Parents and Children Together (PACT)

Evaluation Report

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Parents and Children Together (PACT) was evaluated by a team of researchers at Durham University led by Victoria Menzies and Helen Cramman, which included Paivi Eerola, Jessica Hugill-Jones, Adetayo Kasim, Christine Merrell, Julie Rattray, Nasima Akhter, Sarah Hallett, and Jochen Einbeck working in collaboration with Lyn Robinson-Smith at the University of York.

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Executive summary

The project

The Parents and Children Together (PACT) programme is an early language teaching programme delivered by parents or carers to their child in the year before they start reception. The overall aim of the programme is to improve children's language development by increasing the frequency and quality of parent/carer-child interaction through the use of specific programme activities. PACT provides content for 150 home-based language teaching sessions using storybooks where it is expected parents/carers deliver 20-25 minutes sessions for, five days a week, for 30 weeks. Parents/carers receive a two-hour training session to deliver the programme to their child and a lead contact for the nursery (PACT lead) receives a five-hour training session to support parents.

In this project, 450 children aged three to four from 47 mainly school-based nurseries in Rochdale, Tameside, Lancashire, Bolton, and Warrington participated. At the end of the evaluation, children were in reception, and spread across 122 schools. The evaluation used a two-armed randomised controlled efficacy trial where 225 children received PACT and 225 formed the 'usual care' comparison group. The implementation and process evaluation focused on tracking and monitoring delivery of the intervention with data collected through observations of training sessions, surveys, interviews, and administrative data.

The intervention was delivered between October 2019 and August 2020. As a consequence of the Covid-19 pandemic there was significant disruption to intervention and trial delivery. Key issues included: disruption to family routines and parent's delivery of the intervention, delayed provision of the final pack of PACT materials, assessments of children's language skills immediately following the intervention (in summer 2020) being cancelled, the primary outcome changing to the delayed post-testing point (summer 2021), the measure for language skills changing to the tablet-based assessment LanguageScreen and the assessment being delivered by school staff rather than researchers blinded to allocation. This project was co-funded with financial support from SHINE.

Table 1: Key conclusions

Key conclusions
Assessments completed ten months after intervention delivery (and following continued disruption to education and family life by the pandemic) showed children who received PACT made, on average, no additional months' progress in overall language skills compared to children who did not receive the programme. This result has a moderate to high security rating.
The subcomponents of the language measure show children who received PACT made, on average, one month of additional progress in expressive vocabulary compared to children who did not receive PACT. However, PACT children made, on average, one month less progress in listening comprehension and sentence repetition than non-PACT children. The two groups scored similarly in terms of receptive vocabulary.
The PACT intervention had a positive but low impact on the home learning environment (HLE) when measured immediately after programme delivery but this was not maintained when assessed again five months later. This result has a lower security as there were high levels of missing data at immediate post-test (32%) meaning this finding should be interpreted cautiously.
Parents/carers engaged well with the programme with engagement starting high but decreasing over time. The mean number of weeks completed by parents/carers was 18.71 out of 30. This was a similar number of sessions as the previous trial of PACT even though here Covid-19 disrupted programme delivery. Analysis showed that the more sessions delivered, the greater the impact the programme had on children's language skills. However, even at high levels of delivery (90% of sessions completed), the impact of the programme ten months later was low at one month of additional progress.
Interviews and surveys of participants reported that PACT had increased the amount of quality time parent/carers and their children routinely spent together and that parents/carers and nursery staff perceived that PACT had improved children's language outcomes. The key difficulties faced by families in implementing the programme were finding time in the family routine for PACT sessions at the required intensity and, for some families, keeping children motivated for the duration of the programme.

EEF security rating

These findings have a moderate to high security rating. This was an efficacy trial, which tested whether the intervention worked under developer-led conditions in initially 47 schools with 450 pupils (351 pupils in the final analysis). Following changes due to Covid-19, 22% of pupils were not included in the final analysis because their school was not able to implement the delayed post-test assessments. Missing data was similarly split between the treatment (n = 50) and control group (n = 47) and analysis showed missing data was unlikely to have influenced findings.

Impact

Table 2: Summary of impact on primary outcomes

Outcome/ Group	Effect size (95% confidence interval)	Estimated months' progress	EEF security rating	No of children	P Value	EEF cost rating
Language skills (latent variable)	0.01 (-0.27, 0.31)	0	🔒🔒🔒🔓🔓	351	0.902	£ £ £ £ £
Early Years Pupil Premium subgroup (language skills)	-0.17 (-0.75, 0.41)	- 2	N/A	70	0.354	N/A

Additional findings

Assessments completed ten months after intervention delivery showed children who received PACT ('PACT children') made, on average, no additional months' progress in language skills compared to children who did not receive PACT ('non-PACT children'). This is our best estimate of impact, which has a moderate to high security rating. As with any study there is always uncertainty around the result: the range of possible impacts for this programme include moderate positive effects of four additional months progress to moderate negative effects of four months less progress.

The language measure used at delayed post-test (LanguageScreen) includes four subtests which provided secondary outcomes. PACT children made, on average, one month of additional progress in expressive vocabulary compared to non-Pact children. However, PACT children made, on average, one month less progress in listening comprehension and sentence repetition than non-Pact children. The two groups scored similarly in terms of receptive vocabulary. None of these findings were statistically significant.

The PACT intervention, on average, had a positive but low impact on the home learning environment when measured immediately after programme delivery through a validated questionnaire completed by parents, but this impact was not maintained five months later. This result should be interpreted cautiously as there were high levels of missing data at immediate post-test (32%). The PACT intervention, on average, had no impact on school readiness when measured ten months after intervention delivery through a validated questionnaire completed by school staff. This result should be interpreted with caution as many children scored highly on the measure (ceiling effects).

Children eligible for the Early Years Pupil Premium (EYPP) formed a small subgroup in the sample (= n=70). Exploratory analysis suggests children eligible for EYPP who received the intervention made the equivalent of two months less progress in language skills than similar children who did not receive the programme. However, the PACT programme, on average, had a moderate positive impact on this subgroup's school readiness. These results should be interpreted very cautiously as the number of pupils included was small.

Parents/carers who completed surveys or interviews perceived that PACT had positive impacts on their child and on their families. Perceived impacts included improved vocabulary, increased enjoyment and engagement with reading books, improved storytelling skills, better speech and readiness for school, improved bonding time with the child, reading more with the child at home, and feeling better able and more confident to support their child's learning. Some nursery staff reported that PACT had helped improve their relationship with families and had provided the nursery with high quality resources and ideas to improve their nursery teaching in the future.

Surveys and interviews suggest the PACT programme seemed to be significantly more intense and structured than the usual activities that nurseries sent home to families or those that parents/carers did at home normally. Parents/carers engaged well with the programme with engagement initially being very high but decreasing over time. Analysis showed that the more sessions parents delivered, the greater the impact the programme had on children's language skills.

Cost

The average cost of the PACT programme if provided to five pupils per year, when averaged over three years, was £227 per pupil, per year. The programme is therefore rated as low cost.

Introduction

Background

Vocabulary acquisition and learning to read

Vocabulary acquisition is a key element of early infant development and continues to be an important factor throughout childhood, with vocabulary development in early childhood predicting later reading and academic skills (for example, Snow, Burns and Griffin, 1998). Bergelson and Swingley (2012) reported that babies appear to start learning the sound forms of whole words within the first few months of life and they understand the meanings of several common nouns from the age of six months. At around 18 months, young children's vocabulary begins to expand rapidly and it is estimated that they learn words at a rate of one every two waking hours, a trend that continues or increases into adolescence (Pinker,1994). Vocabulary acquisition in early childhood relies on a number of factors, however, the level of exposure to language through child-adult interactions, in particular parent speech to the child, has a particularly crucial role to play with there being a clear link between the amount of parent speech and a child's vocabulary growth (Huttenlocher et al., 1991).

Vocabulary development in the early years has been linked to the level of reading comprehension later in primary school with pre-school vocabulary predicting reading comprehension after three or four years of schooling even when controlling for other factors including parent literacy and education, the child's early literacy, and phonological awareness (Sénéchal, Ouellette and Rodney, 2006).

In addition to vocabulary acquisition, children need to learn about the features of spoken language, such as where words begin and end, and realise that these units carry a meaning. This phonological knowledge underpins vocabulary acquisition, and growth. Moving on to learning to read, Harrison (2004) suggested that children need different types of knowledge as precursors: knowledge and understanding of the world, knowledge of how our language works, knowledge of conventions of print, and phonological awareness. Such knowledge leads to the development of reading skills with decoding, oral reading fluency, and reading comprehension beginning to be acquired by many children by five years of age.

Exposure to books is a well-established means to developing children's vocabulary and the precursor knowledge of language and print (early literacy skills; for example, McKeown and Beck, 2006, Sénéchal and LeFevre, 2002) and interventions focused on adults and children reading books together have been shown to impact on such skills. For example, a meta-analysis of studies which looked at the impact of interactive and structured shared book-reading in kindergarten (Mol, Bus and de Jong, 2017) found that shared book-reading impacted on oral language skills (including vocabulary) and on early literacy skills. Additionally, the study found that interactive book-reading, one to one with trained researchers, was more effective than interactive book-reading in groups delivered by teachers or researchers at improving oral language; longer programmes delivered over the full school year were shown to have positive impact on pupils' phonological skills.

Home learning environment

Evidence indicates that parenting and educational environment in the early years have a powerful influence on language development. The quality of the home learning environment and educational resources within the home are important factors (Melhuish et al., 2008) and there is a link between this quality and socioeconomic status (Foster et al., 2005). Studies have shown that children from disadvantaged backgrounds enter school with lower levels of language and early reading skills than their more socioeconomically advantaged peers (Tymms et al., 2014) and this trend persists throughout primary school (Merrell, Little and Coe, 2014).

A large-scale multinational study (Kartushina et al., 2022) of 13 countries including the U.K. tested how the home learning environment affected children's vocabulary development during the Covid-19 pandemic. The study concluded that children whose caregivers read more to them and who had less screen time during the early 2020 lockdown had a boost in their vocabulary development compared to the norms from pre-pandemic times even after controlling for socioeconomic status. This study indicates that supporting caregivers to spend more 'quality' time reading with their child may help support vocabulary development.

A recent meta-analysis of the effect of home learning literacy programmes on the emergent literacy skills of children from birth to six years from low socioeconomic backgrounds found an average Cohen's effect size of 0.50 on immediate

post-tests (Fikrat-Wevers et al., 2021) from across 48 studies. They found the most promising home reading programmes for low-SES families were ones that focused on a limited set of activities—shared reading, activities that did not combine home activities with activities at nursery, activities that did not try to have an impact on anything else but literacy skills, and those that were restricted to one training setting, either home or school. Although PACT does not have a specific literacy focus, it shares features with many of the programmes included in this meta-analysis (specifically those that focus on dialogic reading) and shows the impact that interventions that take place in the home with this age-group can support children's learning.

Parents and Children Together evaluations

Parents and Children Together (PACT) is a language teaching programme for pre-school children that parents/carers deliver to their child at home (Burgoyne et al., 2018a). This programme was developed in line with early years policy and practice guidelines (for example, DfE, 2012) and has been shown to support children's early language and emergent literacy skills (Burgoyne et al., 2018b). PACT is centred on improving children's language development through interactive storybook reading supplemented with direct teaching of vocabulary and work on narrative skills. The materials are designed to be easy to use, engaging, and motivating for young children. PACT has a training component for both parents and nursery staff. Parents are also offered support from their nursery throughout the 30-week programme.

The impact of the PACT programme has been robustly evaluated in a previous Nuffield Foundation-funded project using a randomised controlled trial design (reported in Burgoyne et al., 2018b) which was conducted by the developer team. This previous evaluation involved 22 children's centres in three local authorities, two of which ranked highly on indices of deprivation. Altogether, 208 children were randomly allocated to either the PACT programme or a 'motor skills' active control programme. The effects of the PACT programme were tested with a large battery of standardised and non-standardised tests of language. At immediate post-test, the PACT programme produced improvements in language and narrative skills with improvements to language skills maintained six months later. At the delayed follow-up, the programme also produced improvements in some early literacy skills, namely, letter-sound knowledge and regular word-reading.

The present PACT project has aimed to replicate the previous study (Burgoyne et al., 2018b) at a larger scale (n = 450), recruiting participants from 47 school nurseries instead of children's centres and with an independent evaluator. The change to school nurseries as a delivery model was due to government funding cuts for children's centres, which led to reduced capacity across children's centres to support roll-out of programmes such as PACT. School nurseries provided an alternative delivery model with more certainty about sustained capacity. Following the initial trial, there were also some changes made to the PACT materials. The developer partnered with BookTrust as a publisher in order to produce the materials more professionally and feedback from BookTrustBooktrust on the materials to make them more user friendly led to a reduction in the amount of scripting and text in the materials. Some books had also gone out of print between the first trial and the present one and different books with new materials were added into the programme.

The previous trial provided good evidence of promise for the PACT programme; the present trial aimed torun as an efficacy trial investigating the impact of the intervention under ideal conditions.[1] This trial used a within-school randomised controlled design with a 'business as usual' control group instead of the active control group used previously. The business as usual control group approach was expected to be a more realistic comparison to how PACT would be used outside of a trial. This project was set out to use the same language outcome measures as the first trial so that it would be possible to directly compare the results, collecting outcome assessment measures immediately after the intervention delivery period and ten months later when the children were then in school. However, due to Covid-19 restrictions from March 2020 onwards, there has been significant disruption to the delivery of this trial, including to the delivery of the intervention and the impact evaluation data collection. This will be detailed and discussed throughout the report, including changes to the outcome measures that it was possible to collect.

The original design of this trial was a within-school cluster randomised controlled trial, collecting language data at three timepoints: baseline, immediately after the intervention delivery period, and ten months later at delayed post-test. The within-school randomisation design of this trial was chosen as the optimal design for this project. This took into account:

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[1] Unfortunately, due to Covid-19 and associated restrictions, ideal conditions were not possible for the delivery of the intervention. Further details are provided through the report.

- the theory of change for the programme, with the majority of intervention delivery and expected change being through the parent/child interaction at home;

- the maximum school numbers that the developer team had the capacity to deliver to; and

- maximising the power of the trial to detect an effect.

Covid-19 restrictions made it impossible to collect language data immediately following the intervention. In response to the restrictions, the project design changed so that primary outcome data was collected only at the delayed post-test timepoint using alternative outcome measures.

The evaluation included an integrated implementation and process evaluation (IPE). This aimed to investigate how well the PACT programme was delivered both at the nursery level and at the parent/carer and child level; it involved monitoring compliance and intervention fidelity through administrative data collection, interviews, and surveys at different periods. The IPE delivery was only minimally impacted by the Covid-19 restrictions and mostly proceeded as originally planned.

The impact of Covid-19 on childcare provision

The PACT intervention started in November 2019 and was intended to run until June 2020. However, in March 2020, the U.K. government announced that from 20 March 2020, schools and childcare provision in England were to close except for children of key workers and vulnerable children in response to the Covid-19 pandemic. This delayed the end date of the intervention. From 1 June 2020, nurseries and other early years providers, including childminders, were able to open again to all children. A phased reopening of schools to children in reception and Years 1, 6, 10, and 12 was also initiated from 1 June 2020. However, many schools were not able to accommodate the return of students across these years. Schools reopened fully in September 2020, however, there has been continuing disruption of education up to and beyond the end of 2021 due to the number of cases of Covid-19 and varying requirements for self-isolation.

The impact of the Covid-19 pandemic on education has been far-reaching. A report commissioned by the EEF in 2021 reported that from a sample of 58 schools, 96% were concerned about children's communication and language development and 89% were concerned about children's literacy levels (Bowyer-Crane et al., 2021). In the same study, 76% of schools felt that pupils needed additional support compared to pre-pandemic cohorts. A study of 50,000 pupil language assessments of four- and five-year-olds starting school in 2020 also found that at least 20% more pupils were arriving at school with the lowest language levels (Speech Link Multimedia, 2021). In May 2020, a report published by the Department for Education stated that attendance was at 76% of pre-pandemic levels for pre-school children attending high-quality centre-based childcare during the first three years of their life. During the first Covid-19 lockdown only 5% of the number that usually attend Early Childhood Education Centre (ECEC) settings were attending (DfE, 2020). This indicates a significant decrease in children potentially accessing the language and other cognitive benefits which can come from this care (for example, Davies et al., 2021).

The disruption caused by the Covid-19 pandemic to children's home and school environments, and the expected long-term impact on development, has highlighted the ongoing importance of identifying home-based learning programmes that can support children's development. The design of the PACT programme brings together in its design many of the elements that have been shown to be effective for home-based language-learning programmes as well as having shown promising findings in the first trial. This second trial therefore seeks to identify whether these findings can be replicated on a larger scale in school nursery settings.

Intervention

The Parents and Children Together programme (PACT; Burgoyne et al., 2018a) is an early language teaching programme delivered by parents or carers to their pre-school child in the year before they start school. It is an intensive programme delivered over a period of thirty weeks with focused language activities based on storybooks provided by the programme to be completed five days a week for approximately 20 minutes a day. There are two levels of delivery: (a) parents/carers sign up and access the programme and receive programme support through their child's nursery or (b) parents/carers deliver the programme sessions directly to their child at home. Training is provided at both levels for the nursery staff driving the programme (PACT lead) and for the parents/carers. In this trial the PACT programme was delivered by families between November 2019 and August 2020. PACT lead training was provided in April 2019 and

parent/carer training in October 2019. Below sets out the PACT intervention in detail using the TiDieR framework headings (Hoffmann et al., 2014).

Rationale

Oral language skills provide the foundation for formal education and play a critical role in learning to read (Hulme et al., 2015). Children from low income backgrounds are at risk of delayed language development and educational disadvantage (for example, Roulstone et al., 2011). Interventions that promote oral language in the early years have considerable potential to enhance children's learning and development, particularly for those from deprived socioeconomic backgrounds (see Fricke et al., 2012; Reese, et al., 2010; van der Pluijm et al., 2019). PACT is an early language teaching programme for parents/carers to deliver to their pre-school child (aged three to four years). Previous results from a within-school randomised controlled trial reported the PACT programme led to significant gains in oral language skills immediately after intervention, which were maintained six months later. The trial also reported improvements in some early literacy skills at delayed follow-up (Burgoyne et al., 2018b).

Who (recipients of intervention)

PACT was aimed at families with children aged three to four who attended state-maintained school nurseries and who were moving into the reception year-group at school in September 2020 (the academic year immediately following the PACT programme). The initial intention was only to recruit nurseries attached to schools. A small number of nurseries were partnered with schools but not formally part of the school. Further details about the recruitment process are discussed in the Recruitment section. As parents/carers were required to deliver the programme with their child, they were required to have a sufficient level of English to be able to access the programme materials. Children participating in the programme could not be a twin, have a sibling in the same academic year, or have a suspected or diagnosed developmental learning difficulty. At least one of the child's parents/carers (or extended family members) had to attend training to participate in the programme and were responsible for engaging with PACT and delivering the programme content to the child.

One or two nominated staff members in each nursery setting (known as PACT leads) were trained to support the project activities including recruitment, training, and ongoing support to families across the duration of the programme.

What (materials)

PACT is a manualised teaching programme by Burgoyne, Gardner and Hulme (2018a), published for this trial by BookTrust, the UK's largest children's reading charity. The programme is designed for use by parents/carers in the home with their pre-school children.

PACT consisted of 30 weeks of teaching materials organised into six packs each containing five weeks of activities. The packs were presented within a PACT branded cardboard presentation box. Each pack corresponded to a theme and included four storybooks linked to this theme; these were delivered during weeks one to four of the five weeks of activities. The selection of storybooks included a mixture of well-known modern classics, factual storybooks, and new or unfamiliar storybooks. Each storybook came with an accompanying single-use activity book, which included all guidance, activities, and tear-out resources for the parent/carer to be able to deliver a scripted 20-minute interactive learning session, five times a week. Each pack also contained a *Bringing it all Together* activity book, which was used in week five of the five-week segment. The activity book featured consolidation and theme-level activities as well as a sticker chart and stickers to track and celebrate progress. The first pack also contained a parent guide to the whole programme.

The PACT programme incorporated key components designed to promote children's early language development:

- shared reading—parents/carers read storybooks with their child using strategies that support verbal interaction and active engagement;
- vocabulary instruction—selected words are taught using interactive activities to promote new word learning; and
- narrative (storytelling)—activities include sequencing, summarising, and telling/retelling stories.

Some families received PACT packs which had damage to the cardboard box due to problems with the delivery of the materials from BookTrust. This damage was mentioned by some PACT leads and parents/carers during the project but did not affect the contents of the boxes.

What (procedures)

Training—nursery PACT leads

After signing up to the project, one or two members of nursery staff (nominated PACT leads) attended a 4.5- to 5-hour in-person training session delivered by the developer team (two people delivering) at the University of Manchester. Training was offered on two dates to allow schools to choose the most convenient session. This training session included:

- an initial description of the background to PACT and the overall research project;
- specific guidance on the structure of the programme and how parents should deliver the sessions (PACT leads referred to a PACT pack example given to them during the session);
- advice on recruiting families to the project including eligibility criteria and how to talk to parents about the project;
- an overview of the child assessments that would form part of the evaluation;
- an overview of the training parents would receive;
- advice for supporting parents to deliver the programme and in monitoring their progress;
- answers to frequently asked questions from parents about the programme; and
- a summary of the process evaluation activities that would be led by the evaluation team.

The training sessions also included interactive elements that encouraged feedback and questions from participants throughout, together with group discussion and role-playing elements of the PACT programme with other participants.

Each PACT lead received a pack containing the first block of the PACT materials during the training session to help them familiarise themselves with the materials and support parents/carers completing PACT. A copy of the subsequent five blocks of PACT materials was provided to each PACT leadLead with the distribution of the packs for families. PACT leadsLeads were instructed not to use the PACT packs for 'within school' teaching.

Training—parents/carers

Parents/carers assigned to the PACT programme group were asked to attend a 1.5- to 2-hour small group training session delivered by one of three trained developer team members. These sessions were held at the nursery the child attended. The sessions included:

- an introduction to the PACT programme and the research design;
- why improving preschool children's oral language skills and school readiness is important;
- key teaching principles for working with their child;
- the details of the programme and what to do for each of the elements including strategies to support prompting their child;
- recording progress through the PACT app or paper record forms; and
- PACT programme structure and next steps.

Parents/carers were given the first PACT pack at the training session and instructed to refer to it during the session.

If parents/carers were unable to attend the training session in their child's nursery they were invited to attend a session being delivered by the developer in another nursery, or training was provided by the nursery PACT lead using materials provided by the developer team. Parents/carers who did not attend any training should not have been provided with any PACT intervention materials.

Delivering the programme—nurseries

PACT leads were responsible for distributing the PACT packs to parents/carers throughout the programme. The instructions from the developer were that the packs should be distributed so that families could progress straight onto the next pack on completion of the previous one. PACT leads were also responsible for providing support and encouragement to families delivering the programme (as they felt was required), answering questions and encouraging families to continue engaging with the programme for the programme duration.

Due to Covid-19 restrictions, there was a two-month delay to PACT leads receiving pack six (distributed in June 2020). As many children were not attending nursery during the period PACT leads had to change their method of delivery of the packs with some delivering them directly to children's homes or posting them to families.

Delivering the programme—parents/carers

The 30-week programme consisted of six five-week teaching 'blocks' that each encompass a different theme which aligned to common early-years themes including: (1) Animals, (2) The World Around Us, (3) Journeys, (4) The Body, (5) Home, and (6) Places and People.

Teaching sessions started with a brief introduction to give parents/carers time to settle the child and get them ready to focus on the activities. Parents/carers and children then read the storybook together. Following the principles of dialogic reading, parents/carers were asked to support their child to play an active role in shared reading by following their child's interest, asking questions, and linking the story to their child's experience. Vocabulary activities focused on learning a new word from the storybook or theme. New words included a range of word types and were selected to be useful across different contexts. Parents/carers then supported children's story knowledge and storytelling skills by helping them to order pictures from the story, describing what was happening in the pictures from the story, and retelling stories. The teaching sessions end with a recap of the content, praise for the child, and a sticker reward (Burgoyne et al., 2018a, p.8).

Each PACT session was intended to last around 20 minutes including all listed activities and following a consistent structure and routine. Parent/carers were requested to complete a daily record form through an app on a smart device (or a paper record form) to record session completion and whether the child enjoyed it.

The content of the activities in weeks one to four focused on introducing new content. Week five activities encouraged parents/carers and children to revise and build on their learning from the previous four weeks by revisiting each storybook again consolidating the theme of the pack and including extra games and vocabulary. The fifth week also provided opportunities for the child to re-tell the stories as they remembered it, invent a continuation for the story after the storybook finished, and create their own story within the theme of the pack.

Providers and implementers

PACT is designed to be delivered by a caregiver (for example, a parent or carer, a grandparent, or an older sibling) in the home. Parents/carers were required to attend a developer-led small group training session for five to ten people in their child's school lasting 1.5 to 2 hours (detailed above). PACT leads cascaded the training to any parents/carers unable to attend.

Within each nursery, one or two staff members were nominated to support parents/carers to deliver the programme (PACT leads). They were responsible for distributing the PACT packs to parents/carers and providing ongoing support to families delivering the programme.

The developer team provided the training to PACT leads and parents/carers as well as providing ongoing support to PACT leads and to parents/carers if approached directly.

Mode of delivery

PACT provided parents/carers with teaching strategies and activities, materials, and resources to support their child's language development through the six PACT packs and their initial training. Support for families was provided through nurseries by the trained PACT lead.

Location of delivery

State-funded school nurseries, and the families within these settings, were recruited from areas in the North West of England: Rochdale, Tameside, Lancashire, Bolton and Warrington. These areas were identified as areas of deprivation due to their low scoring on the Indices of Multiple Deprivation (IMD, described in more detail in the Participant Selection section below). Eligible settings were state-funded schools with nurseries that had provision for children aged three years and above. This included state-maintained standalone nurseries as well as nurseries attached to infant or primary schools. Delivery of the PACT packs and support for the programme was provided through the nursery by PACT leads. Delivery of the PACT teaching sessions was expected to be outside of the nursery setting.

Duration and dosage

PACT teaching sessions were expected to be delivered for 20 minutes, five days a week, for 30 weeks. In total, there was content for 150 home-based teaching sessions and it was expected that families would receive a new PACT pack every five weeks.

Due to Covid-19 nursery closures and ongoing restrictions, there was interruption to the delivery of the packs to the nurseries and to families. While the fifth pack was sent to settings just before the first Covid-19 lockdown in March 2020 (two weeks earlier than planned), the sixth was not sent to nurseries until the end of May 2020 (originally planned to be beginning May). The intervention delivery period was expected to end mid-June when post-testing would have begun, however, due to the delay to the delivery of the sixth pack and the disrupted delivery period during lockdown, the intervention delivery period was extended by ten weeks to the end of August 2020. The extension was to give families time to have received and engaged with the final pack before the end of the trial period.

Tailoring and adaptation

PACT was a manualised teaching programme delivered in an efficacy trial; therefore, optimal treatment fidelity was emphasised. However, some surface-level adaptations by parents/carers were encouraged in order to make delivery more accessible for the families and specific children taking part (for instance, the prompts used during storybook reading).

PACT leads were able to adapt their level of interaction with, and support for, the families in the PACT trial to respond to the needs of families in their settings (for example, the amount of contact needed).

How well (planned)

The strategies to maximise implementation effectiveness included:

a) Sufficient support for participating families by PACT leads

Nurseries were invited to send more than one member of staff to the developer-led training day in order to mitigate issues from staff absence on the delivery of the PACT programme. During the training day, PACT leads were given suggestions and recommendations for the type of support they should aim to provide and what this might look like in practice. It was suggested by the developer that PACT leads hold weekly support sessions for parents/carers during the first few weeks of delivery. The sessions were for the PACT leads to show interest, to facilitate the sharing of ideas and strategies, to help parents prepare their sessions, to model delivery, and to celebrate successes. After the initial few weeks of delivery, it was recommended that nurseries then tailor this support to what the parents/carers in their setting required and/or what nurseries were able to offer.

b) Families were allowed flexibility in their delivery of the programme

PACT leads informed families that multiple caregivers were allowed to attend training and that they could split delivery of PACT between family members. By training multiple members of the family, it was hoped this would

maximise the likelihood of PACT being delivered at the recommended frequency in the home. Families were given several dates and times for developer led training sessions, hosted either in their child's nursery or a nearby participating nursery. Any families that could not attend the developer led training sessions were trained by the PACT lead at a convenient time. During delivery, families were encouraged to create a routine for 'PACT time' and to deliver sessions at a similar time each day.

The PACT theory of change model is shown in Figure 1. The PACT programme is an evidence- and research-informed programme based around children's storybooks with specific language focused activities to complete five days a week over a 30-week period which parents/carers complete with their preschool child. The overall purpose of the PACT programme evaluated and reported here was to improve pre-school children's language development. It was expected that training for parents/carers and the provision and regular use of the focused learning materials would facilitate improved home-based learning by increasing the frequency and quality of parent/carer-child interaction and communication through the specific programme activities and beyond. It was assumed that training and support for parents/carers would provide them with the required knowledge, skills, and confidence to deliver the programme. The programme described how parents/carers should talk about and deliver each session with the aim of parents/carers delivering it in a standard way and improving parent/carer confidence. The provision of storybooks and activities provided families with learning resources and the range and variety of the storybooks aimed to engage children in the activities. The intensity of the programme (20 minutes per day for five days a week) as well as the length of the programme (30 weeks) aimed to lead to more sustained changes in home learning interactions. Support from nursery staff to parents/carers, particularly in the early stages of the programme, was intended to lead to a more sustained use of the programme by families.

