Independent evaluation of the Oxford Teaching Effective Early Mathematics and Understanding in Primary schools (TEEMUP) professional development programme: A two-armed cluster randomised controlled trial

Evaluation Protocol

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PROJECT TITLE	Independent evaluation of the Oxford Teaching Effective Early Mathematics and Understanding in Primary schools (TEEMUP) Professional Development programme: A two-armed cluster randomised controlled trial
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TRIAL DESIGN	Two-armed cluster randomised controlled trial with random allocation at the school level
TRIAL TYPE	Efficacy
CHILD AGE RANGE AND KEY STAGE	KS1 - 4-6 years: Cohort 1: Starting reception in September 2021, followed to the end of academic year 2023; Cohort 2: Starting reception in September 2022, followed to the end of academic year 2023.
NUMBER OF SCHOOLS	106 primary schools
NUMBER OF CHILDREN	3180 (average 15 per cohort, 30 per school)

PRIMARY OUTCOME MEASURE AND SOURCE	**Child maths attainment:** British Ability Scales 3 Early Number Concepts (BAS3 ENC) by GL assessment.
SECONDARY OUTCOME MEASURE AND SOURCE	**Self-Regulation** Children's Self-Regulation and Social Behaviour Questionnaire (CSBQ), 3 self-regulation subscales: Cognitive, Behavioural and Emotional. Combined mean score. Self-Regulation Early Years Foundation Stage Profile (EYFSP) Early Learning Goal (ELG). **Personal, Social and Emotional Development** CSBQ - 7 subscales: Sociability, Prosocial behaviour, Externalising problems, Internalising problems, Cognitive self-regulation, Emotional self-regulation, Behavioural self-regulation. Each subscale scored separately. Self-Regulation EYFSP ELG, Managing Self EYFSP ELG and Building Relationships EYFSP ELG. Combined. **Child maths attainment** Number EYFSP ELG and Numerical Patterns EYFSP ELG. Combined. **Child general attainment** All 17 EYFSP ELGs average total point score. Good Level of Development met (if available). **Teacher Confidence: Maths** Adapted version of Chen *et al*.'s (2014) 'Early Math Beliefs and Confidence Survey'.

Protocol version history

VERSION	DATE	REASON FOR REVISION
1.0	04/10/2021	N/A
1.1	04/07/2023	Change of co-PI and YTU staff; addition of research question 3.5 to IPE; update to CACE analysis criteria (original compliance criteria copied to appendix for reference); inclusion of sensitivity analysis for Cohort 2 in which the models do not adjust for mean baseline

		BAS3 ENC score from Cohort 2; Timeline amended to reflect decision to submit one NPD application (in 2023 for both Cohort 1 and Cohort 2 data) instead of two separate applications.

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Study rationale and background

In England, the most recent Key Stage 2 assessments show that 21% of children do not meet the expected standard in maths at the end of primary school (Department for Education, 2019). Longitudinal studies have demonstrated that early mathematical achievement is predictive of mathematics and general educational achievement in later life (Duncan *et al.*, 2007; Jordan *et al.*, 2009; Claessens, Engel and Curran, 2014; Nguyen *et al.*, 2016) as well as socioeconomic status across the lifespan (Ritchie and Bates, 2013). These findings highlight the importance of early numeracy education and the need for effective early years' interventions to narrow attainment gaps. Interventions that are designed to facilitate mathematical learning between the ages of 3-5 years old have been shown to have a strong positive effect on children's lives (Clements and Sarama, 2011). Indeed, interventions are considered the most cost-effective and efficacious if administered early in childhood (Easton and Gee, 2012).

Studies have shown a disparity between the mathematics achievement of children from different economic backgrounds. Children from disadvantaged backgrounds start school behind their peers and are more likely to underachieve in maths across primary school (Jordan and Levine, 2009; Siegler, 2009; Department for Education, 2019; Hentges, Galla and Wang, 2019). The quality of education provision impacts on children's outcomes, particularly for those from disadvantaged backgrounds (Melhuish *et al.*, 2015); thus, it is important to evaluate strategies to improve provision quality.

One way to improve mathematics provision, and thus outcomes of children, is to improve teachers' skills through continuing professional development (CPD) (Knowles and Fair Education Alliance, 2017). A previous efficacy cluster RCT (known as FEEL, trial protocol Melhuish et al. 2016) involving 90 pre-school settings in Australia reported that implementing an evidence-based, structured CPD programme to early years' staff who taught 4-5 year-

olds over 7-9 months the year before school start improved the quality of setting provision, as measured by the environmental rating scales, Early Childhood Environment Rating Scale-Extended (ECERS-E) and Sustained shared Thinking and Emotional Wellbeing (SSTEW) scale (Siraj et al, 2018). The trial also investigated 'indirect' impacts on child outcomes (secondary outcomes) shortly after the teacher training intervention had ended, and found evidence of improvements in early numeracy, and verbal comprehension among the children in the intervention group. These differences in child outcomes were not found to be statistically significant in an alternative analyses that adjusted for baseline assessment scores.

