Education
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Foundation

Promoting Alternative Thinking Strategies (PATHS)

Evaluation report and Executive summary

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Independent evaluators:

Manchester Institute of Education, University of Manchester
PATHS to Success Research Team

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The Education Endowment Foundation (EEF)

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About the evaluator

The project was independently evaluated by a team from the Manchester Institute of Education, University of Manchester. The 'PATHS to Success' evaluation team were: Alexandra Barlow, Michael Wigelsworth, Ann Lendrum, Kirsty Pert, Craig Joyce, Emma Stephens, Lawrence Wo, Garry Squires, Kevin Woods, Rachel Calam, Mark Harrison, Alex Turner, and Neil Humphrey.

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Executive summary

The project

Promoting Alternative Thinking Strategies (PATHS) is a school-based social and emotional learning (SEL) curriculum that aims to help children in primary school manage their behaviour, understand their emotions, and work well with others. PATHS consists of a series of lessons that cover topics such as identifying and labelling feelings, controlling impulses, reducing stress, and understanding other people's perspectives. It is delivered twice weekly in 30–40 minute lessons by teachers to all children in a given class, typically in the slots allocated for Personal, Social and Health Education. This curriculum is supplemented by activities that support the application of new skills during the school day and activities that are sent home to parents that cover the topics taught in class.

In this trial, 45 participating schools from Greater Manchester were randomly allocated to implement PATHS for two years (school years 2012–2013 and 2013–2014) or continue their usual practice during the same period. This evaluation focuses on the academic outcomes of the intervention for children in Years 5 and 6 in English/reading and maths.

The main trial was funded by the National Institute for Health Research (NIHR) and focused on the impact of PATHS on the social-emotional wellbeing of children in Years 3–5. The outcomes of this study include: social and emotional competence, quality of life, and attendance. The Education Endowment Foundation (EEF) provided additional funding for PATHS training and materials, in addition to the evaluation of the academic outcomes detailed in this report. PATHS materials were provided by Barnardo's, and training was led by staff from the Evidence-Based Prevention and Intervention Support Centre at Pennsylvania State University (PSU). Teachers implementing PATHS were supported by trained coaches. The findings of the NIHR trial will be published at a later date.

Key Conclusions	
1.	Overall, PATHS did not have a positive impact upon children's academic attainment.
2.	The evidence does not indicate that PATHS produced differential gains for children eligible for free school meals (FSM).
3.	Higher levels of PATHS implementation quality and reach were associated with better academic outcomes.
4.	Teachers reported a lack of time to implement PATHS at the recommended frequency. On average, only half of the lessons were delivered.
5.	While PATHS does not appear to be a cost-effective way of improving students' attainment, it may have an impact on other, non-cognitive outcomes. A full report on the NIHR trial looking at these outcomes will be published at a later date.

Security rating

The findings for Year 6 may be considered of high security, while the Year 5 findings are considered to have moderate to high security. The evaluation was set up as a randomised controlled trial that aimed to compare the progress of pupils who received the programme to very similar pupils who did not. The trial was an efficacy trial, which tested the project in schools where support was made available to optimise implementation conditions (e.g. training led by programme developers, coaching support for teachers).

There were 1,705 Year 5 children and 1,631 Year 6 children in the 45 participating schools. The number of schools that dropped out of the project was less than 20% for the Year 5 cohort, and 0% for the Year 6 cohort. The low dropout rate for Year 6 increases the security of the results and the accuracy of the estimate of the effect it was possible to obtain. In the case of the negative finding in Year 6 English, it appears that the result is attributable to the intervention, rather than chance.

Findings

- Our analyses indicated that PATHS did not have a positive impact on academic outcomes. The effect sizes produced in the study were mixed and extremely modest, with several analyses favouring students that did not take part in the intervention.
- Teachers felt that there was a lack of time to implement PATHS at the recommended frequency. This meant that on average only half of the lessons were delivered. The delivery context of the trial was representative of real-world conditions, and any attempt to implement PATHS on a wider scale would likely face similar challenges.
- The implementation and process evaluation showed that the impact of PATHS was greater when delivered with higher levels of implementation quality, although these effects could be the result of better teaching overall, rather than the programme itself.
- Similarly, higher levels of reach were associated with better academic outcomes, although this effect may reflect the influence of attendance patterns in participating schools.
- This was the first study in the UK to focus on the impact of PATHS on academic attainment. Previous UK studies have focused on the outcomes of children's social-emotional competence, behaviour, and/or mental health rather than academic attainment.
- A previous randomised controlled trial from the USA showed evidence that PATHS can improve aspects of children's academic attainment, albeit to variable and modest degrees. However, the American study experienced an attrition rate of nearly 50%, raising questions regarding the security of the analyses.
- Recent evidence, including the evidence in the Teaching and Learning Toolkit, suggests that high quality, well implemented SEL programmes can impact positively upon a range of outcomes for children, including their academic attainment.
- Given the quality of the evaluation, it is likely that the lack of impact upon children's academic attainment in this trial can be attributed to the lack of success of the PATHS programme itself.
- The mixed findings may indicate issues in relation to the cultural transferability of the programme. Concerns about whether the programme had been transferred successfully to a UK context were raised by teachers that took part in the trial

Group	Effect size	Estimated months' progress	Security rating	Cost
Year 5 Maths vs. control	0.026	1 month[1]	🔒🔒🔒🔒🔓	**£**
FSM vs. control	-0.036	-1 month	–	–
Year 5 Reading vs. control	-0.029	-1 month	🔒🔒🔒🔒🔓	**£**
FSM vs. control	0.017	0 months	–	–
Year 6 Maths vs. control	-0.025	-1 month	🔒🔒🔒🔒🔒	**£**
FSM vs. control	0.016	0 months	–	–
Year 6 English vs. control	-0.106	-2 months	🔒🔒🔒🔒🔒	**£**
FSM vs. control	0.120	+2 months	–	–

Cost

For a single form entry school, the initial cost of PATHS is £6,532. This figure includes the essentials for PATHS implementation: a curriculum pack for each year group from Reception to Year 6, additional/supplementary materials (for example books, CDs, puppets, 'feeling faces', and posters), initial training for seven staff, headteacher and/or PATHS co-ordinator training, and two days of coaching time. Schools can also choose to purchase only the PATHS curriculum packs at an initial cost of £2,100. The average cost per pupil for the full intervention is approximately £11.52 a year, over a three year period.

[1] *Since this report was published, the conversion from effect size into months of additional progress has been slightly revised. If these results were reported using the new conversion, all measures would be reported as 0 months of additional progress rather than -1. The Year 6 English results would remain at -2 and +2 months. See* ***here*** *for more details.*

Introduction

Intervention

Promoting Alternative Thinking Strategies (PATHS) is a school-based social and emotional learning (SEL) curriculum that helps children to manage their behaviour, understand their emotions, and work well with others. It is a universal intervention for all children in a given class. PATHS consists of a series of lessons that cover topics such as identifying and labelling feelings, controlling impulses, reducing stress, and understanding other people's perspectives. This SEL curriculum is supplemented by activities that support the application of new skills during the course of the school day (for example 'teachable moments' such as using a playground incident to demonstrate the importance of resolving conflicts peacefully), and parental materials—such as send-home activities— that aim to extend learning to the home environment. A detailed description of PATHS can be found in the Methods section of this report. The developer of the programme is based at the Evidence-Based Prevention and Intervention Support Centre at Pennsylvania State University (PSU), and has been involved in training, promoting, and supporting the programme worldwide for many years.

PATHS training was led by staff from PSU. The PATHS materials themselves were provided by Barnardo's, which holds the license for the Anglicised version of the curriculum. Ongoing support and assistance with implementation was provided by three members of the evaluation team who were themselves trained in PATHS by PSU staff and were supervised throughout the trial.

Additional information can be found at:

http://www.channing-bete.com/prevention-programs/paths/paths.html

Background evidence

Learning is a social process and therefore the extent to which children are able to manage their behaviour, understand their emotions, and work well with others will likely influence how well they do in school academically. Additionally, the creation of a safe, caring and participatory classroom environment is assumed to influence children's engagement and their readiness to learn. Thus, improvements in academic achievement are viewed as corollaries of SEL interventions ('distal outcomes', see Humphrey, 2013). Three recent meta-analyses have provided evidence to support this assertion, demonstrating that high quality, well implemented SEL programmes can impact positively upon a range of outcomes for children, including their academic attainment (Durlak, Weissberg, Dymnicki, Taylor, and Schellinger, 2011; Sklad, Diekstra, De Ritter, Ben, and Gravesteijn, 2012; Wigelsworth, Lendrum, and Oldfield, in press). These analyses report average effect sizes of SEL on attainment in the 0.27 (Durlak et al., 2011) to 0.46 (Sklad et al., 2012) range. These impressive findings do not appear to be related to methodological features (such as the use of randomised designs or the source of data—Durlak et al, 2011). There is also evidence from individual studies and meta-analyses that children from socio-economically disadvantaged backgrounds may experience differential gains from exposure to SEL interventions when compared to their more affluent peers, albeit in relation to social, emotional and behavioural outcomes rather than academic attainment per se (Holsen et al., 2009; Wilson and Lipsey, 2007). It should be noted, however, that most studies in this body of evidence originate in the United States, and cultural transferability cannot be assumed. Furthermore, around two-thirds were led by, or involved, the intervention developers, and so there is a clear need for independent replication (Wigelsworth, Lendrum and Oldfield, in press).

The PATHS curriculum is supported by an extensive international literature base. This includes multiple randomised controlled trials (RCTs) (for example Domitrovich, Cortes, and Greenberg, 2007). It has been designated as a 'model program' by both the Center for Study and Prevention of Violence, USA (CSPV, 2006) and the Substance Abuse and Mental Health Services Administration, USA (SAMHSA, 2011) as a result of clear evidence of its efficacy, sustained effects, and multiple-site replications. However, the overwhelming majority of PATHS studies focus on social, emotional and behavioural

outcomes. To date there has been limited evidence of the effects of the programme on children's academic attainment. A recently published RCT has indicated that PATHS can improve aspects of children's educational outcomes, albeit to modest and variable degrees: for example, children in PATHS schools were (according to Schonfeld et al., 2014) between 1.51 and 1.91 times more likely to achieve basic proficiency in reading, writing *or* maths than those in control schools *in some year groups*. This particular study also demonstrated a natural variation dose-response relationship in intervention schools, with more children achieving basic proficiency in reading and maths in classes where PATHS was taught more frequently. However, the trial in question experienced an attrition rate of nearly 50%, raising questions about the security of the analyses. Two earlier small-scale RCTs of PATHS—one in mainstream education and another focusing on deaf students in special education—failed to find intervention effects on children's reading or maths, although a marginal, non-significant trend was found in relation to the reading scores of deaf students (Greenberg, Kusche and Riggs, 2004).

There have been only two RCTs of PATHS in the UK education context to date, yielding mixed findings. In both cases, assessment of outcomes focused on children's social-emotional competence, behaviour, and/or mental health. Ross et al.'s (2011) study of a Northern Irish cultural adaptation of the programme found that PATHS (rebranded as 'Together 4 All') produced effects that were 'weak and inconsistent, but generally in a positive direction' (p.61). Little et al.'s (2012) trial of PATHS in Birmingham, England, yielded null results. The study reported herein is the only UK-based trial to assess the impact of PATHS on children's academic attainment. It is also one of only a few trials internationally to focus on children at the upper end of the primary phase of education—most studies of PATHS have focused on children in pre-school and early primary settings (for example the equivalent of the Early Years Foundation Stage and Key Stage 1).