The programme was based on the assumptions that parents/carers and their children engage with the PACT resources and materials at home and that families complete the structured learning activities in the home on a regular basis, which increases parent/carer-child interaction and communication. The expected impact was that targeted activities specifically designed to foster language skills provided by PACT directly improve the child's language and foster a language-rich communication environment in the home. The home learning environment could also be enriched by PACT in the following ways:

- specific provision of the PACT focused teaching and learning opportunities;
- enriched communication in the home;
- availability of more high quality educational resources;
- consistent parent/carer and child behaviour;
- improved parent confidence; and
- better parent/carer relationships.

Together, these factors are expected to lead to the improvement of children's language skills, which in a circular feedback loop allow the child to communicate better with the parent/carer and improve the home learning activities and environment offered. School readiness (including the child's self-regulation and ability to concentrate) is also expected to be improved through the enhanced home learning environment and by more advanced child language development (including concentration and self-regulation). These short-term impacts (HLE, language skills, and school readiness) are also expected to improve early literacy skills during the first year of school and lead to continued development and longer-term improvements to language, literacy, and communication.

We also include a logic model of the PACT programme that was developed jointly between the evaluation and delivery teams. This model includes the key programme inputs, outputs, and expected outcomes, and the way that the evaluation methods are designed to collect data to understand the different elements of this model (Figure 2). Revisions to the model (based on data analysis) are discussed in the Implementation and process evaluation Results section below.

Changes to the programme and logic model due to Covid-19

As described above, due to the Covid-19 lockdown, which took place two thirds of the way through the trial, nurseries, and therefore families, were delayed in receiving the materials for the final block of the PACT programme affecting the main input of the trial. The time-period allowed for completion of the programme was therefore extended to include the summer holidays although the number of weeks of expected sessions remained the same. The support provided from

PACT leads during this time was also reduced or the mode of support changed (from regular in-person catch ups to less frequent phone calls or emails). Covid-19 also impacted on the home environment of the families doing PACT (and the control group children) creating different circumstances for the delivery and for families more generally. This potentially affected the home learning environment immediate outcome. Further detail of how Covid-19 affected the delivery of the programme is discussed in the Implementation and Process Evaluation Results section below.
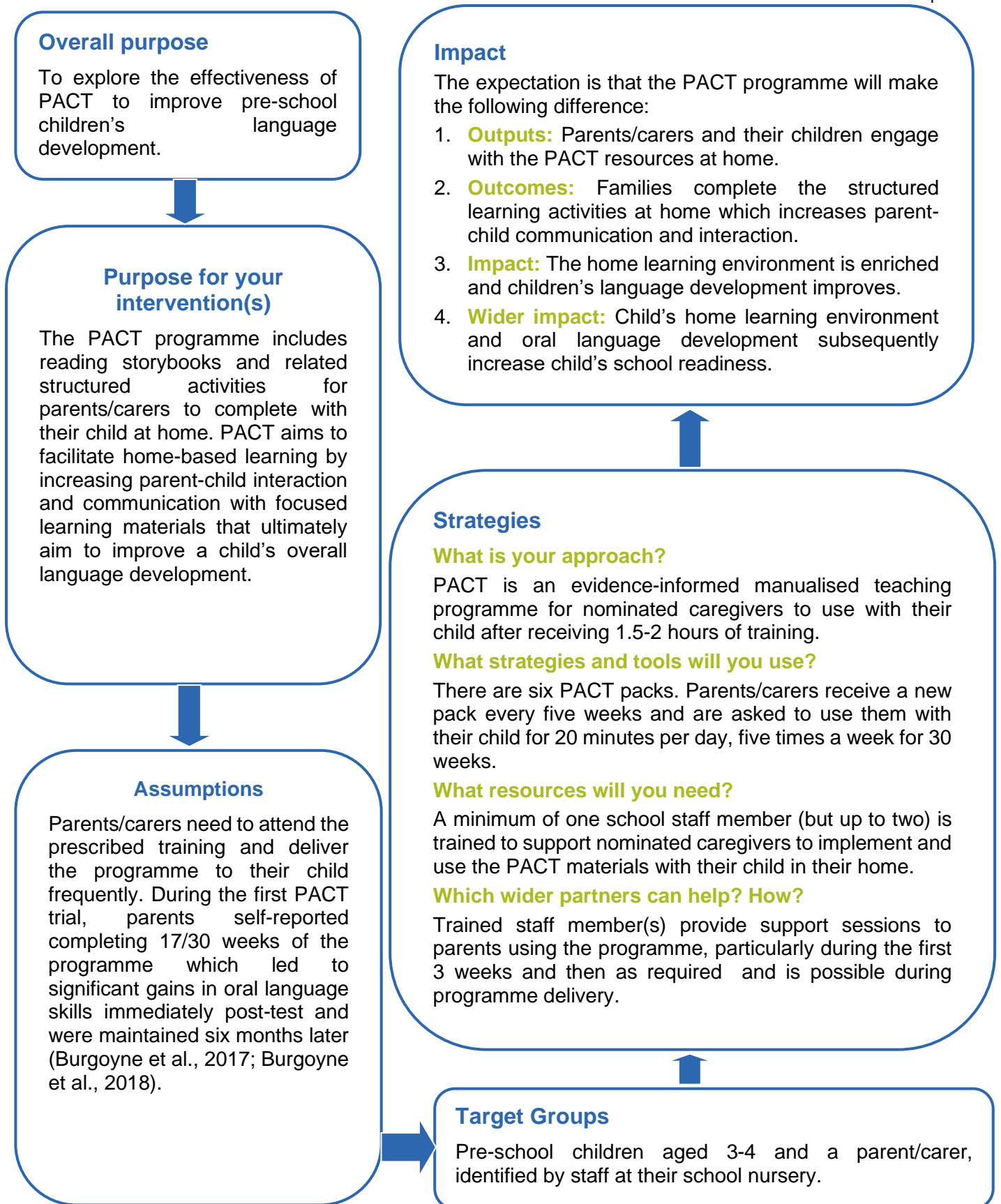
Overall purpose

To explore the effectiveness of PACT to improve pre-school children's language development.

Purpose for your intervention(s)

The PACT programme includes reading storybooks and related structured activities for parents/carers to complete with their child at home. PACT aims to facilitate home-based learning by increasing parent-child interaction and communication with focused learning materials that ultimately aim to improve a child's overall language development.

Assumptions

Parents/carers need to attend the prescribed training and deliver the programme to their child frequently. During the first PACT trial, parents self-reported completing 17/30 weeks of the programme which led to significant gains in oral language skills immediately post-test and were maintained six months later (Burgoyne et al., 2017; Burgoyne et al., 2018).

Impact

The expectation is that the PACT programme will make the following difference:

1. **Outputs:** Parents/carers and their children engage with the PACT resources at home.
2. **Outcomes:** Families complete the structured learning activities at home which increases parent-child communication and interaction.
3. **Impact:** The home learning environment is enriched and children's language development improves.
4. **Wider impact:** Child's home learning environment and oral language development subsequently increase child's school readiness.

Strategies

What is your approach?

PACT is an evidence-informed manualised teaching programme for nominated caregivers to use with their child after receiving 1.5-2 hours of training.

What strategies and tools will you use?

There are six PACT packs. Parents/carers receive a new pack every five weeks and are asked to use them with their child for 20 minutes per day, five times a week for 30 weeks.

What resources will you need?

A minimum of one school staff member (but up to two) is trained to support nominated caregivers to implement and use the PACT materials with their child in their home.

Which wider partners can help? How?

Trained staff member(s) provide support sessions to parents using the programme, particularly during the first 3 weeks and then as required and is possible during programme delivery.

Target Groups

Pre-school children aged 3-4 and a parent/carer, identified by staff at their school nursery.

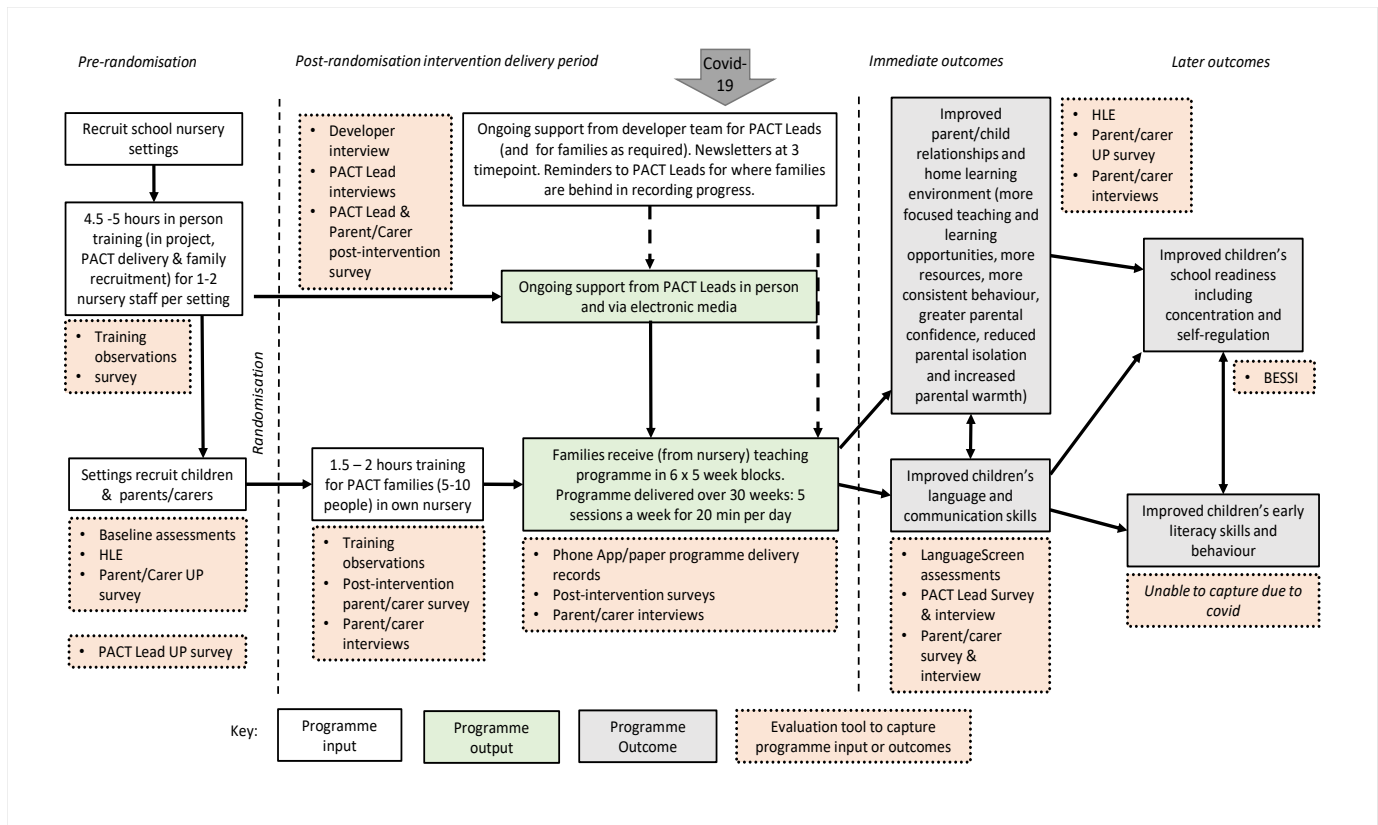*Figure 1: PACT theory of change model*

Figure 2: PACT logic model including evaluation data collection tools at each stage

Evaluation objectives

Due to Covid-19 restrictions in schools and universities it was necessary to change the mode of outcome data collection stated in the original trial protocol from researcher-delivered, face-to-face assessment of children in schools to assessments that could be delivered by staff in schools. Covid-19 restrictions also meant that collection of data immediately after completion of the intervention was not possible as originally planned. The impact evaluation research questions have therefore been adapted from the original protocol to reflect the data it was possible to collect.

Impact evaluation research questions

1. What was the impact of the PACT intervention on the language development of participating children as measured using a language latent variable, assessed by LanguageScreen delivered by school staff at the end of the first year of school (reception year)—12 months after the intervention period (primary outcome)?
2. What was the impact of PACT on the expressive vocabulary, receptive vocabulary, listening comprehension, and sentence repetition (LanguageScreen sub-set items) of participating children (secondary item)?
3. What was the impact of PACT on the home learning environment of participating children at the end of nursery and after two months in school as measured using the Home Learning Environment Index (secondary outcome)?
4. What was the impact of the PACT intervention on the school readiness of participating children as measured by the Brief Early Skills and Support Index at the end of the first year of school (secondary outcome)?

Implementation and process evaluation research questions

5. To what extent was training delivered to nursery staff (fidelity/quality) and how was this received (perceived quality and relevance)?
6. To what extent did initial training take place for parents/carers? How was this training delivered? How many parents/carers attended the training sessions (fidelity)?

7. To what extent did parents/carers deliver the PACT sessions to their children throughout the 30 weeks of the programme (fidelity/dosage)? What were the reasons for variety in this (contextual pressures)?
8. How closely did parents/carers follow the teaching session plans (fidelity, quality, adaptations)?
9. How did schools support parents/carers (quality/adaptation)? How many support sessions were delivered (fidelity/dosage)? How many and which parents/carers attended these events (fidelity/reach)?
10. What was the impact of the intervention as perceived by parents/carers and school staff
11. How did PACT differ from usual practice and control group activity (programme differentiation)?
12. What barriers were faced by schools and by parents/carers in implementing the intervention?
13. Were there any groups of parents/carers that could not access the intervention and why (reach)?
14. What constitutes ideal conditions for the delivery of the intervention and was this possible (fidelity)?
15. How did Covid-19 affect the delivery of PACT (added for the post-covid protocol revision)?

The project protocol and statistical analysis plan (SAP) were both adapted to reflect changes made due to the Covid-19 disruption.

Ethics and trial registration

Ethical approval for the evaluation was originally received from Durham University's School of Education Ethics Committee on 12 December 2018. Additional ethical approval was obtained from the same committee during the course of the project as the data collection tools were developed including survey instruments, interview schedules, as well as information sheets and participation agreement forms for IPE participation. A number of additional ethical approvals were also obtained for changes to the project due to Covid-19 disruption, which included changes to assessment dates and methods, additional incentives for schools, and parent surveys as well as updated information documents for schools and parents. Ethical approval from the committee covered all aspects of the PACT project including the developer's activities. The developer team registered the approval from Durham University with the University of Manchester's Ethics Committee.

Nurseries were provided with an information sheet (Appendix E.1) and completed a memorandum of understanding (Appendix E.2) to indicate their agreement to take part in the trial; this was signed by a member of the school leadership. Updated information letters were provided to schools to inform them of changes to the trial as a result of the Covid-19 disruptions (Appendix E.8).

Parents/carers received an information sheet and signed a participation agreement to take part in the trial. While parents/carers needed to agree to most aspects of the trial to take part, they could opt out of their child's assessments beinge audio recorded and for the school to provide specific information to the research team. A copy of the parent/carer information sheet and participation agreement are included in Appendices E.3 and E.4. The update information letter for parents/carers to describe the Covid-19 changes to the evaluation is included as Appendix E.7.

For all surveys, an information sheet was provided on the front page and participants ticked a box to consent to taking part. All surveys were voluntary and a link to the privacy notice (for online surveys) or a copy of the privacy notice (paper surveys) was provided to participants.

For interview, an information sheet was circulated with the email invitation and agreement to take part was gathered by email response and confirmed at the beginning of the interview.

Copies of information sheets for interviews are provided in the appendices E.9–E.13 and for surveys at the beginning of the survey instruments in appendices Q.1–Q.7.

This trial was registered with the ISRCTN following agreement of the original protocol. The trial registration number is ISRCTN16848772 and can be accessed at https://doi.org/10.1186/ISRCTN16848772.

Data protection

Durham University and the University of Manchester were joint data controllers for the project. Data subjects were the participants in the project, which included children in participating schools, their parents/carers, and staff members

(PACT leads) in participating schools. OxEd and Assessment Ltd (OxEd) was a data processor for the project for the collection and processing of the LanguageScreen data. Once datasets are archived at the end of the trial the EEF will become the data controller for these datasets.

The legal basis for processing the personal data accessed and generated by the trial is 'public task' covered by GDPR Article 6 (1) (e) public task, which states that; 'the processing is necessary for you to perform a task in the public interest or for your official functions, and the task or function has a clear basis in law.' No special category data was collected as part of this project. Research which will be published is an official function of the two data controller institutions.

The roles and responsibilities for the trial for Durham University and the University of Manchester were identified. A three-way data sharing agreement (DSA) was put into place between each nursery/school taking part and Durham University and University of Manchester which included a description of the nature of the data being collected and how it was to be shared, stored, protected, and reported by each party. The DSA was updated to include LanguageScreen data collection in May 2021.

A Data Protection Impact Assessment (DPIA) identifying the privacy risks associated with the processing of personal data and for implementing appropriate controls to manage those risks was carried out. A privacy notice was provided to all PACT lead staff members in schools and participants in the trial; these detailed the processing and storage of data for the evaluation of the trial. Updates to privacy notices were made during the project as a result of collecting additional data and clarifying which data would be archived with the EEF. Participants were emailed the updated privacy notice or sent it by post if email was not provided. All privacy notices have been provided in the appendices (P.1–P.3).

Data quality has been ensured through adherence to a detailed data management plan. Quality assurance checks on datasets along with data minimisation ensured that only required and up to date information was held by the evaluation team. Wherever possible, project identification codes rather than participant names were used in order to improve confidentiality and increase data security. Project data was stored electronically on secure servers and electronic devices authorised by Durham University with paper copies of project data stored in locked cabinets in the project office in the School of Education at Durham University.

This project did not link the participant data collected as part of the trial with the National Pupil Database (NPD) as all participant data required for the project and its analysis was collected directly from the participants or their nurseries/schools. However, parents were informed that their child's personal data and other data from the project would be shared with the EEF, stored in the EEF's data archive, and would be linked with the NPD for future analysis.

The agreement in place between OxEd and Durham University to allow the project the use of LanguageScreen means that it is not possible for Durham University to share the personal data from LanguageScreen outside of the Durham University team. OxEd did not want the LanguageScreen data linked to the NPD data or to be used in ways that had not been agreed. It will therefore not be possible to be archive the LanguageScreen data in the EEF data archive or to link this data to the National Pupil Database.

Project team

Developer team (University of Manchester)

The developer team based at the University of Manchester was responsible for all aspects of delivery of the PACT programme, the recruitment of schools and participants to the project, maintaining records of participants, the delivery of the face-to-face, researcher-delivered baseline assessments, collecting participant data from schools including school destination, EYPP status, UPN, collecting adherence data from intervention parents through the PACT app and paper record forms, and providing nurseries with storybooks for the control group families. The team consisted of:

Dr Kelly Burgoyne: principal investigator (PI) for the developer team leading on the intervention development and delivery of the PACT programme, recruitment to the project, developing and delivering PACT training, and leading on the baseline language data collection.

Steph Hargreaves: research assistant supporting recruitment of settings and participants, providing training, communicating with schools, distributing PACT materials, and supporting baseline assessment data collection.

Evaluation team (Durham University and University of York)

Durham University

Vic Menzies: PI for the evaluation of PACT. Vic led the impact, process, and cost evaluation elements of the trial, contributed expertise to the design, and conduct of the evaluation and the writing of the final report. Vic was on maternity leave from October 2018 to January 2020.

Dr Helen Cramman: Helen contributed to the design and conduct of the evaluation, providing high-level support and advice to the PI during the project, contributed to the writing of the final report, and acted as PI for PACT while Vic Menzies was on maternity leave.

Jessica Hugill-Jones: Research assistant for the evaluation team until March 2020, Jessica was responsible for collecting IPE data through the first round of surveys and interviews, conducting quality assurance of the pre-test assessments and contributed to the writing report.

Paivi Eerola: Paivi provided administrative support to the evaluation team from the commencement of the trial until June 2020. From June 2020 Paivi was the evaluation team research assistant and collected IPE data through surveys and interviews, conducted IPE data analysis, managed the data collection for the LanguageScreen data, and contributed to the writing of the report.

Professor Adetayo Kasim: As senior statistician on the project (until June 2021), Adetayo carried out randomisation allocations, led the writing of the statistical analysis plan, and contributed expertise regarding trial design for the protocol.

Professor Jochen Einbeck: Senior statistician on the project (from July 2021). Jochen contributed to the SAP and provided support and statistical advice to the project statistician.

Dr Nasima Akhter: Trial statistician. Nasima contributed to the writing of the SAP, conducted the impact analysis for the evaluation, and contributed to the writing of the report.

Professor Christine Merrell: Christine provided expertise and advice regarding the trial design and IPE especially at the set-up phase of the project.

Professor Julie Rattray: Julie was the evaluation team psychologist and provided expertise and support regarding the assessments and advice to the project PI.

Sarah Hallett: Sarah was the senior research officer during her time on the project. She provided expertise and support during project set-up, particularly in the areas of project management and data management processes until March 2019 when Sarah left Durham University.

University of York

Dr Lyn Robinson-Smith: Lyn led the writing of the protocol for PACT and provided project expertise and support during Vic Menzies' maternity leave. Lyn left Durham University in November 2018 but continued to work on the project from her new role at York Trials Unit, University of York.

Methods

Trial design

Table 3: Trial Design

Trial design, including number of arms		Two-armed randomised controlled efficacy trial
Unit of randomisation		Pupil level
Stratification variable (s) (if applicable)		Pre-test completeness
Primary outcome	**Variable**	Language development
	Measure (instrument, scale, source)	A latent language variable combining LanguageScreen subscale scores (Expressive Vocabulary, Receptive Vocabulary, Listening Comprehension, and Sentence Repetition), school-delivered LanguageScreen (Hulme et al., 2020) assessment on app.
Secondary outcome(s)	**Variable(s)**	(1) Early language skills (2) Home learning environment (3) School readiness
	Measure(s) (instrument, scale, source)	(1) LanguageScreen standard subscale scores: Expressive Vocabulary (EV) , Receptive Vocabulary (RV), Listening Comprehension (LC), and Sentence Repetition (SR), LanguageScreen assessment (Hulme et al., 2020) (2) Home Learning Environment Index, parent/carer-completed survey (Melhuish et al., 2008) (3) Brief Early Skills and Support Index (BESSI), survey completed by familiar school staff member (Hughes and White, 2015)
Baseline for primary outcome	**Variable**	Language development
	Measure (instrument, scale, source)	A latent language variable combining: • Clinical Evaluation of Language Fundamentals Preschool 2 UK (CELF-Preschool 2 UK) subscale scaled scores for sentence structure and expressive vocabulary (Wiig et al., 2006) • British Picture Vocabulary Scale -3 (BPVS-3) standard score (Dunn and Dunn, 2009) • Renfrew Action Picture Test (APT) grammar and information raw scores (Renfrew, 2019) • Listening Comprehension—developer developed listening comprehension measure (Burgoyne et al., 2018b) With all assessments carried out by researchers visiting the school.
Baseline for secondary outcome(s)	**Variable**	Home learning environment

	Measure (instrument, scale, source)	For (1), early language skills, the baseline latent language variable used for the primary outcome as described above will be used.
		
		For (2), home learning environment, the HLE parent/carer-completed baseline survey will be used as a baseline.

The trial design was a two-armed randomised controlled efficacy trial with allocation at pupil level, aiming to deliver the PACT programme under ideal conditions (see Table 3). Children were allocated to one of two groups on a 1:1 ratio:

- the intervention group—children allocated to receive the PACT programme; or

- the control group—children allocated to 'business as usual' plus equivalent incentive cost of materials (approximately £130) in storybooks to parents/carers at the end of nursery.

The original design of the study intended that the primary outcome data was collected before the control group received their storybooks so that the control group was 'business as usual' practice at home or in nursery. However, due to the need to delay post-testing because of Covid-19, the control group had access to the storybook materials for the 11-month period before the delayed post-testing. This means access to these books may have made an impact on the control group participants; this may be particularly salient given than the study targeted areas of high deprivation where families may struggle to access such resources for their children, particularly so during the Covid-19 period when there was restricted access to libraries and more reluctance to share between families who were minimising contact.

The within-school research design was chosen to maximise the chance of detecting the impact of PACT within a manageable intervention delivery model. The developer was limited in the number of schools to which it had the capacity to deliver the programme and training to: this design allowed the maximum number of schools possible within the delivery model. The within-school design was judged to be more powerful than cluster randomisation due to anticipated negligible heterogeneity in intervention effects between school and limited dilution of the intervention effects as a result of contamination between intervention and control groups. Inspection of the data from the previous Burgoyne et al. (2018a) trial indicated that heterogeneity in intervention effects between schools was minimal in the previous trial.

When designing the trial, the evaluation team anticipated the PACT materials could be shared between intervention and control families or given to control group families in an administrative error. There was also potential for contamination and dilution of the impact if PACT leads changed their classroom practice for all children, both intervention and control. These risks were minimised by:

- PACT pack materials being single-use with the activities for each session being tear-out sections of the activity books, often involving cutting and sticking;

- parents/carers being asked not to share materials; and

- training for PACT leads focusing mainly on the programme theory and background (which was expected to be already familiar to early years staff) and on techniques for directly supporting PACT families.

The importance of not changing practice for control families was emphasised during the training. Throughout the trial, the evaluation team and developer worked to ensure clear messaging was provided to the school and participating families to mitigate the risk of potential contamination. The implementation and process evaluation also investigated whether the PACT programme theory and background was already familiar to nursery staff. The hypothesis was that if PACT leads were already familiar with the principles being introduced by the PACT programme that they would be less likely to change their practice because of what they learned in the training. The IPE also investigated the extent to which control families had been exposed to the PACT materials during the trial. After the intervention period (and IPE data collection period), spare PACT packs were donated to participating schools. Although schools were told not to use these with children in the project we cannot guarantee that they did not use these with these children during the ten-month period between the intervention ending and the post-testing. We feel this is unlikely, however, due to the children being in reception and the packs being given to nurseries.

The primary outcome for the trial was language development at the end of reception year at school, ten months after the completion of the intervention period. The PACT programme was specifically designed to promote language skills. A latent variable combining different aspects of language skills from the LanguageScreen assessment was used to measure this. Due to Covid-19 restrictions and nursery closures it was not possible to collect any pupil language outcome measures immediately following the intervention delivery period as had been originally planned. The originally planned researcher-delivered language assessments also could not be used due to ongoing Covid-19 restrictions and both school and university policies prevented researchers from visiting schools. The decision was therefore made to use the school-delivered LanguageScreen assessment as an alternative to the researcher-delivered assessments. The LanguageScreen assessment is a standardised assessment that measured similar aspects of language to the original protocol.

Home learning environment was included as a secondary trial outcome, measured using the established Home Learning Environment Index (as used in Melhuish et al., 2001), which was collected from parents at baseline (September 2019), at the end of the planned intervention period (immediate post-testing, June 2020), and after two months of the children being Reception class at school (November 2020). It was expected the intervention would support parents/carers to improve their home learning environment both in resources available and in the activities and interactions they had with their child. Due to the impact of Covid-19 restrictions, the HLE Index questions were adapted when used at immediate post-testing. At immediate post-testing, two sets of HLE Index questions were presented to parents/carers with the aim of capturing both the home learning environment before the first Covid-19 lockdown (prior to March 2020) and the remaining delivery period during Covid-19 restrictions (March 2020 onwards). In addition, the question about library visits was removed from the HLE Index as libraries had been closed since March 2020 due to Covid-19 restrictions.

School readiness was included as a secondary trial outcome due to the expectation that in doing PACT, the subsequent improved language development and improved home learning environment would lead to increased school readiness for participants. School readiness was measured using the Brief Early Skills and Support Index (BESSI) completed by a member of school staff familiar with the child at the end of their first year of schooling.

The individual subscales from LanguageScreen were also included as secondary exploratory outcomes to investigate which language development aspects were most impacted by PACT.

It was originally planned that an additional secondary outcome measure of 'early literacy' would be collected at the ten-month delayed post-intervention timepoint. However, this was not possible due to the Covid-19 restrictions still in place for researchers visiting schools.

Participant selection

There were two stages of recruitment to this project in 2019: nursery/school level (January to July) and child/parent/carer level (June to September). Recruitment for this trial was led by the developer team. The flow of participants through the trial is shown in the Participant Flow Diagram in Figure 3 (page 43).

Nursery recruitment—January 2019 to July 2019

Eligibility criteria

Eligible nurseries for the study were maintained nurseries—either nursery schools or schools with a nursery class—classin the North West of England, specifically, Greater Manchester and Lancashire. These areas were targeted for recruitment to the trial as they were ranked as the fifth and eighth Local Enterprise Partnerships, respectively, by the proportion of Lower Layer Super Output Areas (LSOAs) in the most deprived 10% nationally in the 2015 Index of Multiple Deprivation (IMD) ratings. The areas were also geographically close to the developer at the University of Manchester.

Participating nurseries were required to agree to all study requirements outlined in the memorandum of understanding, which described their commitment to the delivery of PACT, the recruitment of a minimum of four families to the trial, and to participate in and support the evaluation elements. They were also required to agree and sign a project-specific data sharing agreement (DSA).

Recruitment

To recruit schools, the developer made direct contact with Local Authorities (LAs) in late 2018 and early 2019; these then advertised the trial to their schools. The EEF also promoted of the project. Schools interested in participating were invited to information sessions run by the developer, which took place within the LAs that had agreed to promote the project. School staff were provided with paper copies of the project memorandum of understanding at these events, to complete if they wished to be a part of the trial (see Appendix E.2).

Ten Greater Manchester and Lancashire LAs were approached by the developer. Of these, three—Rochdale, Tameside, and Lancashire—agreed to promote PACT to their schools. In total, 118 schools were invited by their LA to attend an information event (however, two were ineligible due to being non-LA-maintained Academy Trust settings). Additional schools also independently approached the developer team following the EEF announcement of PACT. In total, 160

schools expressed interest in participating in the project in response to the EEF call. Of these, 55 were eligible and invited to attend an information event (some of the schools approached by the LA overlapped with those who responded to the EEF call). The 105 schools that expressed interest but were ineligible were rejected because of (1) location—being out of the area, (2) being a non-LA maintained setting, (3) having no maintained nursery class at the setting, and (4) unknown reasons (no further contact from setting once inclusion criteria was made clear to them). Where eligible schools expressed interest after the initial recruitment period was closed, they were added to a reserve list.

