£10,000 + travel expenses plus VAT**		

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School information sheet, recruitment

Innovation Unit | Learning through **REAL PROJECTS** | **E**ducation **E**ndowment **F**oundation

Dear *[name of headteacher]*

Innovation Unit is seeking 24 schools eager to transform their teaching and learning in Key Stage 3.

This is your opportunity to participate in a national programme that raises achievement by increasing student engagement in learning.

We are very pleased to invite *[name of school/alliance / cluster / trust]* to register your interest in being one of those 24 schools by 31 July 2013.

We have received a grant from the Education Endowment Foundation to run the first major trial of *Learning through REAL Projects* in the UK. This is one of the larger and more ambitious projects supported by the Foundation.

Learning through REAL Projects uses student enquiry, feedback and public exhibition of student work to promote deep learning of subject knowledge and learning that has a real impact on the world outside school. Please see the enclosed summary for more information on REAL Projects.

There is evidence from the US that *Learning through REAL Projects* has a strong positive impact on student achievement, student engagement in learning and students' success at College and University. Please see the enclosed summary for more information about our US partners High Tech High, world leaders in educational innovation.

Innovation Unit currently employs teachers from High Tech High to support pioneering schools in England to develop world class practice. We are now searching for 24 new schools to participate in this trial. Each trial school will receive:

- training for classroom teachers in *Learning through REAL Projects*,
- in-school coaching from High Tech High teachers,
- leadership coaching and support from Innovation Unit Senior Associates,
- data, research and evaluation from University of Durham, and
- an opportunity to learn from and develop your practice with other schools.

There are two phases to the trial. If selected to participate, your school will be randomly allocated to one of the two phases:

Phase 1: Begins January 2014, with implementation with Year 7 from September 2014 (next year)
Phase 2: Begins September 2015, with implementation with Year 7 from September 2016.

Although the summer break is so close, it would really help us to plan for the autumn term and to guarantee your place on our register, if you could return your statement of interest by 31 July 2013. This only requires minimal information from you at this stage. All interested schools will be invited to an event in October 2013 to find out more, and schools will be chosen and notified by January 2014. Please respond using the enclosed Register of Interest form.

We really look forward to hearing from you.

Parent opt-out letter

CEM
Centre for Evaluation & Monitoring

Rowan House
Mountjoy Centre
Durham University, Stockton Road
Durham, UK DH1 3U2
Tel: +44 (0) 191 3344682
www.cem.org

23rd January 2015

Dear Parent/Carer

Learning through REAL Projects Evaluation by Durham University

I am writing to let you know about a research study which will be taking place in your child's school during the 2014/15 school year. The school has signed up to be involved with the 'Learning through REAL Projects' initiative led by the Innovation Unit. This will involve teachers in the school delivering some Year 7 teaching through project-based learning this year. The school will be able to provide more information on what this means for your child.

Durham University are funded by the Education Endowment Foundation (EEF) to evaluate the impact of the 'Learning through REAL Projects' initiative on pupils' learning and their attitudes to school. The head teacher of the school has given permission for the school to take part, and the study will involve all pupils in Year 7.

We will be asking pupils to complete a literacy assessment at the end of the year in June 2015. The assessments will be marked by GL Assessments and the results will be given to the researchers at Durham University. We will forward the results to the school to inform teaching. We will also ask pupils to complete a questionnaire about their attitudes to school and learning. We plan to match the data from the assessments to the pupils' Key Stage 2 data and their future achievement through linking our results with the National Pupil Database (NPD).

To help us with this research the school will pass on some background information about pupils (name, date of birth, gender, and Unique Pupil Number) to Durham University. This information will enable us to match up the information from the assessment with past and future attainment as well as other contextual information (such as Free School Meal status) from the NPD. All data collected will be treated confidentially and will only be used for research purposes. The data for your child's school will be analysed anonymously, together with data from other schools, and no individual pupils or schools will be named in any report. We will share data with our partner researchers at the University of York, with the Department for Education (to link to the NPD) and also with EEF data managers and the UK Data Archive for future research purposes.

I do hope that we have your support for this important study and that you are happy for your child's data to be used in this way. If you would prefer we did not use your child's data in this research study please contact the school to opt out at any time during the project. You can also contact the research team directly using the contact details below.