Evaluation objectives

In late 2011 the evaluators secured funding for a major cluster-randomised controlled trial of PATHS from the National Institute for Health Research (NIHR; Project Reference 10/3006/01; ISRCTN number 85087674). The primary aim of the 'PATHS to Success' project was to examine the impact of the PATHS curriculum on the social and emotional wellbeing of children aged 7–9 (for example Years 3, 4 and 5) in English primary schools. A series of secondary outcomes, including health-related outcomes and quality of life, were also assessed. The trial included a comprehensive implementation and process evaluation (IPE). Forty-five primary schools in the Greater Manchester region were randomly allocated to (a) implement PATHS for two years, or (b) continue practice as usual over the same period.

The main trial protocol can be found at:

http://www.nets.nihr.ac.uk/__data/assets/pdf_file/0019/81712/PRO-10-3006-01.pdf

The EEF agreed to augment the existing trial design with additional outcome assessments focusing on children's academic attainment. This report focuses solely on this aspect of the trial, and there are therefore some key divergences between the protocol noted above and the research reported here (for example, the primary outcome measures for the main trial are children's social-emotional skills and their mental health, not academic attainment). The findings of the main, NIHR-funded trial will be published in due course.

Our aims were as follows:

- To assess the impact of PATHS on children's academic attainment.
- To determine if PATHS produces 'differential gains' in academic attainment for children eligible for free school meals (FSM).
- To assess the extent to which PATHS implementation variability is associated with variability in children's academic outcomes.

- To identify process-related issues that might serve to illuminate the mechanisms underpinning findings relating to the first three aims.

Evaluators

The evaluation team was led by Professor Neil Humphrey, and comprised Dr Alexandra Barlow, Dr Michael Wigelsworth, Dr Ann Lendrum, Kirsty Pert, Craig Joyce, Emma Stephens, Lawrence Wo, Dr Garry Squires, Professor Kevin Woods, Professor Rachel Calam, Dr Mark Harrison, and Alex Turner.

Ethical review

The study was granted ethical approval by the University of Manchester's University Research Ethics Committee (UREC) in 2012 (UREC Ref 11470).

Eligible schools were recruited using a variety of means, including a one-day conference, the project evaluation team's professional contacts in the region, and letters, telephone calls and follow-up visits to individual schools. Headteachers of prospective trial schools were required to sign a Memorandum of Agreement (MoA) that outlined key information about the project (such as the randomisation process), what 'participation' would entail, and the risks and benefits of taking part.

Consent to participate was sought prior to randomisation at three levels: school (see above), parent, and child. Parental consent was sought using the opt-out method (except in the case of certain aspects of the IPE, for example child focus groups, where opt-in consent was utilised). Finally, children were required to verbally assent to participation in the research. Sample information and consent sheets can be found in Appendix 1.

Trial registration: NIHR Project Reference 10/3006/01; ISRCTN number 85087674.

Methodology

Design

The research design was a cluster-randomised controlled trial (Puffer, Torgerson, and Watson, 2005) with two arms: intervention (PATHS) and control (usual practice). Schools were the unit of allocation as PATHS is a universal intervention—individual or class randomisation was therefore inappropriate (for example, class-level randomisation would have introduced considerable risk of contamination).

The initial project plan was to administer baseline (pre-test) and follow-up (post-test) assessments of children's academic attainment to all children in the target population (Years 3, 4 and 5) in participating schools using a standard pre-test–post-test control group design). However, major problems were encountered with the administration of the Interactive Computerised Assessment System (InCAS—see Outcomes below) that was used as the primary academic outcome measure throughout the trial as well as being intended as the pre-test. These problems included insufficient IT resources in schools, installation difficulties, assessments taking much longer than the estimated time suggested by the developer, and developer server problems. As a result, a post-test only design focusing on children in Year 5 (for whom InCAS assessments were administered) and Year 6 (for whom Key Stage 2 academic attainment data was available via the National Pupil Database—NPD) was adopted. Gorard (2013) notes that a post-test design is 'generally at least as safe as its alternatives, and is sometimes preferable or more feasible than…pre-and-post-test designs' (p.2). Furthermore, we were fortunate in being able to access all participating children's prior (Key Stage 1) attainment data from the NPD to increase statistical power and reduce bias.

Eligibility

Mainstream primary schools providing education for children aged 4–11 in the 10 Local Authorities (LAs) that make up the Greater Manchester region were eligible to participate. The eligible LAs were Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Stockport, Tameside, Trafford, and Wigan. Greater Manchester was chosen primarily because of geographical convenience (it is the region where the evaluation team is based) but also because of the diversity it provides in terms of urban development, socio-economics and other characteristics. Children in Years 3, 4 and 5 on a given school's full-time roll at the start of the 2012–13 academic year were the target population for the study. The evaluation team led the recruitment process.

From an initial pool of 58 schools, 45 met the criteria outlined in the MoA and were randomly allocated to either the intervention or control arm of the trial.

Intervention

In the interests of clarity, we adapt the Template for Intervention Description and Replication (TIDieR, Hoffmann et al., 2014) to describe the PATHS intervention model:

1. Brief name

Promoting Alternative Thinking Strategies (PATHS)

2. Why: Rationale, theory and/or goal of essential elements of the intervention

PATHS is based on the Affective-Behavioural-Cognitive-Developmental model of development, which emphasizes the developmental integration of affect, emotion language, behaviour and cognitive understanding to promote social and emotional competence (Greenberg and Kusche, 1993). Core programme components are a taught curriculum, generalisation activities and techniques, and parent materials. The PATHS programme logic model can be found here:

http://www.episcenter.psu.edu/sites/default/files/ebp/Promoting-Alternative-Thinking-Strategies-Logic-Model-5-12-2014.pdf

The model proposes that the implementation of these core components decreases risk factors (such as impulsive behaviour) and increases protective factors (for example school opportunities for pro-social involvement), leading to key proximal outcomes of improved knowledge and awareness of emotions, self-control, and social problem-solving. Improved academic attainment is viewed as a by-product of PATHS implementation.

3. Who: recipients of the intervention

All children in a given class: PATHS uses a whole-school 'universal' model. The curriculum contains lessons for children in Reception through to Year 6.

4. What: materials

Curriculum packs were provided for each class containing lessons and send-home activities that covered topics such as identifying and labelling feelings, controlling impulses, reducing stress and understanding other people's perspectives, in addition to associated physical resources and artefacts (such as posters and 'feelings dictionaries'). Each lesson contains detailed information for the teacher, including general and specific objectives, materials required, and procedural notes (including suggested wording for teacher input). Sample materials can be viewed at: www.channing-bete.com/prevention-programs/paths/preview-intro-paths.html

Class teachers were also given an implementation guidance manual developed by the evaluation team which emphasised the PATHS programme theory and the importance of effective implementation. PATHS curriculum packs are distributed in the UK by Barnardo's. Supplementary materials used in this trial (such as the implementation guidance manual) are available on request from the evaluation team.

5. What: procedures

PATHS lessons follow a common format that includes an introduction from the teacher (in which the lesson topic and objectives are introduced), a main activity (often built around a group activity or story), and a brief plenary/closure (in which learning is reviewed). Frequent prompts to elicit pupil responses and clarify learning are included throughout.

The programme utilises a 'spiral' curriculum model whereby (i) topics and concepts are revisited; (ii) units and lessons are developmentally sequenced; (iii) new learning is linked to previous learning; and (iv) the competence of learners increases with each successive visit to a topic or concept.

6. Who: implementers of the intervention

PATHS was implemented by class teachers in Years 3, 4 and 5 (Years 4, 5 and 6 in the second year of the trial). All were qualified teachers and had an average of eight years teaching experience; 81% were female.

7. How: mode of delivery

PATHS lessons were delivered as part of the normal class timetable, typically in the slot(s) allocated for Personal, Social and Health Education. This meant that PATHS did not displace any core curriculum subject time such as English, Maths, or Science. Generalization activities and strategies were to be implemented routinely throughout the school day.

8. When and how much: dosage

Lessons lasted approximately 30–40 minutes and were to be delivered twice-weekly throughout the school year. Curriculum packs contained an average of 40 lessons. The recommended dosage for PATHS would be the delivery of most or all of these lessons in a year.

9. Tailoring: adaptation of the intervention

PATHS is a 'manualised' intervention (prescriptively defined in a manual), and optimal implementation fidelity is emphasized by the programme developers. Nonetheless, implementers are encouraged to make surface adaptations (for example changes of names in stories) in order to increase a sense of ownership and fit to local context.

10. Modifications

As noted above, the evaluation team developed an implementation guidance manual to supplement the materials provided by Barnardo's.

11. How well: planned

Strategies to maximise implementation effectiveness included one full day of initial training for teachers with a half-day follow-up four months later. Training was led by staff from the Evidence-based Prevention and Intervention Support Centre at Pennsylvania State University (PSU). This was supplemented by technical support and assistance (for example lesson modelling, observation and feedback) from three members of the evaluation team, who were themselves trained by PSU staff and received ongoing supervision throughout the trial.

12. How well: actual

A range of aspects of implementation (such as fidelity/adherence, dosage, quality, and participant responsiveness) were assessed formally through structured observations of lessons conducted throughout the trial by members of the evaluation team as part of our IPE. Mean scores—on a scale of 1 to 10—for fidelity (8.20), quality (8.48), participant responsiveness (7.34) and reach (9.08) were all high. However, mean dosage scores indicated that classes were an average of 20 lessons behind schedule (the equivalent of 10 weeks at 2 lessons per week) at the point of observation. Thus, PATHS lessons were generally implemented well, but not at the frequency recommended by the programme developers.

'Usual practice' was assessed in *all* schools (whether intervention or control) as part of the IPE, both prior to randomisation and at 12-month follow-up, via school-level surveys. Usual practice comprised a range of named initiatives including (but not limited to): the whole-school component of the social and emotional aspects of learning (SEAL) programme; Circle Time; the National Healthy Schools programme at the universal level; the Targeted Mental Health in Schools programme; nurture groups; and targeted components of the SEAL programme at the indicated/targeted level. Although it is a non-statutory subject, participating schools also taught children personal, social and health education.

Outcomes

Year 5

For children in Year 5 at the point of post-test, InCAS (developed by the Centre for Evaluation and Monitoring—CEM) was used to generate outcome data relating to attainment in reading and maths. InCAS was used as it was recommended by the EEF as a suitable independent measure of academic attainment, and was designed for use with children aged 6–11. Further information about InCAS can be found at the developer's website: http://www.cem.org/primary

InCAS assessments were administered by members of the evaluation team. Scoring was undertaken by CEM, blind to the allocation status of individual schools and children.

Year 6

For children in Year 6 at the point of post-test, Key Stage 2 national curriculum assessments were used to generate outcome data relating to their attainment in English and Mathematics. These assessments were used as they offer optimal external validity (providing the metric by which the academic progress of children is judged as they reach the end of primary education in England) and no additional data burden for participating schools (since the tests are statutory). Testing was undertaken by school staff following the government's recommended protocol (Standards and Testing Agency, 2014). Scoring was undertaken by the Standards and Testing Agency, blind to the allocation status of individual schools and children. This data was subsequently extracted from the NPD.

Sample size

Power and sample size (PASS) calculations for the main NIHR-funded study were based on the primary outcome of children's social and emotional competence and are detailed in the trial protocol (see link above). In view of the issues noted earlier and the ensuing changes to the study design, PASS calculations provided here are necessarily post-hoc. In the case of both cohorts, calculations utilise a prior attainment and demographic covariates model (Hedges and Hedberg, 2007). Prior academic attainment data from end of Key Stage 1 national curriculum assessments were available from the NPD. Demographic covariates were sex and FSM eligibility. School-level minimisation variables (for example FSM and English as an Additional Language—EAL) were also included in the calculation of the intra-cluster correlation coefficients (ICCs) noted below.