This efficacy trial will evaluate a modified version of this CPD programme, which has been developed for use with teachers of Reception (YR) and Year 1 (Y1) school children in England with a focus on mathematics and self-regulation. This intervention is called TEEMUP. Table 1 provides a comparison of the FEEL trial to that planned here for the evaluation of TEEMUP.

A randomised controlled trial (RCT), conducted and reported to the CONSORT standards (Cuschieri, S. 2019), is the best available design for answering questions of effectiveness (Cook and Campbell 1979; Shadish, Cook, and Campbell 2002; Torgerson and Torgerson 2008), and has therefore been chosen to estimate the impact of TEEMUP.

Random allocation eliminates selection bias, and controls for all known and unknown variables. Other potential sources of bias will be minimised through design. For example, outcome assessment will be conducted blind to group allocation.

An integrated Implementation and Process Evaluation (IPE) will be conducted to gain a comprehensive understanding of usual practice, compliance and fidelity in intervention delivery and to help explain any possible differences between randomised groups. An economic evaluation will also be conducted to explore the cost-effectiveness of the intervention.

Table 1: Comparison of the FEEL trial and TEEMUP trial

	Feature	FEEL	TEEMUP
Intervention	Content	'*Leadership for Learning PD' was designed to cover the foundational principles of child learning and development, including: self-regulation; language and communication; conceptual development in maths; and science and critical thinking. The PD featured a cascading model of delivery to prepare participants to take up a leadership role within their workplaces and share their new knowledge with colleagues and families*' (Siraj et al, 2018, p5)	Focus on developing children's mathematical understanding including problem solving, thinking and argumentation, as well as support for children's behaviour for learning. Additionally, aspects such as self-regulation, understanding disadvantage, support for cognitively challenging interactions and intentional and relational pedagogy also feature. Partnership working with families.
	Recipients	90 educators across 38 settings	Minimum of two teachers across 53 schools. Including at least

			1x YR teacher and 1x Y1 teacher (no more than 3 in total), plus 1x SMT can attend initial 2-day training
	Delivery model	2x full days and 5x half days of face-to-face workshops Online support and learning Cascaded to others within workplace	2x full days, 8x half days of face-to-face workshops Specialists needs-based coaching/mentoring in schools (minimum 3 school visits). Website with PD resources and additional materials. Delivered to YR and Y1 teachers No cascade, collaborative working between YR and Y1 encouraged
	Duration	7-9 months	16 months
	Location	Australia	England
Trial Design	Type	Cluster randomised controlled trial	Cluster randomised controlled trial
	Point of randomisation	Randomised once centre environmental quality ratings were completed but before pupil recruitment and completion of pupil baseline assessments	After child recruitment and baseline data collection are completed
	Control condition	Business as usual with wait-list design (control centres received the intervention at the end of the trial)	Business as usual plus £750 with TEEMUP PD available to purchase at the end of the trial at a discounted rate, if found to be effective
Sample	Settings	Long-day care/or preschool Early childhood education and care centres *Main analyses: Total n*=90 (*n*=38 intervention group; *n*=40 control group main analyses *Alternative analyses*: Total *n*=95 (*n*=40 intervention; *n*=55 control)	State funded primary schools *Total n*=106 (*n*=53 intervention group; *n*=53 control group)
	Pupil	Children aged 3-5 years old *n*=1346	Children aged 4-6 years old Total *n*=3180 **Cohort 1** YR children aged 4-5 years old in academic year 2021-22 (pre-test) without significant SEND or EAL, followed until the end of Y1 2022-23 when they are 5-6 years old (post-test) *n*=1590 **Cohort 2**

		Inclusion: Parent/carer opt-in consent	YR children aged 4-5 years old post-tested only at the end of the academic year 2022-23 without Significant SEND or EAL *n*=1590 Inclusion: Completion of baseline assessment Exclusion: Parent/carer withdrawal, significant SEND or EAL
Outcomes and source	Primary	**Environmental:** Early Childhood Environment Rating Scale- Extended (ECERS-E) Sustained shared Thinking and Emotional Wellbeing (SSTEW) SCALE	**Child math attainment**: British Ability Scales 3 Early Number Concepts by GL Assessment at pre and post-test with cohort 1.
	Secondary	**Child language attainment:** Differential Ability Scales (DAS II): Verbal Comprehension Early Years Toolbox Expressive Vocabulary assessment. **Child math attainment:** DAS III Early Number Concepts DAS II Early Numeracy Assessment Preschool Early Numeracy Scale (PENS) **Self-regulation and PSED**: Children's Self-regulation and Behaviour Questionnaire (CSBQ) Strengths & Difficulties Questionnaire	**Child math attainment**: British Ability Scales 3 Early Number Concepts by GL Assessment collected by trained, blinded research assistants at post test – **Cohort 2 only**. Number EYSFP ELG and Numerical Patterns EYFSP ELG. Combined. Cohort 1 and 2. **Self-regulation and PSED:** Children's Self-regulation and Behaviour Questionnaire (CSBQ) Self-Regulation EYFSP Early Learning Goal (ELG) **Child general attainment:** All 17 EYFSP ELGs average total point score Good Level of Development met (if available). Cohort 1 or 2. **Teacher confidence: maths:** Adapted 'Early Math Beliefs and Confidence Survey' (Chen et al.2014)