If you have any questions about the study please contact Clare Collyer, Project Administrator on 0191 334 4682, or email clare.collyer@cem.dur.ac.uk.

Yours faithfully,

Victoria Menzies

Victoria Menzies, Project Researcher

Professor Robert Coe BA FdCE MPhil PhD (Director)
Dr Christine Merrell BSc FdCE MEd PhD (Director of Research and Development)
Mark Wightman BSc (Director of Operations)
Emma Beatty BSc (Director of Technology)
Katharine Bailey BSc MA (Director of Business Development)

Durham University

Pupil focus group, Parent opt-in

CEM
Centre for Evaluation & Monitoring

Rowan House
Mountjoy Centre
Durham University, Stockton Road
Durham, UK DH1 3UZ
Tel: +44 (0) 191 3344682
www.cem.org

Learning through REAL Projects Evaluation by Durham University

Dear Parent/Carer

We are writing to the parents/carers of pupils in Year 7 in your child's school. Durham University has been funded by the Education Endowment Foundation to evaluate the Learning through REAL Projects programme which <school> is taking part in this year. We want to find out more about what pupils think of learning in this way at school and to look at any improvements that could be made to the programme in the future. As part of our evaluation, researchers from the university will be visiting the school over the course of the next few months. This will be to see how teaching through projects works in practice as well as to talk to some of the pupils and staff involved.

We would like to hold a group discussion (or focus group) with some Year 7 pupils. This will involve two researchers from the university meeting with a small group of pupils (5-6 children) accompanied by a member of staff from the school. We will ask the children questions about their experiences of doing different projects at school, including telling us what they enjoyed about each project and what they learned. We expect the focus group to last for about half an hour and to take place during school time. The discussion will be recorded so that we can write up what is said afterwards; however, the recording will be deleted after notes have been taken from it. All comments and responses will be treated confidentially and no individuals will be named in any report about the project. Participation in the focus group is voluntary and pupils will be given the choice to take part on the day.

If you are happy for your child to be involved in a focus group please complete the tear off sheet below and return it to the school, who will pass it on to the research team.

If you need further information about the evaluation or have any questions please contact the Research Team through Clare Collyer, Project Administrator: clare.collyer@cem.dur.ac.uk; 0191 334 4682.

Yours faithfully

Victoria Menzies
Project Researcher

- -

☐ I give consent for my child to be included in a focus group for the Learning through REAL Projects evaluation to find out about the pupils' experiences of learning in this way.

Signed .... Date.................................

Child's name ....Class / teaching group.......................................

Appendix D: Attitudes to School and Learning Questionnaire

Attitudes to School and Learning Questionnaire

Independent Evaluation of Learning through REAL Projects Programme

We would like to learn about how you feel about school and your attitudes to learning generally. This information is being collected as part of a research project being done at Durham University which is evaluating different ways of teaching and learning in schools. We are working with twenty four different schools and looking at whether the way some schools teach different subjects can changes pupils' attitudes.

The answers you give will be kept confidential. We will collect the questionnaire in today and it will be sent back to the university. We won't share your individual answers with your teachers. We will keep your information secure.

The questions require you to indicate how true the statement is for you. Try to be as honest as you can. There are no right or wrong answers.

If you don't want to answer a question just leave it blank and move onto the next one.

Please ask any questions you have by putting your hand up.

You will have up to half an hour to complete the questionnaire.

About you

First Name	
Surname	
Date of birth	
School	
Gender (please tick)	Male		Female	

About school

	Very true	Mostly true	Not very true	Not at all true
1. I feel like a part of the school.				
2. Other pupils in this school take my opinions seriously.				
3. There's at least one adult in the school I can talk to if I have a problem.				
4. I can really be myself at school.				
5. My teachers know I can do good work.				
6. Most mornings I am keen to go to school.				
7. School is a nice place to be.				
8. All pupils at this school have a good chance to be successful in the future.				
9. I respect my teachers.				
10. I make friends easily at school.				
11. At school teachers treat pupils fairly.				
12. Teachers at this school care about the pupils.				
13. My teachers are open and honest.				
14. Teachers listen to pupils' ideas.				
15. Pupils help each other learn.				
16. Pupils are friendly to each other.				