Forty-nine schools attended information events. Forty-seven MoUs were returned, including from three schools which had not attended an information event. Two of the 47 schools withdrew from the trial before the PACT lead training event took place; this was due to staff changes and participation in another programme. Schools from the reserve list were subsequently invited and three returned MoUs. All 48 recruited settings attended the PACT lead training and signed data sharing agreements.

Following the training, three schools withdrew from the study during the subsequent family recruitment stage in June and July 2019. Reasons given for withdrawal were that they were unable to recruit the minimum number of families to the study (two schools), a lack of English skills within their families (one school), and lack of time to commit to the project (one school). Some gave multiple reasons for not being able to participate. A further two schools were then recruited from the reserve list, signing a MoU and DSA in July 2019. Staff from the schools attended training specifically for their settings run by the developer. This made a final number of 47 schools participating in the project. Thirty-six settings were nurseries within infant or junior schools and nine were stand-alone maintained nurseries.

Children and family recruitment—June 2019 to September 2019

Eligibility criteria

For a child to be eligible to take part in the trial they needed to be attending a participating nursery, due to start in reception year at school in September 2020, not have a sibling or step sibling within the same academic year, not have a suspected or diagnosed developmental or learning difficulty, and have a parent/carer at home with a basic level of English. The English requirement of the parent/carer was in order for them to be able to access the PACT materials.

Recruitment

The PACT leads at participating nurseries were responsible for recruiting families to the trial supported by the developer. Each nursery was asked to aim to recruit ten families; however, there was a requirement to recruit a minimum of four families to stay in the trial. Eligible families were approached by the PACT lead, provided with a PACT information sheet (see Appendix E.3), and had the opportunity to ask the PACT lead questions about the project. Following this, families that wished to take part were required to complete a Parent Participation Agreement Form (see Appendix E.4). As part of their PACT training, PACT leads were provided with suggestions for recruitment strategies and were also advised of the eligibility criteria for families. The recruitment period for the project ran from June to September 2019 with schools encouraged to recruit most families before the child started in nursery in September 2019. In total, 469 families agreed to participate. However, 19 children were withdrawn before randomisation. The reasons given for this were that 15 children did not take up their nursery place or left the nursery, two families dropped out due to family circumstances, and two did not meet the eligibility criteria. Therefore, 450 families were included in the trial at randomisation. The schools in the trial had between four and 21 children participating with an average of 9.5 children per school.

Recruitment of new schools that participants attended during reception year

Delayed post-test data collection needed to be carried out at the end of the children's reception year. Where the children attended the same school as their original nursery (293 of the 450 children), the school had already agreed to support the outcome data collection during reception when signing up to the project. However, where children had moved from a school which was already part of the trial (157 children across 77 schools), it was necessary to recruit their new schools to the project. New schools were approached by the developer team by email with an information sheet about the project (Appendix E.5) and asked to sign an MoU (Appendix E.6) as well as a data sharing agreement between the school and the Universities if they agreed to take part. These schools were offered financial incentive of a gift voucher for CosyDirect (an early years school equipment supplier) to the value of £100 per child assessed. Forty-three of the potential 77 new schools agreed to participate in the project (74 children).

Outcome measures

Baseline measures

Early language development

A battery of language assessment measures were collected at baseline in September 2019 before randomisation, which aimed to capture a variety of aspects of early language development. These measures were mostly commercial standardised assessments which had been used previously to evaluate the impact of PACT (Burgoyne et al., 2018b). These measures were used to form a language latent variable, informed by the developer's previous PACT trial (Burgoyne et al., 2018b). It was originally expected this language latent variable would also form the primary outcome measure for the trial but due to Covid-19 impact and associated in-person test data collection issues there was a change in plan. It was necessary to change the post-test data collection tool to one that could be delivered by schools (see further detail below). The language assessment battery comprised:

(a) **Clinical Evaluation of Language Fundamentals Preschool 2 UK (CELF-Preschool 2 UK) subscales of sentence structure and expressive vocabulary**. The CELF-Preschool 2 UK is a commercially available, standardised and validated assessment with the proposed age group and U.K. sample which has been used previously in EEF-funded early years evaluations. The sentence structure (SS) subscale evaluates a child's ability to interpret spoken sentences that increase in complexity over a maximum of 22 items. Expressive vocabulary (EV) is assessed by testing the child's ability to label illustrations of people, objects, and actions over a maximum of 20 items. Both subscales use discontinuation rules. The scaled score from each subscale was used for analysis.[2]

(b) **British Picture Vocabulary Scale – 3 (BPVS-3)**. This is a standardised measure of receptive vocabulary appropriate to three-year-olds validated with a U.K. sample. This was chosen as the programme activities specifically target vocabulary learning and it involves increased exposure to a variety of storybooks and resources. Each item in this measure consists of presenting the child with a set of pictures and asking the child to point to the picture representing a given word. This assessment uses starting and discontinuation rules. The standardised score was used for analysis.[3]

(c) **Renfrew Action Picture Test (APT)**. This is a standardised test that requires children to give samples of spoken language in response to picture stimuli. The test considers grammatical structures and the expressive vocabulary used. The test is suitable to use with children between the ages of three and eight and provides normed scores. This assessment provides two scores: information score (APT information: raw score range 0–40) and grammar score (APT grammar: range 0–38).

(d) **An experimental measure of Listening Comprehension (LC)**. This has been used previously across a variety of projects (details in Burgoyne et al., 2018b). In this assessment children listen to a recording of a short story. The tester then asks eight comprehension questions and records the child's response verbatim for later scoring by the research team using detailed scoring guidance. The test takes approximately three minutes to administer. As a standardised score was not available for this assessment the raw score was used for analysis.

These measures were collected at the baseline/pre-test timepoint by face-to-face visits to schools by researchers employed by the developer. The researchers were trained to deliver the assessment at an off-site training session day after which they conducted an audio recorded practice assessment that was quality assured by the evaluation team; the researcher was provided with detailed feedback. Each researcher was then accompanied on their first assessment visit in school by the developer. In school, the researchers observed the developer conduct assessments with two children and were in turn observed by the developer when they delivered the assessment battery to another two children. This allowed the developer to quality assure the delivery of the assessments and provide immediate feedback to the researchers when necessary.

The assessments were conducted in two sessions with the children in the pre-specified order of CELF sentence structure, CELF expressive vocabulary and listening comprehension in session 1 and BPVS-3, and APT in session 2.

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[2]**https://www.pearsonclinical.co.uk/store/ukassessments/en/Store/Professional-Assessments/Developmental-Early-Childhood/CELF-Preschool-2-UK/p/P100009267.html**
[3] **https://www.gl-assessment.co.uk/assessments/products/british-picture-vocabulary-scale/**

In total, the two sessions took around 30 minutes to complete per child. Where parents/carers consented, assessments were audio recorded to allow the evaluation team to perform quality assurance checks on the delivery and scoring of the assessments. The assessments were scored and data entered by the developer team and the data securely transferred to the evaluation team. The evaluation team then performed quality assurance checks on the data for 10% of the assessments carried out by each researcher and all of the assessments carried out by the developers. Using audio recordings of the assessments, the quality assurance process used a detailed mark scheme to score each selected assessment for:

- the quality of the record form completion—for example, whether all parts of the form were completed, whether additional information had been added where necessary, whether writing was legible;

- the coherence and accuracy of the answers the assessor recorded—whether they had accurately recorded what the child had given as an answer and if they had accurately scored the answers; and

- assessor behaviour in assessment administration—for example, clarity of speech, age appropriate communication, appropriate encouragement to the child, keeping the child engaged, following the assessment rules, and guidance including discontinuation or repetition rules.

Dual marking was carried out on 20% of the quality assurance checks to ensure the marking scheme was clear and fair. If discrepancies arose in the marks awarded, these were discussed, the mark scheme updated to include additional clarity, and the marking carried out again. The outcome of the quality assurance process was to provide a numeric overall score for each assessor and to provide summary written feedback based on each of the above criteria for each assessor. In the majority of cases, the quality assurance checks found the quality of marking by the assessors to be high. In cases where inaccuracies in assessor scoring or in obeying discontinuation rules had been found, re-marking of the assessments was carried out by the developer team using the audio recordings.

Home learning environment

As described in the logic model, the PACT intervention is expected to work by improving the home learning environment of the child participating, helping parents to provide a greater number of home learning opportunities, and increase their confidence and tools to support their child's learning. To measure the impact of PACT on these areas, the trial used the Home Learning Environment Index (HLE Index; Melhuish et al., 2008) at pre- and post-testing as an outcome measure. The HLE Index is a validated measure developed as part of the Effective Provision of Pre-school Education (EPPE) study and has been used in several large studies including the Millennium Cohort Study, National Evaluation of Sure Start (NESS), and a study of the Home Learning Environment by the Scottish Government (Melhuish, 2010). The HLE Index asks parents/carers to report the frequency of seven routine activities which are conceptually linked to learning (including being read to, going to the library, playing with numbers, painting and drawing, being taught letters, being taught numbers, and songs/poems/rhymes). These seven items were positively linked with predicting under- and over-achievement of children aged five (Melhuish et al., 2008). Frequency of the seven activities is coded on a 0 to 7 scale and gives a total score of between 0 and 49. Previous studies conducted data collection over the phone, however in this trial the questions were included as part of the baseline usual practice survey for parents/carers at the beginning of the trial in September 2019 and again as part of the endpoint usual practice surveys (in June and November 2020). HLE Index data was collected by an online survey link sent to parent/carer email addresses before randomisation. Where no response was returned online (or where no email address was available), a paper copy of the survey was sent to the PACT lead at school to distribute and collect responses from families (at baseline) and was subsequently sent directly to the home address of the family in June 2020 and November 2020. A stamped addressed envelope was provided for the return of the posted surveys. For this trial, the HLE Index measure was a secondary outcome and the baseline measure has been used as a covariate in the secondary outcome analysis. A copy of the questions used in the HLE Index are included as part of the surveys in appendices Q.4, Q.5, Q.6, and Q.7.

Primary outcome

The primary outcome for the trial is a language latent variable created from the subscale scores in the LanguageScreen assessment, collected when children were at the end of reception year in school (June and July 2021), ten months after the end of the intervention delivery period. Latent variables are indirect measures inferred from observed variables. Observed variables are those that can be measured directly (Schumacker and Lomax, 2016; Muthén, 2002). In this evaluation, we used observed variables generated through the LanguageScreen assessment undertaken at the post-test stage. A language skills latent variable created from the LanguageScreen assessment has been used previously

as an outcome measure in a randomised controlled trial of the Nuffield Early Language Intervention (NELI) programme funded by the EEF (Dimova et al., 2020; West et al., 2021) showing effects of the programme.

LanguageScreen is a standardised app-based assessment delivered by a member of school staff. The use of LanguageScreen removed the need for researchers to visit schools (which was not permitted by some schools and by the University of Manchester at the time of the delayed post-testing assessment). The LanguageScreen assessment is made up of four subtests:

1. Receptive Vocabulary (RV)—23 items where the child chooses which of four pictures matches a spoken word, which is automatically scored;

2. Expressive Vocabulary (EV)—24 items asking the child to name pictures scored by the test administrator;

3. Listening Comprehension (LC)—the child listens to three stories, each followed by a series of questions about the story to assess understanding of the story (16 items) scored by the test administrator; and

4. Sentence Repetition (SR)—the child is asked to repeat verbatim 14 spoken sentences scored by the test administrator.[4]

Standardised scores are provided through automatic processing by LanguageScreen. The primary outcome for the trial was a latent variable formed from the standardised scores of four subtests similar to that described in West et al. (2021).

The LanguageScreen assessment was administered using an app on a tablet by a member of staff in the child's school. Full instructions were included within the app for the delivery of the assessment without the need for external training. Verbal instructions and items for the child were played aloud through the app, which was expected to minimise variability in the delivery of the assessments across all the settings. There was guidance in each section for the adult delivering the assessment. Assessors using the app were encouraged to use a practice version to run through the assessment in advance of assessing any children. The four assessments were presented in a set order and took around 25 minutes in total to complete. The assessment administrator was required to mark on the app whether the child answered the questions correctly for the cases where the child gave a verbal answer. Data from the app was then uploaded to the LanguageScreen website automatically and scoring and results were generated automatically by LanguageScreen. Description of measure development is provided in the Statistical Analysis section below.

For the delivery of LanguageScreen, the developer team prepared the data for the participating children and communicated initially with schools about the upcoming assessment period. The evaluation team uploaded all the children's information into the assessment software and liaised with schools during the testing period to support their delivery of LanguageScreen. Where schools had difficulties with accessing the LanguageScreen assessment on their hardware the evaluation team couriered tablets to schools for schools to conduct the assessments. It was not possible to blind the assessor to the intervention allocation of the child, therefore there was the potential for bias in the completion of the assessments. However, as children were in reception rather than nursery at the time of delivery, it was likely that the assessor carrying out the assessment would not be a member of staff involved in the delivery of the PACT programme in the nursery and therefore was unlikely to know the allocation of the child in the trial.

Both the timing and measure used for the primary outcome have changed from the original PACT trial protocol. It was originally planned to repeat the use of the language baseline measures, described in the section above, immediately following the planned intervention period in June and July 2020. However, due to Covid-19 restrictions it was not possible to collect any language outcome data immediately after the intervention. A broad range of alternatives to researcher-conducted in-school testing were considered in detail, including piloting of assessments using remote delivery of some of the assessment battery in autumn 2020 at the start of the child's time in reception. However, schools reported they did not have the staff, space, or internet capability to support this method of delivery. The decision was therefore made to delay the primary outcome data collection to the end of the reception year. Continued uncertainty about Covid-19 restrictions within schools, and restrictions placed on visits to schools by the developer and evaluation team's institutions, meant a decision was made to change to the LanguageScreen assessment as the primary outcome. LanguageScreen could be delivered in schools without a researcher present; it was also being used in parallel with another EEF project (NELI).

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[4] OxEd Assessment Ltd: https://oxedandassessment.com/language_screen

Data provided by the LanguageScreen developer indicated that LanguageScreen assessment scores correlated strongly (r = 0.95) with a latent variable created from scores on standardised researcher-delivered measures (CELF-Preschool – Expressive Vocabulary subtest and APT information and grammar scores included in this study as well as CELF-Preschool Recalling Sentences subtest not included in this study) in a previous study of more than a thousand participants (West et al., 2021). This gave a strong indication that the LanguageScreen assessment was measuring the same constructs as the latent variable in the West et al. (2021) study and was a good alternative measure for this research given the similarity of assessments.

Secondary outcomes

LanguageScreen subtests scores of Receptive Vocabulary, Expressive Vocabulary, Listening Comprehension, and Sentence Repetition collected in June and July 2021 were used as individual secondary outcomes. The logic model expects that PACT will impact on the whole language development of the child. However, the teaching materials focus particularly on vocabulary. The standardised subtest scores of each aspect of Language Development measured by LanguageScreen have therefore been used to investigate whether there is a greater improvement in the targeted areas of language.

The Brief Early Skills and Support Index (or BESSI) questionnaire, collected when children were at the end of their reception year (June or July 2021), was used to evaluate school readiness. BESSI is a standardised, validated, and reliable 30-item questionnaire for reception and nursery children completed by a member of school staff, which assesses how well children are making the transition to school.[5] Questions are answered for an individual child to reflect the child's behaviour over the previous week and statements are answered on a four-point 'strongly agree' to 'strongly disagree' scale. This scale contains four subscales measuring Behavioural Adjustment (12 items), Language and Cognition (6 items), Daily Living Skills (6 items), and Family Support (6 items). For this trial, the total score for the assessment has been used in the analyses.

The evaluation team were responsible for the delivery of BESSI. School PACT leads were emailed a link to an online survey to be completed for all the participating students in their settings and the PACT lead was responsible for making sure that a member of staff who knew the child completed the BESSI for that child (ideally the child's keyworker). Where settings had difficulties accessing the online survey, a paper copy was provided which could be copied for each child and returned by post. Instructions for completing the BESSI were sent at the same time as those for LanguageScreen.

The Home Learning Environment Index (described in further detail above in the Baseline Assessment) is a seven-item self-report questionnaire completed by parents. Each item is scored on a scale of 0 to 7 to describe the frequency of the occurrence of each item giving a maximum total score of 49. The HLE Index was used to measure the home learning environment when the child was at the end of nursery (June 2020) at the end of the intervention delivery period. As the intervention period covered the time before Covid-19 hit and immediately after when all restrictions were in place, the survey was amended to ask parents to respond to each item for the period immediately before Covid-19 (February 2020) and for the time they were completing the survey (June 2020). We expected that Covid-19 had disrupted the normal home environment, especially with children being home-schooled, nurseries closed, and parents potentially furloughed or working from home. Parents/carers were therefore asked to complete the HLE Index questions for (a) the period in February 2020 immediately before the Covid-19 lockdown and (b) for the time of data collection in June 2020 when Covid-19 restrictions were in place. An additional HLE Index data collection point was added in November 2020 when children were then in their reception year at school. Collection at this timepoint aimed to see if any changes to the HLE caused by PACT had persisted beyond the PACT delivery period. For the HLE Index questions relating to timepoints after March 2020, it was not appropriate to ask parents to complete the item about whether they had attended a library with their child as many libraries were shut during this period. This item was therefore removed, and the overall score adjusted to be out of 42 instead of 49.

Due to the Covid-19 restrictions it was not possible to collect the originally planned Early Literacy Skills or the additional CELF secondary measures stated in the original protocol as these would both have required researchers to attend settings to deliver these assessments.

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[5] **https://www.cfr.cam.ac.uk/tests-questionnaires/bessi**

Sample size

At protocol we aimed to recruit a sample of 48 nursery settings with ten participants per setting aiming for 480 participants overall. Forty-eight settings were the maximum number to which the developer had the capacity to deliver. Sample size calculations conducted using Optimal Design software indicated that this would allow the detection of a minimal effect size of 0.18 when assuming a two-sided test, a pre-post-test correlation of 0.60 (as found in the Burgoyne et al., 2018b, previous PACT trial using the same outcome measure), a 0.10 intracluster correlation (based on the average value observed in EEF trials in Xiao et al., 2016), along with 5% type I error and 80% power (Table 8). The MDES using these assumptions is lower than the effect sizes found in the previous trial, which found an effect size of 0.21 on language scores immediately after the intervention period. Many early years trials suffer drop-out and attrition both at pre-randomisation stage and in collecting post-test outcomes and the increased sample size in this trial aimed to account for potential attrition as well as the likelihood of a smaller effect size on a trial run by an external evaluation team rather than being developer-led like the previous trial.

At randomisation, 47 nursery settings—with a total of 450 participants—were participating with an average of ten participants (five intervention, five control) providing data per school. The sample size estimate at this stage—for 47 schools with a mean of ten children and an estimated pre-post correlation of 0.60—indicated that it would still provide the same MDES (0.18) as was calculated at the protocol stage. Details of this estimate are provided in Table 8.

The sample size estimate for the analysis of post-test data for a total of 45 schools (the number of original nurseries where it was possible to collect delayed post-testing for at least one pupil even if they now attended a different school)[6] with, on average, ten participants per school, a pre-post test correlation of 0.67, and an ICC of 0.23, indicated that this sample would be adequate to detect a minimum effect size of 0.17 (Table 8). This MDES is slightly lower than the estimate at protocol or randomisation stages (0.18). Further estimation of sample size using post-test data for the subgroup ineligible for EYPP from a total of 30 schools (on average two children per school) with a ICC of 0.29 and pre-post test correlation of 0.69 indicated that this sample would be able to detect a minimal effect size of 0.37. However, this study was not powered to detect an effect on the EYPP subgroup as the primary population of interest.

We note that the ICC at post-test across the sample was higher than that originally assumed (0.10 compared to 0.23). Our initial ICC assumption was based on the average across all EEF trials, however, it may be that this assumption was an underestimate of a typical ICC in early years trial settings.[7] Another reason the ICC may have been higher than expected is that different settings may have clustered the types of families they recruited to the trial, however, this seems unlikely as the IPE found no evidence of specific targeting of different types of families other than within the eligibility criteria and most settings reported inviting all eligible families to the trial.

Randomisation

Randomisation was completed in October 2019 by the trial statistician who was not involved in the recruitment of schools or parents/carers. Participants had been recruited by the developer team.

Ideally, to minimise any potential bias in completing pre-testing and to provide maximum data for the study, all pre-testing would have been completed before randomisation. However, due to the tight timeframe for fitting in the 30-week intervention during the school year and difficulties with children being absent from nurseries when researchers visited, randomisation needed to take place before all pre-testing was complete. Children were included in the study if they had completed a minimum of the CELF Expressive Vocabulary and the CELF Sentence Structure assessments during one assessment session with a researcher. Where a researcher had sat and attempted to complete the assessments with

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[6] The children that were assessed with LanguageScreen at delayed post-testing came from 45 of the original nurseries. These children had moved from nursery into school before post-testing and therefore testing took place in a larger number of schools as described in the Participant Selection and Attrition sections.

[7] We note that Tymms, Merrell and Bailey (2017), for example, found that for reception classes across a large U.K. sample, the school-level variance was 0.139 while the U.S.-based Institute for Educational Science's What Works Clearinghouse (2022) recommend using 0.20 as default ICC for achievement outcomes across educational trials.

the child but the child was not compliant in completing the pre-testing assessments, these children were still included in the randomisation. To account for any potential systematic bias, which may have explained whether pre-test was complete or not at the date of randomisation, randomisation was undertaken to ensure the two groups (control and intervention) were balanced on pre-test completion status as follows:

- pre-test complete—children who have completed all baseline assessments, which form the originally planned latent language variable (CELF Expressive Vocabulary, CELF Sentence Structure, Listening Comprehension, BPVS-3, APT) and the CELF Word Structure measure;[8]

- partial pre-test complete—children who have completed a minimum of both the CELF Expressive Vocabulary and the CELF sentence structure; and

- no pre-test data available—where participants were non-compliant with the assessment process.

Participating children were allocated to either intervention or control on a 1:1 ratio across the sample. The randomisation scheme was based on permuted block randomisation with mixed block sizes of two, three, and four. The randomisation results were marginally balanced across treatment groups and by pre-test completion status. Imbalances within schools was mostly one, except for one school where it was two.

The evaluation team informed the developer team of children's allocations and informed schools and parents of the allocation.

Statistical analysis

The analyses of outcomes followed an intention to treat (ITT) principle, as suggested by the EEF statistical analysis guidelines (EEF, 2018). Therefore, the effect sizes for primary and secondary outcomes were estimated based on group allocation of participants at randomisation stage, irrespective of whether they later complied or not. Since the study was a multisite trial, we used multilevel models (MLMs) adjusted for prior attainment, which will account for the variability in average pupil attainment across schools participating to the trial and variation in the intervention effect across schools. The choice of analytical model is considered an optimal choice following the study design. As per analysis guidelines by the EEF, our main analysis for estimating effect sizes used the unconditional variance generated from an empty model in the denominator, while estimates for the numerator of the effect size is obtained from the conditional multilevel model. The model specification for the empty unconditional model and for the conditional model including intervention and pre-test as a covariate is shown below.

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[8] The CELF Word Structure measure was collected at baseline as this was originally planned to be part of a secondary outcome measure, the CELF Preschool 2 UK Core Language Score. However, when it was not possible due to Covid-19 to collect our researcher-delivered face to face assessments, this secondary outcome was dropped from the study. It is not included in the baseline measures for this study as it was not intended to form part of the language latent variable as described in Burgoyne et al. (2018) used in the current study.

$$y_{ij} = \begin{cases} \beta_{00} + b_{0j} + \epsilon_{ij0} & \text{for unconditional model} \\ \beta_0 + \beta_1 t_{ij} + \beta_2 pretest_{ij} + \ldots + b_{1j} + b_{2j} t_{ij} + \epsilon_{ij} & \text{for conditional model} \end{cases}$$

$$y_{ij} = \begin{cases} \beta_{00} + b_{0j} + \epsilon_{ij0} & \text{for unconditional model} \\ \beta_0 + \beta_1 t_{ij} + \beta_2 pretest_{ij} + \ldots + b_{1j} + b_{2j} t_{ij} + \epsilon_{ij} & \text{for conditional model} \end{cases}$$

Here, y_{ij} = outcome variable (continuous), for ith child in jth school where $j = 1,2,\ldots,M$ and $i = 1,2,\ldots,n_j$;

M = number of schools;

n_j = number of children in each school;

$\epsilon_{ij} \sim N(0,\sigma_1^2)$ = conditional residual error;

($\epsilon_{ij0} \sim N(0,\sigma_0^2)$) = unconditional residual errors reflecting individual child differences in post-test and

t_{ij} is = intervention variable for child i in school j;

$b_{1j} \sim N(0,\sigma_{11}^2)$, $b_{2j} \sim N(0,\sigma_{22}^2)$ = random effects capturing the variation between schools from conditional models and

$b_{0j} \sim N(0,\sigma_{00}^2)$ = random effects from unconditional models;

β_1 = regression coefficient for the intervention variable for child i in school j;

$pretest_{ij}$ = pre-test variable for child i in school j; and

β_2 = the regression coefficient for the pre-test variable for child i in school j.

The notation '…' reflects additional fixed effects, specifically the stratification variables which were used for sensitivity analyses, following EEF statistical analysis guidelines.

The modelling approach was consistent for both primary and secondary outcomes and included pre-test scores for baseline adjustments (analysis code for outcome analysis is included in Appendix I). Sensitivity analyses were done on primary and secondary outcomes using conditional variance, additionally also including the stratification variable used in randomisation as a covariate in a separate model (see Randomisation section) and these results are provided in Appendix D.

Primary analysis

The primary outcome was constructed as a latent language variable derived by combining four variables from standardised scores on LanguageScreen subtests—Receptive Vocabulary (RV), Expressive Vocabulary (EV), Language Comprehension (LC), and Sentence Repetition (SR)—through using a Confirmatory Factor Analysis (CFA) model in MPlus. A similar modelling approach was used in the previous PACT trial. This modelling approach enables estimation of impacts of PACT across the different components of language development as measured by the latent outcome. It assumes that the language skills may be better assessed as a latent construct that uses shared variance of the subtests and can reflect important elements of language skills that may be difficult to measure relying on observed variables. Our post-test latent variable (primary outcome) used a similar approach as was done by West et al. (2021). However, there was unexpected Covid-19 disruption and the same measure could not be used at both pre- and post-test stages for practical reasons. Therefore, the pre-test score adjustment required constructing an alternative latent variable. While we constructed the primary outcome, post-test latent variable, using four LanguageScreen sub-items, the pre-test latent language variable was constructed using baseline measures (CELF-2 SS, CELF-2 EV; BPVS-3; LC, APT information). This pre-test latent variable was then used for baseline adjustment. Further details about the construction of the pre- and post-test latent variables is included in Appendix F. While identical measures were not available at both stages, we consider this a reasonable approach since both latent variables are reflecting dimensions of early language development (Schumacker and Lomax, 2016). Three out of the five items used for the pre-test language latent variable were similar to measures used for the post-test latent variable, such as (1) LanguageScreen EV similar to CELF2 EV, (2) LanguageScreen RV similar to BPVS RV, and (3) LanguageScreen LC similar to Listening Comprehension measure. West et al. (2021) looked into the correlation between their LanguageScreen latent variable and a second language latent variable generated from four other measures: two CELF2 measures, EV and SR subtests, plus two APT measures—information and grammar test scores. While they observed a very strong correlation (r = 0.95) between two latent variables, both assessed at the same time at post-test (West et al., 2021), our latent variables (pre-

test and post-test) also had a high correlation (r = 0.67). It is worth noting that our pre-test and post-test data collection gap was 21months, which still showed reasonably high correlation indicating the pre-test latent variable and post-test latent variables are both measuring similar dimensions of language ability. Sensitivity analysis was conducted using raw scores of the variables used for the creation of the primary outcome latent variable instead of standardised scores. A similar approach was also used for pretest latent variable creation.

Secondary analysis

As mentioned in the earlier section describing secondary outcomes, seven variables were included as secondary outcomes: LanguageScreen sub-items RV, EV, LC, and SR, BESSI, HLE at post-test, and HLE assessment at delayed post-test. Similar to analysis of the primary outcome, each of these models analysing secondary outcomes used the pre-test latent variable as the pre-test measure for effect size estimation, except for the HLE variable. This was done so that a consistent approach can be applied to mitigate the fact that the study required to use a different measure at pre and post periods due to COVID context. There was reasonable correlation between the pre-test latent variable and LanguageScreen sub-items: RV, r = 0.67; EV, r = 0.63; LC, r = 0.40; and SR, r = 0.42. The HLE Index assessment was available for baseline and therefore it was used as pre-test score when post-test HLE Index outcomes were analysed as secondary outcome.

Analysis in the presence of non-compliance

Participants recorded their involvement with PACT using a phone app or paper record form. Intervention dosage was the number of PACT sessions completed per child (range 0–150) obtained by combining and cleaning the data from the phone app and paper records. Data cleaning was required to remove duplicate records where the same session had been recorded through multiple devices, or in both the paper form and the app, so that only one session was counted. To do this, it was necessary to infer which week in the PACT programme the app session data referred to using the date the record was completed (the PACT app does not record the specific week in the programme that the record was from).

We used the Complier Average Causal Effect (CACE) analysis as an additional sensitivity analysis to assess whether there was an association between outcome and adherence to the intervention. The CACE analysis grouped children based on their compliance levels to examine whether the effect would vary by compliance. We used the statistical function for a previous version of eefAnalytics package (version 1.0.11) in R software to estimate this weighted effect size. The previous trial of PACT had found that participants had completed 17.48 of 30 weeks of the programme, which was around 58% of the sessions (Burgoyne et al, 2018b). This level of completion had allowed the trial to show a positive impact of the programme on language skills. Discussion with the developer team indicated that they were not expecting a specific level of compliance with the programme and wanted families to get into a routine and do more than they were doing previously. They understood that the intensity of the programme was quite demanding and that it was unlikely most participants would complete all the sessions. The Results section shows the variability in CACE depending on the level of compliance and specifically presents the CACE assessed for impact of PACT in the subgroup of children with 50% compliance (similar to the delivery level found in Burgoyne et al., 2018b) and 80% compliance (an optimistic level as discussed with the developer).