Statistical Analysis		Environmental quality (as measured by ECERS-E and SSTEW) for settings in the intervention group and settings in the control group compared using regression, controlling for geography, service type, NQS rating, area-level SES, baseline environment quality ratings.	Maths attainment (as measured by BAS3 ENC) for children in the intervention group and those in the control group will be compared using a mixed effects linear regression model at the child-level. Group allocation, baseline BAS3 ENC score, and the minimisation factors (geographical location of school, FSM and EAL) will be included as fixed effects in the model, and school as a random effect. Analysis will be on an intention to treat (ITT) basis.

Intervention

Schools randomly allocated to the intervention group will receive the Oxford TEEMUP professional development (PD) programme over a 16-month period. Nominated YR and Y1 teachers will receive specialist training from the Oxford TEEMUP PD team in improving maths content/domain knowledge and how to support children's mathematics and self-regulation.

The PD allows teachers to:

- explore best practice in mathematics teaching,
- work together to support transitions into and across classrooms,
- effectively engage the children's home in their maths education,
- build their mathematical confidence, knowledge and understanding,
- explore novel techniques to strengthen children's self-regulation, and
- effectively self-evaluate, plan for improvement and monitor their own and the children's progress.

The primary goals of the TEEMUP PD are to:

- improve pupils' maths attainment at the end of YR and Y1, and
- improve pupils' personal, social and emotional development (PSED) and self-regulation at the end of YR and Y1.

Further detailed information about the Oxford TEEMUP PD is included in the TIDier Table (Table 2) below.

TIDier Table

Table 2: Description of the programme using the Template for Intervention Description and Replication (TIDieR) checklist Written by Kingston, D., Siraj, I., Melhuish, E. and Barrett, J., 12/05/2021

TIDieR Item	Description
Brief name	**Teaching Effective Early Mathematics and Understanding in Primary schools (TEEMUP) Professional Development**
Why: Rationale, theory or goal of the elements essential to the programme	**Background** Mathematics skills are crucial for health, wealth and quality of life (OECD, 2013; Muijs *et al.*, 2014; Nguyen *et al.*, 2016) Young children's mathematics achievements are known to be predictive of long-term educational attainment (Duncan *et al.*, 2007; Wylie and Hodgen, 2011; Claessens and Engel, 2013), and may be a better predictor of later life success than literacy (Bynner and Parsons, 1997, 2000). However, many children fail to acquire the mathematical skills necessary for success in adulthood, particularly those from disadvantaged backgrounds (Clements and Sarama, 2011). As they enter school some children are already behind their peers in mathematical skills. The home learning environment is an important predictor of children's mathematical development (Melhuish *et al.*, 2008; Walker, Shenker and Hoover-Depsey, 2010). The type and frequency of maths activities that children engage with at home can influence their future mathematics performance. Further, the potential to improve children's mathematical skills is influenced by teachers' confidence and understanding in how to teach emergent and early mathematics. Sometimes teachers describe strong feelings of shame, humiliation, alienation and disengagement, linked to their own school experiences with maths (Bibby, 1999, 2002). The potential of continuing professional development (CPD) is well documented as the most cost-effective way to maximise workforce capacities (e.g. Charalambous and Praetorius, 2018). The proposed CPD, designed to enhance the effectiveness of mathematics teaching, is in line with existing literature (Brophy, 1986; Muijs *et al.*, 2018)- effective teaching is likely to be a conglomerate of behaviours and it is unlikely that one isolated behaviour will make the difference. Rather, it is the combination of effective teaching behaviours that will lead to better mathematical performance in pupils. It is for this reason that the TEEMUP professional development (PD) covers support for the teaching of mathematics, including problem solving, thinking and argumentation, as well as support for children's behaviour for learning (Ellis and Todd, 2015). **TEEMUP PD overview:** In the TEEMUP study, improvement in children's mathematical abilities is the primary outcome, and there is a focus on developing children's mathematical understanding, reflecting early mathematics' strong associations with later success or failure in school (Claessens, Engel and Curran, 2014) However, the TEEMUP PD is not confined to the mathematical knowledge, skills and attitudes teachers require to support children's learning effectively; problem solving, thinking, reasoning and argumentation is strongly evident, which will build conceptual understanding in mathematics (Franke and Kazemi, 2001; Mulligan and Mitchelmore, 2009; Scharton, 2004). Additionally, aspects such as self-

regulation, understanding disadvantage, support for cognitively challenging interactions and intentional and relational pedagogy also feature (Whitebread, 2012; Ofsted, 2019).