Motivation at school

	Very true	Mostly true	Not very true	Not at all true
17. I like work that really makes me think.	☐	☐	☐	☐
18. I enjoy learning new things.	☐	☐	☐	☐
19. I try to learn from my mistakes.	☐	☐	☐	☐
20. I always try to get the best marks possible.	☐	☐	☐	☐
21. What we learn at school makes me interested to learn about new things.	☐	☐	☐	☐
22. I normally enjoy my classes.	☐	☐	☐	☐
23. I am interested in what I learn at school.	☐	☐	☐	☐
24. What I learn at school will be important in my future.	☐	☐	☐	☐
25. My school work is useful to me.	☐	☐	☐	☐

How I do at school

	Very true	Mostly true	Not very true	Not at all true
26. I think I will get good marks in school.	☐	☐	☐	☐
27. I find it easy to understand what is taught at school.	☐	☐	☐	☐
28. I am confident in my ability to succeed in school.	☐	☐	☐	☐
29. I think I'll get good marks in maths.	☐	☐	☐	☐
30. I think I'll get good marks in science.	☐	☐	☐	☐
31. I think I'll get good marks in English.	☐	☐	☐	☐

Getting involved in school

	Very true	Mostly true	Not very true	Not at all true
32. I talk with people outside of school about what I'm learning in class.	☐	☐	☐	☐
33. In class, I work as hard as I can.	☐	☐	☐	☐
34. I get involved in class discussions.	☐	☐	☐	☐
35. I pay attention in class.	☐	☐	☐	☐
36. I often answer questions in class.	☐	☐	☐	☐
37. I take pride in the quality of my school work.	☐	☐	☐	☐
38. I'm happy to ask my teachers for help.	☐	☐	☐	☐
39. In class, I ask questions to help me learn.	☐	☐	☐	☐
40. I let my teachers know what I'm interested in.	☐	☐	☐	☐
41. Sometimes I get so interested in my work I don't want to stop.	☐	☐	☐	☐
42. I help to choose what we learn about.	☐	☐	☐	☐
43. I am enthusiastic about most of the things we do in class.	☐	☐	☐	☐
44. Sometimes I do extra work outside of school because I'm interested in the topic.	☐	☐	☐	☐
45. I often find myself thinking about what we are learning after a lesson is over.	☐	☐	☐	☐
46. I carry on learning when I'm not at school.	☐	☐	☐	☐

My school work

	Very true	Mostly true	Not very true	Not at all true
47. After finishing a piece of work I check it carefully to make sure it's as good as possible.	☐	☐	☐	☐
48. I try to understand how different ideas fit together.	☐	☐	☐	☐
49. I plan my work before I start.	☐	☐	☐	☐
50. I try to do well on my schoolwork even when it isn't interesting to me.	☐	☐	☐	☐
51. When I'm doing work for school I try to connect what I'm learning with my own experiences.	☐	☐	☐	☐
52. I always make sure that I understand the question or task before I start work.	☐	☐	☐	☐
53. I ask other people for ideas about how to improve my work.	☐	☐	☐	☐

Appendix E: Case studies in two schools doing PBL

Case studies

Introduction

PBL is a complex intervention which requires commitment and effective working at many levels in participating schools. This section seeks to provide an insight into how the various essential elements of PBL can come together to provide effective implementation. We look at two schools where it was agreed by both the Innovation Unit, as developer and delivery partner, and the evaluation team, that the implementation of REAL Projects has been effective. Both schools also agreed that their implementation has been effective. Importantly whilst there are quite substantial similarities between the schools, the implementation has nonetheless been different in a number of respects – supporting the notion that there is no simple 'one size fits all' version or implementation of PBL.

Background to the schools

Both schools are larger than average, well established and draw the majority of their pupils from nearby communities on the outskirts of large conurbations. There were relatively small differences in their last Ofsted ratings (2 and 3 with one having gone up, and the other down) but nonetheless both were judged to be reasonably effective with good leadership. In both instances, English teaching at KS3 was identified as an area that could be improved, which is the primary outcome for the trial. Attitudes to learning and support from parents were judged to be good, as was attendance and relationships between pupils and teachers. It can therefore be reasonably assumed that from an Ofsted perspective both schools were in a good position to implement and manage the necessary organisational changes required for PBL.