Year 5

There were 1,705 Year 5 children in the 45 participating schools. After accounting for the covariates specified above, the sample ICC was 0.08. With an average of 38 children per cluster, an average correlation of 0.71 between the prior attainment and post-test data, and Power and Alpha set to 0.8 and 0.05 respectively, the minimum detectable effect size (MDES) was determined to be **0.19**.

Year 6

There were 1,631 Year 6 children (PATHS n = 847; usual practice n = 784) in the 45 participating schools. After accounting for the covariates specified above, the sample ICC was 0.04. With an average of 36 children per cluster, a correlation of 0.73 between the prior attainment and post-test data, and Power and Alpha set to 0.8 and 0.05 respectively, the MDES was determined to be **0.17**.

Randomisation

Schools were randomly allocated to the intervention and control arms of the trial independently of the evaluation team by the Manchester Academic Health Science Centre Trials Co-ordination Unit (MAHSC-CTU). The randomisation procedure incorporated a minimisation algorithm to ensure balance across the arms of the trial in terms of the proportions of children eligible for FSM and speaking EAL in participating schools.

Analysis

Outcome data was analysed using hierarchical linear modelling (also known as 'multi-level modelling') in MLWin Version 2.32 in view of the clustered and hierarchical nature of the datasets. Three-level (school, child, time) models were constructed, with allocation status (PATHS vs. usual practice) and minimisation variables entered at the school level, sex and FSM eligibility entered at the child level, and academic outcome data (prior attainment and post-test) entered at the time level. We utilised both

intention to treat (Gupta, 2011) and sub-group (Petticrew et al., 2012) analyses, the former providing an estimate of the overall impact of PATHS on children's academic attainment and the latter allowing us to identify any differential gains experienced by children eligible for FSM. All continuous data was standardised prior to analysis to facilitate comparison of ES (Cohen's d) within and across models. All ES were then converted to Hedge's g as per EEF specifications.

MLWin by default incorporates all available data (for example it includes data for participants with and without complete datasets) in its model fitting using full information maximum likelihood (FIML) estimation procedures under a random dropout assumption (where 'missingness' is assumed to depend on observed measurements). FIML has been shown to be an effective method in handling missing data (Twisk, 2006; Twisk and de Vente, 2002) and is considered by some to be superior to multiple imputation techniques as it correctly estimates standard errors (Larsen, 2011).

Implementation and process evaluation (IPE) methodology

A process evaluation was not commissioned as part of this EEF study. However, as noted earlier, the main NIHR-funded trial included a comprehensive IPE, from which some relevant data is reported here.

Briefly, the IPE comprised:

I. Surveys of usual practice in all participating schools at baseline and 12-month follow-up. These surveys assessed each school's involvement and implementation status for a wide range of both universal and targeted/indicated SEL interventions, and were completed by each school's Key Stage 2 co-ordinator.
II. Structured observations of PATHS lessons in intervention schools to assess *fidelity/adherence* (for example, to what extent were the prescribed activities in the lesson replicated?), *dosage* (for example, what lesson was being delivered relative to the planned delivery schedule in the implementation manual?), *quality* (for example, how well prepared, enthusiastic, engaging and participatory is the teacher's delivery of the lesson?), *participant responsiveness* (for example, to what extent do children in the class engage with the lesson?), *reach* (for example, what proportion of the class are present in the lesson?) and *adaptations* (for example, what is the nature and extent of changes made to the lesson by the teacher?). The observation schedule was adapted from existing rubrics in other studies. It was piloted and refined using video footage of lessons being implemented in schools in the aforementioned Birmingham trial (Little et al., 2012). The observations were conducted by three members of the evaluation team (each observing in schools where they were not providing technical support and assistance in order to minimise bias), and 10% were moderated by our IPE lead. In view of the use of multiple observers, the aforementioned video footage was also used to help ensure consistency.
III. Teacher self-report implementation surveys in intervention schools to assess fidelity/adherence, dosage, quality, participant responsiveness, and reach. These surveys were developed to mirror the observation schedule described above.
IV. Teacher self-report surveys to assess a range of factors *affecting* implementation, including preplanning and foundations, implementation environment, implementation support system, implementer characteristics, and intervention characteristics. These surveys were all adapted from existing measures.
V. Semi-structured interviews with teachers and other members of school staff (such as headteachers) in intervention schools to explore implementation and process issues (for example the acceptability and feasibility of PATHS).
VI. Focus groups with children in intervention schools to explore their experiences of PATHS.
VII. Interviews with parents to assess the extent of their awareness of, involvement in, and attitudes towards PATHS.

Of the above, we utilise (I), (II) and (V) in this report as these were felt to provide the most useful explanatory data (and, of course, we experienced natural restrictions on what could be included because of reporting deadlines).

Costs methods

We report the 'real world' costs of PATHS—those that would be experienced by a typical primary school outside of the context of a major randomised trial. These costs were provided by the PATHS team at Birmingham City Council as it provides both materials and implementation support for PATHS as part of a traded service with English schools. The basic unit cost per pupil in the first year of implementation was calculated by dividing the overall cost by an estimated 189 pupils (that is, seven classes of 27 children from Reception to Year 6).

Impact evaluation

Timeline

School recruitment took place from January to April 2012. Baseline assessments for the main trial took place in May, June, and July 2012. Following the completion of the baseline, schools were randomised by MAHSC-CTU. Teachers in intervention schools received their initial PATHS training in early September 2012 (with the half-day follow-up in January 2013). Implementation began immediately after the initial training. In the second year of the trial, training was provided for any new teachers in the target year groups and those responsible for Year 6. Post-test assessments took place in May, June, and July 2014.

Participants

All mainstream primary schools in the 10 LAs in Greater Manchester were invited to participate in the project in January 2012. Initially schools were sent email and postal invitations to a recruitment event in March 2012: 35 schools attended, of whom 19 signed up for the trial. In parallel, schools were sought via the team's professional contacts in the region (such as LA staff), and letters, telephone calls, and follow-up visits were made to individual schools. These methods secured the remainder of the initial recruitment sample.

Schools were randomly allocated to the intervention and control arms of the trial, independently of the evaluation team, by the Manchester Academic Health Science Centre Trials Co-ordination Unit (MAHSC-CTU). The randomisation procedure incorporated a minimisation algorithm to ensure balance across the arms of the trial in terms of the proportions of children eligible for FSM and speaking English as an additional language.

A diagram illustrating the flow of participating schools and children through the main study is provided below (Figure 1). In the interests of clarity we provide separate flow information for the two cohorts (Year 5 and Year 6) because of the different attrition rates at school and pupil levels (due to, for example, school drop-out or pupil absence). For the Year 6 cohort (N = 1,631), there was zero attrition at the school level and 3% (N = 49) at the pupil level. For the Year 5 cohort (N = 1,705) there was 16% (N = 268) attrition at the school level and 19% (N = 320) at the pupil level.

Figure 1: Flow of schools and children through the main trial.

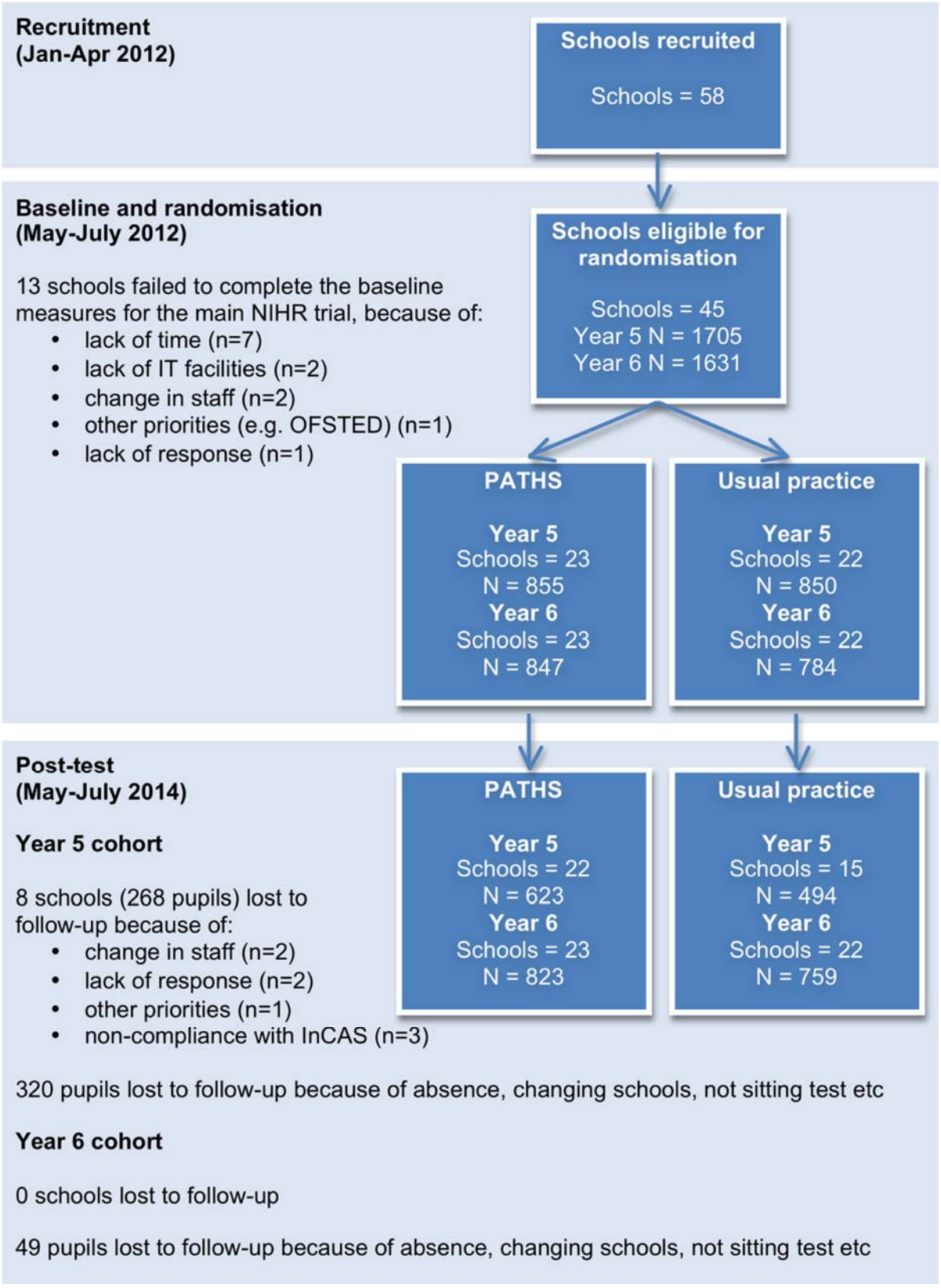


Table 1 summarises the characteristics of the schools in each arm of the trial, with national averages provided as a reference point against which to assess the representativeness of the sample. The school sample characteristics mirror those of primary schools in England well, with the exception of being

somewhat larger and having higher proportions of pupils eligible for FSM and speaking EAL. This probably reflects the fact that project was more likely to appeal to large, ethnically diverse urban schools in disadvantaged areas, where the perceived need for SEL is typically greater. In terms of balance, the difference between intervention and control schools was negligible across all characteristics with the exception of attainment and attendance (both small ES using Cohen's (1992) criteria, although attendance was on the cusp of a medium ES).