Missing data analysis

The primary outcome was constructed as a latent variable using a confirmatory factor analysis in MPlus (version 8.6) and a similar approach was also used for constructing the pre-test latent variable. Of a total of 450 children, only six had provided no data at all for the baseline variables used for the creation of pre-test latent variable. The rest (444) provided full or partial data on variables included in calculation of this latent variable (the breakdown of the missing data for each baseline variable is included in Appendix J). In order to control for the existence of missing data in the pre-test and post-test latent variables, the Full Information Maximum Likelihood (FIML) estimator is employed at the CFA stage. The use of the FIML is accompanied by the assumption that the missingness mechanism can be characterised as Missing At Random (MAR). Following the CFA stage, there is some missingness leftover within the constructed primary outcome of post-test language latent variable and the pre-test language latent variable used as a covariate for baseline status in the model. For the pre-test language latent variable, the number of missing cases, however, represents a negligible percentage of the total dataset (1.3%) and is thus allowed to be automatically dropped by the model without affecting estimates in any real or practical sense. Similarly, for the primary outcome post-test language latent variable, any missing values in the dependent variable can be effectively ignored as missingness implying an unbalanced data structure, which, statistically, poses no problems for a multilevel model; this again follows the MAR assumption

conditional on the covariates included in the model. The superiority of FIML estimation as an unbiased and more efficient method than others has also been reported by other researchers (Enders and Bandalos, 2001). Furthermore, characteristics of missingness for the primary outcome (see Results section) found no significant difference between pupils who provided data and those who did not.

Subgroup analyses

The subgroup analysis followed the same analytical approach as mentioned above, but here the models were run for a subset of 70 children who were eligible for Early Years Pupil Premium (EYPP). The only other difference is that for the HLE Index delayed post-test outcome analysed among EYPP children, the model included the random intercept but not the random slope. As mentioned above, all other models included pre-test and intervention as covariates and used unconditional variance from empty model in the denominator.

Estimation of effect sizes

The effect size for the primary outcome was obtained from a MLM appropriate for multisite trial using the eefAnalytics package in Rstudio. The scores for post-test latent variable constructed in MPlus was saved and used in the MLM as primary outcome. The effect size was estimated for primary and secondary outcomes using Hedges' g effect size from a multilevel model defined as

$$ES = \frac{\widehat{\mu_T} - \widehat{\mu_C}}{\sqrt{\sigma_w^2 + \sigma_s^2 + \sigma_I^2}}$$

where $\widehat{\mu_T} - \widehat{\mu_C}$ is the adjusted average difference between the intervention and control group, σ_w^2 is residual variance, σ_s^2 denotes between-school variance, and σ_I^2 denotes the variance of school by intervention effects.

As per EEF guidelines (EEF, 2018), the main analysis for effect size was computed using unconditional variance. Unconditional effect size is estimated using the formula provided above. Conditional effect size was estimated using the method proposed by Singh et al. (2021), which includes variance components for child, school, and school-by-intervention effects. The sensitivity analysis using conditional variance is provided in the Appendix D. The effect sizes calculated using both conditional and unconditional variances were comparable and there was no significant difference between the models.

Estimation of ICC

We estimated ICCs for the analysis of the individual outcome data using multilevel models. The pre-test estimation of ICCs used a model with only the overall mean and with schools as random effects. The estimation of ICCs for post-intervention data was undertaken with schools as random effects and computed at school level. The results table for ICC is included in Appendix K, which shows that both conditional and unconditional models produced very similar ICCs.

Longitudinal analysis

We have not completed any longitudinal analysis as the study was not planned to include follow-up data. However, we will make the analysis dataset (excluding LanguageScreen results) available for the EEF archive. This will enable longitudinal analysis in the future by linking the data with the NPD. Delayed LanguageScreen post-test data could only be archived anonymised and will not be available to link with the NPD as there is no agreement with the LanguageScreen developer to link its dataset with administrative data.

Implementation and process evaluation

Research methods

The implementation and process evaluation (IPE) focused on tracking and monitoring fidelity, dosage, quality, and stakeholder perceptions at each of the different aspects of intervention delivery:

- support and training provided by the developer to schools and families;
- schools' targeting and delivering of support and materials to families; and

- families' use of the PACT programme materials and programme during the year.

The design of the IPE aimed to collect data about each aspect of the logic model. The data collection tools, which captured the different elements of delivery and impact, are shown in the orange boxes in the logic model in Figure 2 (page 16).

Table 4 shows further detail of the research and data collection methods. There is a longitudinal element of the design, which involved interviews with PACT leads and with parents/carers conducted at two timepoints during intervention delivery to look at any changes in delivery across the period of the intervention. Covid-19 restrictions began in March 2020 during the intervention delivery period. Interview schedules and surveys after this period were adapted to reflect the restrictions that were in place and also to collect data on the impact that Covid-19 had on the delivery and implementation of the programme.

Table 4: IPE research methods overview

Research methods	Data collection methods	Participants/data sources	Data analysis methods	RQs	Implementation/logic model relevance
Observation	Observation of PACT lead training session using semi-structured observation schedule and field notes	PACT lead training session (2 sessions observed)	Deductive using research question as framework	1	Fidelity, quality, perceptions relating to PACT lead training
	Observation of parent/carer training sessions using observation schedule	Parent/carer PACT training session (3 sessions observed, 1 from each deliverer)	Deductive using research question as framework	2	Fidelity, quality, perceptions relating to parent/carer training
Surveys	PACT lead post-training attitudes survey	PACT leads attending training sessions (65 survey responses)	Frequencies of responses Inductive coding of free text responses	1, 7	Perceptions of the training, PACT lead characteristics and motivation, programme differentiation from usual practice
	Baseline usual practice surveys	PACT leads in all participating settings (57 survey responses)	Descriptive statistics, frequencies of responses Inductive coding of free text responses	7	Differentiation from usual practice, understanding counterfactual, context, barriers to recruiting families, cost of delivery
	June–July post-intervention period surveys (including usual practice)	PACT leads in all participating settings (48 survey responses)	Descriptive statistics, frequencies of responses Inductive coding of free text responses	5, 6, 7, 8, 9, 10, 11	Quality of delivery, how this was perceived, adaptation in delivery of support to parents/carers, fidelity, usual practice, understanding counterfactual, cost of delivery
	Baseline usual practice survey	All parents/carers (373 survey responses)	Descriptive statistics, frequencies of responses Analysis by control and intervention group Inductive coding of free text responses	7	Usual practice, context
	June post-intervention surveys (including usual practice)	All control and intervention parents/carers (some questions differ for intervention and control, 306 survey responses)	Descriptive statistics, frequencies of responses Analysis by control and intervention group Inductive coding of free text responses	2, 3, 4, 5, 6, 7, 8, 9, 11	Fidelity and quality of delivery, perceptions of the programme, adaptation, understanding counterfactual, perceived impact, barriers to delivery
	Delayed post-intervention November surveys (including usual practice)	All parents/carers (254 survey responses)	Descriptive statistics, frequencies of responses Analysis by control and intervention group Inductive coding of free text responses	6, 7	Usual practice, perceived impact on home learning environment
Semi-structured interviews	Semi-structured interviews at two timepoints with same participants	PACT leads (20 interviews of 12 PACT leads)	Combination of inductive and deductive coding using thematic analysis	1, 2, 5, 6, 7, 8, 9, 10, 11	Fidelity and quality of delivery, adaptations in terms of support provided, programme differentiation, perceptions of the

				programme, delivery model, cost evaluation, barriers to delivery
	Semi-structured interviews at two timepoints with same participants	Parents/carers in settings where PACT leads are interviews (39 interviews of parent/carers)	Combination of inductive and deductive coding using thematic analysis	2, 3, 4, 5, 6, 8, 10, 11	Fidelity and quality of delivery, support, barriers to delivery, perceived impact, adaptations, delivery over time
	Semi-structured interview/focus group with developer	Developer team (1 interview)	Combination of inductive and deductive coding using thematic analysis	1, 2, 8, 10, 11	Fidelity and quality of delivery, support provision, adaptations, delivery model
Workshop	Guided cost workshop with developer to establish 'ingredients', delivery model of 3 years and costs	Evaluation team and developer team (1 workshop)	Notes from session used to create description of model and costs shared between evaluation and developer teams		Cost evaluation, delivery model beyond trial
Admin data	Training attendance records	Records of attendance at all training sessions	Attendance analysed by percentage of sample trained and type of training received/attended	1, 2	Fidelity, training for PACT leads, training for parents/carers
	PACT app delivery data/paper record forms	Electronic or paper records from all intervention group parents/carers (records from 204 participants)	Descriptive statistics on number of sessions completed Exploratory analysis of patterns of delivery longitudinally Used for CACE analysis	3, 10, 11	Fidelity, dosage of PACT delivery by families

Observations

Observations using semi-structured observation schedules (Appendices Q.8 and Q.9) were conducted by one member of the evaluation team of both the main PACT lead training sessions and three observations of parent/carer developer-led training sessions (sampled to observe one session conducted by each member of the developer training team). Observations were designed and analysed in order to consider the content of the training sessions against their aims, the response of participants to the session, and the consistency of training sessions delivered by different trainers.

Surveys

PACT lead surveys
PACT leads completed an initial paper-based attitudes survey during the developer-led PACT training sessions (during April and May 2019; Appendix Q.1). The survey asked the PACT leads to state their role within the school, their rationale for signing up to PACT (if applicable), their perceived potential impact of the programme, and their confidence in recruiting families and delivering the required administration and support.

PACT leads from each of the participating schools completed an online 'usual practice' survey at baseline (September 2019; Appendix Q.2) and in June and July 2020 (Appendix Q.3), after the original planned end date of the intervention, detailing their usual practice for providing support to parents generally and, specifically, around language development. In addition, the usual practice data collection also aimed to explore whether there was any spillover or compensation rivalry in the control group.

The questions in the baseline survey were piloted with a headteacher and an early years practitioner in two settings not connected with the trial. The development of questions for the post-intervention survey was informed by PACT lead and parent/carer responses in interviews and the baseline usual practice survey. Adaptations to questions in the June-July 2020 survey were piloted with staff connected with EYFS provision.

Response numbers to the three surveys are given in Table 5. The attitudes survey was given to all training session attendees (n = 67) and 65 completed it (97% response rate). Baseline surveys were sent to all PACT leads for whom details were held (n = 57); however, while in some nurseries two PACT leads responded to the survey, in other schools, the survey was completed by one PACT lead on behalf of both members of staff. Responses were received from 100% of schools and from 74% of those contacted. For the June-July 2020 survey, only one response was requested on behalf of each school (100% completion rate). Data from the PACT lead surveys was analysed using descriptive statistics. All responses from participants in the attitudes survey were analysed as the questions asked about personal views. In the baseline and June-July 2020 surveys, where quantitative data was received from more than one PACT lead in a school, the responses have been averaged in order not to weight the analysis towards schools with more than one response. All qualitative responses have been included in the analyses.

Table 5: Survey responses to the three PACT lead surveys

	Attitudes Survey (at training) April-May 2019	Baseline Survey September 2019	Post-intervention June-July 2020 Survey
Number survey was sent to	67	77	47
Number of individual responses	65	57	49*
Response rate (PACT lead level)	97%	74%	-
Response rate (nursery level)	100%	100%	100%

The number of participating nurseries was 47. For all surveys at least one response was provided by every participating nursery.
One response received was a duplicate due to a PACT lead completing the survey twice: the first response has been removed.
In another school, two PACT leads completed the survey: in order not to weight the findings towards an individual school, the two responses have been averaged.

Parent usual practice surveys

Parents/carers were asked to complete a 'usual practice' survey at baseline (September 2019; Appendix Q.4), in June 2020 (at the end of the originally planned intervention delivery period; Appendices Q.5 and Q.6), and in November 2020 (three months beyond the end of the actual intervention delivery period; Appendix Q.7).

Surveys at all timepoints—for both control and intervention parent/carers—included the HLE Index (Melhuish et al., 2008). In June 2020, separate surveys were delivered to the control and intervention groups. The latter were asked to provide feedback on intervention delivery; the control group on their usual practice to do with reading at home and home learning as well as access to the intervention materials to assess contamination. These summer and autumn surveys in 2020 were used to delve into greater detail about the delivery of the PACT programme by parents/carers.

The 2020 autumn survey was additional to the original protocol and included as a result of the immediate post-test period being postponed and later cancelled due to Covid-19 lockdowns. This survey included the HLE Index measure from the impact evaluation together with questions about continued use of PACT and home activities surrounding reading. This additional survey aimed to capture practice beyond the intervention period and any changes to home practice which persisted once children had started in school. Participation in the November 2020 survey was incentivised through the use of a prize draw to win one of four £25 Amazon vouchers.

The development of the 2020 summer and autumn survey questions was informed by interviews with parents/carers and their responses to the baseline survey. The baseline and June 2020 surveys were piloted with parents who had children of a similar age to those participating in the trial, but that were not part of the trial. Data from the surveys were analysed using descriptive statistics.

Response numbers and response rates to parent/carer usual practice surveys are given in Table 6.

Table 6: Survey responses to the PACT parent/carer surveys at three different time-points; response rates shown for both intervention and control parents/carers

Parent survey responses	Baseline survey (September 2019, before randomisation)		Post-intervention survey (June 2020)		Delayed post-intervention survey (November 2020)	
Intervention (n = 225)	186	83%	138	61%	122	54%
Control (n = 225)	187	83%	169	75%	131	58%
Response rate	83%		68%		56%	

Interviews

PACT lead interviews
The project aimed to conduct two telephone interviews with ten PACT leads from ten different schools. PACT leads from ten schools were interviewed by a member of the evaluation team early in the intervention delivery (December 2019 to January 2020). Eight of these agreed to a second interview at the end of the originally planned intervention delivery period (June 2020) and two PACT leads from an additional two schools were recruited for the second interview. PACT leads were chosen to represent the spread of geographical areas involved in the project: eight were interviewed from the Warrington and Lancashire regions (19 nurseries in the project), two from the Tameside region (15 nurseries in the project), one from Rochdale (seven nurseries in the project), and one from Bolton (six nurseries in the project). The PACT lead interview plans are presented in appendices Q.10 and Q.11. The interviews aimed to capture resource usefulness and acceptability, intervention delivery, and the perceived impact of PACT. Interviews also gathered details on the intervention costs to schools (such as direct costs and staff time). The interviews were aimed to be 20 to 30 minutes long and ranged between 12 and 35 minutes. They were audio recorded and transcribed to assist with analysis. The interview data was analysed using inductive thematic analysis as well as being coded by research question using NVivo software released in March 2020 (QSR International Pty Ltd., 2020). Findings from the interview data related to the research questions were triangulated with those from the PACT lead surveys—which gave a broader but less in-depth view of the relevant areas—and with the parent/carer interviews and surveys to help understand whether nursery staff and families' experiences were similar. The findings are presented in the IPE Results by Research Question sections as well as by stages within the logic model.

Parent/carer interviews
Telephone interviews were conducted with 20 parents/carers in February 2020 and with 19 in July 2020. The same parents/carers that participated in the first interviews were invited to participate in the second interviews, however, five were unable to participate in the July round. Four new parents/carers were recruited. The sampling strategy was to invite parents/carers from schools in which PACT leads had participated in interviews, however, this was not possible in all cases: parents/carers from four schools were invited to participate in February 2020 where no associated PACT lead had been interviewed. In one of these schools, it was, however, possible to invite a PACT lead to participate in June 2020. The PACT parent/carer interview schedule is presented in Appendices Q.12 and Q.13.

The February 2020 interviews aimed to capture:

- parents/carers views on their training and support for PACT;

- how PACT was being delivered;

- the responsiveness of their child to the PACT programme;

- the acceptability of PACT to parents/carers;

- any barriers that had been faced implementing PACT; and

- any impact on parents'/carers' understanding of child development or engagement with their child's learning.

The July 2020 interviews aimed to capture:

- progress and continued use of PACT;

- how PACT was used during the Covid-19 lockdown period;

- views on the PACT materials and activities;

- the support accessed for PACT;

- communication with other PACT parents/carers; and

- the perceived impact of PACT for the child/family.

Each interview was aimed to be 15 to 20 minutes long and parents/carers were offered a £15 Love2Shop voucher for participating in both the February and July interviews. Parent/carer interviews were audio recorded and transcribed to assist with analysis. The interview data was analysed using inductive thematic analysis as well as being coded by research question using NVivo software released in March 2020 (QSR International Pty Ltd., 2020). Findings from the parent/carer interviews were triangulated with those from other sources of data in the evaluation including PACT record data and parent/carer survey responses, which represent a broader sample of participants, and PACT lead interview and survey data in order to explore whether family experiences and nursery staff experiences of PACT are similar. Results are presented by research question as well as by stages within the logic model.

Developer interview
An 80-minute interview with both members of the developer team was held in August 2020 via Microsoft Teams. The developer interview schedule is presented in Appendix Q.14. The interview aimed to capture their views on a range of topics including:

- changes made to PACT delivery during the trial;

- the extent to which schools and parents/carers delivered PACT as expected;

- problems or barriers that were faced in delivering the programme;

- known programme adaptations;

- ideal conditions for delivery of PACT and whether this was achieved;

- prerequisites for schools/nurseries to deliver the PACT programme;

- the support for PACT provided by the developer team;

- reflections on training provision; and

- consideration of delivery models for PACT beyond the trial.

The interview was audio recorded and transcribed to assist with analysis. The interview data was manually analysed using inductive thematic analysis as well as being coded by research question. Findings were triangulated with those from other sources of data in the evaluation and are presented by research question as well as by stages within the logic model.

Costs

This project's protocol was agreed before the EEF's latest cost evaluation guidance (EEF, 2019). Efforts were made to adhere to the new guidance where possible but where data collection points had already past, it was not possible to collect the level of cost detail required by the new guidance.

Cost data was collected within the IPE data collection (described above) as well as in a specific cost workshop between the developer and the evaluation teams.

The cost workshop took place via Microsoft Teams in August 2021 and explored the PACT logic model in detail to extract the 'ingredients' that formed the intervention and explored their costs. As the developer did not currently market the programme commercially, the workshop was used to develop an estimate of the cost to the developer of providing the training, materials, and support necessary for delivery. The workshop also explored what schools, PACT leads, and parents/carers would require for delivering the PACT programme as well as the cost for delivery in the same setting over a second and third year.

The baseline usual practice survey for PACT leads as well as the post-training PACT lead attitude survey contained questions to explore the counterfactual of delivery from the school setting. Parent/carer usual practice surveys also explored the counterfactual for non-PACT families.

Time spent delivering the PACT programme for school settings was gathered in the PACT lead usual practice surveys. This included collecting data on the time spent on training and programme set-up collected via the baseline survey

(number of days across all staff in the setting) and time spent delivering the programme through the year, collected via the June/July 2020 survey. For the delivery through the year, this time was collected separately for the first five weeks of the programme (total number of days) and ongoing delivery for the remainder of the programme (days per month). For the ongoing costs, staff time was split by PACT lead time and time for other staff in the setting. The surveys also asked about whether any supply cover was required by settings and, if so, the number of days.

Unexpected or 'hidden' costs were explored in the interviews both with PACT leads and with parents/carers along with any prerequisites that were felt necessary for delivery of the programme along with questions in the usual practice surveys for PACT leads and parent/carers.

Parent/carer time commitment in delivering the intervention is reported separately from school delivery costs and not included in the cost estimate analysis. We report separately the programme expectation for time required for parent/carer delivery and the reported mean amount of time spent preparing for and delivering sessions as reported in the June 2020 post-intervention PACT parent/carer survey for the mean number of sessions reported in the PACT app or paper records.

To calculate the cost per child for the trial, we assumed that five children would access the programme per year per school and that the programme would be delivered across 47 schools, as was delivered during this trial. We assumed that PACT lead training would be required only for the first year of programme delivery. The programme would serve different children each year and would require new PACT packs for each child.

Timeline

Table 7 shows a timeline of the activities related to the evaluation. Items in *italics* indicate changes to the original protocol schedule, mostly due to Covid-19 restrictions and the follow-on impact of those restrictions.

Table 7: Timeline

Dates	Activity	Staff responsible/ leading
Jul–Aug 2018	Set-up meetings	All
Sep 2018–Jul 2019	Protocol development	Evaluation team
Oct 2018	Ethics application	Evaluation team
Oct 2018–Apr 2019	Recruit and train settings	Developer (with support from evaluation team)
Apr–Sep 2019	Recruit parents/carers and children	Developer (with support from evaluation team)
Mid Sep–Oct 2019	Pre-testing - CELF Preschool-2 (Sentence Structure, Expressive Vocabulary, Word Structure), BPVS-3, APT, Listening Comp (Snowy) HLE, usual practice surveys	Developer Evaluation team
Early Oct 2019	Randomisation	Evaluation team
End Oct	Training for parents	Developer (observation by evaluation team)
Oct 2019–Aug 2020 (*end date changed from Jun 2020*)	Parents/carers deliver programme (30 weeks)	Developer
Dec 2019–Feb 2020 (*end date change from Jan 2020*)	First PACT lead and parent phone interviews	Evaluation team
Mar 2020	COVID-19 RESTRICTIONS BEGIN	
Jun 2020	Parent/carer survey	Evaluation team
Jun 2020	PACT lead survey	Evaluation team

Jun 2020	Second PACT lead phone interviews	Evaluation team
Jun–Jul 2020 (cancelled)	Immediate post-testing scheduled but unable to be completed due to Covid-19	Developer
Jul 2020 *(delayed from May/Jun 2020)*	Second parent/carer phone interview	Evaluation team
Jul–Aug 2020	Developer interview	Evaluation team
Aug–Oct 2020 *(additional activity due to Covid 2019)*	Piloting remote assessment	Evaluation team /Developer
Sep–Nov 2020	Follow up where children attend school	Developer
Nov 2020 *(additional activity)*	Additional parent usual practice survey (including HLE)	Evaluation team
Jun–Jul 21 *(delayed from May 21)*	Delayed post-test - LanguageScreen (Expressive Vocabulary, Receptive Vocabulary, Listening Comprehension, Sentence Repetition) BESSI	Evaluation team
Sep 2021–Feb 22	Data analysis and report writing	Evaluation team
Mar 22 *(delayed from Nov 21 due to delivery of PACT-3 trial)*	Submission of draft report	Evaluation team

Impact evaluation results

Participant flow including losses and exclusions

Full details of the recruitment processes and the flow of participants through the recruitment stage of the trial are included in the Participant Selection section above. Details of participant flow through each stage of the evaluation is shown in Figure 3. Table 8 shows the minimum detectable effect size at each stage of the trial.

Table 8: Minimum Detectable Effect Size (MDES) at each stage of the trial

		Protocol	Randomisation	Analysis	
		Overall	Overall	Overall	EYPP
MDES		0.18	0.18	0.17	0.37
Pre-test/post-test correlations	Level 1 (child)	0.60	0.60	0.67	0.69
	Level 2 (class)	NA	NA	NA	NA
	Level 3 (school)	NA	NA	NA	NA
Intracluster correlations (ICCs)	Level 2 (class)	NA	NA	NA	NA
	Level 3 (school)	0.10	0.10	0.23	0.29
Alpha		0.05	0.05	0.05	0.05
Power		0.8	0.8	0.8	0.8
One-sided or two-sided?		Two-sided	Two-sided	Two-sided	Two-sided
Average cluster size		10	10	10	2
Number of schools	Intervention	48	47	45	21
	Control	48	47	45	23
	Total:	48	47	45	30
Number of children	Intervention	240	225	174	30
	Control	240	225	177	40
	Total:	480	450	351	70

Figure 3: Participant flow diagram (two arms)

Recruitment

Approached
(school n=234)

Excluded (school n=182):
- Not meeting inclusion criteria (school n=108)
- **Did not agree to participate:** (school n=74)

Agreed to participate
(school n=52)

Excluded (school n=5):
- Not meeting inclusion criteria – minimum numbers (school n=3)
- Staff changes (school n=1)
- Capacity issues (school n=1)

Allocation

Randomised
(school n=47; pupil n=450)

PACT
(school n=47;
pupil n=225)

Business as usual
control
(school n=47;
pupil n=225)

Delayed follow-up

Lost to
follow up
(pupil
n=50)

Post-test data
collected
(pupil n = 175)

Lost to
follow up
(pupil
n = 47)

Post-test data
collected
(pupil n = 178)

Analysis

Not analysed
(pupil n=1)

Analysed
(pupil n = 174)

Not analysed
(pupil n=1)

Analysed
(pupil n = 177)

Attrition

Child-level attrition from the trial is shown in Table 9:.

Table 9: Child-level attrition from the trial (primary outcome)

		Intervention	Control	Total
Number of children	Randomised	225	225	450
	Analysed (LS test data in the delayed post-test)	174	177	351
Child attrition (from randomisation to analysis)	Number of children (attrition)	51	48	99
	Percentage	22.7	21.3	22.0

Three participants in the intervention group withdrew from the trial during the intervention period.

After the intervention period in the nursery, the participants progressed into reception classes in schools. The majority, 293 children, attended reception class in 37 'original' schools that were already taking part in PACT and had agreed to take part in the delayed post-test. An attempt was made to sign up 77 schools—where 154 participants attended—to take part in the delayed post-test. The sign-up was successful in 43 schools. Altogether an additional 94 participants were lost to the delayed testing because they:

- attended unknown schools or schools that would not agree to take part in the delayed post-test (79 participants);
- were home schooled (one participant);
- had moved abroad (one participant); or
- were not tested by schools due to staff or pupil absence (often due to Covid-19; 13 participants).

After post-testing had taken place an administrative error at test administration meant that it was not possible to analyse the data for two further participants.

Overall, 22% of child-level data (n = 99/450) was missing for the primary outcome (no primary outcome test scores), the main reason being loss to follow-up (97 cases; see above) plus two cases of administrative error. The missingness did not vary by the sub-items (EV, RV, LC, SR). Background characteristics for children lost to attrition are included in **Error! Reference source not found.** in the Missing Data Analysis section below. The pre-test latent variable, on the other hand, had a relatively small amount of missing data (1.3%): only six cases not providing data out of the total 450 participants.

Pupil and school characteristics

School-level characteristics

School-level characteristics are provided in Table 10:. Due to the within-setting randomisation design, all schools are both intervention and control settings. Nurseries in the PACT trial were state-funded, most attached to a primary school. Seven were stand-alone nurseries and two were independent nurseries linked to a school. We have FSM and performance information only from the schools hosting the nurseries. Ofsted ratings are for the full school where the nursery is part of the school and for the nursery only in stand-alone nurseries. Most nurseries participating in the project were 'good' or 'outstanding' in terms of Ofsted ratings and their school-level reading progress scores were average for the majority of settings. The settings were mostly community settings funded by the local authority, although there were eight voluntary controlled or aided settings and three academy converter settings. All were in urban areas. The average percentage of FSM pupils for the 37 school-based settings in this trial was 29.1% (the measure for the whole school), higher than the national average of 19.7% (GOV.UK, 2021). This indicated that the

recruitment strategy of the project to target areas of higher deprivation was successful with the schools involved having higher levels of deprivation as measured by free school meals eligibility.

Table 10: School-level characteristics

School-level variables (categorical)	National - level mean	All schools (both intervention and control group as within-school randomisation design)	
		Count	Percentage
School Ofsted rating			
Outstanding		14	29.8%
Good		28	59.6%
Requires improvement		3	6.4%
Inadequate		0	0.0%
No data		2	4.3%
School-level reading progress score (2019)		Count	Percentage
Well below average		2	5.88%
Below average		3	8.82%
Average		24	70.59%
Above average		3	8.82%
Well above average		2	5.88%
Missing data		13	
Type of school		Count	Percentage
Local authority nursery		9	19%
Community		26	55%
Academy converter		3	6%
Voluntary aided		7	15%
Foundation		1	2%
Voluntary controlled		1	2%
School location		Count	Percentage
Urban city and town		18	38%
Urban major conurbation		28	60%
No data		1	2%
School level variable (continuous)		Mean (sd)	
FSM	19.7%	29.1% (17.5)	

Pupil-level characteristics

Pupil-level demographic characteristics are presented by control and intervention group in Table 11:. There was no significant difference between groups at baseline in terms of age, sex, percentage of children eligible for Early Years Pupil Premium (EYPP), or whether English was spoken as the main language at home (all P > 0.05). In terms of baseline

measures, the listening comprehension score varied between groups (p = 0.016) but none of the other measures were significantly different. The distribution of pre-test scores for all pupil is shown in the Appendix G.