School E

The starting point for school E was an ongoing internal review of their curriculum and wider school development, and an identified need to improve KS3 teaching. Some elements of 'project work' and student-led or independent learning were already being undertaken and the school as a whole was keen to encourage similar initiatives. In such circumstances it was not surprising that the offer to be included in the trial, in particular the intervention arm, was enthusiastically accepted. The headteacher emphasised that the school was looking for something like PBL to provide more structure and rigour to their plans and aspirations for KS3.

Organisation and challenges

Both the headteacher and the PBL lead, as well as several of the teachers we spoke to, reported that one of the biggest challenges of doing the PBL project was the very tight timescale. In practice this amounted to signing up in February with training taking place in May/June and starting to deliver REAL Projects the following September. This was necessary for the timing of the trial, but there was a consensus that at least a term or two is needed to plan for the necessary organisational changes, and ideally schools should be looking a year ahead when? planning to implement REAL Projects. It follows that quite a few schools would not have been able to undertake the necessary preparatory work in this short time period, and that this school was able to is a reflection on the school, and should be considered when generalising. The school felt in a secure position internally and externally to address the challenges of a major new initiative such as PBL.

A major perceived challenge identified early in the planning phase was getting the necessary 'buy-in' and support from three departments not used to working together. They found that the departments were able to work well together but they emphasised that it was important to ensure that all three were equally valued and time taken for REAL Projects from subject teaching accordingly. Once the project

was underway, most aspects of concern centred on logistical issues. Whilst it was felt that some of these could have been better planned for, in practice it seemed likely that they would have occurred with any major organisational change. It was also emphasised that many staff needed additional support when working outside of their 'comfort zone', which included working in a cross-curricular way as well as with new subjects and teaching such as ICT. For the Year 7 pupils, secondary school generally was a new experience, however it was emphasised that their "student voice" survey indicated pupils very much enjoyed working in a project way (comparison was made to the previous year as well as other non-PBL subjects).

An important commitment was made at an early stage of planning, that the curriculum needed to drive the timetable, even when this might have knock on effects on other subjects. In practice the REAL Projects curriculum was not found to constrain wider school working significantly. The pupils did PBL twice a week for 150 mins at a time (i.e. triple 50 min lessons). One session was humanities focused and the other Business and ICT. This was found to be a good and effective arrangement which fitted well with the wider school organisation and will continue for future years.

The staff we spoke to emphasised the value and importance of headteacher, senior staff and governor buy-in to the pedagogy. Again, this largely reflects the nature and values of the school and importantly was identified by everyone we spoke to at the school as an essential pre-requisite for effective PBL. There was quite considerable emphasis on the need for planning and meeting time at the school, in particular when there were up to 12 teachers delivering PBL. The school also placed considerable importance on the role of teaching assistants (TAs) to support the pupils generally as well as individually for those with specific needs. Indeed we saw one lesson where the pupils had reading ages ranging from 6 to 15 years as well as EAL pupils, and in such instances TAs played a very important role.

Training and Innovation Unit support

The school was impressed with and highly valued the support from the Innovation Unit, both in terms of the Leadership and Classroom Coaches, although in different ways. The Classroom Coaches were found to be very approachable and knowledgeable, and importantly were happy to work alongside the teachers. The Leadership Coach, needed to adopt a role 'sympathetic' to the needs of the headteacher and leadership team, and this school felt it worked well.

In addition to two of the staff attending the QUEST training in London, the Classroom Coach replicated the programme in the school for most of the REAL Projects teaching team. This took place over a two day period and was found to be highly productive and beneficial, and importantly helped bring the staff together for PBL in a way that just one or two teachers reporting back to the rest of the staff would not have done.

It was felt that the Classroom Coach had unique skills and experience that was unlikely to be available currently in U.K. based trainers. However, the Leadership Coach skills were viewed as more generic, and could therefore be 'bought in' locally or regionally. Nonetheless it was suggested that some of the school's PBL staff would be able, in time, to share their PBL skills and expertise with other schools.