Table 1: School sample characteristics and national averages

School characteristic	National average	PATHS sample mean (SD)	Usual practice mean (SD)	Balance at randomisation (ES)
Size[1]—number of full-time equivalent pupils on roll	233.4	313.26 (111.15)	287.36 (96.47)	0.24
Attendance[2]—overall absence (% half-days missed)	5.2	5.06 (0.94)	5.60 (1.24)	0.48
FSM[1]—proportion of pupils eligible for free school meals	18.2	30.13 (20.12)	30.86 (19.29)	0.04
EAL[1]—proportion of pupils speaking English as an additional language	17.5	20.63 (24.65)	23.55 (24.51)	0.12
SEND[3]—proportion of pupils with special educational needs and disabilities	19.8	16.50 (5.99)	17.28 (5.96)	0.12
Attainment[4]—proportion of pupils achieving level 4 (or above) in English and Maths at end of KS2	75	80.73 (12.09)	75.38 (11.88)	0.43

[1] Department for Education (2010), [2] Department for Education (2014), [3] Department for Education (2012), [4] Department for Education (2013).

Pupil characteristics

Table 2 summarises the characteristics of pupils in each arm of the trial, with national averages provided as a reference point against which to assess the representativeness of the sample. Our pupil sample characteristics mirror those of primary schools in England closely, albeit with a similar pattern of deviation in terms of FSM and EAL to that noted above. In terms of *balance on key observables*, the difference between intervention and control pupils in relation to both *eligibility for FSM* (ES = 0.08) and *prior attainment* (ES = 0.03) was negligible. All other observables were considered to be well balanced at randomisation.

Table 2: Pupil sample characteristics and national averages

Pupil characteristic	National average	PATHS sample mean (SD)	Usual practice mean (SD)	Balance at randomisation (ES)
Sex—proportion of male students	50	49.9	53	0.08
FSM[1]—proportion of pupils eligible for free school meals	28	31.6	28.6	0.08
EAL[1]—proportion of pupils speaking English as an additional language	14.8	22.1	22.3	0.01

Mental health[2]—mean SDQ Total Difficulties (teacher-rated) subscale score	6.7	7.72 (2.46)	7.43 (2.42)	0.17
Prior attainment—KS1 average points score for English/Maths	-	15.24 (3.78)	15.12 (3.85)	0.03

[1] Department For Education (2010), [2] www.sdqinfo.org

Outcomes and analysis

Table 3 summarises the main findings of our analyses. Full details of the models can be found in Appendix 2.

Table 3: The impact of PATHS on pupils' academic attainment—key findings.

Outcome	Post-test means				Effect size		
	PATHS		Usual practice				
	N (missing)	Mean (95% CI)	N (missing)	Mean (95% CI)	Hedge's g (95% CI)	Months progress	Statistical significance
Year 5 Maths (InCAS)	623 (232)	97.83 (96.31 to 99.36)	494 (356)	98.35 (96.65 to 100.04)	0.026 (-0.08 to 0.13)	1	✗
Year 5 Reading (InCAS)	642 (213)	100.53 (99.49 to 101.57)	492 (358)	100.98 (99.87 to 102.10)	-0.029 (-0.13 to 0.07)	-1	✗
Year 5 Maths (InCAS) *if FSM eligible*	166 (88)	90.19 (87.67 to 92.70)	115 (113)	86.61 (83.67 to 89.55)	-0.036 (-0.24 to 0.17)	-1	✗
Year 5 Reading (InCAS) *if FSM eligible*	167 (87)	95.17 (92.97 to 97.37)	114 (114)	93.50 (91.01 to 95.99)	0.017 (-0.18 to 0.22)	0	✗
Year 6 Maths (KS2)	823 (24)	29.11 (28.75 to 29.48)	759 (25)	28.77 (28.39 to 29.14)	-0.025 (-0.012 to 0.07)	-1	✗
Year 6 English (KS2)	823 (24)	28.73 (28.45 to 29.01)	759 (25)	28.52 (28.21 to 28.83)	-0.106 (-0.19 to 0.02)	-2	✓
Year 6 Maths (KS2) *if FSM eligible*	261 (5)	27.46 (26.80 to 28.12)	202 (2)	26.55 (25.86 to 27.25)	0.016 (-0.015 to 0.19)	0	✗
Year 6 English (KS2) *if FSM eligible*	261 (5)	27.28 (26.73 to 27.83)	202 (2)	26.70 (26.08 to 27.32)	0.120 (-0.03 to 0.27)	+2	✗*

**Marginal, non-significant trend (for example p<0.10)*

As can be seen from the above table, the overall trend is that PATHS failed to impact upon pupils' attainment. This is generally consistent across year groups (Year 5 and Year 6), outcome measures

(InCAS and KS2 assessment), subject areas (maths and English/reading), and analytical frames (intention to treat and sub-group). The only exceptions are an effect on KS2 English scores at intention to treat favouring the control group and a marginal, non-significant effect (p = 0.06) on KS2 English scores for FSM eligible pupils favouring the PATHS group. However, in both cases the ES are somewhat modest, equating to only 2 months progress, and so are unlikely to be 'practically significant' (Hill, Bloom, Black, and Lipsey, 2008). Thus, in relation to our first study aim outlined at the beginning of this report, *PATHS did not appear to have any impact on children's academic attainment*. With regard to our second study aim, *PATHS did not appear to produce 'differential gains' in academic attainment for children eligible for FSM*.

Cost

The cost of PATHS in the context of this trial differs significantly from the 'real world' costs of the programme because (a) intervention costs were funded by the EEF rather than schools, (b) a 'bulk discount' was applied to the intervention materials because a large number of curriculum packs were ordered, and (c) training was carried out en masse, with coaching support being provided free of charge. Thus, below we provide the *typical costs for a school under normal circumstances.* The figures presented were provided by the PATHS team at Birmingham City Council as it provides both materials and implementation support for PATHS as part of a traded service with English schools.

For a single form entry school, the initial cost of PATHS is **£6,532**. This 'bundle' figure includes the essentials for PATHS implementation: a curriculum pack for each year group from Reception to Year 6; additional/supplementary materials (for example books, CDs, puppets, 'feeling faces' and posters); initial training for seven teaching staff; headteacher and/or PATHS co-ordinator training; and two days of coaching time. Each of the different components included in this bundle are also available separately (for example, the Reception–Year 6 curriculum pack is available for £2,100, with individual year group packs costing between £295 and £515). Additional coaching is charged at £250/£500 per half-day/day. Finally, supplementary and/or advanced courses are available (for example a PATHS awareness course for parents costs £2,200).

Thus, for a single form entry school with seven classes with an average of 27 pupils (189 pupils on roll), the cost per pupil in the first year of implementation—for schools adopting the bundle cost above—is £6,532/189 = **£34.56**. Obviously, this figure reduces in each subsequent year as most of the above items are one-off, non-recurrent costs. Thus, in the eighth year of implementation—at which point a total of 378 pupils (the original cohort of 189 plus a new intake of 27 per year) would have participated—the cost per pupil is £6,532/378 = £17.28. However, there are recurrent costs associated with additional coaching and/or training days should schools wish to make use of the external support model recommended by the PATHS developers. For schools seeking *only* the PATHS curriculum packs themselves, the initial cost per pupil is £2,100/189 = **£11.11**. By the eighth year of implementation, this drops to £2,100/378 = **£5.56**.

In terms of teacher time, basic training is 1.5 days (1 initial day, 0.5 day follow-up), or approximately 10.5 hours. Each lesson is assumed to incur a relatively small amount of planning and preparation time given the prescriptive manual-driven nature of the intervention—approximately 20 minutes to allow familiarisation and preparation of materials. Each lesson takes on average 30 minutes to deliver. Thus, a single PATHS lesson uses around 50 minutes of teacher time. Taking Year 5 as an example, the 56 lessons (44 plus 12 'Jump Start' lessons recommended for use with classes that have not previously taken part in PATHS) would incur around **57 hours** of teacher time in the first year of implementation if training was attended and all lessons were delivered. Obviously, this figure is approximate and does not include activities which are much more variable (for example time spent engaging with coaches, and generalisation activities).

Implementation and process evaluation

As noted earlier, a process evaluation was not commissioned as part of this EEF study, however we are able to draw upon certain elements of the comprehensive IPE conducted as part of the main trial.

Implementation variability and its association with pupil outcomes

In the first section of this chapter we present quantitative analyses in which we examine the associations between different aspects of PATHS implementation and children's academic outcomes. Here we use data drawn from our independent, structured observations as this is generally considered a more rigorous and valid means through which to assess an implementation rather than teacher self-report (which can be prone to social desirability and/or impression management effects—see Domitrovich et al., 2008; Domitrovich, Gest, Jones, Gill, and DeRousie, 2010). However, the use of such observational data comes with its own limitations, chief amongst which is that it necessarily captures only a 'snapshot' of the implementation process.

Given that there are no agreed thresholds for implementation ratings (for example, it is not possible to definitively say what counts as an 'acceptable' level of fidelity/adherence), we used the observational data to grade each class/teacher as either 'low', 'moderate' or 'high' for each aspect of implementation according to where their raw scores sat in the overall distribution—low, < -1 SD; moderate, -1 to +1 SD; and high, > +1 SD. The only exception to this was *reach*: this was coded as high (100% of pupils present), moderate (90–99%), or low (< 90%) according to the proportion of pupils present during the PATHS lesson being observed. For all aspects of implementation, 'low' was set as the reference group in the models noted below.

As already noted, mean scores (minima 1; maxima 10) for fidelity (8.20), quality (8.48), participant responsiveness (7.34) and reach (9.08) were all high. However, mean dosage scores indicated that classes were an average of 20 lessons behind schedule at the point of observation (the equivalent of 10 weeks at 2 lessons per week). Thus, PATHS lessons were generally implemented well, but not at the frequency recommended by the programme developers.

As in the assessment of outcomes reported in the previous chapter, data was analysed using hierarchical linear modelling (also known as 'multi-level modelling') in view of the clustered and hierarchical nature of the datasets. Four-level (school, class/teacher, child, and time) models were constructed: minimisation (for example FSM) and usual practice (for example use of universal and targeted SEL approaches) variables were entered at the school level; implementation variables (for example fidelity/adherence, quality, dosage) were entered at the class/teacher level; sex and FSM eligibility were entered at the child level; and academic outcome data (prior attainment and post-test) was entered at the time level. As with the assessment of outcomes, continuous data was standardised to facilitate comparison of ES within and across models.

Table 4 summarises the main findings of these analyses. Full details of the models can be found in Appendix 3.