Table 11: Pupil-level demographic and baseline characteristics

Pupil characteristics	Intervention group		Control group		
Pupil-level (categorical)	n/N (missing)	Count (%)	n/N (missing)	Count (%)	
Gender	(1 missing)		(0 missing)		
Female	98/224	43.8	104/225	46.2	
Male	126/224	56.2	121/225	53.8	
English is main language spoken at home	(0 missing)		(0 missing)		
No	19/225	8.4	19/225	8.4	
Yes	206/225	91.6	206/225	91.6	
EYPP	(10 missing)		(5 missing)		
No	185/215	86.0	180/220	81.8	
Yes	30/215	14.0	40/220	18.2	
Pre-test	(0 missing)		(0 missing)		
Completed all	211/225	93.8	211/225	93.8	
Partially	10/225	4.4	12/225	5.3	
Did not complete	4/225	1.8.2	2/225	0.9	
Pupil-level (continuous)	n/N (missing)	Mean (SD)	n/N (missing)	Mean (SD)	Effect size
Age in months at baseline	222/225 (3)	42.38 (3.45)	225/225 (0)	42.29 (3.45)	-0.027
Language latent variable (pre-test)	221/225 (4)	-0.03 (1.85)	223/225 (2)	0.03 (1.80)	0.030
CELF_SS (scaled score)	221/225 (4)	7.81 (2.88)	221/225 (4)	7.76 (3.19)	-0.013
CELF_EV (scaled score)	217/225 (8)	8.80 (3.32)	218/225 (7)	8.80 (3.42)	-0.001
Listening Comprehension	217/225 (8)	0.95 (1.06)	218/225 (7)	1.22 (1.19)	0.232
BPVS-3 (standardised score)	214/225 (11)	90.33 (14.45)	214/225 (11)	90.39 (13.70)	0.005
APT Information	219/225 (6)	18.77 (7.05)	217/225 (8)	19.38 (6.39)	0.090

| APT grammar | 219/225 (6) | 13.56 (6.43) | 217/225 (8) | 14.64 (6.53) | 0.165 |
| HLE1 | 186/225 (39) | 28.87 (8.66) | 187/225 (38) | 28.91 (.53) | 0.004 |

Outcomes and analysis

Primary analysis

Our primary outcome measure is a language latent variable constructed using the LanguageScreen sub-items for which higher score indicates better language skills. It had an overall mean score of 0.00 with a standard deviation of 9.90. There were no significant differences between the groups: the intervention group had a relatively lower mean score than the control group (-0.02, SD 9.6 vs 0.02, SD 10.2), see Table 12 and Table 13—similar to the difference at baseline. The primary outcome (post-test latent variable) followed an approximately normal distribution with values ranging from -27.45 to 23.91. The distribution of the primary outcome measure is illustrated in Figure 4. A sensitivity analysis that used raw scores for the creation of the latent variables (see Appendix F for details of the construction of these latent variables) found that the conclusions about the results (effect size -0.02, CICis: -0.26, 0.30) would remain the same.

Table 12: Analysis of primary outcome (a)

| | Unadjusted means | | | | Effect size | | |
| | Intervention group | | Control group | | | | |
Outcome	n (missing)	Mean (95% CI) (SD)	N (missing)	Mean (95% CI) (SD)	Total n (intervention; control) (missing)	Hedges g (95% CI)	p-value
Primary outcome: language latent variable	174 (51)	-0.02 (-1.46, 1.41) (9.6)	177 (48)	0.02 (-1.49, 1.54) (10.2)	351 (174; 177) (99)	0.01 (-0.27, 0.31)	0.902

Table 13: Analysis of primary outcome (b)

| | | | Intervention group | | Control group | | |
Outcome	Unadjusted differences in means	Adjusted differences in means	n (missing)	Variance of outcome	n (missing)	Variance of outcome	Pooled variance
Primary outcome: Language latent post-test	-0.05	0.10	174 (51)	92.08	177 (48)	104.66	98.15
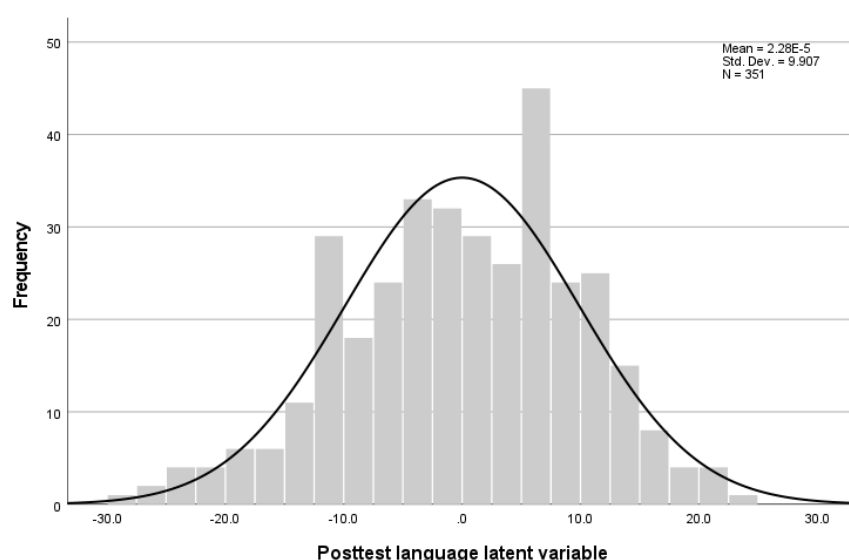
Figure 4: Distribution of scores for primary outcome (= n351, missing = n 99)

Secondary analysis

Table 14: presents the mean scores and variances for the secondary outcomes among the intervention and control groups using standardised scores where possible as described in the SAP. Descriptive statistics using raw scores for the LanguageScreen subscale scores are also presented in Appendix N. There was no significant difference between scores for any of the measures: the distribution of scores of the secondary outcomes (presented as histograms in Appendix O) reflects that they were following similar patterns with no systematic deviation from normality in any particular direction. This means the MLMs used to estimate effect size were not affected by the distribution of variables. The largest effect was seen for the item Home Learning Environment (HLE) at post-test (0.10), followed by LanguageScreen sub-item Expressive Vocabulary (EV) (0.08); the smallest effect was seen for the sub-item Listening Comprehension (LC) (-0.06). While the control group significantly outperformed the intervention group on listening comprehension at baseline (effect size 0.23), this was accounted for in analysis by the inclusion of the pretest latent variable, which included listening comprehsion. A sensitivity analysis replacing the pretest latent variable with the listening comprehension variable at pretest found no difference to the above conclusion. The inclusion of an interaction term for interventions and listening comprehension also found that the interaction between intervention and listening comprehension was not significant (p =0.419). In terms of mean difference, EV had the largest difference whereas LC had the smallest difference (Table 15:).

Table 14: Analysis of secondary outcomes using MLM and unconditional variances

| | Unadjusted means | | | | Effect size | | |
| | Intervention group | | Control group | | | | |
Outcome	n (missing)	Mean (95% CI) (SD)	n (missing)	Mean (95% CI) (SD)	Total n (interven-tion; control)	Hedges g (95% CI)	p-value
Secondary outcome: LanguageScreen_EV	174 (51)	105.98 (103.99, 107.96) (13.27)	177 (48)	105.18 (103.06, 207.29) (14.27)	351 (174; 177)	0.08 (-0.20, 0.36)	0.408
LanguageScreen_RV	174 (51)	104.71 (102.62, 106.80) (13.96)	177 (48)	104.93 (102.87, 107.00) (13.91)	351 (174; 177)	0.04 (-0.22, 0.31)	0.667
LanguageScreen_LC	174 (51)	105.57 (103.43, 107.71) (14.330	177 (48)	106.65 (104.54, 108.76) (14.23)	351 (174; 177)	-0.06 (-0.34, 0.21)	0.488

LanguageScreen_SR	174 (51)	101.87 (99.89, 103.85) (13.24)	177 (48)	102.45 (100.38, 104.52) (13.96)	351 (174; 177)	-0.05 (-0.30, 0.20)	0.619
BESSI	170 (55)	3.24 (2.62, 3.86) (4.09)	169 (56)	3.17 (2.55, 3.79) (4.11)	339 (170, 169)	-0.03 (-0.26, 0.19)	0.753
HLE_post-test	137 (88)	28.37 (27.05, 29.69) (7.83)	168 (57)	27.90 (26.51, 29.29) (9.10)	305 (137, 168)	0.10 (-0.15, 0.34)	0.341
HLE_delayed post	123 (102)	28.98 (27.54, 30.42) (8.07)	131 (94)	28.92 (27.38, 30.45) (8.88)	254 (123, 131)	0.03 (-0.22, 0.28)	0.803

Table 15: Analysis of secondary outcomes difference in means

			Intervention group		Control group		
Secondary outcomes	Unadjusted differences in means	Adjusted differences in means	n (missing)	Variance of outcome	n (missing)	Variance of outcome	Pooled variance
LanguageScreen_EV	0.80	1.06	174 (51)	176.02	177 (48)	203.52	189.51
LanguageScreen_RV	-0.22	0.60	174 (51)	194.75	177 (48)	193.47	193.56
LanguageScreen_LC	-1.08	-0.90	174 (51)	205.28	177 (48)	202.44	203.560
LanguageScreen_SR	-0.58	-0.64	174 (51)	175.29	177 (48)	194.86	184.740
BESSI	0.07	-0.14	170 (55)	16.7	169 (56)	16.87	16.74
HLE_post-test	0.47	0.83	137 (88)	61.26	168 (57)	82.86	72.98
HLE_delayed post-test	0.06	0.24	123 (102)	65.07	131 (94)	78.89	71.92

Analysis in the presence of non-compliance

Complier Average Causal Effect (CACE) analysis was done as a sensitivity analysis to assess the relationship between outcome and adherence to the intervention. The distribution of compliance levels across the intervention group is shown in Table 16. The CACE analysis results (Table 17) indicates that there was a positive association between effect size and compliance level, that is, the effect size would be higher with increased compliance. For example, compared with overall effect size of PACT 0.01 (-0.27, 0.31), the effect size adjusted for 50% compliance was 0.04, and for 80% compliance it would be 0.05. However, even at the highest level of compliance the effect size was 0.07 and therefore low in terms of impact.

Table 16: Compliance level among intervention group pupils

Compliance level	% (n)
<10%	11.4 (24)
10–19%	5.3 (11)
20–29%	6.6 (14)
30–39%	11.9 (25)
40–49%	8.1 (17)
50–59%	4.8 (10)
60–69%	4.9 (10)
70–79%	7.1 (15)
80–89%	13.8 (29)
90–99%	9.0 (19)
100%	17.1 (36)

Table 17:. Complier Average Causal Effect results for all pupils

Compliance level	CACE (confidence intervals)
P >0	0.02 (-0.11, 0.16)
P >10	0.02 (-0.12, 0.18)
P >20	0.02 (-0.13, 0.19)
P >30	0.03 (-0.14, 0.20)
P >40	0.03 (-0.17, 0.25)
P >50	0.04 (-0.20, 0.29)
P >60	0.04 (-0.22, 0.31)
P >70	0.04 (-0.25, 0.36)
P >80	0.05 (-0.31, 0.45)
P >90	0.07 (-0.42, 0.61)

Missing data analysis

As mentioned in the Methods section, the pre-test latent variable was constructed using a CFA model in MPlus that by default uses the Full Information Maximum Likelihood (FIML) estimation when there are missing valuesvalue for some of the items included for latent variable construction (Johnson and Young, 2011). Therefore, our pre-test latent variable only has six (1.3%) missing data out of a total of 450 children, which is less than 5% and negligible to affect our analysis of effect size.

In terms of missingnessmissingess for primary outcome (post-test latent variable,) a logistic regression was performed to check if pupil characteristics varied by missingness. There was no significant difference in missingness by age, sex, eligibility for early years pupil premium, English as main language at home, or baseline completion status (**Error! Reference source not found.**). Furthermore, the use of FIML implies that any missing values in the dependent variable can be effectively ignored as missingness implying an unbalanced data structure, which, statistically, poses no problems for a multilevel model; this again follows the MAR assumption conditional on the covariates included in the model. The superiority of FIML estimation as an unbiased and more efficient method than others has also been reported by other researchers (Enders and Bandalos, 2001).

Table 18: Characteristics of pupils by missingness for primary outcome

Variables	Categories	Data available for primary outcome		Data missing for primary outcome		
		n	% or mean (SD)	n	% or mean (SD)	P-value
Age (mean, SD)		351/447	42.3 (3.50)	96/447	42.5 (3.34)	0.261
Sex (%)	Girls	158/350	45.1%	44/99	44.4	0.902
	Boys	192/350	54.9%	55/99	55.6	
Early Years Pupil Premium	Not eligible	280/341	82.1%	85/94	90.4%	0.052
	Eligible	61/341	17.9%	9/94	9.6%	
English as main language spoken at home	No	30/351	8.5%	321/351	91.5%	0.883
	Yes	8/99	8.1%	91/99	91.9%	

Both the pre-test and post-test variables used the FIML estimator at the CFA stage, which implicitly assumed that the missingness mechanism can be characterised as Missing At Random (MAR). The analysis of effect size was then done on the constructed primary outcome post-test language latent variable implying an unbalanced data structure using MLM that still follows the MAR assumption conditional on the covariates included in the model, therefore, statistically it causes no problem to influence the model. Comparison with the estimation approach by other researchers (Johnson and Young, 2011; Enders and Banldalos, 2001) showed that FIML is superior, more efficient than other estimation methods, and provides unbiased estimates (Enders and Bandalos 2001). We have also completed some initial analysis to predict drop-out, which showed none of the variables included in the model (age, sex, pre-test completion status, English as main language at home, EAL, EYPP, or pre-test latent variable) could predict drop out. Therefore, no further multiple imputation of data was done.

Subgroup analyses

All the outcome data was analysed with regard to Early Years Pupil Premium (EYPP) eligibility ('EYPP pupils'). The average score of EYPP pupils in the intervention group was -5.23 (9.63) and was -3.77 (8.80) for the control group. Overall, EYPP data was available for 435 pupils. Among them, 23.3% (85/365) of non-EYPP pupils and 12.9% (9/70) of EYPP pupils (p = 0.052) were missing post-test data. The outcome models are fitted separately for the EYPP subgroup (n = 70/435: 30 intervention group participants and 40 control group participants). We also conducted additional analysis including interaction term for EYPP and intervention and found it was not significant (ES = -2.67, 95% CI -6.48, 1.21). Effect sizes and confidence intervals are shown in Table 19 below. Compared to the overall results among all children, the primary outcome effect size was largely negative in this group (-0.17 vs 0.01 among all pupil). On the other hand, effect size for expressive vocabulary was positive and larger in this group (0.14 vs 0.08 among all) as were BESSI scores (0.26 vs -0.03 among all). All other secondary outcomes had a smaller effect among the EYPP children. The results here need careful interpretation and would require further investigation in a suitably powered study with a larger sample as this evaluation was not powered to do EYPP-specific subgroup analysis.

Table 19: Analyses of primary and secondary outcomes among children eligible for EYPP

Outcomes	Adjusted mean difference	Effect size, 95% confidence intervals
Post-test latent variable	-1.57 (-4.62, 1.52)	-0.17 (-0.75, 0.41)
LanguageScreen Expressive Vocabulary	1.86 (-3.93, 8.03)	0.14 (-0.43, 0.71)
LanguageScreen Receptive Vocabulary	-5.12 (-10.66, 0.37)	-0.42 (-0.98, 0.13)
LanguageScreen Listening Comprehension	-4.34 (-10.24, 1.59)	-0.31 (-0.87, 0.25)
LanguageScreen Sentence Recall	-1.36 (-8.23, 5.56)	-0.09 (-0.62 - 0.43)

Outcomes	Adjusted mean difference	Effect size, 95% confidence intervals
BESSI	1.19 (-0.91, 3.29)	0.26 (-0.26, 0.79)
HLE post-test	-2.02 (-8.03, 4.10)	-0.21 (-0.76, 0.34)
HLE delayed post-test	-0.32 (-5.94, 5.30)	-0.04 (-0.52, 0.43)

Additional analyses and estimation of ICC

Additional analyses were carried out to assess whether the effect size estimate would vary by inclusion of stratification variable and the results remained largely the same, with minor implications on the range for confidence intervals. We have also reported conditional and unconditional ICCs: no noticeable difference was observed (Appendix K).

Implementation and process evaluation results

Fidelity and adaptation

In this section, the extent to which the PACT programme was delivered as intended at the different stages of the programme is considered. Taking a chronological approach, we start by considering the training that was delivered to nursery staff and parents. We then consider the delivery of the PACT programme sessions including the number and frequency of sessions completed, the activities completed within a session, and the extent to which adaptations were made in the delivery of the programme. We also discuss the level and type of support provided by the nursery to families across the programme. Finally, we consider the impact of Covid-19 on delivery and whether delivery of the programme under ideal conditions was possible during this trial.

Training

IPE RQ5 (a): To what extent was training delivered to nursery staff (fidelity/quality)?

Training for the nursery staff was delivered as planned with high fidelity. Two PACT lead training days were delivered by two members of the developer team on 25 and 30 April 2019. The content at both sessions was the same and PACT leads were only expected to attend one of the two sessions. The sessions followed a planned programme (PowerPoint slides) and there was limited adaptation to the programme in either session. The training sessions lasted between four and four and a half hours and included many opportunities for PACT leads to ask questions. Attendees were observed to be very engaged in these sessions. Training was attended by 67 people, which included at least one staff member from all participating settings and two staff from 18 settings. Training attendees varied in terms of seniority and role across schools and included teaching assistants (10), class teachers (35), middle or senior leaders (20), and headteachers (10). (Some attendees held multiple roles within their schools and are therefore counted in two categories; PACT lead post-training survey, n = 65.) Those attending the training had an average of 16.05 years' classroom experience ranging from 0 to 31 years (post-training survey). Nurseries recruited after the two main training sessions (n = 2) were provided with their own individual training in-school by the developer.

IPE RQ6: To what extent did initial training take place for parents/carers? How was this training delivered? How many parents/carers attended the training sessions (fidelity)?

Parent/carer PACT training sessions were delivered by the developer team in each of the 47 participating nurseries between 10 and 22 October 2019. These sessions were scheduled to last for two hours, however were closer to 90 minutes in the observed sessions: observations indicated that this timing worked well for the concentration of the group and enabled covering the material in a non-rushed way. Parent/carer training was run by three trainers. Observations of five sessions, including sessions delivered by each of the three trainers, showed very little variation in the way the sessions were delivered between trainers and that parents/carers engaged well with the sessions. The delivery of these sessions within such a short timeframe was intense for the developer team, with each trainer carrying out between one and three sessions per day, each in a different geographic location over nine days.

Table 20: Type of training attended by participating families

Training attended	Participant families receiving each training (n = 225)
Developer delivered	186
PACT lead delivered	31
None attended	8

Table 20 indicates that for most participants a parent or carer attended the developer-led training sessions described above. For 31 participants unable to attend, training was provided by the PACT lead in the school (following a briefing to the PACT lead from the developer team as well as resources being provided for this purpose including slides and extensive notes). For eight participants, no training was attended meaning these participants were not subsequently provided with access to the PACT programme. The reason given for not attending training was lack of time due to several factors including a new job, a new baby, and changes to family circumstances (as reported by PACT leads). For the majority of participants (189 of 217 who attended training) only one parent/carer attended training (168 mothers, 16 fathers, five grandparents) while for 28 participants training was attended by more than one parent/carer (including the other parent or another family member or friend as reported in administrative training records collected by the developer).

Ongoing programme delivery

IPE RQ7 (a): To what extent did parents/carers deliver the teaching sessions to their children throughout the 30 weeks of the programme (fidelity/dosage)?

PACT app or paper record data was available for 204 of the 225 intervention group participants, indicating whether they had completed PACT sessions. For the eight participants who withdrew from the programme before or at the training stage, it has been assumed that they did not complete any sessions. Data is missing for an additional 13 participants, some of whom withdrew from the PACT programme during the year.

The mean number of sessions recorded as complete by the end of the intervention period was 87.19 out of a possible 150 (standard deviation 51.32) for all intervention participants including those withdrawn at training stage (n = 212). For those that started the programme, the mean number of sessions completed was 90.61 (standard deviation 49.25; n = 204). The high standard deviation here indicates the wide spread of data on number of sessions completed. Participants continued to deliver the programme for a mean of 18.71 weeks (standard deviation 9.80); this count includes weeks where at least one PACT session was delivered.

Table 21: Participation in PACT as recorded by PACT app and paper record forms (n = 204)

Pack number	% of all possible PACT sessions completed by all participants that started the programme (n = 204)	% of participants engaging with any sessions in pack	Average no. of completed sessions per pack out of a possible 25, including participants that started the programme (n = 204)	Average no. of sessions per Pack for those still engaged with PACT at the time of that Pack (n)
1:	91.04	100%	22.76	22.76 (n = 204)
2:	81.14	88%	20.28	22.99 (n = 180)
3:	62.61	74%	15.65	21.43 (n = 149)
4:	52.94	58%	13.24	23.08 (n = 117)
5:**	44.04	50%	11.01	22.02 (n = 102)
6:**	30.67	38%	7.67	20.31 (n = 77)

* Packs 5 and 6 coincided with Covid-19 lockdown and there are, therefore, additional contextual factors outside of the programme which impacted on engagement (further detail provided later).

Engagement with the PACT programme declined as the trial progressed. Table 21 shows the percentage of possible PACT sessions completed by all participants that started the programme for each of the six consecutive PACT packs.

Engagement started off high for the first and second packs but dropped to around 62% of possible sessions by the third pack and continued declining with each subsequent pack. This drop is mostly explained by participants recording zero sessions completed for a pack, as opposed to recording sporadic engagement with the programme. By pack five (20 weeks into the programme and when the first Covid-19 lockdown occurred) around half of participants had stopped reporting that they were engaging with PACT, recording no sessions complete for pack five. However, where participants continued to be engaged with the programme (recorded completion of at least one session from that pack) the average number of sessions completed per pack remained fairly similar, between 20 and 24 completed out of 30 possible sessions. This indicates that those who continued to report their engagement continued to deliver a good number of sessions per pack all the way throughout the programme.

The delivery of the programme is illustrated in **Error! Reference source not found.**. The different coloured lines refer to each of the themed five-week PACT packs (1–6). This figure clearly illustrates that participation diminishes with each subsequent pack. There are dips in activity during the Christmas break and the Covid-19 lockdown, which came into place towards the end of March 2020, showing the disruption that the Covid-19 lockdown had on delivery. The delivery of the sixth pack was delayed to early June because of lockdown. This meant that engagement with packs five and six was spread over ten weeks rather than the five that was originally planned. However, the pattern of delivery for pack six was similar to that for the earlier packs but shifted later due to the delay in receiving the packs.
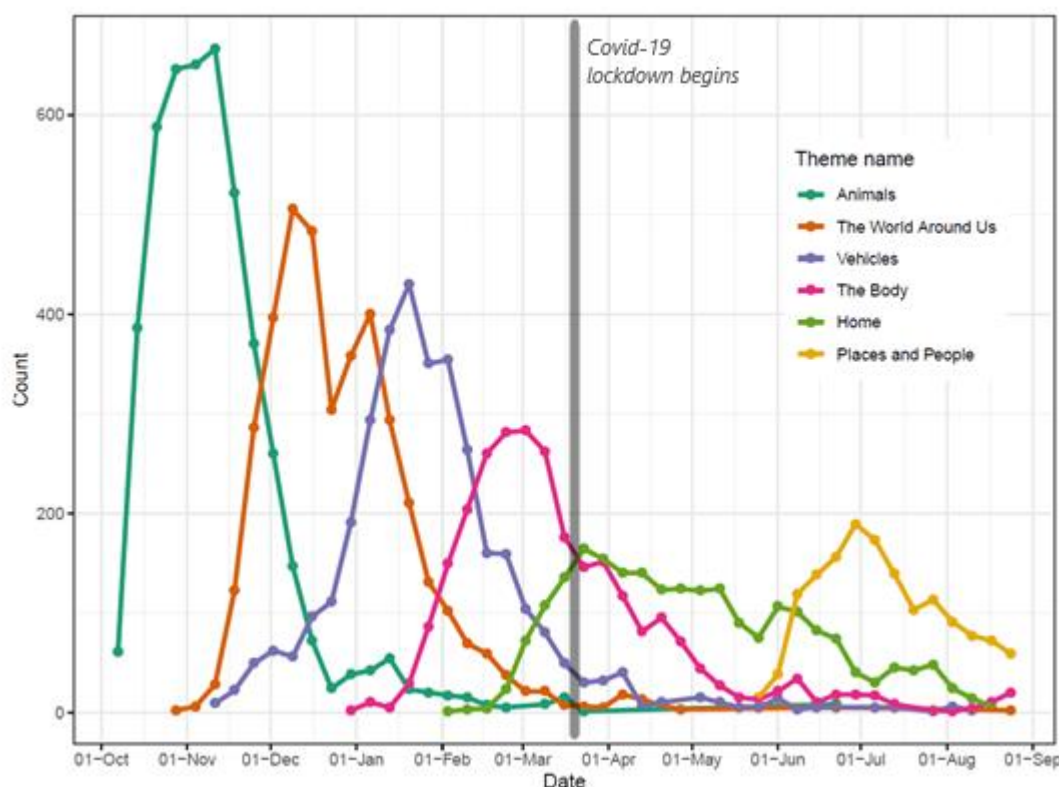

Figure 5: Number of PACT sessions completed per week between October 2019 and August 2020 by themed pack as reported by parents using the PACT app and paper records

Exploratory analysis was conducted to look at whether delivery of PACT was different for disadvantaged families—where the child was eligible for EYPP—compared to families who were ineligible for EYPP. We found that EYPP families (n = 30) recorded an average of 14.2 weeks (standard deviation 11.9) of PACT while ineligible families (n = 185) recorded an average of 19.9 weeks (standard deviation 10.0). The lower engagement of EYPP families may be related to the intervention being less effective for this group (as found in the impact evaluation). There were ten children where the EYPP data was unknown. The delivery of PACT sessions was also compared for families who self-reported as English not being the main language spoken at home compared to those where English was the first language. We found that the former (n = 19) recorded an average of 17.1 weeks (standard deviation 12.0) of PACT while the latter (n = 206) recorded an average of 19.0 weeks (standard deviation 10.5). These results should be interpreted with caution given the small numbers of EYPP families and those where English was not main language spoken at home.

We have some evidence from email communication with participants and from the post-intervention parent/carer survey that participants completed more sessions and continued longer with PACT than is indicated by the app and record form data. When chasing missing records, some parents/carers often responded that they had been delivering the sessions but had forgotten to complete the record. Forgetting to record progress in the PACT app was also described by parents/carers in the post-intervention survey as one of the challenges of doing PACT (see further details below).

The post-intervention survey also asked participants to indicate which PACT storybooks and activities they had completed so far () allowing the calculation of the number of weeks they had been engaged with PACT. From the survey data (n = 138), participants had completed a mean of 22.05 weeks of engagement (standard deviation 6.21) while the same participants recorded a mean of 20.44 (standard deviation 9.70) weeks of engagement through the app (n = 135). However, it should be noted that participants who were engaged enough to complete the survey recorded greater engagement than the full sample and so may not be representative of the full sample.

In interview, the PACT developers acknowledged the programme is long and intensive and that families may not be able to engage with the full length of the programme. However, they felt it was valuable to maintain the length and intensity of the programme so that the expectation was high, and that even if families did not manage to do all the sessions, there would still be a sufficient engagement to enable benefit for the families and children.

> 'If you made [the programme] zero to 20 [weeks], your average would start coming down more to, like, ten. So … I would keep it at 30 weeks. But with the caveat that we know many parents won't do the 30 weeks and that is okay' (developer interview).

The delivery and engagement with the programme is similar to that from the Burgoyne et al. (2018b) previous trial where PACT parents/carers reported completing an average of 17.48 out of 30 weeks of the programme.

IPE RQ8: How closely did parents/carers follow the teaching session plans (fidelity, quality, adaptations)?

Parents/carers completing the post-intervention survey reported spending almost seven minutes preparing for each PACT session and an average of 25 minutes delivering each PACT session (see Table 22), which is slightly longer than the twenty-minutes suggested by the PACT programme.

Table 22: 'Typically, how long (in minutes) did you spend doing a PACT session/preparing to do each PACT session?'—post-intervention parent/carer survey (n = 136)

	Average in minutes (SD)	Range in minutes
Length of PACT session*	24.7 (8.0)	10–60
Preparation time for each PACT session*	6.8 (5.1)	0–30

* One outlier response of 200 minutes for length of PACT session and 100 minutes for preparation time has been excluded.

Both survey and interview data indicated that most families were doing all the activities provided within a PACT session. Sixty-eight percent of parent/carer post-intervention survey respondents reported completing all the PACT activities in a session, all or most of the time, while 19% of respondents said they did all of the activities 'some of the time' or 'occasionally'; and 13% of families said they 'never' did all of the activities in a session.
At interview all parents/carers said they were following the PACT guidance, doing all the activities, and using all the materials that came with PACT to the best of their knowledge.

Table 23: 'How often did you do all of the PACT activities in a session?'—parent/carer post-intervention survey (n = 136)

Frequency of doing all PACT activities in a session	Frequency of response	Percentage of sample
All of the time	46	33.8%
Most of the time	46	33.8%
Some of the time	18	13.2%
Occasionally	8	5.9%
Never	18	13.2%

Participation in, and enjoyment of, the different elements of the PACT programme was explored in more detail in the parent/carer post-intervention survey. Table 24 and Table 25: ' show that a high level of enjoyment was reported for almost all levels of the programme across the respondents to the survey. Respondents were completing all the different PACT activities for the Weeks 1 to 4 sessions (with only one respondent stating that they did not do the introduction) and 79% to 96% of respondents reporting their child enjoyed each activity 'all' or 'most' of the time. Between 4% and 19% of respondents reported that their child enjoyed each activity only 'some of the time' or 'never'.

Table 24. 'How often did your child enjoy the different activities in PACT (Weeks 1–4)?'—parent/carer post-intervention survey (n = 134–137)

Frequency of enjoying week 1 to 4 activities	Introduction	Reading book	Vocabulary	Stories	Reward
All of the time	41.2%	65.0%	46.7%	55.9%	73.9%
Most of the time	38.2%	31.4%	38.7%	33.1%	19.4%
Some of the time	16.9%	3.6%	12.4%	9.6%	6.0%
Never	2.2%	0.0%	2.2%	1.5%	0.7%
Not done	1.5%	0.0%	0.0%	0.0%	0.0%

There were different activities to complete in the fifth week of each pack that aimed to recap and build on the storybooks and activities they had completed over the previous four weeks instead of having activities with a new storybook. Most parents/carers (71%–75%) reported their children enjoyed these activities 'all' or 'most' of the time. There was a higher proportion of respondents than for the Weeks 1–4 activities that reported that their child enjoyed the activities 'some of the time' or 'never' (21%–26%) and a small number of respondents who had not delivered the activities in the Week 5 packs. This data indicates that most participants were following the activities of the PACT programme within a session with a high degree of fidelity and enjoyment, although the less frequent recap activities from Week 5 were enjoyed less and were reported as not being completed by a small percentage of participants (Table 25: ').