Perceived benefits and pupil progress

The school largely followed the Innovation Unit specifications and suggested projects in the first year of delivery, but started to vary their offering and approach in the second year. This was felt to be of more value to the staff and the school's development more generally as it was more targeted at the school's needs. This also helped departments to think and work together and therefore had positive benefits in other subjects and areas of the school, potentially leading to benefits pupils beyond Year 7 and 8.

It was also found that REAL Projects supported the existing primary /secondary transition activities, as well as wider local contacts and educational opportunities. For instance, the school had worked with a local museum and local designers in some of the projects. Likewise, a number of staff visited other PBL schools, both locally and further afield, which they suggested helped bring in new ideas. More generally, working in a team was found to help many staff reflect on their own practice and skills and it was thought it would therefore support staff development more generally. For the pupils' progress through the school it was felt that the PBL approach to learning instilled valuable learning skills, such as research skills, as well as giving them an introduction to subject / department organised teaching, which they would not have been familiar with from primary school.

As with many of the other schools there were some challenges in assessing impact. They found that their approach in the first year of delivery lacked consistency and it was difficult to draw firm conclusions about progress. However, in the second year, the systems were more aligned and integrated with the whole school approach which allowed them to make direct comparisons both year on year and between subjects. The school emphasised that consistency in assessment and the ability to compare progress was important for maximising the returns from PBL, as well as giving wider credibility to the approach.

In general, feedback from the various departments suggested that the Year 7 group as a whole had made more progress than previous years. It was also felt that PBL encouraged deeper leaning of the particular topics and increased the breadth of content that could be explored by going beyond the national curriculum. Specifically it was felt PBL helped the development of a wide range of learning skills which would be useful throughout the pupils' education, such as research, team work and presentational skills. The school had also found the PBL approach more suited to low-ability learners and were able to point to instances of far more progress being made by such learning than would have been expected. However, they did recognise this was not in itself a solution for all such pupils and more planning and adaption of lessons needed to be done.

Conclusion

This school was very enthusiastic about PBL and felt that it was of substantial benefit to their teaching and learning. They were also positive about the potential benefits to other schools, however they did point to the need for the school to be in a 'secure' position, both internally and externally. From their experience, a great deal of commitment had to be made to properly implement the project, and to reap the benefits for pupils.

School F

This school was motivated to do REAL Projects in order to holistically improve educational outcomes for pupils leaving secondary school, both in terms of exam outcomes but also promoting skills required for employment and further / higher education (including in particular STEM subjects) as well as local needs. They felt the architecture for what they wanted was largely already in place, but that the curriculum, both nationally and how it was being interpreted locally, was not able to support the outcomes they desired. The school had a long term interest in initiatives such as the CBI 21st Century Skills and the more recent RSA Opening Minds competencies framework, which mesh well with the underlying philosophy and principles of PBL. As the head and PBL lead emphasised, pupils come from primary schools with a passion to learn and it is essential they put in place a way for that passion to continue and thrive in secondary school.

Organisation and challenges

In addition to having much of the organisational structure in place for PBL, the PBL lead had recently completed a Masters degree, focusing on how STEM could be effectively taught at the school through PBL, when they were approached by the Innovation Unit to join the trial. This, combined with support

from the governors, made it relatively straightforward (compared to other schools) to implement PBL; however, they were aware that it did not really fit clearly with government policy in practice, or with 'playing safe' with Ofsted. They cited the reason for this uncertainty with how it would be perceived as being due to a lack of empirical evidence supporting the PBL type of approach. However, this is also the case with a lot of educational approaches e.g. what works for white working class boys performing below their peers.

The school benefited from good community links and at that time teachers were organised on a faculty basis, rather than along strict subject lines – both of these factors helped with the organisation and implementation. Whilst PBL was a high profile project, the school sought to play this down internally so as to reduce the chance of some element of resentment. The PBL teachers were organised on a small team basis, with most of their teaching being PBL. Overall the school sought to 'grow' the teachers in to their role, and had great success with new or NQT teachers in the PBL team who were able to get support from the lead staff and the PBL processes. Although much of this was likely down to the skills and abilities of the PBL lead, it shows the potential value of team working for staff support and development.