Table 4: PATHS implementation variability and its association with academic outcomes

		Y5 English		Y5 Maths		Y6 English		Y6 Maths	
		ES	Sig ?	ES	Sig ?	ES	Sig ?	ES	Sig ?
School level	Usual practice (universal)	-0.013	✗	-0.017	✗	0.031	✗*	0.025	✗
	Usual practice (targeted)	0.001	✗	0.012	✗	-0.014	✓	0.004	✓
Class level	Fidelity (compared to low)	0.032 (if moderate)	✗	0.021 (if moderate)	✗	-0.177 (if moderate)	✗	-0.104 (if moderate)	✗
		0.316 (if high)	✗	-0.140 (if high)	✗	0.031 (if high)	✗	-0.036 (if high)	✗
	Dosage (compared to low)	-0.032 (if moderate)	✗	-0.050 (if moderate)	✗	-0.001 (if moderate)	✗	-0.069 (if moderate)	✗
		0.000 (if high)	✗	0.000 (if high)	✗	0.000 (if high)	✗	0.000 (if high)	✗
	Quality (compared to low)	0.109 (if moderate)	✗	0.065 (if moderate)	✗	0.691 (if moderate)	✓	0.682 (if moderate)	✓
		0.315 (if high)	✗	0.066 (if high)	✗	0.622 (if high)	✗*	0.695 (if high)	✗
	Reach (compared to low)	0.323 (if moderate)	✓	0.341 (if moderate)	✓	0.458 (if moderate)	✓	0.298 (if moderate)	✓
		-0.178 (if high)	✗	-0.212 (if high)	✗	0.151 (if high)	✗	0.190 (if high)	✗
	Participant responsiveness (compared to low)	0.180 (if moderate)	✗	0.301 (if moderate)	✗	-0.345 (if moderate)	✗	-0.422 (if moderate)	✓
		0.000 (if high)	✗	0.000 (if high)	✗	-0.123 (if high)	✗	-0.261 (if high)	✗

**Marginal, non-significant trend (for example p < 0.10)*

There are several themes worthy of note here. First, variability in usual SEL practice at the targeted level, implementation quality, reach and participant responsiveness were each associated with outcome variability in one or more of our analyses. This speaks to the need for a comprehensive approach to the assessment of implementation (Lendrum, Humphrey and Greenberg, 2016). Second, in most cases, it is moderate rather than high (compared to low) levels of implementation that appear to make a

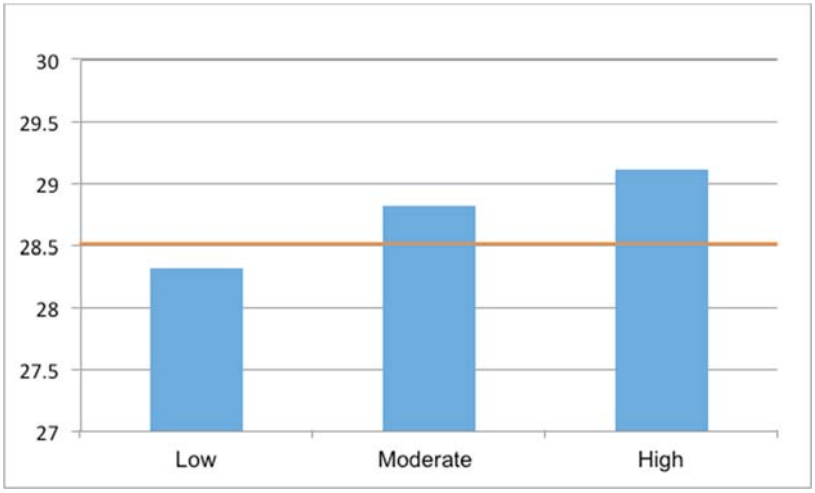
substantive difference. This is consistent with some previous research in the field of implementation science (for example Durlak and DuPre, 2008). Third, where findings are statistically significant, the ES associated with implementation variability are of a magnitude that is likely to be practically significant, for example a 0.691 SD increase in Year 6 English scores is associated with moderate (compared to low) quality implementation.

Implementation *fidelity* and *dosage* of PATHS appear to be unrelated to academic outcomes. Given the extensive literature base supporting these two aspects of implementation as moderators of intervention outcomes, this was somewhat surprising. However, many previous studies have examined *only* fidelity and dosage, and so it may be that the more comprehensive approach taken here has revealed a more complete picture (for example, the influence of fidelity may be greatly lessened once we have taken into account the actual *quality* of delivery). Also, much less is known about how implementation variability influences distal, as opposed to proximal, intervention outcomes (thus, fidelity and dosage variability may be more closely associated to outcomes such as children's social and emotional skills). Finally, in relation to dosage, it is important to note that classes/teachers were, on average, 20 lessons behind schedule. The nature of the exposure–response relationship may be such that none of the classes had received the sufficient number of lessons for us to be able to detect a dosage effect (a point which we return to later).

Quality also appears to be a key moderator of student outcomes, producing the largest ES across the four implementation analyses for Year 6 English and Maths respectively (see Figure 2). Taken in tandem with the (null) fidelity findings reported above, it would appear that teacher preparedness, enthusiasm, and the manner in which they engage children in PATHS lessons are ultimately more strongly associated with children's attainment than the extent to which they adhered to the lesson scripts. This is an important message given the dominant discourse of fidelity, particularly in 'manualised' (prescriptively documented) interventions such as PATHS.

Of all the aspects of implementation assessed in our observations, *reach* was the only one associated with outcome variability across all four analyses. To a certain extent this is self-explanatory—an intervention can only trigger change if the intended recipients are present when it is being delivered (particularly given the relatively meagre dosage levels noted above). Finally, *participant responsiveness* produced an unexpected finding, with an *inverse* association with Year 6 Maths scores being found (indicating that where children were rated as moderately responsive in PATHS lessons (compared to the low group), this was associated with a 0.422 standard deviation decrease in their Maths scores).

Figure 2: Year 6 English SAT scores and PATHS implementation quality



NB: Reference line is control group mean.

Control group activity

As noted earlier in this report, our assessment of usual practice extended to both arms of the trial and data was available via school-level surveys prior to randomisation and at one-year follow-up. 'Usual practice' in the control group comprised a range of named initiatives including (but not limited to): the whole-school component of the social and emotional aspects of learning (SEAL) programme; Circle Time; and the National Healthy Schools programme at the universal level; and the Targeted Mental Health in Schools programme; nurture groups; and the targeted component of the SEAL programme at the indicated/targeted level. Our analyses indicated that compared to those implementing PATHS, schools in the control arm had significantly increased their SEL-related activities at both the universal (ES = 0.42, $p < 0.05$) and targeted (ES = 0.52, $p < 0.05$) levels at the one-year follow-up stage. This so-called 'John Henry effect' (also known as compensation rivalry) is seen as a direct response to being randomly allocated to the usual practice arm and poses a potential threat to validity. However, re-analysis of the outcome data, presented in Table 3, that incorporated this data in the modelling procedures revealed no substantive differences in outcomes. That is, *the changes in control group behaviour observed had no bearing on the failure of PATHS to improve children's academic outcomes relative to the control group*.

Selected process evaluation findings

Here we provide a brief summary of selected findings from our qualitative exploration of the implementation and process-related issues that were evident in PATHS schools. This section is deliberately highly selective and purposive in nature. We present data that can help to illuminate and explain the findings reported earlier in this report. Data excerpts in the following text are from teacher interviews.

Philosophical fit

Staff interview data yielded useful insights regarding the cultural transferability of PATHS. This included perceptions of the programme's *philosophical fit* (for example, congruence with community, school, and teacher values/norms), *social validity* (for example, the extent to which it met a perceived need within the school), *practical fit* (for example, organisational and classroom requirements, pedagogical style, appropriate resources) and issues relating to *implementer understanding and skills* (for example, teachers' understanding of the principles of SEL). In relation to *philosophical fit*, the approach underpinning PATHS appeared to be compatible with the ethos of most of the intervention schools: *'We believe in delivering a whole curriculum, not just the academic subjects, to our children. We want them to be good social individuals when they leave our school'*. Certain aspects of the programme were particularly well received, including the 'Golden Rule', in which pupils are taught about the maxim, 'treat others as you would expect to be treated yourself': *'That's like my philosophy on life'*.

Meeting perceived needs

For many, PATHS was seen as meeting a clear need within school: *'I think because of contextual background there are a lot of children with a lot of varying social and emotional needs, and issues with understanding how to deal with anger or frustration. They may not have the verbal skills, they may not have the role models that some people have'*. In particular, several teachers noted the utility of PATHS for children with difficult or chaotic home lives: *'There are a lot of children here with problems outside of school and they will have had issues… it's been very good in that way'*. However, this view was by no means universal, and some staff questioned the extent to which a whole school approach—that they saw as benefiting only a few pupils—was justified (*'It's obviously more useful for children who need it more… but when you don't have that many issues with them anyway it's harder to keep bringing it up because you're not needing it'*), or indeed whether it was actually an effective model for vulnerable children (*'It doesn't work for the kids who need it just because they're too much into a raw emotion, sometimes they can't even explain what the issue is'*).

Practical fit—curriculum and implementation issues

In terms of practical fit, the approach schools and teachers took to integrating PATHS into the timetable had a clear bearing on their attitudes and approach to implementation:

'It's replaced our PSHE, so it means we don't discuss the wider PSHE issues anymore like global warming… that kind of stuff is basically just gone… I would like a bit more balance so maybe if it could be like that [PATHS] *once a week and then PSHE once a week just to give that balance again'*.

The PATHS materials themselves produced mixed reactions from teachers, with some praising its developmental appropriateness ('*I think they have been very appropriate… it seems to be about the right pitch for their age'*) while others felt that it was insufficiently anglicized ('*It's too Americanised*'; *'Some of the things in the booklet are very American'*). As a result, adaptations were common, but were primarily 'surface' changes to improve fit with pupils' needs, context, and/or individual teaching styles: *'I will change it into my own words that I know would fit more with my children… but still making sure the elements are the same'*. Although less frequent, some teachers reported making deeper changes, such as collapsing two lessons into one, or skipping lessons or concepts that they felt were inappropriate:

'*Like the Islamic population of the school really. Not that it's a taboo thing, it's just… we just decided not to do that one. We just skipped that one. We thought maybe we needed to give it a bit of time and come up with another problem that wasn't that. And I think… it could have got misconstrued if children had gone back saying we did a story about children drinking alcohol. It isn't that but parents wouldn't understand.'*

Pedagogical fit

Teacher responses regarding the pedagogical fit of PATHS centred primarily on the fact that it is a 'manualised' intervention. For some, this high level of prescription was comforting:

'*It's very simple to follow… and you don't really have to prepare anything.' 'It's straightforward, it's very basic common sense really… the objectives are very clear and… you don't have to worry about making resources.'*

But for others it was constraining and not conducive to pupils' engagement:

'The plans have far too much detail in and there's a lot of reading to get to the bare bones of what the lesson's doing… quite often they [the pupils] *kind of sit there and however many strategies you use they go "Oh its PATHS, we're going to get a story, we're going to talk about it, we're bored of it".'*

There were concerns about the length of some lessons, and many teachers reported that they would prefer a more interactive approach ('*I think sometimes the lessons are really, really long… I can't teach too much from a script'*). Despite these concerns, there was a clear sense that PATHS lesson objectives were directly relevant to key aspects of the teacher's role, such as classroom management, or were useful as a tool for responding to individual incidents: *'I like doing it with them because a lot of it is really relevant, the lessons that will come up, I will have had an incident happen linking to that… so I can see the value of it'*. However, some teachers struggled to fully embed PATHS into their existing behaviour management strategies:

'*You have to embed it throughout for it to be truly effective. I think what we're lacking is implementing it all the time. So referring to it daily within your behaviour rules… I'm just talking from my class really because I have my own behaviour strategies that I often forget to relate to the PATHS, to embed that in. So I'd say they, to really adopt it fully. Adopt it fully, take it on and make sure they're using it all the time.'*

Most teachers were highly familiar with the underlying principles and concepts of PATHS (*'It's common sense really'*). The trial followed on from a period of approximately six years in which the SEAL programme had been established in most primary schools across England. As a result, there was a

strong foundation in place already: *'I think because I've done SEAL… it's kind of familiar because I've been doing it for a long time'*. However, for some, the impression was that PATHS was perhaps insufficiently distinctive: *'It seems to cover a lot of the SEAL aspects that we were doing before*'.

Barriers and facilitators to effective implementation

Our process evaluation revealed explicit barriers to, and facilitators of, effective implementation that may help to account for the findings. At the macro level, an increasing shift toward a 'rationalist' model of education under the current Coalition government meant that many struggled to prioritise PATHS:

'*With all the pressure that we're under to have children achieve in English, Maths and Science… I'd much rather somebody who was a whizz at Maths could come in and say: "that's not working, let's try this"*. *It's obviously not as important as literacy, numeracy, and things like that—and we've got a huge focus on reading this year. It's there, but I don't think it's a huge focus*.'