Table 25: 'How often did your child enjoy the different activities in PACT (Week 5, 'Bringing it together' additional activities)?'—parent/carer post-intervention survey (n = 135–137)

Frequency of enjoying week 5 activities	Revisiting books	Extra vocabulary	Extra activities	Additional stories	Word map	Tell a story
All of the time	39.4%	33.3%	39.4%	45.3%	40.9%	40.9%
Most of the time	35.0%	38.5%	35.0%	29.9%	29.9%	29.9%
Some of the time	21.2%	23.0%	21.2%	20.4%	24.8%	24.8%
Never	2.2%	3.0%	2.2%	0.7%	0.7%	0.7%
Not done	2.2%	2.2%	2.2%	3.6%	3.6%	3.6%

Adaptations made to PACT delivery

Half of the interviewed parents/carers said that they had adapted the PACT programme to suit their child's interest. Adaptations to the programme were also written about in free response questions in the PACT post-intervention parent/carer survey. A few parents described letting their child choose which storybook to read in a pack and not always following the pre-specified order of the programme, while some parents changed the order of the activities in the session in response to their child's enjoyment or to work better to engage their child. A small number of parents/carers reported rushing activities or skipping activities or even whole sessions where their child was not interested in the storybook or activities that day.

> 'I've also mixed up the weeks sometimes. Not on purpose, but because [child] is going, "I want to read that book"' (first parent/carer interview).

> 'I think it does need to be quite flexible, otherwise I don't think I'd be able to manage it, the amount of time every day. And there's definitely things he's interested in, things he's not interested in, and I think, unless you changed it up or just some days said, "You're not interested, I need to leave it," I think … he might end up getting a bit fed up of it' (first parent/carer interview).

One parent also reported adding more difficulty into the activities for her son as she felt he needed more challenge to keep him interested:

> 'I often added in more complex questions/tasks, after speaking with his teacher, as he found the tasks provided too simple and would start losing interest quickly as he would already make great sentences and use advanced vocabulary/communication for his age right from the beginning' (parent/carer post-intervention survey).

Where parents/carers were unable to deliver the sessions on a particular day due to illness or other commitments, they described catching up on other days or sometimes families reported doing more than one PACT session in one day. The post-intervention survey indicated this was a regular occurrence for 15% of families and an occasional occurrence for 53% (n = 137). Half of the parents/carers interviewed also said they 'often' or 'sometimes' did multiple PACT sessions together or did more than one session in a day so that they could still aim to complete all the activities in the PACT pack, even when they did not have time to do it every day. When multiple sessions were put together, they did not read the storybooks more than once but did two days' worth of activities in the session.

> '[We have used] all the activities in all the packs, that's why it's taken us a bit longer to do it. Sometimes we've done two activities in a day, so we've done two special words, and then we've done two different activities in the day because she's wanted to do it. So, sometimes it takes longer than the 15 or 20 minutes. … We've definitely not skipped books but we sometimes don't do it every day, we'll sometimes skip three days, if I don't get the chance, and then I'll do it on the fourth day [and catch-up]' (first parent/carer interview).

Data from the post-intervention survey showed that 59 families (43%) reported they always delivered PACT one to one with their child (there were never any other children involved in any of the PACT sessions). For the remaining families, other children were involved in PACT sessions 'occasionally' in 37 families (27%), 'some of the time' in 19 (14%), 'most of the time' in 15 (11%), and 'all of the time' in seven (5%). A number of parents described in the parent/carer interviews and post-intervention survey how they delivered the programme with older or younger siblings involved rather than one to one with the child. This sometimes involved changing the way they delivered PACT, which included using the materials differently or involving more than one child in the activities together.

> 'I thought the picture cards etc. were lovely but I found it very difficult to use them as I also have a toddler who was around and picking up items; there was no one available to entertain my youngest child whilst I completed the PACT. I made the decision to only use the books with [son] and not the additional materials to see if it made life easier' (parent/carer post-intervention survey).

> 'She's a year older, … the one that's in reception. … We don't let her answer the questions and things like reading, because she knows all the answers whereas [child] has to think about it. But she likes the activities and things, especially like the wipe clean board thing' (second parent/carer interview).

> 'I know initially when we'd had the first training session, they said that, if possible, maybe try not to include siblings … but she always does, to be honest. There's probably a couple of days a week where it is just us look at them, but the rest of the time she's kind of joining in too. … I think it keeps him more interested, actually, when she's involved, because they make it into a little game between them when they do things, so I think on the two days he's on his own, you can really sit and look at the books, but then I think those other times when she's around, she does keep him more interested in the games' (first parent/carer interview).

Adaptations to the delivery of the programme were sometimes suggested by PACT leads in response to parents struggling to deliver the programme. Three PACT leads described making suggestions to parents including letting the child choose which storybook to read and only doing the activities they were interested in to start with, adding in additional activities as they progressed with the next storybook, that a parent stop trying to do all the activities with the child and concentrate on reading the storybook together to overcome the stress that she was feeling during the session, and that parents should try to catch up with sessions they had missed.

IPE RQ9 (a): How did schools support parents/carers (quality/adaptation)?

Table 26 shows the methods of support provided to parents by PACT leads throughout the programme, most of which were used—both in the first few weeks of the programme and beyond—with almost all schools providing support by checking in with parents when bringing or collecting their child and generally showing interest in how PACT was going.

'I check in with them every week, just to make sure that they're okay and get some feedback on how things are going for them. Then, when the parents get the new boxes, so I've given two new boxes out now, when they get the new ones, I spend some time with them. Only about half an hour, but it's individually, because they're all at different stages going through the content of the new box and just making sure that they're happy and confident to continue to deliver really' (first PACT lead interview).

More than half of schools reported supporting individual families and troubleshooting issues both initially and throughout the programme. Around a third of the PACT leads reported modelling doing the PACT activities and inviting parents in to share ideas as a group during the first five weeks of the programme but this dropped as the programme progressed beyond the first pack. It is also worth noting that more than half the PACT leads provided support with completing record forms or the PACT app, which was not part of the intervention but an evaluation requirement to monitor compliance with the programme.

Table 26: 'What support was offered to PACT parents in your nursery/school?'—post-intervention PACT lead survey (n = 48)

Support offered to PACT parents	Number of schools using each method	
	First five weeks	Five weeks onwards
Showing interest checking in with parents at pick-up/drop-off	47	45
Troubleshooting issues	27	35
Working with individual families	26	27
Celebrating successes	29	26
Help filling in record forms or app	26	25
Preparing resources for families	15	15
Promoting PACT via website/school social media	15	11
Modelling doing the activities	15	4
Inviting parents to share ideas and strategies as a group	15	3
Other	4	4

The post-intervention parent/carer survey data corroborated these findings, with parents/carers reporting that nurseries supported them with PACT in similar ways throughout the year (Table 27). The most frequently reported type of support was discussion of PACT at pick-up/drop-off time and when new packs were handed out.

Table 27: 'Please tell us how your nursery has helped you with PACT during the year?'—post-intervention parent/carer survey (n = 131)

Nursery help for PACT	Number of parents reporting support type	Percentage of parents reporting support type
Discussion of PACT at pick-up/drop-off time	78	60%
Offer of support when new PACT packs were given	51	39%
Mention of PACT at parents' evenings/events	41	31%
Paper handouts about PACT	40	31%
Emails/phone calls about how to use PACT	39	30%
Support sessions in the first few weeks	29	22%
Support sessions during the year such as drop-in sessions or coffee mornings	9	7%
Other	9	7%

PACT leads were asked about the common issues or questions families had needed support with during the PACT programme (in the post-intervention PACT lead survey) and their responses are summarised in Table 28. The two most cited issues were 'lack of time to deliver the programme' and 'recording progress with PACT'. Parents'/carers' issues about the suitability of the materials and struggling to engage children with PACT increased slightly after the first five weeks. These themes are echoed and described in more detail below in the Barriers to Delivering PACT section.

Table 28: 'What were the common issues/questions that parents had during and after the first five weeks of PACT?'—post-intervention PACT lead survey (n = 47)

Issues/questions from parents	Number of PACT Leads reporting issue		Example
	During first 5 weeks	After first 5 weeks	
Time/catch up/getting behind	21	20	*'Concern because they had missed a week/weeks due to unforeseen circumstances.'*
Recording progress/phone app	16	17	*'Mainly issues around the app, parents changing phones.'*
Activities being done correctly	9	2	*'Most parents needed reassurance that they were using the resources correctly; they asked were they 'doing it right.'*
Child's attention span/tiredness	5	5	*'Struggled to get children to remain engaged. Lots of the children taking part attend nursery full-time and were therefore tired after school.'*
Child's engagement	4	6	*'Whether they should continue with a book even if the child wasn't interested/enjoying it.'*
Suitability of PACT materials	2	7	*'One parent thought it wasn't challenging enough ... another thought it was too challenging.'*

PACT leads tailored their support to the needs of the families taking part, with some families requiring more intensive support. An example of this was given by two PACT leads who provided a space and support for parents to deliver the PACT sessions within the nursery setting. This was reported where parents had found it difficult to get their children engaged at home and where parents/carers were unsure of what they were doing. In one case this was a family where English was a second language, and the first language was always spoken in the home. Parents/carers conducted the session with their child, with the PACT lead only intervening if they felt it was necessary. This support enabled these parents/carers to gain confidence in delivering the programme and to engage their children initially in a setting outside of the house. This level of support happened more at the beginning of the programme and less as the programme went on.

'What we've done is I set some time aside each day, when the parents bring the children to nursery, or they come a little bit earlier on collecting them, and we just have a room where we've got a couple of parents. Well, one parent doing it now and one that's going to be doing it very shortly, their child's off ill at the minute, where I don't deliver, but I support and encourage the parents' (first PACT lead interview).

'Now, obviously we couldn't deliver the programme for parents, but we found a space in nursery and the parents delivered the programme and I sat in, just to give a bit of encouragement, just by being there really and the child engaged. Now, that will have taken a lot for those parents to trust that … imagine having a teacher or the lead of this programme sitting in and watching me, as a parent, deliver this programme' (first PACT lead interview).

A third of PACT leads also supported families by preparing PACT resources for them. An example of this was given in a PACT lead interview:

'One family said it would be easier if the resources were prepared prior to her delivering the session so we did this for a short time while encouraging her to "plan ahead"' (PACT lead post-intervention survey).

PACT leads saw that a key part of providing PACT support had been to provide encouragement to parents to keep going with the programme along with reassurance to parents who were not confident or who were struggling to engage their child with the programme. They also saw their role as helping to celebrate the success of families during the programme to show what they had achieved.

'Parents needed lots of reminding and encouragement to complete the PACT at home' (PACT lead post-intervention survey).

'I also celebrated the end of a block with the children so they felt like they had achieved something and could be proud of themselves' (PACT lead post-intervention survey).

All PACT leads interviewed considered their role to be a contact person for the parents and vital to the project, stating that it was important for parents to know who to contact and that someone was able to provide support and encouragement to parents who were struggling.

> *'Yes, I think you need somebody who parents can come to if they have an issue or they want to talk about something. Yes, they need to have a go-to person' (second PACT lead interview).*

The majority of parents/carers who responded to the post-intervention survey felt the level of support provided by the nursery was about right (109/135) with only seven (of 135) reporting the support was not enough and 19 stating that it was more than enough.

> *'No. If I needed support, I know that they were there, and I know that we could contact you at PACT, but we haven't really needed to' (second PACT parent/carer interview).*

Support to schools from the developers

Evidence from the PACT lead post-intervention surveys and interviews suggested that schools felt well supported by the developer team in delivering the programme. PACT leads appreciated the regular communication and the swift response to queries by the developer team.

> *'It has not been a challenge in an administrative role at all. The only thing, as I said, the frustrations lie with not being able to get the engagement that you would like and then, but [the developers] have just been amazingly supportive, and they just constantly checked in with us, sent us emails' (second PACT lead interview).*

IPE RQ12: What barriers were faced by schools and by parents/carers in implementing the intervention?

Barriers faced by parents

The fidelity data revealed that many participants stopped delivering PACT completely, with engagement in the programme diminishing with each PACT pack. We explored the reasons for this through the post-intervention parent and PACT lead surveys and PACT lead interviews.

Data from the parent/carer post-intervention survey showed that 86 of 138 survey respondents had stopped doing PACT at some point during the project ('At any point did you stop doing PACT?') although not all had stopped permanently. The most common reasons for stopping were due to Covid-19. Twenty-eight respondents described that they had stopped due to their normal home routine being disrupted by the lockdown, including having additional children at home, home schooling, or change to working routines. Twenty-one respondents said that they stopped due to the Covid-19 lockdown delaying receipt of their PACT packs. Other common reasons for stopping were parent/carer or child illness (13 respondents), their child not wanting to do the PACT activities or engage with it (12 respondents), and stopping during family or school holidays when they were out of normal routine (eight respondents). Other less common reasons (reported by more than one participant) were family circumstances (for example, death in family or new baby), parental working patterns, not having enough time generally, and the child leaving the nursery.

PACT leads were also asked about why families in their settings had disengaged. The main reasons PACT leads gave were lack of time to deliver the programme (24 families) and parents/carers being unable to commit to the programme (12 families; post-intervention PACT lead survey). In the interviews, PACT leads said that the reasons families stopped PACT were usually unrelated to PACT, for example, illness and personal issues within the family.

> *'Even though she'd had lots of advice and guidance from us, I think part of the issue for that family is they've already got three children, and number four was on the way. And I think mum was finding things a bit too busy' (second PACT lead interview).*

Figure 6 shows the extent to which parents/carers encountered specific issues with PACT as reported in the post-intervention parent/carer survey. Respondents to the survey reported occasional or frequent issues related to:

- finding the time for the programme—including being able to fit the five PACT sessions into a week (90/135) or to fit the twenty-minute sessions into the day (80/136);

- keeping the child interested and motivated—participants reported that their child was not always interested in the storybook (74/137), did not want to do PACT (87/137), or struggled with concentrating on it (89/135); and

- the level of difficulty of the PACT materials—being too easy (51/135) or being too difficult (19/136).
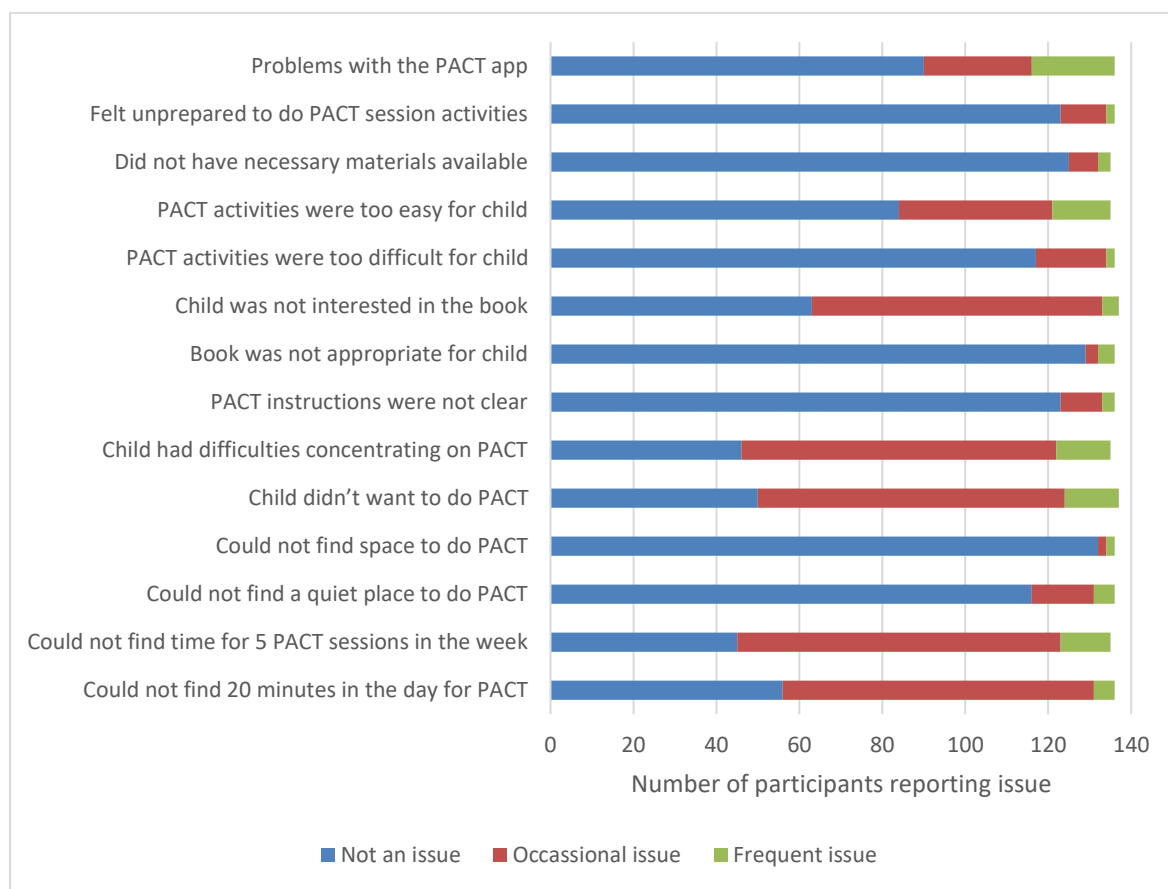

Figure 6: 'Please tell us if you have experienced any of the following issues with PACT?'—post-intervention parent/carer survey (n = 137)

Telephone interviews and open responses in the surveys completed by parents and PACT leads also highlighted similar issues to those stated above for parents delivering PACT with difficulties in finding time to do PACT and trying to engage their child with it being the most frequently reported challenges.

> 'We received the PACT materials but didn't get further that the first book because alongside full-time nursey it was too difficult to find protected time for [my child] when he was in the mood for looking at the book and when we weren't disturbed by his toddler sister' (parent/carer November post-intervention survey).

A specific issue mentioned by ten parents in the survey was their child losing interest in reading the same story multiple times. This meant the child did not want to carry on with the PACT sessions for that week or do the further activities associated with the storybooks.

> 'The five days on one book were too many. Three days were perfect then she would lose interest in the book most of the time. Which, in turn, meant Week 5 rarely happened as she didn't want to go back to the book' (parent/carer post-intervention survey).

The disturbance of PACT sessions by siblings was also specifically highlighted as a challenge by parents/carers who described siblings interfering with the materials and distracting the child participating. This was reported as a bigger issue during the Covid-19 lockdown when more children were in the house:

> 'I've got my seven-year-old and my twelve-year-old at the [kitchen] table. I'm trying to go from [the kitchen to] the living room … table, … and then do the PACT, and then make sure that they are not coming off, because they are liking the stories and the activities I'm doing with her, so they will come into the front room there, and I'm having to put them back into the kitchen' (second parent/carer interview).

Difficulties with finding time for the sessions were also increased by the Covid-19 lockdown, which disrupted family routines and meant that some parents were working from home and needing to home-school older children while also doing PACT.

> *'I think I found it more difficult, only for the pure reason that I had to home-school … my eldest, and I had less time. Obviously [because of going to] work, [being in charge of] eldest learning, I found a bit less time for [my son and] PACT, when usually, during the school period, it was a bit easier and I managed to get it a bit more structure in the days' (second parent/carer interview).*

Barriers faced by nurseries

PACT leads reported very few barriers regarding the nursery-level delivery of PACT. Most PACT leads said the lead role was very similar to what they would usually be doing and that they did not have any problems delivering PACT. A small number of leads described frustrations with being able to engage some PACT parents during the programme.

> *'The only thing, as I said, the frustrations lie with not being able to get the engagement that you would like [from parents]' (second PACT lead interview).*

Some PACT leads reported in the interviews that they had found it difficult to find suitable times for all parents/carers to attend the training or to provide support sessions for families. Families where the parent/carer was not working could come into nursery during the day, however, for working parents, especially those with varying shift patterns, it was more difficult for them to attend during the day. PACT leads were flexible to offer training times for those that could not attend the developer-led training.

> *'Heavens! I ended up training them on different days when it was their day off, or something like that' (first (PACT leadLead interview).)*

> *'As a group, the majority of the parents who are on the programme are working parents, and so offering them sessions or things during the nursery wasn't viable, because they were working' (second PACT lead interview, in regard to being able to offer support to families).*

Covid-19 also posed challenges to PACT leads in physically delivering the packs to parents and providing support for parents. Nurseries were either totally closed during lockdown or only open for the children of keyworkers. Where support and handing out packs had taken place face to face during droff-off or pick-up times, this was no longer possible.

> *'Just probably as with everyone, lockdown, because you're not seeing the parents every day to check with them. But you're trusting them more to be doing it, aren't you?' (second PACT lead interview).*

In some settings, nurseries delivered PACT packs to the houses of parents to ensure they received them. In other settings this was not possible due to staff shortages and staff shielding from Covid-19, so parents were asked to collect the packs from nurseries. Some parents were reluctant to come to nursery to collect packs due to the risk of exposure to Covid-19.

> *'Parents are not keen to come and collect it. Even though it has all been sanitised and they do know that, and we can make arrangements for them to pick it up' (second PACT lead interview).*

IPE RQ15: How did Covid-19 affect the delivery of PACT?

The introduction of Covid-19 restrictions and national lockdowns delayed the delivery of the sixth PACT packs to nurseries. Once the packs had been delivered, nursery closures and the shielding requirement for vulnerable people meant that nurseries were unable to hand out the sixth pack to parents as had been done previously and had less contact in general with nursery children and their families. Reluctance to collect the packs from nurseries and less engagement with nursery staff likely meant that some families were further delayed in receiving their sixth PACT pack, as illustrated by this comment from a parent:

> *'I was just so paranoid as to where I could go. The nursery has made it quite clear that everything is hygienic. "You don't have to come in the nursery, we will leave it here." There's just something inside me that makes me think, "But, what if…?" So, we are behind, but we will be back into it as soon as we get packs' (second parent/carer interview).*

From interviews with PACT leads, nursery staff indicated that they were communicating with families via phone or Zoom calls as well as face to face on doorsteps if they were able to deliver the PACT packs to families. Where the PACT lead was a member of the school leadership team, they reported that PACT became less of a priority while they tried to sort out general education provision in a completely new way during the pandemic.

Covid-19 restrictions disrupted the home routines of many participant families. During lockdown most children were at home, with parents balancing the requirements of work and additional children at home. Without any additional family support, PACT was often more difficult to deliver. In the post-intervention parent/carer survey, 91 parents/carers reported having to change some aspects of their PACT delivery during lockdown. Some reported stopping PACT completely or engaging with it less frequently due to the disruption to routine the lockdown caused and having to home-school older children.

> 'It has been more difficult as [child] is one of four of our children and it has been hard juggling working as a key worker with home schooling and keeping everybody happy' (post-intervention parent/carer survey).

Many families that continued with PACT reported that other siblings had to be involved in PACT sessions and that in some cases this disrupted their delivery. A few families reported that the person who did PACT with their child changed due to other adults or older siblings being at home. For some, lockdown provided more time for delivering PACT and parents valued the PACT activities during a time when they had children at home and fewer activities to do with them. Many took the opportunity to change when they did PACT sessions, moving them to the morning or during the day instead of the evening when the child was often tired. A few families reported doing more than one session each day.

> 'During lockdown we could sit and complete the tasks every morning. [Child] was much more engaged as he wasn't tired from a full day' (post-intervention parent/carer survey).

Several parents commented that it was more difficult to get their child motivated to do PACT or to concentrate on PACT when they were out of routine.

> 'During lockdown is was difficult to motivate my child, he seemed to lose interest in it, I'm unsure why. This affected how often we have done it' (post-intervention parent/carer survey).

Perceptions of the programme and its outcomes

In this section we begin by exploring the response of participants to the PACT training and to the programme more generally. We then discuss the perceived impact of the programme, first by considering the opinions of parents and carers and then those of the PACT leads. This section covers the perceived impact of the programme on participating children, on parents/carers and families, as well as on nurseries and PACT leads. Interview and survey data has been analysed to do this. Finally, we discuss whether there were any groups of participants who were unable to access the PACT programme considering the recruitment of parents and participation in the project.

IPE RQ5 (b): How was PACT training received?

Perceptions of the PACT lead training

Immediately after attending PACT lead training, attendees reported feeling confident to carry out the required administration for PACT in their school and confident to support parents/carers in their school to deliver PACT (post-training survey, see Table 29).

Table 29. 'How confident do you feel about carrying out the required administration for PACT in your school?' and 'How confident do you feel about supporting parents/carers in your school to delivery PACT?'—post-training attitudes survey. Frequency of response. (n=65)

N	Very confident	Fairly confident	Somewhat confident	Slightly confident	Not at all confident
Confidence about carrying out required administration for PACT	29	33	3	0	0
Confidence about supporting parents/carers with PACT	27	35	2	1	0

In interviews, most PACT leads interviewed described the training as informative and found it extremely useful to have the opportunity to go through the material and to have personal conversations with the developers and other school staff about how it would work in their setting.

> 'I thought it was very informative really. There was a bit of background and theory to it, a little bit about the project that had already gone on and which has led to this, a bigger scale project' (first PACT lead interview).

> 'It was good to talk about how it would work in your setting with other people. I thought it was really really useful…' (first PACT lead interview).

After seeing the material and hearing about the PACT programme at the training, some PACT leads felt concern that parents/carers might not be willing to take part in the programme due to its length and intensity.

> 'There were times when we thought, "Is that really going to happen?", especially with it being a 30-week programme, we were wondering whether parents would want to do it' (first PACT lead interview).

Perceptions of the parent training

The post-intervention parent/carer survey asked parents/carers how confident they felt to do PACT with their child after receiving training. Almost all who responded (131/137) felt very confident or somewhat confident to do PACT after the training. Only five reported they were not at all confident to deliver PACT with their child (Table 30).

Table 30: 'How confident did you feel to do PACT with your child after receiving the PACT training at the beginning of the programme?'—post-intervention parent survey (n = 137)

Confidence to do PACT after training (Q16)?	Frequency of response
Very confident	64
Somewhat confident	67
Not at all confident	5
I was not trained in how to use PACT	1

The parent/carer interviews indicated that parents/carers found the training to be very thorough. However, some parents said that they felt there was an overload of information. They described how they had been confused about what the different elements of the programme and PACT packs were. However, once they were able to go through it at their own pace, they felt that they understood what they needed to do.

> 'They were easy after they explained them when we first got the packs, but I did misinterpret something initially about when you're supposed to do the games, so on the first week, I did mess up, but when I re-read it, I was like, "Oh, that makes more sense now"' (first parent/carer interview).

The developer also recognised that the training covered a large amount of content in a short time:

> 'The training was about an hour and a half, wasn't it? And then, we were explaining about a session that was supposed to be 20 minutes. So, it was a lot of information, so they are sat there thinking, "How am I going to condense this into a 20 minute session?" But from a lot of the feedback that we received, it seems that once they had done it a few times, when they were in the flow of it, which is what we kept trying to reiterate, they were fine with it' (developer interview).

Only three people (of the 137 who completed the parent/carer post-intervention survey) reported that they had further questions during the year.

General perceptions of programme as a whole

Data from all data sources indicated that PACT was received positively by parents/carers and school staff.

More than 90% of parents/carers who responded to the post-intervention survey stated that their child had enjoyed PACT 'all of the time' or 'most of the time' (Table 31).

Table 31: 'In general, how would you describe your child's enjoyment of PACT across the whole of the programme?'—post-intervention parent/carer survey (n = 136)

Child enjoyment of PACT?	Frequency of response	Percentage
My child enjoyed it all of the time	50	36.8%
My child enjoyed it most of the time	74	54.4%
My child enjoyed it some of the time	11	8.1%
My child did not enjoy it	1	0.7%

When entering their daily engagement on the PACT phone app, parents/carers indicated whether the session had been enjoyed or not (Table 32). Only 3.2% of all sessions were recorded as not having been enjoyed. Eighty-five parents reported one or multiple sessions as not enjoyed (range 1–40). Over time the proportion of 'not enjoyed' sessions reported fell. Enjoyment of PACT sessions may have increased as families got more familiar with doing PACT, however, we believe it is more likely to be due to families where the child was not enjoying sessions stopping doing PACT completely.

Table 32: Total number of PACT sessions enjoyed by child (or not) by pack number as recorded in the PACT athepp

	Pack 1	Pack 2	Pack 3	Pack 4	Pack 5	Pack 6
Total number of sessions enjoyed by child	4065	3598	2909	2395	1865	1243
Total number of sessions **not** enjoyed by child	195	109	101	64	52	23
% number of sessions **not** enjoyed by child	4.58%	2.94%	3.36%	2.60%	2.71%	1.82%

Although the number of 'not enjoyed' sessions are minimal, they did seem to increase as the week progressed with more 'not enjoyed' sessions reported towards the end of the week (Table 33). This may be further evidence for participants engaging less with the programme for multiple readings of the same storybook.

Table 33: Sessions reported on the phone app as 'not enjoyed' by days of the week

	Day 1	Day 2	Day 3	Day 4	Day 5
Number of sessions reported as 'not enjoyed'	70	92	94	126	140

Parents/carers were positive about the PACT programme in the post-intervention surveys as well as in the interviews, finding the programme easy to use and that their child liked all or a variety of the activities offered. Comments at the end of the survey were positive: 48 parents left positive comments about the programme, storybooks, and activities. Seventeen commented on improved learning due to the programme.

'I would recommend PACT to all parents. It is brilliant' (parent/carer post-intervention survey).

'What a fantastic programme. [Child's name] has loved the books and the activities have helped the children during lockdown' (parent/carer post-intervention survey).

However, 14 participants commented that the programme required too much of a time commitment in terms of length and intensity.

'It is a big commitment, though, and difficult to fit in at times because it has been a structured programme with timescales; we have prioritised it over other things but I'm not sure that would be realistic for the long term' (parent/carer post-intervention survey).

Two thirds of PACT leads reported in the post-intervention survey that they had received complimentary feedback from parents/carers about the materials, storybooks, and activities. Around half of PACT leads reported that parents had provided feedback to them that the parents had found it enjoyable to spend one-on-one time with their child, and that the children enjoyed and looked forward to the PACT sessions.