The evidence-based TEEMUP PD draws on current knowledge about effective mathematics teaching but is also designed to suit the participants and curricula requirements. It is informed by the delivery team's previous projects featuring continuing professional development, which have been shown to shift classroom practice and enhance children's outcomes (Kingston, 2017; Siraj, Cheeseman and Kingston, 2017; Iram Siraj *et al.*, 2018; I Siraj *et al.*, 2018).The TEEMUP PD was developed in-line with the literature detailing the characteristics of effective professional development (see, for example, Kingston, 2017) and the content, affect and process of delivery are evidence-based (e.g Siraj-Blatchford et al., 2003; Halle and Martinez-Beck, 2013; Pianta, 2012).

Teachers are supported to make quality improvements through the use of practice-development and self-reflection tools, building mathematical confidence, knowledge and understanding. They will be guided on effective self-evaluation, planning for improvement and monitoring of their own and the children's progress. The training encourages active engagement and collaboration of the participants as they explore best practice in the teaching of mathematics and work together to support transitions and the home learning environment. The focus on theory-to-practice supports the development of the classroom climate and purposeful, developmentally appropriate mathematical instruction and behaviour for learning. Teachers learn from each other, the tutors - and the information and materials they provide - during the face-to-face sessions as well as when they visit them in school, taking the roles of coaches and mentors (Meyers, Durlak and Wandersman, 2012; e.g Siraj, Cheeseman and Kingston, 2017; Iram Siraj *et al.*, 2018; I Siraj *et al.*, 2018).

The TEEMUP PD is designed to support the teaching of mathematics to all children. However, it is designed to support the kind of high quality teaching, which includes assessment of the children's current understandings and achievements to ensure children are working within their zone of proximal development (Vygotsky, 1978); monitoring of the effectiveness of their teaching; active engagement of children with purposeful, real-world and interesting (to the children) problems; an emphasis on thinking, deep learning and perseverance rather than achievements and getting the right answer; a classroom culture of trust, collaboration and the belief that all children are mathematicians which is likely to be particularly effective with children from disadvantaged backgrounds and those with Special Educational Needs (National Council of Teachers of Mathematics, 2014).

TEEMUP PD and how it meets the characteristics of effective PD

Content and Affect

The content and affect (support for teachers' developing positive relationships with children and their families, and their beliefs and attitudes towards their teaching of mathematics) within the TEEMUP PD was developed following consideration of the literature on effective teaching, including the delivery teams own previous experiences of delivering PD. Generally, PD has been found especially useful to augment the knowledge

and skills of teachers after initial training, it also keeps teachers up-to-date with research into best practice and effective teaching. In this study, effective teaching is considered to be in classes where the teachers enhance and support children's learning outcomes.

Coe et al. (2014) suggested the following features are important for teachers to be effective in schools.

1. Pedagogical content knowledge.

Effective teachers have a good knowledge of the subject they are teaching, and the concepts that children must grasp to understand what they intend them to learn. Teachers need to be aware of the children's responses to the learning, and how they are thinking about the content, including being able to identify children's misconceptions.

2. Quality of instruction

The quality of interactions or sustained shared thinking (see Siraj-Blatchford *et al.*, 2002) the teacher has with, and supports between, the children is fundamental to the quality of instruction. Elements of practice, such as reviewing previous learning, effective questioning, providing models, using formative assessment, giving adequate time and practice to embed skills securely and progressively introducing new learning (scaffolding), are also prevalent within high quality instruction.

3. Classroom climate

The expectations set within the classroom and the relationships built are important for effective teaching and learning. When teachers are positive and respectful, setting learning within the children's Zone of Proximal Development (Vygotsky, 1978) that is challenging but also attainable, it builds and supports the children's sense of self-worth. When the teacher values effort and persistence over ability, they build children's resilience and support their developing self-regulation.

4. Classroom management

A teacher's abilities to support children's behaviour for learning through the classroom climate (see above) and how they structure and organise their learning – for example, by avoiding long periods of waiting, making efficient use of learning time, coordinating and making resources and space accessible, and promoting behaviour for learning through the use of clear and consistent rules - are all relevant to effective teaching. These environmental factors set the scene for good learning, enabling high quality of instruction.

5. Teacher beliefs

Teachers' theories about learning and how it happens impact on the practices they adopt in their classrooms. They impact on the role they take as the teacher, as well as the expectations they have of the children and what they aim to achieve. Teachers who believe children capable of co-constructing knowledge, rather than seeing learning as reliant solely on the teacher and on rote learning techniques, support children to be creative thinkers and problem solvers.