Even in cases where PATHS was viewed as critical, instruction in core academic curriculum areas always won out ('*Well obviously it's massively important, but in terms of literacy and numeracy… it is below that'*). As one teacher noted: '*something has to give'*.

The issue of prioritisation often resulted in a perceived lack of time in the timetable to teach PATHS lessons at the recommended frequency ('*We have introduced a new literacy curriculum which takes up* [lots of time] *and it's very, very inflexible'*). Other initiatives (for example *'We are going for the Rights Respecting Award… so there hasn't really been a focus on PATHS as a whole school at the moment'*) or local, contextual issues ('*We're a church school so we have to do two and a half hours of RE'*) regularly took precedence over PATHS. Indeed, even routine school events and processes were perceived to affect the consistency of PATHS delivery: *'You've got the performance things for Easter, and the summer term one, Christmas, and harvest, and when you get rid of all these blocks you're trying to fit it in your timetable'*. These practical issues meant that, despite their best intentions, most teachers were unable to deliver PATHS on a twice-weekly basis:

'The intention was twice a week, but the reality of it was very different. Twice a week is nigh on impossible with everything else. I'm sure you've heard that from everybody. You know we did aim to do it twice a week and I'm sure that I wasn't on my own in losing that quite quickly. Just time constraints and having so much else to do on the curriculum—it really was impossible.'

For Year 6 classes, the understandable focus on SATs in the final year of the trial made it even more difficult to implement PATHS at anywhere near the recommended dosage: *'I think it would be later on in the year…* [when] *SATs have gone, then that is probably when I will get time to do them'*. This perceived lack of time also extended to being able engage with the recommended level of coaching support:

'*She's tried so hard to get in and help us with lessons and come in and observe us and teach us, and something else always just happens.' 'When she needs to talk to you about something and it's very difficult because* [of the] *limited amount of time, even five minutes is a big chunk of your time at lunch time.'*

Technical support and assistance

The technical support and assistance (or 'coaching') aspect of PATHS implementation met with mixed reactions. Very few teachers had experienced what they perceived to be such an intensive model of external support. Nearly all respondents felt that coaching was important and valued its intended purpose—to maximise implementation effectiveness: *'Oh you need it, definitely'*. Despite this, for some it was viewed as unnecessary, either because they were confident in their own skills and knowledge ('*To be honest, I don't mean to undervalue anyone's role, but I think the teachers who are implementing this PATHS course are well able to do it and know what's expected'*), or because they viewed the coaching model as intrusive ('*I wouldn't want someone checking up on me all of the time'*). Some felt

that continual support throughout the year was not needed (‘*Once you’re up and running with it… I doubt I’ll need* [coaching] *as much for the rest of the year’*).

For others, however, the availability of external support was viewed positively: it helped to build confidence (‘*She has come in and modelled a lesson for me, which was nice, and it was nice to know that I wasn’t doing things wrong’*); it provided valued opportunities for feedback and sharing of practice (‘*It was good because she was feeding back about other schools’ experiences’*); it engendered a sense of feeling collegiality and feeling supported (‘*She’s always on email if need be, and she readily makes herself available to you and she emails a PATHS newsletter and things like that’*); and in many cases served a motivational purpose (‘*It reinvigorates you’*).

School leadership

The involvement of school leadership also emerged as a critical factor affecting implementation. Where school leaders were perceived to be supportive of PATHS, teachers felt better equipped to deliver it in class and viewed it as more likely to become embedded across the school:

‘*Our head asked me about some of the things from PATHS and he did an assembly linked with some of the problem-solving… it’s sort of dripping it into other parts of the school*;’ *‘They support it to make sure it’s run consistently… throughout the school going to lunchtime organisers.’*

Some headteachers took on an active monitoring role, which was viewed as increasing the likelihood of consistent delivery:

‘Even though [the headteacher] *isn’t administering it… having him as someone who is saying “right I’m going to check out what is happening in PATHS”… I think knowing that he is there has been really, really useful. Because otherwise… it’s not coming down from the top… they need to put it on a higher profile for everyone to realise how important it is.’*

However, in some cases, school leadership influence was viewed as a barrier to implementation. For example, one teacher reported having the class timetable set inflexibly by the headteacher (*‘It’s not negotiable’*), which left only a small, token amount of time for PATHS lessons (*‘At the end of the day, which is not a good time… 3pm to 3.15pm, the children go home at 3.15pm’*). This created a frustrating situation in which there was the will, but not the way, to deliver PATHS regularly: *‘Its easy to implement if you’re given the time. If you’re not given the time it isn’t’.*

Conclusion

Key Conclusions
1. Overall, PATHS did not have a positive impact upon children's academic attainment.
2. The evidence does not indicate that PATHS produced differential gains for children eligible for free school meals (FSM).
3. Higher levels of PATHS implementation quality and reach were associated with better academic outcomes.
4. Teachers reported a lack of time to implement PATHS at the recommended frequency. On average, only half of the lessons were delivered.
5. While PATHS does not appear to be a cost-effective way of improving students' attainment, it may have an impact on other, non-cognitive outcomes. A full report on the NIHR trial looking at these outcomes will be published at a later date.

The primary aims of this study were:

1. to assess the impact of PATHS on children's academic attainment;
2. to determine if PATHS produces 'differential gains' in academic attainment for children eligible for free school meals (FSM);
3. to assess the extent to which PATHS implementation variability is associated with variability in children's academic outcomes; and
4. to identify process-related issues that might serve to illuminate the mechanisms underpinning findings for 1, 2 and 3 above.

We utilised a cluster-randomised controlled trial design with a parallel implementation and process evaluation in order to achieve these aims. In relation to the first aim, our analyses did not produce any evidence of the impact of PATHS on children's attainment in English (reading) or maths. Indeed, the only statistically significant finding at the intention to treat level favoured schools in the 'usual practice' arm of the trial (Year 6 English). At the sub-group level of analysis (the second aim above), there was no reliable evidence that PATHS produced differential gains in attainment for children eligible for free school meals. Although there was a marginal, non-significant trend indicating greater gains in English among FSM-eligible Year 6 pupils in PATHS schools, the associated effect size was extremely modest, being the equivalent of only two months' progress compared to equivalent pupils in usual practice schools.

Implementation analyses (the third aim above) revealed that PATHS implementation variability was associated with variability in children's academic outcomes. Variability in usual SEL practice (targeted), quality, and reach each predicted child-level outcomes in at least 2 of our 4 analyses, with the largest ES being associated with increased implementation quality. Finally, our evaluation of process (the fourth aim) produced useful explanatory data. Of particular note in the light of the results outlined above was teachers' perceived lack of time to implement PATHS at the recommended frequency: this was ascribed to a variety of issues including competing priorities.

Limitations

As with any study, this research was subject to limitations. First, the problems experienced with the InCAS measure (see Methods section) necessitated a design change—not ideal in the context of a major trial of this nature. However, the use of a post-test design (with prior attainment data used as a baseline covariate) is considered to be an extremely robust alternative, and ultimately our analyses proved to be adequately powered, with MDES ranging from 0.17 (Year 6) to 0.19 (Year 5). In the case of the Year 6 analyses we were also able to benefit from an unbiased sample as the use of attainment

data derived from the NPD meant that there was zero school attrition. Second, given that improvements in academic attainment are viewed as a *distal* outcome of PATHS, a case could be made that our trial design was not of sufficient length to allow measurable improvements in attainment to be triggered. However, this view is incongruent with the findings of the aforementioned PATHS trial by Schonfeld et al. (2014) that reported improvements in both reading and maths over an equivalent period of time (albeit the attainment of a basic level of proficiency as opposed to the degree of change in test scores reported in this study). Furthermore, the three recent meta-analyses of universal SEL interventions (Durlak et al., 2011; Sklad et al., 2012; Wigelsworth, Lendrum and Oldfield, in press) each reported meaningful improvements in academic attainment for interventions over much shorter periods of time (for example, 77% of the interventions reported by Durlak et al. (2011) lasted less than one year).

A third and more plausible limitation relates to the low dosage rates identified in our IPE (as a reminder, our data indicated that teachers were implementing PATHS at an average of half the recommended frequency—one lesson per week). Although this is not a limitation of our research design per se, it could be argued that the apparent failure of PATHS to improve children's academic attainment in this trial was attributable to implementation failure. To draw an analogy from pharmacology, for the intervention to trigger distal changes in outcomes such as attainment, there may be a 'minimum effective dose' (MED) (Liu, 2010) that PATHS schools failed to reach. The SEL theory of change outlined earlier would seem to support this—children presumably need a certain level of consistent exposure in order to produce the kind of meaningful changes in their social and emotional skills (such as being better able to manage their behaviour, understand their emotions and work well with others) and improvements in their classroom climate that could then feasibly influence how well they do in school academically. Given the established dose–response relationships found elsewhere (for example Durlak and DuPre, 2008; Schonfeld et al., 2014) the failure of our implementation analyses to identify any relationship between dosage variability and outcome variability provides some confirmatory evidence for this hypothesis. As the MED was not reached overall, *relative* variability in dosage within the sample proved to be insignificant. However, even if this is indeed the case, questions are still raised in relation to the feasibility of PATHS as a tool for improving the attainment of children in England. That is, if schools in a major trial in which training, materials and external support and assistance were made available at no cost were not able to deliver PATHS at the frequency and consistency required to trigger academic change, what is the likelihood that schools will be able to do this in typical circumstances and conditions?

A fourth set of limitations pertains to our assessment of implementation. Although generally considered to be a more valid means through which to assess implementation than the more frequently used teacher self-report surveys (Humphrey, 2013), independent observations only provide a snapshot of activity that may or may not be representative of implementation activity across the school year. Furthermore, it is impossible to rule out so-called 'observer effects' (that is, a change in behaviour as a result of knowing one is being observed). Finally, it is important to acknowledge that a number of the aspects of implementation that were assessed in this study could feasibly be viewed as a proxy for latent factors that co-vary with children's attainment. So, for example, the quality of implementation of PATHS may simply be a proxy for teaching quality more generally. As we did not have the resources to observe teachers implementing non-PATHS lessons, this cannot be ruled out. Similarly, reach may be a proxy for attendance patterns within a given school.

Interpretation and generalizability

What is to be made of the findings of this study? It is important to consider the extent to which they may be considered robust and secure, and in light of this we refer to the EEF's guidance on classifying the security of trial findings (see Appendix 4), which assigns up to 5 'padlocks' for each of 5 key criteria, with a higher number of padlocks equating to greater security.

The Year 6 findings were awarded the full 5 padlocks, while the Year 5 findings were awarded 4 (due to attrition during the trial and the fact that the administrators of the Year 5 test were not blind to the treatment status of participants). Overall, the findings of this study can be considered to be robust and secure. Additionally, it is worthy of note that the study also complied with the EEF's various quality markers. In terms of trial set-up, the study was registered at ISRCTN and a protocol was produced that was made available online:

http://educationendowmentfoundation.org.uk/projects/promoting-alternaive-thinking-strategies-paths-manchester-university/

The outcome measures used were evaluated by the EEF and considered to be reliable, externally valid and non-intervention specific. Outcome tests were marked by individuals or organisations that were blind to each school's allocation status. Randomisation was conducted independently of the evaluation team by a statistician in the MAHSC-CTU. All analysis and reporting is based on CONSORT standards and EEF guidelines.