IPE RQ10: What was the impact of the intervention as perceived by parents/carers and school staff?

Impact as perceived by parents/carers

Parents/carers were asked in the post-intervention survey to provide free comment on any changes they felt had been the result of engaging with PACT (either positive or negative) for their child and for the parent/carer and family. The most common themes from the surveys are reported in Table 34: '

Table 34: 'Please describe any changes (either positive or negative) you feel have been the result of doing PACT'—parent/carer post-intervention survey, most common themes (n = 116)

	Number of respondents reporting theme	Example response
Impact of PACT for your child		
Improved vocabulary	48	*'His vocabulary has improved massively, family have commented on this.'*
Increased enjoyment of reading and books	40	*'[My son] loves to read and revisit books from PACT and enjoys getting new ones.'*
Positive engagement in reading/PACT activities	21	*'When reading a book with [girl], she is more observant, asks questions and notices more whereas before she'd have probably forgot the story by the morning after.'*
Increased storytelling skills	20	*'[Girl] enjoys stories, especially the ones she's familiar with. Since PACT [girl] is able to pick a book up and use her imagination more by looking at the pictures and is able to tell her version of the story. I find she appears more confident in doing this now more than before.'*
Improved speech	15	*'[Her] speech has improved and she's good at describing what's going on and speaks better sentences.'*
Improved concentration/attention	9	*'Can sit for longer at home and concentrate longer.'*
Improved confidence	9	*'She's more confident, understanding and knowledgeable when reading books she will ask for her special word and will concentrate more with books.'*
More frequent/better quality one to one bonding time	9	*'More focused 1-2-1 time.'*
Impact of PACT for you and your family		
Provided bonding time with child	47	*'No negatives. It has been lovely to spend the time together quietly after dinner reading the stories and doing the activities (which is [boy]'s favourite part!) … It was the first time I had ever sat down and done 'homework' with [boy] so I feel like it helped prepare me for the lockdown period where we have been home schooling.'*
Reading more	19	*'Before PACT we did read with [daughter] but not all of the time however now we do it a lot more.'*
Better able to support child's learning	18	*'PACT has helped amazingly for me, I learnt how to teach a child and how a child can learn and have fun at the same time.'*
Greater family involvement in reading	15	*'We now read more as a family (not just PACT with [son]) and instead of just reading to the children we talk about the book and all get fully involved in all books now. PACT has had an amazingly GOOD effect on our whole house. Not just [the boy].'*
Rewarding to see child progress/learn	15	*'It is lovely to see my child learning new things and getting involved in activities and being able to understand a story.'*
Read books differently now	11	*'It has been beneficial to me as it has taught me how reading the words isn't good enough there is a lot more you can do with a book.'*
Increased confidence	9	*'It gave me the tools to develop my son's language skills. The confidence to unpick the book.'*

Interviews with parents and carers provided further examples of the above themes and how the programme had impacted families. Across the surveys and interviews, many respondents felt that PACT had improved their child's vocabulary and increased their child's enjoyment and enthusiasm for reading and books.

> *'If we're out and about and she sees something, she's like, "Mum, farm, that was our special word", or she'll say, "Day and night". I think there was one of day and night, and she was going, "Look, mum, it's daytime; that was our special word", and that thing. So, she does, sort of, the observing and then she'll mention it and she'll remember what the special word of the day was, even a couple of days after we've done it actually' (second parent/carer interview).*

Parents/carers often reported that PACT had provided quality bonding time, often one to one, with their child that they hadn't always managed previously. PACT had also encouraged more reading across different family members in the household.

> *'But those days when I am working I do not really have so much time with her at all, so doing PACT was like a, you know, like a set—a set little bonding time every day, so yes, I do think it has had a big impact' (second parent/carer interview).*

> *'It gave you more of a reason to sit down and do one-on-one stuff whereas before, it might have been tempting to just … because he's at the age where he will entertain himself a bit more … With my eldest son, I might have let him just carry on playing and not really interfered so much. But now, I have a reason to sit and do different things on [him], one-on-one' (second parent/carer interview).*

Improvements to their child's speech, storytelling, and early literacy skills were also mentioned by parents in the interviews and surveys.

> *'With reading, his reading has improved, actually. He can look at the page and I can ask him … sometimes I'll say to him, "Find the word", and he's found the word "sunshine"' (second parent/carer interview).*

> *'It's made a massive difference to my child's speech. Beforehand, he used non-existent words. He would make words up for other things. He had very limited speech, and he used to just point and grunt a lot of the time. But since doing the PACT, its full sentences. If he doesn't know the word, he'll keep on saying different words until he figures out what the word is. He didn't do that before PACT' (second parent/carer interview).*

Some parents reported that PACT had an impact on their child's concentration and confidence. However, these impacts were reported less frequently than the language and reading-related impacts.

> *'It says it on her report thing as well. It helps her, in the sense that she's got more confidence now. Even at nursery, they've got that book corner and everything else. She wouldn't go to it. Now, it's given her that confidence to pick up a book and just start reading it. Obviously, if she doesn't know what the words say, she'll look at the pictures and she'll make something up to go with the story. So it's given her the confidence to actually go and do that. Whereas before, I think she thought, "Oh, it's a book, I'm not going to that section." But now she actually goes to it. So I'd say, yes, it has given her the confidence as well' (second parent/carer interview).*

Almost all parents interviewed described how they felt that PACT had better prepared their child for school, especially with the impact of Covid-19 meaning that their children had been unable to attend the nursery setting.

> *'I think it's been a great help in the current climate. I mean, she won't have done any of her school readiness at nursery that she would have done in any other year group. But I think that might be more because I'm having to take on the teacher role, I'm more aware of what she's doing. And more aware of trying to make sure she's ready for school' (second parent/carer interview).*

Parents/carers welcomed the opportunity to support their child's learning through PACT and took pride in seeing their child progress. For one parent who already had knowledge of child development, they reported it helped her to put theory into practice:

> *'PACT has helped amazingly for me. I learnt how to teach a child and how a child can learn and have fun at the same time. I am extremely grateful to who invented this and made it happen. Thank you' (post-intervention parent/carer survey).*

Interview data, along with further survey responses, highlighted that parents/carers felt they had a better understanding of their child's development.

> 'I would like to think that I have some understanding but doing this is sort of like putting it into practice, and sometimes you can actually, you can see it happening, it is really cool. So yes, I do think that it has massively improved my understanding' (second parent/carer interview).

Some parents responded that PACT had changed their practice at home in the way they read with their child. This was investigated in more detail in a survey question which specifically asked PACT parents/carers whether doing PACT changed the way they read other books with their child and how. The majority of parents/carers (98/137) stated that they now read storybooks differently. This included doing more than just reading the storybook, trying to make the reading more engaging for the child, asking their child questions during the story, discussing the pictures and what is going on in the storybook, checking the child's understanding, and retelling the story.

> 'I will read a book with different kinds of voices, I will also read it with a lot more enthusiasm as the story may need to keep it exciting then that keeps [boy]'s attention also he gets excited, which I love, and makes me want to read more and him wanting me to read more' (post-intervention parent/carer survey).

> 'We spend more time looking at the front cover and exploring that, which is weird, because as I said before, when I had the last interview, I'm actually an illustrator by profession. So it was weird that I didn't actually concentrate more on the illustrations on the cover. But I am making more of an effort to explore what's on the front cover first, and then we get an idea of what's inside. I don't think I actually did that before. We'd just dive straight in, really. So yes, that's one thing that's changed' (first parent/carer interview).

There were very few negative comments, and most were unique to one respondent. However, four mentioned that PACT had caused them stress or anxiety in trying to fit the sessions in, getting behind in sessions, or being unable to engage their child in the sessions.

Impact as perceived by nursery staff

PACT leads were asked in their post-intervention survey and interviews to describe any impact (positive or negative) they felt the programme had had on participating children, on participating families, on their nursery settings, and on themselves. Table 35: ' to Table 38 present the themes that emerged from analysing the responses to these questions. PACT leads described similar themes to parents/carers on the impact of the PACT programme on the children and families involved. They also highlighted there had been perceived improvement on children's language skills and increased engagement with, and enjoyment of, books and stories. Positive changes to children's confidence and attention in nursery were also mentioned by a smaller number of respondents. PACT leads also described positive impact on parent and child practice at home with almost half of respondents reporting that families spent more time together with their child, which supported parent/child bonding.

> 'Families have said they've really enjoyed [PACT] because it has given them time with the children, so they have more family time, and they said they actually are going to continue doing that when the PACT programme has finished. They are going to continue having that time with the child' (second PACT lead interview).

A third of respondents also noted richer home learning environments including families having access to a greater number of high-quality resources, families using structured learning activities, prompts and asking questions, as well as increased parent and child conversation. Improvements to parent skills and confidence in their ability to support their child's learning was also mentioned. However, five PACT leads mentioned the programme had caused some families stress in trying to deliver to the prescribed routine and worrying about falling behind. These perceived impacts were almost identical to those reported by parents/carers.

Table 35: 'Please describe any impact you feel that doing PACT has had on children in your setting'—post-intervention PACT lead survey, most common themes

Impact of PACT for the children in your setting (n = 47)	Number of PACT leads	Example response
Increased engagement with books	21	*'I've seen a definite improvement in some children in terms of their engagement with stories in nursery and the number of times they choose to look at books independently.'*

Improved language/literacy skills: including vocabulary (7), comprehension (2), speech (3), storytelling, (3)	19	*'Good support for language and literacy development. Some children used the stories and language back in our setting.'*
Increased enthusiasm/enjoyment of books/reading	13	*'Children are visibly excited when they collect their next pack; parents sometimes ask for them to be in a carrier bag so the child doesn't know new books have arrived so that the parents have control over when they will be introduced!'*
Improved concentration/attention	9	*'The staff in nursery have found the children doing the PACT project have developed their language, can maintain their attention at story time, and answer questions accurately.'*
Enjoyment of parent/child one to one time	8	*'Quality time with their parents reading and working together.'*
Improved confidence	7	*'One child in particular has grown in confidence through the PACT project.'*
Improved home learning environment	4	*'It has given some parents a focus at home that they may not otherwise have had and also has provided them with ideas of what to do during story time.'*

Table 36: 'Please describe any impact you feel that doing PACT has had on families in your setting'—post-intervention PACT lead survey, most common themes

Impact of PACT for the families in your setting (n = 37)	Number of PACT leads	Example response
Improved/increased family bonding time	20	*'A positive aspect is that families have spent time together, learning and enjoying books.'*
Enhanced home learning environment: including structured activities, high quality resources, prompts for parents, increased parent/child conversation	16	*'It has been great for the parents to have the prompts for questions and guidance. It has led to many positive conversations.'*
Established a reading routine/increased reading frequency	9	*'Getting into a routine was difficult for some of our families but they all managed to do this eventually.'*
Improved parents' skill and knowledge to support learning	8	*'Good learning for parents as they see, read, and deliver language skills. Opened their eyes to new strategies.'*
Improved parent confidence for supporting home learning	6	*'I feel that it is a very useful programme that has given these families confidence in how to approach reading with their children.'*
Caused some families stress	5	*'Some parents have felt worried and anxious about falling behind due to unforeseen circumstances.'*

Table 37: 'Please describe any impact you feel that doing PACT has had on the nursery'—post-intervention PACT lead survey, most common themes

Impact of PACT for the nursery (n = 42)	Number of PACT leads	Example response
High quality resources and ideas to improve nursery teaching in future	18	*'We now have a lovely set of resources to use with other children in future years. We will be able to build in some of the activities and approaches to our own literacy work.'*
Improved PACT children's development— language, concentration, relationships with others	13	*'Better concentration. Enthusiasm when reading stories. Better ability to talk about stories read.'*
Improved relationships between nurseries and families	9	*'Great to be involved in a "shared project" with parents. It has enabled us to build stronger relationships with some parents, using the draw of free resources to obtain that initial engagement.'*
No impact on nursery	4	*'None. As we have been unable to apply the training, books, and resources during the programme there has been no impact on children who are not participating.'*
Control group/non-participant disappointment	4	*'There was a lot of families who after the fact then when they saw the resources decided they wanted to take part. It caused a little*

| | | *bad feeling. There would have been so much more uptake of the project if they had seen a pack from the beginning.'* |

Table 38: 'Please describe any impact you feel that doing PACT has had on you'—post-intervention PACT lead survey, most common themes

Impact of PACT for the PACT lead (n = 36)	Number of PACT leads	Example response
Improved relationship with parents	16	*'It has been a pleasure to work on the project, building better relationships with some parents and hearing their positive comments about their child's learning.'*
Provided ideas and resources for teaching of language and communication	14	*'PACT has improved my teaching in a way because of the fun aspect and all the different activities gave me lots of new ideas to use in play, phonics and with story time.'*
Reflected on current practice	5	*'Very useful, made me think about my own teaching and practice and how I can make it better.'*
Wanted to work with more families	4	*'I think it's a great project but … I would have loved more families to be involved. It was hard with only two chosen.'*

Two key impacts were identified by PACT leads for their nursery setting and for themselves other than children's improved development. The first was that the programme provided the nursery and the PACT lead with high quality resources and ideas for improving their teaching of language and literacy in the future. Some PACT leads also mentioned that it supported them to reflect on their current practice and what to prioritise in nursery practice. PACT leads were keen to note they had not used these ideas during the year of the project as they were not allowed to, in case it impacted on the control group. The other key impact was that it supported nurseries and PACT leads in building relationships with the families taking part—providing resources to families to engage them and then an opportunity to regularly catch up with the parent/carer about their progress. There was some disappointment expressed by a small number of PACT leads who would have liked to work with more families rather than just the small intervention group.

IPE RQ13: Were there any groups of parents/carers that could not access the intervention and why (reach)?

Recruitment to the programme

At the family recruitment stage, PACT leads reported inviting almost all families who met the inclusion criteria for the project to take part. In the baseline survey, PACT leads reported the numbers of children eligible, invited, and signed up to the project in each setting. Settings had an average of 30 children in the appropriate year group with 22 families meeting the criteria for taking part in the project. On average, settings invited 21 of these to take part and ten families per setting signed up to the project. Therefore, around half of those families eligible and invited to take part chose not to participate.

PACT leads were asked in the pre-intervention survey if there was a reason why they chose not to recruit any eligible families—'Did you choose not to approach any eligible families? If yes, why?' (PACT lead baseline survey). In the majority of nurseries, all eligible children had been invited. However, 13 PACT leads did not invite families that, in their view, did not have the capacity to complete the programme. In some cases, this was due to individual family circumstances, for example, where the child was part of a large family, where one of their children (not necessarily the PACT child) had special needs, or where the parent/carer had low levels of English language literacy. In a few of these cases—such as the latter—the reason given would have made the family ineligible for the project.

> *'I think one of the [issues for nurseries] was about identifying and recruiting the families, so I think, for some of our nurseries, they didn't know who was coming to them in the September, so they didn't know the children and the families' (developer interview).*

PACT leads provided qualitative responses in the baseline survey about the reasons families gave for choosing not to take part. The most common was not having the time to commit to the programme (mentioned by 29 PACT leads). Some PACT leads mentioned this lack of time was due to parent/carer work commitments, for example, working shifts or working full time while the child attended nursery, having responsibilities for other siblings, or large families at home where they would be unable to dedicate the time to the one child. The PACT programme was perceived by these families as not being accessible to them.

'One family has two working parents, their child in full time nursery and before/after school club. She will continue to read with her child but could not commit to more' (baseline PACT lead survey).

'They felt that it would be too time consuming alongside their day to day activities, having other children, and that they wouldn't be able to commit to it fully' (baseline PACT lead survey).

Some PACT leads said that a small number of parents/carers had not felt the need for a structured programme as they already read with their child at home or do other language activities.

'One parent felt they just wanted to share a story and not make it any more formal' (baseline PACT lead survey).

While most PACT leads did not find any specific groups of families more difficult to recruit than others—'Were there any groups of families for whom recruitment was particularly challenging (for example, EAL, EYPP)?' (baseline PACT lead survey)—a small number of PACT leads reported having greater difficulty recruiting families with poor language skills and families who already did not engage with their child's school or general education.

'I was concerned about how some of my parents would've been able to access it because of their own literacy levels. I think some of them would've struggled with it. … I do think that is a major area, sort of looking at it, you know, whether it could be replicable on a bigger scale. I know that some of my families would really struggle with the amount of work, especially in that book, in order to support. And I understand that it's there as a prompt, as a support, but I do also think that, that would just put off some of my parents as well' (PACT lead interview, T1).

Delivery of the programme

Around half of PACT leads reported in the post-intervention survey that there had been some families who had struggled to use PACT (23/48)—'Have there been any families in your setting that have struggled to use PACT?' (post-intervention PACT lead survey). However, the difficulties reported were varied and did not mention specific groups of participants. Difficulties reported included a lack of time for programme delivery, issues with engaging the child with PACT, family circumstances, including multiple children, child illness, and suspected poor parent literacy (previously reported in the Barriers sections).

From the data described in this section, it appears that families with significant time constraints, such as work commitments or having more than one child, experienced more difficulties in fulfilling the required regular PACT session schedule.

Usual practice

IPE RQ11: How did PACT differ from usual practice and control group activity?

Usual practice for nurseries

PACT leads were asked to provide information about their nursery's usual practice in the provision of home learning opportunities in the baseline survey (September 2019), before the PACT programme started for families. Survey questions asked about the focus of the activities/materials, the types of activities, and how long the activity would take. They also asked about the extent to which families in the nursery engage with the nursery-generated home learning activities.

Of the 47 participating nurseries, 42 reported that activities or parent guidance were sent home with the aim of helping parents/carers support their child's development in the areas most closely related to PACT. These included language, parent/child relationships, concentration, and self-regulation—'Do you typically send home materials which contain focused activities or guidance around supporting child development for parents/carers to complete with their children, relating to improving one or more of the following?' Five nurseries reported not sending any material home for parents/carers in these areas. Materials sent home were most commonly aimed at promoting children's language, communication, and behaviour skills (reported by 40 PACT leads). Twenty-six nurseries reported sending home materials aiming to support the parent/child relationship, 16 reported sending home materials to support concentration, and seven materials which aimed to support self-regulation.

When asked, 'How long (in minutes) would you expect a typical activity to take for a parent/carer to complete with their child?', responses from nurseries ranged from five to 30 minutes (mean of 13 minutes; standard deviation, 6).

Around half of nurseries reported collecting evidence of whether parents/carers completed activities with their children (21/44 respondents). Family engagement with home learning varied across the sample with the majority of settings reporting that 'some parents/carers engage with the activities' (see Figure 7 below).
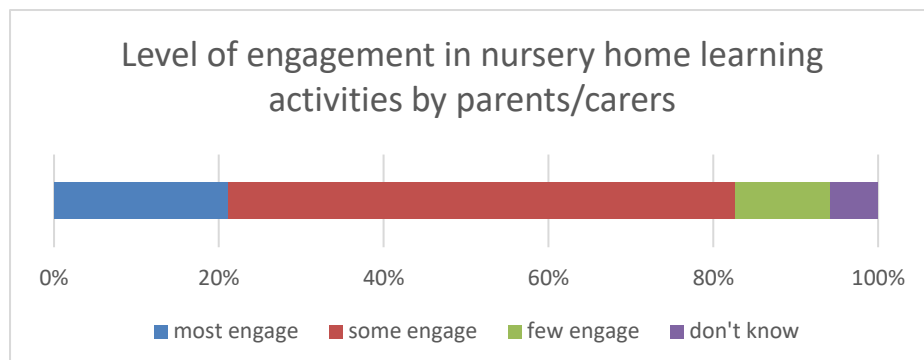
Figure 7: Engagement with nursery home learning activities (n = 47)

In interviews, most PACT leads said that PACT was different to their usual home learning provision. A few mentioned sending home storybooks and reading related activities (for example, story bags), however, these were not to the scale of PACT and rarely contained specific activities to go with the books.

> *'I mean, we do Early Talk Boost, which is sharing a book, but it doesn't have the follow up activities or anything like that' (first PACT lead interview).*

In interviews, the developers discussed their assumption that usual practice at nurseries is less intense than the PACT intervention:

> *'In terms of how nurseries support parents, I doubt very much any nursery gives parents daily stuff to do which, of course, PACT is daily stuff to do, or even weekly stuff to do. It's probably the odd worksheet here and there, or the odd bit of guidance on, you know, "Here is how to introduce letter sounds to your child or whatever." It won't be anything near as structured and detailed as PACT is, I don't imagine' (developer interview).*

Nurseries also reported whether they were engaging with any other early language/reading skills programmes. These were not expected to be home learning activities, rather programmes undertaken in the nursery setting. Of the 46 responses, 20 settings reported they were not undertaking additional programmes. The other 26 mentioned specific programmes. The most popular programme was 'Wellcomm', which nine nurseries were taking part in. Three nurseries reported they took part in 'Blast', 'Talk Boost', or had access to a speech and language therapist at least one day a week. The following programmes were followed in two nurseries each: 'Looking and Listening', 'Read Write Inc.', 'Stories for Talking', and 'Tales Toolkit'. The following programmes were mentioned by at least one nursery: 'Chat, Play, Read', 'Ginger Bear', 'Elklan', 'NELI' and 'Word aware'.

PACT lead familiarity with PACT teaching strategies

An assumption in using the within-school randomisation design for the impact evaluation was that PACT leads would not adapt their teaching to all students as a result of the training they received, resulting in spillover effects for the control group participants. The developer team believed that all teaching staff would already be familiar with the teaching strategies included in PACT and would therefore not change their general teaching practice based on the programme. Almost all PACT lead training attendees reported they were already familiar with most of the teaching strategies included in the PACT lead training and in the PACT materials (with 63 of 65 survey respondents stating that all or most of the teaching strategies were familiar and two stating that some were familiar). This provides evidence that the developer's assumption about PACT lead knowledge was correct, although it was not possible to test whether PACT leads acted on any knowledge from the programme during the year. We know that some leadsLeads reported that PACT gave them new ideas and strategies to try in their own practice, however, many PACT leadsLeads emphasised that they had not implemented these during the intervention year.

Table 39: Response from post-training survey to, 'Were all of these teaching strategies familiar for you?' (N = 65)

Familiarity of teaching strategies	Frequency	Percentage
None of them were familiar to me	0	0%
Some of them were familiar to me	2	3%
Most of them were familiar to me	19	29%
All of them were familiar to me	44	68%
Total	65	100%

Usual practice for families

Activities from nurseriesFurther details about the home learning activities nurseries sent home during the intervention period were explored in the post-intervention parent/carer survey for both the PACT group and the control group participants. As nursery provision was disrupted by the Covid-19 restrictions, which came into place in March 2020 during the trial delivery, data collection aimed to capture what this practice looked like before the Covid-19 lockdown as well as at the time of data collection during lockdown. As described in Table 40 below, more than half of respondents were receiving activities from nursery to complete at home at the pre-Covid-19 timepoint and the number of participants receiving home activities increased significantly during the Covid-19 lockdown period when nurseries were closed. Before the Covid-19 pandemic, a higher proportion of the control group parents/carers reported receiving activities sent home. There is potential this could have been compensation bias for this group not having access to the PACT materials. However, this gap between the groups disappeared when nurseries closed in the lockdown.

Table 40: 'Did your nursery send activities for your child to complete at home?'—post-intervention parent/carer survey

		Percentage response to whether activities were sent home for the child to complete			
		Before Covid-19 lockdown (Feb/Mar 20)		During Covid-19 lockdown (Apr/May 20)	
Group	n	Yes	No	Yes	No
Intervention	136	50%	50%	80%	20%
Control	168	61%	39%	82%	18%
Total sample	304	56%	44%	81%	19%

The most common frequency for home learning activities from nursery was once a week. However, during the lockdown period activities became more frequent for many participants with 51% of respondents receiving activities more often than once per week (Table 41).

Table 41: '. "How often were learning activities sent home from the nursery?'—a follow-up question for those parents/carers who replied 'yes'yes to the previous question

	Percentage response to how often activities were sent home	
Frequency options	Before Covid-19 lockdown (Feb/Mar 20) (= n=170)	During Covid-19 lockdown (Apr/May 20) (= n=247)
Every day	9%	30%
Several times a week	13%	21%
Once a week	58%	33%
Every two weeks	6%	6%

Once a month	5%	3%
Less often	8%	6%

Activities were most frequently reported by parents/carers to take between 10 and 20 minutes to complete before the Covid-19 lockdown (this aligns with the PACT lead reporting). The distribution of the typical length of activities was broader during the Covid-19 lockdown, with a shift towards longer activities: 17% of respondents reported activities of 30+ minutes pre-Covid-19 increasing to 33% during lockdown (Table 42).

Table 42: 'How long did these activities typically take?'—post-intervention parent/carer survey, frequency of responses in each category

Duration options	Percentage response to how long activities typically take	
	Before Covid-19 lockdown (Feb/Mar 20) (= n=170)	During Covid-19 lockdown (Apr/May 20) (= n=247)
Up to 10 minutes	18%	9%
10 to 20 minutes	40%	28%
20 to 30 minutes	25%	26%
30 to 40 minutes	10%	13%
40 to 50 minutes	2%	1%
50 to 60 minutes	2%	6%
More than 60 minutes	3%	13%

According to parents/carers, the home learning activities included reading and story activities (for example, reading a story with a child or playing a related game), number activities, early literacy activities (for example, letter focused),) and more general activities that could not be specifically categorised (Table 43). During lockdown, the delivery methods and range of subjects became more diverse. Rather than receiving activities and reading material on paper, these switched to online delivery. During lockdown, diary and 'show and tell' activities were replaced by tasks encouraging outdoor exploration, for example, 'nature walk with things to look and hear for'.

Table 43:. Types of activities that nurseries sent home between February and March 2020 (before lockdown, n = =154) and April and May 2020 (in lockdown, n = =220); categorised from the qualitative responses to the post-intervention parental survey, for b.oth control and intervention parents

Free response: activities sent home (themes)	Before lockdown	In lockdown	Examples from open text responses in the post-intervention parent/carer survey
Reading, book	86	96	*Before lockdown: 'Activity bags with stories and games in themed around a book.'* *In lockdown: 'Stories are read out by the teachers on a video for the children to watch and then we discuss the story and the characters.'*
Activities (drawing, PE, crafts)	72	111	*Before lockdown: 'Drawing, games, poems.'* *In lockdown: 'Ideas like collecting seven green things on a nature walk for the letter g and the number 7.'*
Maths	39	102	*Before: 'Counting, number recognition.'* *During: 'Finding numbers around the house.'*
Early literacy activities	38	54	*Before: 'One reading book per week with an activity set by the teacher, for example, count how many S there are on a page.'* *During: 'Learning about one letter and one number each week.'*

Home learning environment

Usual practice in terms of the home learning experience for the children participating was captured by the Home Learning Environment Index collected as a secondary outcome measure and described in the Impact Analysis section. We used

the HLE Index items here to understand elements of usual practice at home where they align to the PACT programme. In Table 44 we look at how frequently participants reported doing each of the learning activities. The responses are condensed to when activities were taking place at least five days a week —or daily due to the question wording on one question—as this was the frequency of the activities in the PACT programme. We also looked at when activities occurred at least once a week (full breakdown of this data can be found in Appendix L).

At baseline, more than half of the sample read to their child at least once a day and almost all parents/carers reported that they read at least weekly to their child. Only around 20% of children played with letters at home at least five times a week. For around 35% of children, someone at home helped the child to learn the alphabet at least five times a week, while around 60% of children had someone at home trying to teach them numbers or counting as well as songs or nursery rhymes at least five times a week. By the end of the academic year, during the Covid-19 lockdown, the frequency of activities had generally increased for both groups with more people reporting these activities being carried out at least five times a week. The only exception to this was for how often someone at home tried to teach their child songs, poems, or nursery rhymes, which declined slightly by the post-intervention survey. The frequency of these activities for both groups may be due to the home schooling and nursery closures so parents/carers had more time at home with their children and more opportunity to do activities. It may also be that activities that would have been carried out in nursery were being sent to parents/carers to do in the home. Additionally, it could be that the child was more developmentally mature nine months after the baseline survey and ready for more learning activities in the home.

Table 44: Usual practice with home learning environment items—percentages of sample reporting durations

		Baseline survey		Post-intervention survey	
		Control (n = 187	Intervention (n = 186)	Control (n = 169)	Intervention (n = 138)
How often does anyone at home read to your child?	At least once a day	59%	59%	63%	67%
	At least weekly	96%	96%	97%	98%
How often does your child play with letters at home?	At least 5 times a week	20%	17%	48%	49%
	At least weekly	63%	64%	84%	87%
How often does someone at home help your child to learn the ABC or alphabet?	At least 5 times a week	38%	33%	52%	51%
	At least weekly	80%	83%	88%	92%
How often does someone at home try to teach your child numbers or counting?	At least 5 times a week	56%	59%	65%	69%
	At least weekly	92%	95%	93%	98%
How often does someone at home try to teach your child songs, poems, or nursery rhymes?	At least 5 times a week	62%	67%	56%	55%
	At least weekly	92%	93%	90%	94%
How often does your child paint or draw at home?	At least 5 times a week	52%	48%	63%	57%
	At least weekly	93%	92%	93%	98%

Parents/carers were asked about their reading habits with their child in the period immediate before lockdown in the post-intervention survey (the period where intervention effects should have been least disrupted by Covid-19). The majority of PACT parents/carers (97%) said they were also reading outside PACT. The average duration of a reading session outside of PACT—'Typically how long would one reading session with your child have lasted (in minutes)?' (parent/carer post-intervention survey)—was five minutes for both the intervention and control groups. The short duration of a non-PACT reading session indicates that a PACT session is quite different to what parents do when reading books with their child.

Control group practice

Control group parents/carers were asked in the post-intervention survey what advice or support they had from their nursery to help them read with their child during the year of the trial. Responses by 112 parents/carers reported having received reading materials (mentioned in 25% of the responses), activity packs (17%), and advice (41%) mainly by email as links to online sources (13%). Earlier in the year, support sessions in person were also provided (11%).