6. Professional behaviours

While these may be more indirect aspects of effective teaching, there is some evidence to suggest that behaviours exhibited by teachers, such as

	reflecting on and developing professional practice, including participation in professional development and collaborating with and supporting colleagues, can impact on children's outcomes. In addition, liaising and communicating with parents, including supporting the home learning environment (particularly with younger children) can also support children's learning. ***Process of Delivery*** The process of delivery was also influenced by the literature on the effective characteristics of PD. For example: teachers are encouraged to collaborate; specific teaching (during face-to-face sessions) is combined with follow-up coaching and mentoring in the classrooms; attention is paid to the intensity, and duration of the TEEMUP PD, and attendance will be monitored; at least two members of staff from each school will join the TEEMUP PD and a member of the Senior Management Team (SMT) will act as the main contact; and, finally, networks of connections across and within the schools will be encouraged to support sustainability and the notion of lifelong learning. **The goals of the TEEMUP PD are to:** • Improve pupils' maths attainment at the end of YR and Y1 • Improve pupils' personal, social and emotional development (PSED) and self-regulation at the end of YR and Y1 • Improve attainment in maths, PSED and self-regulation for children from disadvantaged backgrounds • Improve staff understanding and implementation of Developmentally Appropriate Practice, in particular with maths instruction • Improve staff capacity to relate mathematics to the rest of the curriculum • Improve partnership working with families on Home Learning Environment (HLE) • Longer term: Improve SATS results at the end of Key Stage 2 (although not investigated within the context of this specific trial)
Who: Recipients of TEEMUP PD	A minimum of two teachers, one from YR and one from Y1 (3 teachers welcome) from state funded primary and infant schools, primarily located in the East of England. In addition, one member of the senior management team, who may attend days 1 and 2, to support the teachers' in implementing changes in school. No cascading from trained teachers to teachers beyond their classroom is required/expected.
What: Physical or informational materials used in the programme	Teachers will receive specialist training from the Oxford PD team in how to support children's mathematics and self-regulation. Teachers will be offered: • **2 full days (9.30-16.00) in Spring 2022 and 8 half day (14.00-17.45) face-to-face workshops (7 half days in Spring 2022 and 1 half day in Summer 2023).** Two consecutive days followed by seven half day sessions once a fortnight, allowing time between sessions to use the new ideas and activities and involve other staff within their team. The final, half day, follow-up workshop is offered in 2023.

	• **Specialist needs-based coaching/mentoring in schools.** Following the workshops, mentoring/coaching will be provided on a needs-based model, with a minimum of 3 coaching/mentoring sessions. Supporting the implementation of changes, adapting the approaches to suit the school's context and children/families, and getting other staff (e.g., Teaching Assistants) involved. Where school teachers require more support the mentors will offer further support within the time they have allocated. • **Website with PD resources and additional materials.** A dedicated website by the DT supports in-class teaching, provides additional materials, cascading the approach to other staff, and provides information and ideas to support early maths & self-regulation learning at home.
What: Procedures, activities and/or processes used in the PD	**Vehicles for delivering the PD (How)** A minimum 53 hours of face-to-face workshops (2 x full days at 6 hours 30 minutes each day; 7 x half day workshops and 1 x later half day workshops i.e. 8 half day at 3 hours 45 minutes each) and in-school mentoring (a minimum of three visits at 3 hours 30 minutes each). The workshops include the use of power-points, videos, mathematical materials, examples of good practice, assessment tools for use at the classroom and child level, games and books. The fortnightly sessions are sufficiently spread out to allow for practices/strategies to be trialled in between them. The mentoring visits are to individual schools and/or small groups of schools if requested. Access to a bespoke online learning/knowledge base website with discussion forums, materials, articles, suggestions of games activities, resources to download, copies of the power-points videos, etc. Ongoing access to TEEMUP mentors/trainers through workshops, school visits, skype, email and phone **Specific Content of the PD (What)** Two TEEMUP reflective self-assessment scales will be introduced early and used throughout the PD: 1) Behaviour for learning (BfL) (maths) scale; and 2) Improving maths practice scale (IMPS) for YR and Y1. A set of ideas/activities and resources to try in between sessions (from theory to practice) in the classroom. Together with a reflective practice and planning framework designed to support planning for change, capture changes, support sharing of ideas/changes with others and evaluate any impact those changes made within classes. A set of maths materials/information designed to support planning, implementation and evaluation of activities and lessons to support children's learning. Formative assessment ideas and examples, for measuring mathematical achievements to monitor child progress and inform planning. A set of materials, ideas and games designed to support teachers working with parents/carers on the home learning environment.