For Year 7 about 50% of the timetable was assigned to PBL and this reduced in Year 8. PBL included ICT, Science, Design and Technology and humanities, as well as an element of English. The PBL team did not however possess the whole range of subject expertise and where necessary the specific departments and teachers from elsewhere in the school contributed to the planning and design of the REAL Projects and materials. The team were very cohesive which helped with joint planning, and this was helped by having a period when the full team could meet each week on Friday afternoons.

Training and Innovation Unit support

Two of the teachers and one of the SLT attended the QUEST training in London. This was found to be very helpful and in particular helped the school to identify ways in which their educational aspirations could be realised as well as training them to effectively implement REAL Projects. The cost of attending this, both time and expenses, were described by the headteacher as significant 'front loaded' costs which it was not possible to continue funding beyond the first year of the project (despite continuing with PBL). Therefore, the following year the QUEST training was done in the school by the Classroom Coach and the PBL lead. This approach helped them to tailor the project and training more to local needs although while still retaining the essential elements of PBL.

The input of both the Leadership and Classroom Coach was very much valued by the school and PBL team. Both worked mainly with the PBL lead as the role of the Leadership Coach, which was normally to support the head to establish the right structure and conditions for PBL to work, was not really necessary given what the school was already doing. Moving forwards, the school would be happy to purchase support as required, but not necessarily the whole package.

At quite an early stage the school were encouraged by the Innovation Unit to help other schools adopt the programme given their positive experience. However, they took a cautious approach to this, both through recognising that particular expertise of the Classroom Coaches would not be that easy to replicate, and also risk of not paying enough attention to their own needs. The PBL lead has since gone on to do some support / consultancy work with another school, but with still being able to support the project in her own school, at home, and has benefited professionally from this.

Perceived benefits and pupil progress

For the school the most important tangible benefit was improved engagement in the learning process, for both pupils and their parents. With regards to parents we were told that far more attended parents evenings than previously as well as accessing on-line reports.

It will take time before any academic impacts can be properly assigned to PBL, however the school feel that by improving engagement even in just one of the target groups (white working class boys) it is likely to improve their academic performance. The school also pointed to future learning benefits, including life-long learning and 21st century skills. They feel that embedding these skills at this early stage should have future benefits, including for pupils going on to do IBs or more vocational courses. We were told of improvements in terms of PBL directly supporting the primary / secondary transition as well as the longer term integration of the Year 7 pupils in to the school.

We were also told that the programme is likely to go on to help support local employment needs, for example in the area of STEM and progression to Higher Education. It was also evident that the programme was playing a valuable role in terms of staff training and support, in particular through team working, and more generally, for the school to help meet its broad educational aims.

Conclusion

Even though the school was well prepared to implement the project, in their own words, they still went through a 'massive learning curve' in implementing the project. PBL did provide many of the benefits they sought as well as a number of further benefits. They did, however, point to the quite substantial costs, both financially and in terms of staff time, necessary to properly implement the programme, but felt this to be a good investment in future teaching and learning.

Appendix F: Security classification of trial findings

Rating	Criteria for rating			Initial score		Adjust		Final score
	Design	**Power**	**Attrition***					
5 🔒	Well conducted experimental design with appropriate analysis	MDES < 0.2	0-10%			Adjustment for Balance [- 1]		
4 🔒	Fair and clear quasi-experimental design for comparison (e.g. RDD) with appropriate analysis, or experimental design with minor concerns about validity	MDES < 0.3	11-20%					
3 🔒	Well-matched comparison (using propensity score matching, or similar) or experimental design with moderate concerns about validity	MDES < 0.4	21-30%					
2 🔒	Weakly matched comparison or experimental design with major flaws	MDES < 0.5	31-40%	2 🔒		Adjustment for threats to internal validity [ ]		
1 🔒	Comparison group with poor or no matching (E.g. volunteer versus others)	MDES < 0.6	41-50%					1 🔒
0 🔒	No comparator	MDES > 0.6	> 50%					

- **Initial padlock score:** lowest of the three ratings for design, power and attrition = 2 padlocks
- **Reason for adjustment for balance** (if made): differential attrition and imbalance in Ofsted ratings (see notes below)
- **Reason for adjustment for threats to validity** (if made): none
- **Final padlock score:** initial score adjusted for balance and internal validity = 1 padlock

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