In terms of generalizability, while the robustness and security of our findings noted above are important, it is worth questioning the extent to which the composition of our study sample mirrors that of schools and children across England—are our schools and children 'typical'? On this front we are in relatively good shape, albeit with a school sample that reflects the primarily urban setting of the trial schools (somewhat larger schools, with higher proportions of pupils eligible for FSM and speaking EAL than is the case nationally). Of note here is the fact that the trial schools were spread across seven diverse LAs.

Noting the security of our findings and their likely generalizability, it is not possible to recommend PATHS as an effective intervention for improving the academic attainment of children in English primary schools. Of course, this conclusion comes with some caveats (see earlier), chief amongst which is the likely lack of an MED being reached, in other words, the findings may be due to implementation failure as opposed to programme/theory failure. We also note the marginal, non-significant trend toward higher English SAT scores for FSM-eligible pupils in PATHS schools when compared to their counterparts in usual practice schools. Given the low cost per pupil of the intervention, we can speculate that PATHS is, perhaps, an inexpensive vehicle to produce relatively small improvements in attainment for this specific sub-group, but further research would be needed to confirm this. Specifically, this study was initially powered for ITT rather than sub-group analysis, and we would need to determine a means through which to ensure that the MED is reached across schools/classes in order to produce practically meaningful effects. In relation to the latter, close attention would need to be paid to the factors affecting implementation that were identified through our process evaluation.

Future research and publications

As noted earlier, the research documented in this report is an augmentation of a larger trial funded by the NIHR. The main trial focused on the impact of PATHS on children's social and emotional wellbeing, health-related quality of life, and other outcomes. The findings of this trial will be published and disseminated in due course, alongside papers derived from our IPE. We also anticipate publications based on the findings reported here to appear in academic and practitioner-oriented periodicals. The evaluation team is currently engaged in a follow-up phase, tracking the outcomes of the Year 6 cohort (who are now in secondary school) for a further two years in order to identify any sleeper or maintenance effects among our primary and secondary outcomes.

In terms of future research on PATHS, we feel that further study is warranted regarding (a) the potential impact upon Year 6 English scores for FSM-eligible pupils, (b) how best to facilitate and document a MED for PATHS in relation to attainment, and (c) the possible interaction between (a) and (b), that is: if the conditions for a PATHS MED can be facilitated, does this produce more meaningful and measurable changes to Year 6 English scores among FSM-eligible pupils?

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Appendix 1: Sample Parent information and consent sheet

PATHS TO SUCCESS

INFORMATION SHEET FOR PARENTS

Your child's school is involved in an exciting project about the Promoting Alternative Thinking Strategies (PATHS) curriculum, called 'PATHS To Success'. PATHS is a programme for all children that helps them to manage their behaviour, understand their emotions and work well with others. Our research project will help us to understand if PATHS works for children in Years 3-6. The project is funded by the National Institute for Health Research.

We are writing to you because your child's school is involved in the project and we would like to know what you think about it. We will collect your views, those of your child, and his/her teacher once a year starting June/July 2012 (see below).

Please take time to read the following information carefully and decide whether or not you would like to take part.

If you would like any more information or have any questions about the research project, please telephone Dr Alexandra Barlow on 0161 275 3504 or email her at alexandra.barlow@manchester.ac.uk.

Who will conduct the research?

The research will be conducted by Professor Neil Humphrey and his research team at the School of Education, University of Manchester, Oxford Road, Manchester M13 9PL.

Title of the research

"PATHS To Success"

What is the aim of the research?

Our main aim is to examine the impact of the PATHS curriculum on the social and emotional wellbeing of children in primary schools in England.

Where will the research be conducted?

Primary schools in Greater Manchester.

What is the duration of the research?

The project itself runs from January 2012 until August 2017. The schools that implement PATHS (see below) will do so from September 2012 to July 2014.

Why have I been chosen?

We are writing to you because your child's school is taking part in the PATHS to Success Project. Schools will be randomly chosen to (a) implement PATHS over a two year period (PATHS schools), or (b) continue as normal (comparison schools). We will be collecting data in both PATHS and comparison schools. After two years, all schools will be free to decide whether they wish to start/continue using PATHS.

What would I be asked to if I took part?

You will be asked to complete a brief online survey about your child's strengths and difficulties. Your child's class teacher will complete a similar survey.

Your child will be asked to complete a short survey about how well they work with others and how they feel about themselves and their school. If your child needs help to do this, they will be able to get support from a member or school staff or one of our researchers.

These surveys will be completed three times – in June/July 2012, 2013 and 2014. They will take approximately 10 minutes to complete each time.

In consenting to take part you are also giving permission for your child and his/her teacher to complete these surveys.

If you do not have access to the internet we will be happy to either provide a paper copy or complete it over the telephone with you at an agreed time. If you would like to do this please contact Dr Alexandra Barlow (details below) and she will arrange this for you.

What happens to the data collected?

The data will be analysed by our research team at the University of Manchester. We will write a report based on our analyses for the National Institute for Health Research. It is also likely that we will write articles for academic journals based on what we find out in the project. Finally, it is possible that we will write a book about the research. Your child's name will not be used in any of the reports that we write.

How is confidentiality maintained?

All data provided will be treated as confidential and will be completely anonymous. Identifying information (your child's name) will only be used in order to match responses about the same individual from different respondents (e.g. parents and teachers) and across different times (e.g. June/July 2012, 2013, and 2014). After this matching process is complete, all identifying information will be destroyed.

The website that houses the survey will be completely secure and password protected. All survey data will be stored on a secure, password protected computer to which only senior members of the research team have access.

What happens if I do not want to take part or I change my mind?

It is up to you if you want to take part.

If you decide to take part you do not need to do anything – you will be sent further details about when and how to complete the survey in the near future.

If you decide not to take part then you need to either complete the opt-out consent form enclosed and return it to our research team at the address above or contact Dr. Alexandra Barlow by telephone or email (details above) by Friday 1st June 2012.

If you decide to take part and then change your mind, you are free to withdraw at any time without needing to give a reason. If you do this please rest assured that we will destroy any data collected about your child as part of the study.

Will I be paid for participating in the research?

We are not able to offer any payment or incentive for participating in this study.

Criminal Records Check

Every member of our research team has undergone a Criminal Records Bureau check at the Enhanced Disclosure level.

Contact for further information

Dr. Alexandra Barlow
Educational Support and Inclusion
School of Education
University of Manchester
Oxford Road
Manchester
M13 9PL
Tel: 0161 275 3504
Email: alexandra.barlow@manchester.ac.uk

Also, please see our website for further details about the PATHS curriculum and background, the project design and project team.

The website can be found at: www.pathstosuccess.info

What if something goes wrong?

If completing the survey makes you worry about your child's wellbeing then you should contact the school in the first instance and ask to speak to his/her teacher.
You can also get independent support and advice from a charity called Young Minds. Their parent helpline number is 0808 802 5544.

If you ever wish to make a formal complaint about the conduct of the research you should contact the Head of the Research Office, Christie Building, University of Manchester, Oxford Road, Manchester M13 9PL.

PATHS TO SUCCESS

PARENT CONSENT FORM

An information sheet is attached to this form. Please read it carefully before making a decision about taking part.

If you are willing to take part then you do not need to do anything at the moment.

If you decide not to take part, then you need to complete the opt-out consent form below and use the freepost code below and return it to:

FREEPOST RLYU-KAAB-AXRC
Dr Alexandra Barlow,
Educational Support and Inclusion,
School of Education,
University of Manchester,
Oxford Road,
Manchester,
M13 9PL.

Alternatively, Dr. Barlow can be contacted by telephone on 0161 275 3504 or email at alexandra.barlow@manchester.ac.uk. If you do not wish to participate please let us know by Friday 1st June 2012.

Finally, please also remember that if you do decide to take part, you are free to change your mind at any point in the study.

I **do not** wish to participate in the PATHS to Success project. My details are as follows:

My name	
My child's name	
Name of my child's school	

Signed: _____ Date: _____

Appendix 2: Impact analysis multi-level model tables

NB: All continuous data in Tables 6–13 was standardised prior to analysis to facilitate comparison of ES within and across models (all ES were then converted to Hedge's g as per EEF specifications—see right hand column).

Table 6: Year 5 Reading

		Empty model $\beta_{0ij} = -0.049\ (0.051)$			Test model $\beta_{0ij} = 0.184\ (0.079)$			Hedge's g
Level		**Co-efficient β**	**SE**	**p**	**Co-efficient β**	**SE**	**p**	
School		0.091 (9%)	0.024	.001	0.031 (3.5%)	0.011	<.001	
	FSM				-0.007	0.002	<.001	
	EAL				-0.000	0.001	ns	
	If PATHS				0.022	0.078	ns	
Pupil		0.638 (63.2%)	0.030	<.001	0.574 (65%)	0.028	< .001	
	If FSM				-0.546	0.078	<.001	
	If female				0.320	0.043	<.001	
Time		0.280 (27.8%)	0.012	<.001	0.278 (31.5%)	0.012	<.001	
	If Post-test				-0.032	0.038	ns	
Interaction	**Group*time**				**-0.029**	**0.052**	**ns**	**-0.029**
	Group*FSM				0.087	0.106	ns	
	FSM*time				0.006	0.077	ns	
	Group*FSM*time				**0.017**	**0.102**	**ns**	**0.017**
-2*Loglikelihood		7007.149			6692.027			
		X2 (27, n = 2730) = 315.122, p < .001						

Table 7: Year 5 Maths

		Empty model $\beta_{0ij} = -0.053\ (0.058)$			Test model $\beta_{0ij} = 0.352\ (0.099)$			Hedge's g
Level		**Co-efficient β**	**SE**	***p***	**Co-efficient β**	**SE**	***p***	
School		0.127 (12.8%)	0.032	<.001	0.063 (7.1%)	0.018	ns	
	FSM				-0.007	0.002	<.001	
	EAL				-0.003	0.002	ns	
	If PATHS				0.013	0.095	ns	
Pupil		0.856 (57.5%)	0.028	<.001	0.539 (60.4%)	0.027	<.001	
	If FSM				-0.458	0.078	<.001	
	If female				0.045	0.043	ns	
Time		0.293 (29.7%)	0.012	<.001	0.291 (32.6%)	0.013	ns	
	If Post-test				-0.020	0.039	ns	
Interaction	**Group*time**				**0.026**	**0.053**	**ns**	**0.026**
	Group*FSM				0.158	0.107	ns	
	FSM*time				-0.060	0.079	ns	
	Group*FSM*time				**-0.036**	**0.104**	**ns**	**-0.036**
-2*Loglikelihood		6906.135			6664.674			
		X^2 (27, n = 2712) = 241.461, *p* < .001						

Table 8: Year 6 English

		Empty model $\beta_{0ij} = -0.032\ (0.052)$			Test model $\beta_{0ij} = 0.110\ (0.084)$			Hedges g
Level		**Co-efficient β**	**SE**	**p**	**Co-efficient β**	**SE**	**p**	
School		0.094 (9.4%)	0.025	<.001	0.036 (4%)	0.013	.004	
	FSM				-0.008	0.002	<.001	
	EAL				-0.001	0.002	ns	
	If PATHS				0.201	0.083	.011	
Pupil		0.666 (66.3%)	0.029	<.001	0.618 (69.1%)	0.027	<.001	
	If FSM				-0.362	0.084	<.001	
	If female				0.266	0.044	<.001	
Time		0.244 (24.3%)	0.009	<.001	0.240 (26.9%)	0.009	<.001	
	If post-test				0.063	0.030	.018	
Interaction	**Group*time**				**-0.106**	**0.043**	**.007**	**-0.106**
	Group*FSM				-0.066	0.111	ns	
	FSM*time				0.072	0.058	ns	
	Group*FSM*time				**0.120**	**0.078**	**.062**	**0.120**
-2*Loglikelihood		7471.066			7157.864			
		X^2 (28, n = 3062) = 313.202, p < .001						