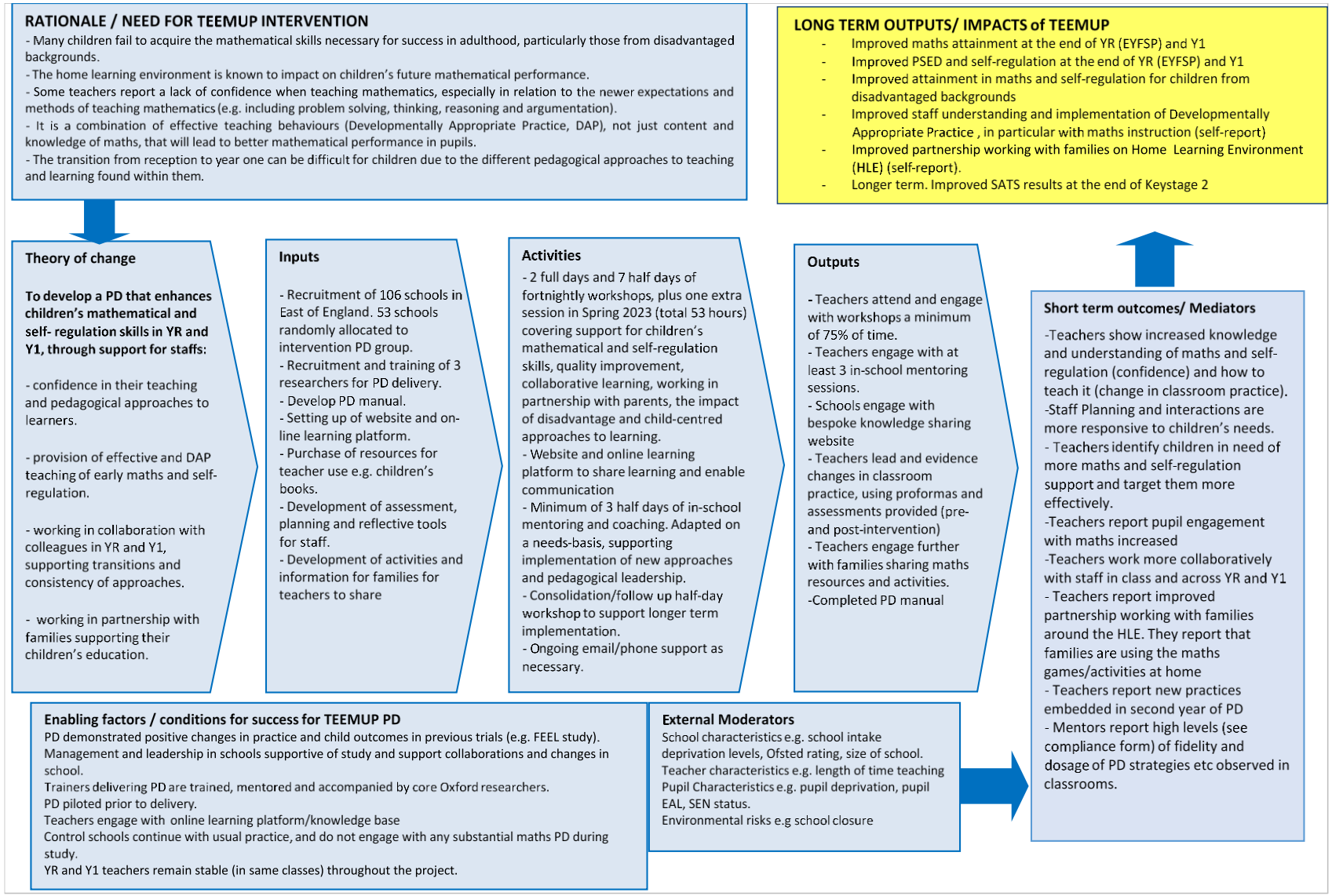
	A set of ideas/resources for use in class to support children's behaviour for learning. The opportunity to work in collaboration with other teachers at school and within workshops (across schools) developing a community of learners. The face-to-face sessions: **Day 1** **Introduction** to the TEEMUP study and what to expect **Session One: All about maths**, why maths is important, some common myths about maths, maths anxiety, charting maths in my classroom **Session two: What is maths like in my classroom?** The self-reflection scale – Improving maths practice, knowledgebase and quality improvement proforma **Day 2** **Session One: How do I support children's behaviour in class?** What we do now and introducing Behaviour for learning (maths) scale **Session two: Supporting problem solving and curiosity in my classroom** **Half days** **Session one: Patterns and generalisations** **Session two: Early number skills and counting** **Session three: Number skills and place value** **Session four: Addition and subtraction** **Session five: Mathematical talk and spatial awareness** **Session six: Supporting Behaviour for Learning maths** **Session seven: Parents as partners and improvement** **Mentoring/coaching: a minimum of 3 visits per school** **Session Eight: in Summer 2023 sharing of good practice, strategies and materials – what worked and what did not and why** Note: There may be some changes to sessions following the pilot.
Who: PD providers/ implementers	Prof Iram Siraj and Dr Denise Kingston plus 2 mentors/trainers with teaching maths and early education experience. Technical and website support from Judy Barrett.
How? Mode of delivery	PD workshops for teachers will be provided in local centres/schools in groups of 20 to 30 with an option of attending another session in the same area if a session is missed or viewing a presentation of the session on the website. There will be six groups for all the sessions. The 6 groups will be held in different geographical areas. The half day sessions will all be run on different days once a fortnight to allow participants to attend different sessions if possible and needed. PD face to face sessions will be videoed so that they can be viewed at a later date and by those who missed sessions due to illness etc.