In the post-intervention survey, the control group parents/carers were asked if they had seen or used any of the PACT materials (Q20). A small proportion (14% of 165) replied that they had seen PACT materials and 5% reported to have used them. In the PACT group interviews, parents/carers confirmed that they had maintained caution not shared information about PACT with those in the control group, indicating that this had been made clear in the PACT training.

> *'I don't know for sure, but I think they've been told we're not allowed to reveal that half the class are doing it and half the class aren't … So, I don't know if it's a secret that some children have got books out of the class, or not' (first parent/carer interview).*

Usual practice summary

While most nurseries were involved in the practice of sending home materials and activities to support children's learning, these usual practice activities were generally less detailed, less structured, and less regular than the PACT programme; they were generally fairly short activities—mostly shorter than the 20-minute sessions that PACT involved—and sent home, typically, once or twice a week compared to the five days a week required by PACT. Although the frequency and duration of activities sent home during the Covid-19 lockdown when nurseries were closed did increase closer to what was expected by the PACT programme, it seems that the PACT programme is quite different to the usual practice activities usually provided (outside of nursery closures) for home learning and supporting families to read with their child.

Almost all families reported reading with their child at least once a week at baseline with more than half of the sample reading with their child every day, however, these reading sessions were typically much shorter than a PACT session—around five minutes of reading. Again, in terms of what families are usually doing when reading with their child, PACT seems quite different to usual practice in the home.

While the control group had not consistently had access to advice and support to help parents read with their children, some schools had provided reading materials, other advice, and online links to help parents read with their child, however, no control parents reported regular structured activities to support them read and support their child's development or described receiving any programme like PACT. Control families also had very limited exposure to the actual PACT materials and resources and it seems likely that contamination between groups was minimal.

Cost

This PACT programme was fully subsidised by the EEF. As the programme was not commercialised, a developer cost workshop—using EEF costing guidance—explored the costs to the developer of providing the programme to nurseries during the trial. Based on the time estimates given by the developer team we have estimated the personnel cost using mid-band hourly estimates from pay scales of a Russell Group university for the staff roles involved. A table detailing the breakdown of the programme costs is included in Appendix M. The cost of the programme to a school would be £556.72 for the first year plus the cost of the PACT packs at £122 per set. Costs have been calculated assuming five PACT families per school as was the average for this project. This programme cost covers:

- providing in person training to PACT leads;
- in person training for parents/carers in schools;
- storing, collecting, and delivering the PACT packs to schools throughout the programme; and
- providing ongoing support to schools for the first year.

The cost of the support for the programme would be slightly less during a second and third year as PACT lead training would not be required.

The ingredients of the PACT intervention from a school's perspective are listed below in Table 45. The time spent delivering the programme was collected using the PACT lead surveys.

Table 45: Ingredients of the PACT programme for schools

Category	Ingredients
Personnel for preparation, training, and delivery	Set-up phase: 6 days across school (including 5-hour training) for one to two PACT leads
	First five weeks of delivering PACT: one PACT lead for 2.4 days and one other staff member for 0.63 days
	Ongoing delivery of PACT: one PACT lead for two days per month (seven months) and other staff members for 0.48 days per month
Training and programme costs	£435 per school for UoM provision of training, postage of PACT packs, and ongoing support for schools (jassuming 47 settings with five PACT families per school)
	6 PACT packs per school at £122 per set
	Travel costs to attend PACT lead training: £20 per PACT lead attended by one to two per school
Facilities, equipment and materials	Room in a school to allow ten people to attend with AV for in-person parent training
	Incidental stationary to support families with programme, for example, glue sticks, wallets
	Catering for parent meetings
Parent time to deliver PACT	Parent time to attend training, 1.5 hours
	Parent time to deliver PACT sessions: EXPECTED/IDEAL: 5 x 20 minutes x 30 weeks = 50 hours ACTUAL: 91 (mean number of sessions completed in the project) x 24 minutes (reported mean length of session) + 6.8 minutes (reported mean time to prepare for a session) = 46.7 hours

Interviews with PACT leads confirmed there were few additional costs other than the personnel and programme costs, with 44 settings reporting no additional spending and only three reporting additional spending. In one of these three settings, the school had spent up to £20 to provide families with stationary items including plastic folders, glue sticks, and tape to help families manage the different components; the second setting had spent money to provide tea, coffee, and biscuits to parents; the third talked about teaching supply cover costs. Just over half the schools involved reported needing to provide supply cover for the PACT lead to carry out their role (25/47). For those requiring supply cover, the mean number of days needed was 1.58 (range 1–4) during the year. As we do not know what those supply days were for, it is not possible to say conclusively if the same cover would be needed each year. However, we have made the assumption that cover was likely to be to allow staff to attend the PACT lead training and we have allocated this as a set-up cost. Within the cost calculations, we have taken a conservative view assuming two staff from each school attend training and that all schools would require the use of supply cover. The material costs and staff time costs are presented in Table 46 and Table 47 below.

Table 46: Material costs of delivering PACT

Item	Type of cost	Amount	Total cost over 3 years	Total cost per pupil per year over 3 years
Cost of PACT lead training and school materials	Start-up cost per school	£152.75	£152.75	£10.18
Ongoing PACT programme support and material distribution from developer	Running cost per school	£397.47	(£397.47 x 3) = £1,192.41	£79.49

PACT Packs	Running cost per pupil	£122.00	(£122 x 15 x 3) = £1,830	£122.00
Room for 10 people to attend parent/carer training	Prerequisite, required each year	-	-	-
Cost of staff cover through the programme (including to attend training and parent training)	Set-up cost, per school	1.58 days' supply cover: (£150 x 1.58) = £237	£237.00	£15.80
Total			£3412.16	= £227.47

Table 47: Staff time costs of delivering PACT

Item	Type of cost	N staff	Days for first year	N days over 3 years	N days per year per pupil assuming delivery over 3 years
PACT lead training	Start-up cost per school	1 PACT lead	1 day*	1 day	0.07 days
		1 other staff/2nd PACT lead	1 day*	1 day	0.07 days
Annual project set-up (school signing up, recruiting families, organising parental training)	Running cost per school	1 PACT lead	4 days*	(3 x 4) = 12 days	0.8 days
		1 other staff/2nd PACT lead			
Personnel to provide support to families during first five weeks of the programme	Running cost per school	1 PACT lead	2.4 days (range 0–12)	(2.4 x 3) = 7.2 days	(7.2/3/5) = 0.48 days
		1 other staff/2nd PACT lead	0.63 days (range 0–5)	(0.63 x 3) =1.89 days	(1.89/3/5) = 0.13 days
Personnel to provide support to families through rest of the project	Running cost per school	1 PACT lead	2 days per month (range 0–10) x 7 months = 14 days	(14 x 3) = 42 days	(42/3/5) = 2.8 days
		1 other staff/2nd PACT lead	0.48 days per month (range 0-7) x 7 months = 3.36	(3.36x3)=10.08 days	(10.08/3/5) = 0.67 days
Total		PACT lead		62.2 days	4.15 days
		1 other staff/2nd PACT lead		12.97 days	0.87 days

* Data was collected for overall time spent by PACT lead and any colleague for the period of the project up to September 2019, which included training, recruitment, and admin. Data showed a mean of six days (range 1–30). In this table, we have assumed two days for PACT training for two people and four days for the PACT lead and other project delivery.

Conclusion

Table 48: Key conclusions

Assessments completed ten months after intervention delivery (and following continued disruption to education and family life by the pandemic) showed that children who received PACT made, on average, no additional months' progress in overall language skills compared to children who did not receive the programme. This result has a moderate to high security rating.

The subcomponents of the language measure show children who received PACT made, on average, one month of additional progress in expressive vocabulary compared to children who did not receive PACT. However, PACT children made, on average, one month less progress in listening comprehension and sentence repetition than non-PACT children. The two groups scored similarly in terms of receptive vocabulary.

The PACT intervention had a positive but low impact on the home learning environment (HLE) when measured immediately after programme delivery, but this was not maintained when assessed again five months later. This result has a lower security as there were high levels of missing data at immediate post-test (32%) meaning this finding should be interpreted cautiously.

Parents/carers engaged well with the programme with engagement starting high but decreasing over time. The mean number of weeks completed by parents/carers was 18.71 out of 30. This was a similar number of sessions as the previous trial of PACT even though here Covid-19 disrupted programme delivery. Analysis showed that the more sessions delivered, the greater the impact the programme had on children's language skills. However, even at high levels of delivery (90% of sessions completed), the impact of the programme ten months later was low at one month of additional progress.

Interviews and surveys of participants reported that PACT had increased the amount of quality time parent/carers and their children routinely spent together and that parents/carers and nursery staff perceived that PACT had improved children's language outcomes. The key difficulties faced by families in implementing the programme were finding time in the family routine for PACT sessions at the required intensity and, for some families, keeping children motivated for the duration of the programme.

Impact evaluation and IPE integration

Evidence to support the logic model

The results of the evaluation indicate that there is evidence to support most of the delivery elements of the PACT logic model (Figure 2) but limited or contradictory evidence to support the expected outcome elements.

For the delivery elements, training for nursery staff and for parents/carers was delivered, well attended, and well received; PACT leads and parents/carers felt confident to deliver the programme after the training. Settings were able to recruit an appropriate number of families to the project although the timing of the project meant that children who were new to the setting in September 2019 were less likely to be included in the sample as recruitment took place mainly in July 2019, focusing on families already familiar to the setting.

Most families felt that the level of support provided by their nursery to help them with PACT was appropriate and nurseries reported providing ongoing support both at the beginning of the programme and throughout the delivery period, which was tailored to the needs of their families. There was a change to the support that nurseries were able to provide during the Covid-19 lockdown period as nurseries were seeing fewer of the children and staffing capacity was reduced; face-to-face support at nursery drop-off and pick-up times was often replaced by occasional phone calls with parents/carers. PACT leads felt well supported by the developer team throughout the project.

The delivery of the PACT pack sessions by families was similar to that seen in the previous PACT trial (Burgoyne et al., 2018b). Almost all families started out engaging with the PACT materials, delivering almost all the sessions in the first PACT pack, however, engagement decreased as the programme continued, dropping to only 38% of families completing any PACT sessions from the final pack (although there had been a delay to families receiving this pack due to Covid-19). Not all families were, therefore, able, or motivated, to continue with the programme for the full 30-weeks, especially after Covid-19 lockdowns were put into place. However, when families were delivering the sessions, they reported delivering these with high fidelity, following the guidance provided and doing all the activities. Where adaptations were made, these were usually around following the child's interest, level of ability, or adapting their delivery to include siblings.

For the expected outcomes predicted by the logic model there is more limited evidence. There is contradictory evidence from the impact evaluation and the IPE for the expected language outcomes. The impact evaluation found no evidence of improvements to overall language and communication skills from the primary outcome, and mixed evidence from the secondary outcomes for the PACT intervention group compared to the control group with small improvements found for the vocabulary scales while a negative impact was found on the other two language scales. In the IPE, however, parents/carers participating in PACT, and PACT leads, reported positive perceived outcomes for language skills, specifically reporting improved vocabulary—in line with the impact evaluation—as well as improved story-telling skills, speech, and greater enjoyment and engagement with reading activities. It may have been that the delay of a year to collecting the impact evaluation language skills assessment data affected the ability to detect any more immediate changes. It also may have been that the LanguageScreen assessment was not as sensitive to detect the language skills changes found in the previous PACT trial.

There was some evidence for improvements to parent/child relationships and the home learning environment. The impact evaluation found a potential small effect of the PACT programme on the home learning environment (secondary outcome: effect size 0.1, confidence intervals -0.15 to 0.34) for PACT families compared to control families towards the end of the intervention period. The IPE evaluation data also found that parents/carers felt that PACT increased the amount of time they spent bonding with their child, that it encouraged them to read with their child more, and that parents/carers felt better able (and more confident) to support their child's learning because of PACT. These reported benefits from parents/carers and PACT leads lend some support to the improvement of parent/child relationships and improvements to the home learning environment.

We also found limited evidence from the evaluation that PACT boosted children's school readiness. The impact evaluation found no impact of PACT for those that received the intervention compared to those in the control group on the BESSI secondary outcome measure of school readiness. However, this measure was conducted at the end of the reception year when children had been in school for a year and at the top end of the measure's appropriateness. On the other hand, parents/carers reported in the IPE that PACT had positively impacted on their child's concentration and confidence as well as preparing them better for school. PACT leads also reported that they perceived children's concentration, attention, and confidence had improved due to the project.

It was not possible in the impact evaluation to collect data about children's early literacy skills, as had been originally intended, due to the Covid-19 disruption. We are therefore unable to provide any evidence of whether PACT impacted on these in the way the logic model suggested. We propose that this is investigated in more detail in an already funded, and in progress, future evaluation of PACT.

The logic model in Figure 2 did not include the impact of the programme on PACT leads and nurseries and how this might impact on future teaching provision. The IPE provided evidence that PACT had given the settings high quality resources, teaching ideas, and opportunities for reflection, which they reported that they would use to improve their future practice and provision. However, all were keen to emphasise that they had not used these during the project to minimise the risk of contamination. PACT leads also felt that the project had led to improved relationships between nursery staff and the parents/carers involved in the project. For future refinement of the logic model, it may make sense to add in outcomes for nurseries to the logic model as this may feedback in to the support they provide to all children in the setting and the improved relationships with parents/carers may also interact with other potential outcomes.

Interpretation of evaluation findings

This evaluation was conducted under difficult circumstances with disruptions to the evaluation methods and programme delivery caused by Covid-19 making interpretation of the findings more difficult. While originally designed as an efficacy trial—evaluating the impact of the PACT programme under ideal conditions—this was clearly not possible in the delivery of the programme or in the collection of impact data outcomes.

The impact evaluation did not find PACT to have an impact on overall language skills when measured ten months after the intervention, however, small improvements to vocabulary (one month's progress) were found. It is possible that improvements to language skills existed immediately after completing the PACT programme but we were unable to measure them at this point. The context of Covid-19 meant that for the children in the trial who started school in reception during the pandemic there may have been a greater emphasis from schools on 'catching up' on lost learning and this

may have led to greater assessment and support for children during their reception year, reducing the ability to evaluate the impact of PACT (for example, control group children may have started behind their PACT group peers and, therefore, received additional intervention to help them catch up). Parents and PACT leads perceived that PACT led to improvements in language skills and school readiness during and immediately after the intervention.

We were able to collect data on the home learning environment immediately after completion of the intervention, which found a small, positive impact—equivalent to two months' progress for the PACT group compared to the control group. However, the HLE Index information was not complete for all participants in the study (32% attrition) therefore results must be interpreted with caution. We cautiously suggest that PACT may have led to change in the practice of parents and their learning-focused interactions and activities—one of the key ways PACT was expected to create impact. Future studies could investigate the mediating effect of the home learning environment on improving children's outcomes through structured dialogic home-reading interventions such as PACT.

Analysis which looked at the relationship between the language skills latent variable outcome and the number of PACT sessions completed found a positive association, meaning that the effect size increased as more sessions were completed. However, even when adjusting the effect size for 80% sessions completed, the effect size was still low (0.05), and much smaller than that found in the previous PACT trial (Burgoyne et al., 2018b) and of minimal practical significance. Again, caution should be used in interpreting these findings given the division of the sample for the CACE analysis.

For the group of children who were entitled to the Early Years Pupil Premium (EYPP), a proxy indicator of disadvantage, the trial found that the PACT programme showed a negative impact on language skills (effect size -0.17). Negative impacts were also found for most of the secondary outcome measures for this group, with only BESSI school readiness and the LanguageScreen Expressive Vocabulary subscale showing small positive effects (0.26 and 0.14, respectively). However, this trial was not powered to detect the effect of the intervention for this subgroup, and the sample size is very small (n = 70) in comparison to the main trial, meaning that these results should be interpreted with particular caution. Exploratory analysis of the compliance data indicated that participants entitled to EYPP completed a lower number of PACT sessions than the full sample, a mean of 67.31 (n = 26) sessions compared to the full sample's mean of 87.19 (n = 210). It may be that implementation is more challenging for this group or that other factors lead to the group completing fewer sessions.

The implementation and process evaluation results provide evidence that the PACT programme was provided and delivered as intended through the majority of the programme, although engagement with PACT did decline as the intervention period progressed. However, Covid-19 lockdown and restrictions, which came into force just over half-way through the programme delivery, impacted on the distribution of the final PACT packs and also on the capacity of parents/carers to deliver the programme. This disrupted the established routines for many families (intervention and control alike) and often changed their home learning environment due to a number of factors: control group families, for example, were more likely to be doing more home learning than prior to Covid-19; conversely, i.ntervention group families may have delivered PACT for longer through the intervention period had they not been affected by Covid-19. The most frequently reported challenges to implementation related to families finding the time to complete the full complement of sessions in a week and keeping children engaged with the books and activities in the programme through multiple sessions with the same books and through books that the child was not always interested in. However, most families did not report any barriers as frequent occurrences and for many families they felt the PACT structure and routine meant they spent more time reading and engaging with their child's learning and progress.

This trial's impact evaluation findings are not in line with the previous literature cited in the introduction, nor with the prior developer-run trial (Burgoyne et al., 2018b), which found positive impact of PACT on children's early language skills both immediately after the intervention period and at a six-month delayed post-test (a slightly earlier timepoint to the data collection in this trial). The earlier trial utilised an active control group to control for the intensity of the programme and was undertaken in children's centres rather than in school nurseries. The materials had also been revised after the first trial of PACT using some different books and activities and removing some of the more scripted instructions. However, none of these differences would obviously account for greater impact in the first trial compared to the present findings. It was originally intended to use the same outcome measures in the present trial as in the first trial to allow direct comparison of the results, however, due to Covid-19 restrictions on visitors to schools, this was not possible and the language outcome measures were changed to LanguageScreen, delivered by school staff rather than blinded researchers. It may have been that the LanguageScreen assessment was not as sensitive to detect the changes to

language development as the measures used in the previous trial (Burgoyne et al., 2018b). Alternatively, the disruption to the intervention delivery due to Covid-19 may have limited the potential impact of the present programme.

Limitations and lessons learned

This trial was designed as an efficacy trial, however, due to Covid-19, it was not possible for the trial to be delivered under ideal conditions. Covid-19 restrictions also affected when it was possible to collect impact data, with data collection delayed until the children were at the end of their reception year in school. It was therefore not possible to investigate whether PACT had an impact immediately following the intervention period. There is also potential that the Home Learning Environment measure may have been less valid due to Covid-19 restrictions reducing access to external opportunities (for example, closing libraries) and also changing home circumstances (for example, by introducing home schooling). In the period between the end of the intervention in August 2020 and the delayed post-testing in June and July 2021, schools were also being encouraged to introduce interventions to target the impact of Covid-19 on children's development. This could, therefore, have potentially reduced the measured impact of PACT as schools would have been seeking to target children with a lower baseline at the start of the reception year for additional support.

The most common reason given by PACT leads for not inviting families to participate in the trial was the timing of the recruitment. Due to the trial design, and to enable 30 weeks of intervention delivery during the school year, the parental recruitment mostly happened in the summer term. This meant that children already enrolled in the nursery were invited to take part in the programme but where the children due to start nursery in September 2019 were not yet confirmed— or the nursery had yet to contact and engage with the families of the new starters—they were not invited. A limitation of the design of the trial is that it is therefore possible the timing of the recruitment biased the sample if there was a systematic difference between families where children were already attending the nursery or signed up in advance to attend the nursery, and those families where the decision was made later.

A lesson learned from the trial was that children in the nurseries went on to attend a much broader range of schools than had originally been anticipated. This meant that 77 additional schools needed to be recruited to the project in September 2020 to minimise attrition at delayed post-testing. However, despite significant effort and the inclusion of incentives, only 43 of the additional schools signed MoUs to be part of the project leading to a moderately high level of attrition. In the forthcoming trial, the aim will be to minimise the number of standalone nurseries participating in an effort to reduce the number of additional schools that need to be recruited.

Additional lessons learned in the present trial, which will be implemented within the design of the next, include modifying the research questions to reduce the number of IPE questions, thus enabling a more focused investigation of key areas. The timing of the BESSI secondary outcome measure will also be changed to be conducted at the end of the nursery year (in line with immediate post-testing) rather than at the end of the reception year. This is due to ceiling effects having been observed in the data collected at the end of the reception year.

As with many research trials, there is potential for the IPE data to be biased towards parents/carers that were more engaged with the programme. Attempts were made to mitigate for this (for example, through the use of incentives and targeted invitations to participate in interviews), however, this should be borne in mind when interpreting the findings. Attrition in the number of children participating in the delayed post-testing LanguageScreen assessments, and a reduction in response rates to surveys at the end of the programme, should also be noted as a limitations of the research. Finally, the relatively confined geographical location of the schools participating in the trial should be considered when making assertions about the generalisability of the results.

Future research and publications

Due to the impact of Covid-19 on this trial, it has not been possible to answer certain research questions; the forthcoming efficacy retrial will seek to answer some of these. Future publications, including findings from this trial, are planned to include a methodological paper on the implications for the delivery of randomised controlled trials during periods of significant disruption in school and home environments.

IPE data from this trial showed that the average number of weeks completed within the PACT programme was significantly less than the full 30 weeks intended by the materials provided, which was similar to the findings from the

previous trial (Burgoyne et al., 2018b). Future research could, therefore, investigate the optimum number of sessions to include in the programme to maximise the duration of participation by families.

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Appendix A: EEF cost rating

Appendix table 1: 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.

Appendix B: Security classification of trial findings

OUTCOME: Language development

Rating	Criteria for rating			Initial score		Adjust		Final score
	Design	**MDES**	**Attrition**					
5 🔒	Randomised design	<= 0.2	0-10%					
4 🔒	Design for comparison that considers some type of selection on unobservable characteristics (e.g. RDD, Diff-in-Diffs, Matched Diff-in-Diffs)	0.21 - 0.29	11-20%					
3 🔒	Design for comparison that considers selection on all relevant observable confounders (e.g. Matching or Regression Analysis with variables descriptive of the selection mechanism)	0.30 - 0.39	21-30%			Adjustment for threats to internal validity [X]		3
2 🔒	Design for comparison that considers selection only on some relevant confounders	0.40 - 0.49	31-40%					
1 🔒	Design for comparison that does not consider selection on any relevant confounders	0.50 - 0.59	41-50%					
0 🔒	No comparator	>=0.6	>50%					

Threats to validity	Threat to internal validity?	Comments
Threat 1: Confounding	Low	Adequate allocation sequence and minimal imbalance on primary outcome (latent language variable) at baseline (ES=0.03)
Threat 2: Concurrent Interventions	Low	Concurrent interventions explored in detail but not controlled for in analysis, however there is no real evidence of differential uptake
Threat 3: Experimental effects	Low	Low risk of contamination- 5% reported used PACT materials.
Threat 4: Implementation fidelity	Low/moderate	Dosage is well below the 'target' level even if consistent with previous trial. However, CACE analysis demonstrates that the null results are not likely to be a consequence of lack of compliance
Threat 5: Missing Data	Moderate	Missing data are moderate but well accounted for in analyses
Threat 6: Measurement of Outcomes	Moderate	The primary outcome measure was implemented by the school and so it was not possible to blind the assessor to the child's intervention allocation. However, as the assessment took place at a delayed testing point it is less likely the assessment was carried out by a member of staff involved in programme delivery.
Threat 7: Selective reporting	Low	No concerns here

- **Initial padlock score:** 3 Padlocks – MDES at randomisation was 0.20 but attrition was 22%
- **Reason for adjustment for threats to validity**: -0 padlocks – missing data and implementation issues are accounted in the attrition padlock drop, other threats were minimal
- **Final padlock score:** initial score adjusted for threats to validity =3 Padlocks

Appendix C: Changes since the previous evaluation

No previous Education Endowment Foundation funded Trial. Previous developer led trial was funded by the Nuffield Foundation and details of this trial can be found in Burgoyne et al (2018b). Changes since the previous evaluation are described through the body of the report.

Appendix D: Effect size estimation

Appendix table 2: Analysis reflecting adjusted mean difference between groups, effect size using conditional and unconditional variances, for both the usual MLM model in pre-test only as covariate, and for the model with pre-test and stratification variable used for randomisation as covariate.

Outcomes	Parameters	Effect size (ES) for model with pre-test, Confidence intervals	Effect size(ES) for model with pre-test + stratification variable, confidence intervals
Post-test latent variable	Adjusted mean difference	0.10 (-1.57,1.78)	0.09 (-1.58, 1.76)
	ES_conditional*	0.01 (-0.21, 0.24)	0.01 (-0.21, 0.24)
	ES_unconditional**	0.01 (-0.27, 0.30)	0.01 (-0.28, 0.29)
LanguageScreen Expressive vocabulary	Adjusted mean difference	1.06 (-1.46, 3.56)	1.05 (-1.47, 3.55)
	ES_conditional	0.10 (-0.13, 0.33)	0.1 (-0.13, 0.33)
	ES_unconditional	0.04 (-0.22, 0.31)	0.05 (-0.22, 0.31)
LanguageScreen Receptive vocabulary	Adjusted mean difference	0.60 (-2.1, 3.31)	0.64 (-2.06, 3.35)
	ES_conditional	0.05 (-0.19, 0.30)	0.06 (-0.19, 0.30)
	ES_unconditional	0.04 (-0.22, 0.31)	0.05 (-0.22 - 0.31)
LanguageScreen Listening comprehension	Adjusted mean difference	-0.90 (-3.48, 1.65)	-0.95 (-3.54, 1.60)
	ES_conditional	-0.07 (-0.27, 0.13)	-0.07 (-0.27, 0.12)
	ES_unconditional	-0.06 (-0.34, 0.21)	-0.07 (-0.35, 0.21)
LanguageScreen Sentence Recall	Adjusted mean difference	-0.64 (-3.17, 1.90)	-0.52 (NA, NA)
	ES_conditional	-0.05 (-0.26, 0.15)	-0.04 (-0.27, -0.18)
	ES_unconditional	-0.05 (-0.30, 0.20)	-0.04 (-0.29, 0.21)
BESSI	Adjusted mean difference	-0.14 (-0.99, 0.71)	-0.12 (-0.98, 0.73)
	ES_conditional	-0.04 (-0.27, 0.19)	-0.03 (-0.26, 0.20)
	ES_unconditional	-0.03 (-0.26, 0.19)	-0.03 (-0.25, 0.19)
HLE_post-test	Adjusted mean difference	0.83 (-0.87, 2.54)	0.84 (-0.86, 2.55)
	ES_conditional	0.11 (-0.13, 0.35)	0.11 (-0.13, 0.35)
	ES_unconditional	0.10 (-0.15, 0.34)	0.10 (-0.15, 0.34)
HLE_delayed post-test	Adjusted mean difference	0.24 (-1.66, 2.15)	0.28 (-1.62, 2.19)
	ES_conditional	0.03 (-0.24, 0.30)	0.04 (-0.23, 0.31)
	ES_unconditional	0.03 (-0.22, 0.28)	0.03 (-0.22, 0.28)

**Unconditional model is included in the report as the main analyses

*Conditional model is done as sensitivity analysis.

Appendix table 3: Analysis reflecting adjusted mean difference between groups, effect size using conditional and unconditional variances, for both the usual MLM model in pre-test only as covariate, and for the model with pre-test and stratification variable used for randomisation as covariate for the subgroup eligible for EYPP.

Outcomes	Parameters	Model with pre-test	Model with pre-test + randomization stratification
Post-test latent variable	Adjusted mean difference	-1.57 (-4.62, 1.52)	-2.07 (-5.01, 0.91)
	ES_conditional*	0.10 (-1.57,1.78)	0.09 (-1.58, 1.76)
	ES_unconditional**	-0.17 (-0.75, 0.41)	-0.23 (-0.8, 0.35)
LanguageScreen Expressive vocabulary	Adjusted mean difference	1.86 (-3.93, 8.03)	0.93 (-4.21, 6.61)
	ES_conditional	0.18 (-0.51, 0.87)	0.09 (-0.52, 0.7)
	ES_unconditional	0.14 (-0.43, 0.71)	0.07 (-0.5, 0.64)
LanguageScreen Receptive vocabulary	Adjusted mean difference	-5.12 (-10.66, 0.37)	-5.22 (-10.8, 0.34)
	ES_conditional	-0.53 (-1.22, 0.16)	-0.53 (-1.23, 0.16)
	ES_unconditional	-0.42 (-0.98, 0.13)	-0.43 (-0.99, 0.12)
LanguageScreen Listening comprehension	Adjusted mean difference	-4.34 (-10.24, 1.59)	-4.22 (-10.19, 1.78)
	ES_conditional	-0.35 (-0.91, 0.21)	-0.34 (-0.90, 0.23)
	ES_unconditional	-0.31 (-0.87, 0.25)	-0.30 (-0.86, 0.26)
BESSI	Adjusted mean difference	1.19 (-0.91, 3.29)	1.30 (-0.80, 3.40)
	ES_conditional	0.29 (-0.37, 0.95)	0.32 (-0.34, 0.98)
	ES_unconditional	0.26 (-0.26, 0.79)	0.28 (-0.24, 0.81)
HLE_post-test	Adjusted mean difference	-2.02 (-8.03, 4.10)	-2.020 (-8.03, 4.10)
	ES_conditional	-0.25 (-0.75, 0.25)	-0.25 (-0.75, 0.25)
	ES_unconditional	-0.21 (-0.76, 0.34)	-0.21 (-0.76, 0.34)
HLE_delayed post-test	Adjusted mean difference	-0.32 (-5.94, 5.30)	0.38 (-5.26, 6.02)
	ES_conditional	-0.04 (-0.51, 0.43)	0.05 (-0.42, 0.52)
	ES_unconditional	-0.04 (-0.52, 0.43)	0.05 (-0.42 , 0.52)

**Conditional model is done as sensitivity analysis, and

*Unconditional model is included in the report as the main analyses.

Further appendices

Further appendices are available on the EEF website.

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