Table 9: Year 6 Maths

		Empty model $\beta_{0ij} = -0.033\ (0.051)$			Test model $\beta_{0ij} = 0.300\ (0.086)$			Hedges g
Level		**Co-efficient β**	**SE**	**p**	**Co-efficient β**	**SE**	**p**	
School		0.094 (9.4%)	0.025	<.001	0.038 (4.1%)	0.013	.003	
	FSM				-0.007	0.002	.001	
	EAL				-0.001	0.002	ns	
	If PATHS				0.158	0.085	.036	
Pupil		0.606 (60.7%)	0.028	<.001	0.579 (63.2%)	0.027	<.001	
	If FSM				-0.404	0.085	<.001	
	If female				-0.073	0.044	.049	
Time		0.299 (29.9%)	0.011	<.001	0.299 (32.6%)	0.011	<.001	
	If post-test				0.003	0.034	<.001	
Interaction	**Group*time**				**-0.025**	**0.047**	**ns**	**-0.025**
	Group*FSM				0.035	0.113	ns	
	FSM*time				0.017	0.064	ns	
	Group*FSM*time				**0.016**	**0.087**	**ns**	**0.016**
-2*Loglikelihood		7722.919			7472.368			
		X^2 (28, n = 3062) = 250.551, p < .001						

Appendix 3: Implementation analysis multi-level model tables

Table 10: Year 5 Reading

Empty model $\beta_{0ij} = -0.045\ (0.066)$				Test model $\beta_{0ij} = 2.90\ (0.736)$				
Level	**Co-efficient β**	**SE**	**p**			**Co-efficient β**	**SE**	**p**
School	0.048	0.034	ns	School		0.000	0.000	ns
					FSM	-0.001	0.003	ns
					EAL	0.002	0.002	ns
					Universal SEL	-0.013	0.017	ns
					Targeted SEL	0.001	0.022	ns
Class	0.045	0.031	ns	Class		0.000	0.000	ns
					Dosage (compared to low)	-0.032 (if mod) 0.000 (if high)	0.102 0.000	ns ns
					Fidelity (compared to low)	0.032 (if mod) -0.316 (if high)	0.164 0.319	ns ns
					Quality (compared to low)	0.109 (if mod) 0.315 (if high)	0.263 0.351	ns ns
					Responsiveness (compared to low)	0.180 (if mod) 0.000 (if high)	0.299 0.000	ns ns
					Reach (compared to low)	0.323 (if mod) -0.178 (if high)	0.146 0.165	.019 ns
					Observed week number	-0.144	0.035	<.001
Pupil	0.662	0.043	<.001	Pupil		0.603	0.048	<.001
					If female	0.351	0.077	<.001
					If FSM	-0.433	0.090	<.001
Time	0.289	0.016	<.001	Time		0.278	0.019	<.001
					If post-test	-0.087	0.035	.006
-2*Loglikelihood = 3729.046				**-2*Loglikelihood = 2324.768**				
X^2 (25, n = 958) = 1404.278, p < .001								

Table 11: Year 5 Maths

Empty model $\beta_{0ij} = -0.064\ (0.071)$				Test model $\beta_{0ij} = 3.479\ (0.922)$				
Level	**Co-efficient β**	**SE**	**p**			**Co-efficient β**	**SE**	**p**
School	0.052	0.039	ns	**School**		0.000	0.000	ns
					FSM	-0.001	0.004	ns
					EAL	-0.001	0.002	ns
					Universal SEL	-0.017	0.019	ns
					Targeted SEL	0.012	0.025	ns
Class	0.073	0.037	.029	**Class**		0.016	0.013	ns
					Dosage (compared to low)	-0.050 (if mod) 0.000 (if high)	0.146 0.000	ns ns
					Fidelity (compared to low)	0.021 (if mod) -0.140 (if high)	0.184 0.353	ns ns
					Quality (compared to low)	0.065 (if mod) 0.066 (if high)	0.300 0.390	ns ns
					Responsiveness (compared to low)	0.301 (if mod) 0.000 (if high)	0.337 0.000	ns ns
					Reach (compared to low)	0.341 (if mod) -0.212 (if high)	0.173 0.189	.030 ns
					Observed week number	-0.166	0.029	<.001
Pupil	0.512	0.037	<.001	**Pupil**		0.468	0.044	<.001
					If female	0.110	0.070	ns
					If FSM	-0.347	0.082	<.001
Time	0.317	0.018	<.001	**Time**		0.283	0.019	<.001
					If post-test	-0.066	0.036	.036
-2*Loglikelihood = 3615.510				**-2*Loglikelihood = 2221.771**				
X^2 (25, n = 948) = 1393.739, p < .001								

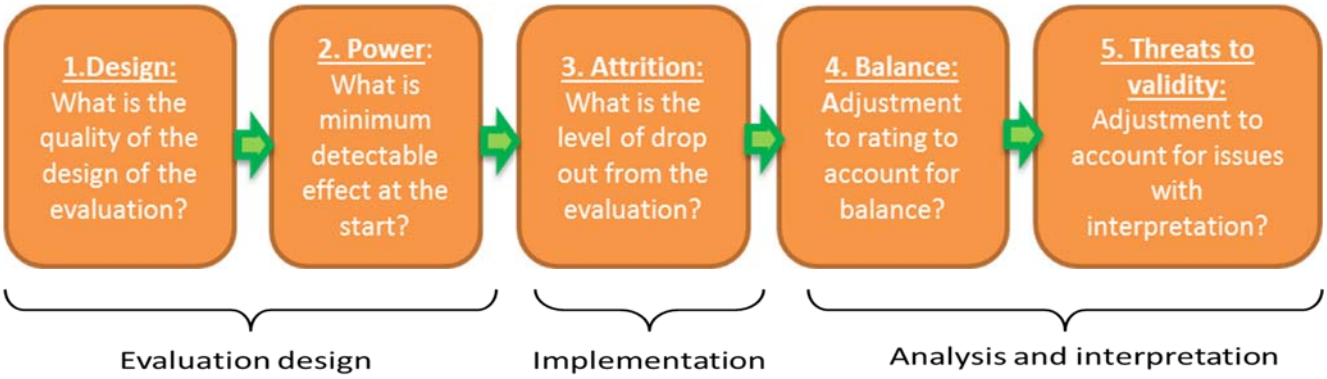
Table 12: Year 6 English

Empty model $\beta_{0ij} = 0.024\ (0.074)$				Test model $\beta_{0ij} = -1.271\ (0.741)$				
Level	**Co-efficient β**	**SE**	**p**			**Co-efficient β**	**SE**	**p**
School	0.055	0.042	ns	**School**		0.000	0.000	ns
					FSM	-0.009	0.004	.019
					EAL	0.003	0.003	ns
					Universal SEL	0.031	0.019	.060
					Targeted SEL	-0.014	0.023	ns
Class	0.077	0.039	.029	**Class**		0.029	0.016	.044
					Dosage (compared to low) Dosage (compared to low)	-0.001 (if mod) 0.000 (if high)	0.115 0.000	ns ns
					Fidelity (compared to low) Fidelity (compared to low)	-0.177 (if mod) 0.031 (if high)	0.168 0.259	ns ns
					Quality (compared to low) Quality (compared to low)	0.691 (if mod) 0.622 (if high)	0.302 0.381	.017 .060
					Responsiveness (compared to low) Responsiveness (compared to low)	-0.345 (if mod) -0.123 (if high)	0.256 0.304	ns ns
					Reach (compared to low) Reach (compared to low)	0.458 (if mod) 0.151 (if high)	0.170 0.152	.007 ns
					Observed week number	0.063	0.036	.049
Pupil	0.575	0.037	<.001	**Pupil**		0.548	0.039	<.001
					If female	0.324	0.065	<.001
					If FSM	-0.398	0.079	<.001
Time	0.263	0.013	<.001	**Time**		0.255	0.014	<.001
					If post-test	-0.010	0.028	ns
-2*Loglikelihood = 3872.527				**-2*Loglikelihood = 3038.233**				
X2 (25, n = 1308) =834.294, p < .001								

Table 13: Year 6 Maths

Empty model $\beta_{0ij} = 0.031\ (0.069)$				Test model $\beta_{0ij} = -0.995\ (0.679)$				
Level	**Co-efficient β**	**SE**	**p**			**Co-efficient β**	**SE**	**p**
School	0.048	0.037	ns	**School**		0.041	0.021	.033
					FSM	-0.012	0.005	.014
					EAL	0.004	0.003	ns
					Universal SEL	0.025	0.023	ns
					Targeted SEL	0.004	0.028	ns
Class	0.062	0.034	.044	**Class**		0.000	0.000	ns
					Dosage (compared to low) Dosage (compared to low)	-0.069 (if mod) 0.000 (if high)	0.121 0.000	ns ns
					Fidelity (compared to low) Fidelity (compared to low)	-0.104 (if mod) -0.036 (if high)	0.191 0.257	ns ns
					Quality (compared to low) Quality (compared to low)	0.682 (if mod) 0.695 (if high)	0.256 0.343	.008 ns
					Responsiveness (compared to low) Responsiveness (compared to low)	-0.422 (if mod) -0.261 (if high)	0.225 0.290	.038 ns
					Reach (compared to low) Reach (compared to low)	0.298 (if mod) 0.190 (if high)	0.164 0.166	.043 ns
					Observed week number	0.061	0.035	.049
Pupil	0.555	0.037	<.001	**Pupil**		0.562	0.042	<.001
					If female	-0.013	0.068	ns
					If FSM	-0.382	0.082	<.001
Time	0.313	0.016	<.001	**Time**		0.326	0.018	<.001
					If post-test	0.005	0.032	ns
-2*Loglikelihood = 4010.200				**-2*Loglikelihood = 3243.888**				

Appendix 4: Security classification of trial findings



Rating	1. Design	2. Power (MDES)	3. Attrition	4. Balance	5. Threats to validity
5 🔒	Fair and clear experimental design (RCT)	< 0.2	< 10%	Well-balanced on observables	No threats to validity
4 🔒	Fair and clear experimental design (RCT, RDD)	< 0.3	< 20%		
3 🔒	Well-matched comparison (quasi-experiment)	< 0.4	< 30%		
2 🔒	Matched comparison (quasi-experiment)	< 0.5	< 40%		
1 🔒	Comparison group with poor or no matching	< 0.6	< 50%		
0 🔒	No comparator	> 0.6	> 50%	Imbalanced on observables	Significant threats

Padlock factors shown in light green for Year 6 results, and dark green for year 5 results.

The final security rating for this trial is 4 🔒 for the Year 5 results, and 5 🔒 for the year 6 results. This means that the Year 5 conclusions have moderate security, and the Year 6 results have high security.

This evaluation was designed as a randomised controlled trail. The sample size was designed to detect a MDES of less than 0.2 for both year groups. Only 37 of the 45 schools (82%) randomised were followed up for Year 5 testing, reducing the security for this year group to 4 🔒. All schools were followed up for Year 6 tests. Balance at baseline was high. The post-tests in year 5 were administered by Research Assistants that were not blind to the treatment status of participants, incurring a potential threat to the validity of the findings for this year group, but not enough to reduce the security to 3 🔒. Therefore, the final security rating is 4 🔒 for Year 5 and 5 🔒 for year 6.

Appendix 5: Cost rating

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.

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