	Minimum of 3 sessions of mentoring and coaching will occur within the schools i.e., small group and/or one-to-one support as needed/appropriate. To be agreed with the schools. Additional support via email, video or telephone calls where required. Contingency planning to respond to non-attendance due to, for example, illness, external circumstances or newly appointed staff.
Where? Location of Delivery	The programme is available in the East of England and close surrounding areas. Face-to-face sessions will be located so that they are within 45 minutes or less travel time for most schools. However, for those schools slightly outside the Eastern region the distance may be greater, ideally with no more than a maximum travel time of one and a half hours.
When and how much? Duration	Schools will be supported for approximately 16 months.
Tailoring? Adaptation of the programme	The workshops will be standardised and the delivery team will follow a manual. However, there will be individual differences, as part of the sessions, the trainers will be responsive to feedback from schools/cohort of teachers regarding their changes and practice between sessions. Teachers will plan their own activities/lessons as practice between sessions, adapting the materials, strategies and ideas in the sessions to suit their context. The mentoring and coaching will also be responsive to needs of the staff and school.
How well (planned): Strategies to maximise effective implementation	In addition to the extensive training, resources, and support outlined in the sections above, the following strategies will be employed to maximise effective implementation: • Piloting of newly developed materials prior to PD (through expert panel review of resources and materials and pilot with at least 4 schools). • The introductory two days will take teachers step-by-step through the process and will familiarise them with the online website, the self-reflection tools and what to expect throughout the PD. • We will phone participants if any concerns arise rather than email, we may use web calls. • Face-to-face visits to schools to support implementation; to review how revised approaches and resources are working in practice. We will collect photographic evidence/short videos if possible for future PD. • Additional resources and materials for use in class and for sharing with families will be available on the learning platform/ website. • Teachers who cannot attend a session will be invited to an alternative one or directed to it online and then a tutor will follow-up. • 'Catch-up' training will be given where needed e.g. change of teacher/new teacher. • A whole school staff development session resource explaining the study (trainers/mentors and teachers working together) will be offered as an online resource for staff to use in schools if they wish.

	• An early information session to gain school ‘buy-in’ will be given to Head Teacher, Senior Leadership, maths lead and will be run by mentors/trainers. • A move to some sessions/meetings online rather than face-to-face, if considered appropriate.

Logic model

Figure 1: TEEMUP Logic Model


RATIONALE / NEED FOR TEEMUP INTERVENTION
- Many children fail to acquire the mathematical skills necessary for success in adulthood, particularly those from disadvantaged backgrounds.
- The home learning environment is known to impact on children's future mathematical performance.
- Some teachers report a lack of confidence when teaching mathematics, especially in relation to the newer expectations and methods of teaching mathematics (e.g. including problem solving, thinking, reasoning and argumentation).
- It is a combination of effective teaching behaviours (Developmentally Appropriate Practice, DAP), not just content and knowledge of maths, that will lead to better mathematical performance in pupils.
- The transition from reception to year one can be difficult for children due to the different pedagogical approaches to teaching and learning found within them.
LONG TERM OUTPUTS/ IMPACTS of TEEMUP
- Improved maths attainment at the end of YR (EYFSP) and Y1
- Improved PSED and self-regulation at the end of YR (EYFSP) and Y1
- Improved attainment in maths and self-regulation for children from disadvantaged backgrounds
- Improved staff understanding and implementation of Developmentally Appropriate Practice , in particular with maths instruction (self-report)
- Improved partnership working with families on Home Learning Environment (HLE) (self-report).
- Longer term. Improved SATS results at the end of Keystage 2
Theory of change
To develop a PD that enhances children's mathematical and self- regulation skills in YR and Y1, through support for staffs:
- confidence in their teaching and pedagogical approaches to learners.
- provision of effective and DAP teaching of early maths and self-regulation.
- working in collaboration with colleagues in YR and Y1, supporting transitions and consistency of approaches.
- working in partnership with families supporting their children's education.
Inputs
- Recruitment of 106 schools in East of England. 53 schools randomly allocated to intervention PD group.
- Recruitment and training of 3 researchers for PD delivery.
- Develop PD manual.
- Setting up of website and on-line learning platform.
- Purchase of resources for teacher use e.g. children's books.
- Development of assessment, planning and reflective tools for staff.
- Development of activities and information for families for teachers to share
Activities
- 2 full days and 7 half days of fortnightly workshops, plus one extra session in Spring 2023 (total 53 hours) covering support for children's mathematical and self-regulation skills, quality improvement, collaborative learning, working in partnership with parents, the impact of disadvantage and child-centred approaches to learning.
- Website and online learning platform to share learning and enable communication
- Minimum of 3 half days of in-school mentoring and coaching. Adapted on a needs-basis, supporting implementation of new approaches and pedagogical leadership.
- Consolidation/follow up half-day workshop to support longer term implementation.
- Ongoing email/phone support as necessary.
Outputs
- Teachers attend and engage with workshops a minimum of 75% of time.
- Teachers engage with at least 3 in-school mentoring sessions.
- Schools engage with bespoke knowledge sharing website
- Teachers lead and evidence changes in classroom practice, using proformas and assessments provided (pre- and post-intervention)
- Teachers engage further with families sharing maths resources and activities.
-Completed PD manual
Short term outcomes/ Mediators
-Teachers show increased knowledge and understanding of maths and self-regulation (confidence) and how to teach it (change in classroom practice).
-Staff Planning and interactions are more responsive to children's needs.
- Teachers identify children in need of more maths and self-regulation support and target them more effectively.
-Teachers report pupil engagement with maths increased
-Teachers work more collaboratively with staff in class and across YR and Y1
- Teachers report improved partnership working with families around the HLE. They report that families are using the maths games/activities at home
- Teachers report new practices embedded in second year of PD
- Mentors report high levels (see compliance form) of fidelity and dosage of PD strategies etc observed in classrooms.
Enabling factors / conditions for success for TEEMUP PD
PD demonstrated positive changes in practice and child outcomes in previous trials (e.g. FEEL study).
Management and leadership in schools supportive of study and support collaborations and changes in school.
Trainers delivering PD are trained, mentored and accompanied by core Oxford researchers.
PD piloted prior to delivery.
Teachers engage with online learning platform/knowledge base
Control schools continue with usual practice, and do not engage with any substantial maths PD during study.
YR and Y1 teachers remain stable (in same classes) throughout the project.
External Moderators
School characteristics e.g. school intake deprivation levels, Ofsted rating, size of school.
Teacher characteristics e.g. length of time teaching
Pupil Characteristics e.g. pupil deprivation, pupil EAL, SEN status.
Environmental risks e.g school closure

Impact evaluation

Design

The impact evaluation will consist of a two-armed cluster randomised controlled efficacy trial. Randomisation will be at the school level. Two cohorts of children will be recruited to take part in the evaluation; children beginning Reception (YR) in September 2021 (Cohort 1), and children beginning YR in September 2022 (Cohort 2). Cohort 1 will be followed up until the end of Year 1 (Y1) (June/July 2023). Cohort 2 will be followed up until the end of YR (June/July 2023).

At the outset of the evaluation, before randomisation, schools will nominate a minimum of two teachers, one from YR and one from Y1 (3 teachers welcome), who will participate in the TEEMUP PD, if their school is allocated to the intervention group. Teachers in intervention schools will receive TEEMUP PD and support over a 16-month period (Jan 2022 - May 2023). Changes to practice would be expected to build over this period and therefore the evaluation seeks to investigate the impact of the TEEMUP PD on children in Cohort 1 (who, at the end of Y1, will have been taught by YR and Y1 teachers receiving TEEMUP PD) and Cohort 2 (who, at the end of YR, will have been taught by the nominated YR teachers at the end of receiving the full TEEMUP PD). Participating schools/teachers will be asked to (1) retain nominated YR and Y1 teachers in their respective year groups for the duration of the trial, and (2) keep participating children in classes taught by nominated YR and Y1 teachers.

Aim

The primary aim of this independent evaluation is to investigate the impact of the Oxford TEEMUP professional development programme for teachers on the maths development of children in YR and Y1 of primary school in England.

Research questions

Primary research question

What is the impact of the TEEMUP PD, in comparison to usual teaching practice, on children's maths attainment at the end of Y1? [Cohort 1 only]

Secondary research questions

Cohort 1

In comparison to usual teaching practice, what is the impact of the TEEMUP PD at the end of YR *and* Y1 on children's self-regulation and PSED (measured using the CSBQ)?

Cohort 2 *– Included to investigate the impact of a YR teacher at the end of receiving TEEMUP PD on children's outcomes (exploring teacher development/experience and whether change in practice remains after first year of training).*

What is the impact of the TEEMUP PD, in comparison to usual teaching practice, on children's maths attainment at the end of YR?

In comparison to usual teaching practice, what is the impact of the TEEMUP PD at the end of YR on children's self-regulation and PSED (measured using the CSBQ)?

Both cohorts

What is the impact of the TEEMUP PD, in comparison to usual teaching practice, on children's Early Years Foundation Stage Profile (EYFSP) scores at the end of YR, including Mathematics Early Learning Goals (ELGs), Self- Regulation, PSED ELGs and general development?

Is the TEEMUP PD effective in raising the maths attainment of children who are eligible for FSM at the end of YR and Y1, in comparison to usual teaching practice?

Teachers

Is the TEEMUP PD effective in improving nominated teacher's confidence in supporting children's maths development in comparison to usual teaching practice?

Table 3: Trial design

Trial design, including number of arms		Two-armed cluster randomised controlled efficacy trial, 2 cohorts. Cohort 1 followed for 2 years: YR 21-22 to Y1 22-23 Cohort 2 followed for 1 year: YR 22-23
Unit of randomisation		Primary schools
Minimisation factors		Minimisation will be undertaken to ensure balance across the trial arms on: the percentage of pupils eligible (ever-6) for free school meals (FSM) in the school (latest available data), the percentage of pupils identified as having English as an Additional Language (EAL) in the school (latest available data), and the school's geographical location.
Primary outcome	variable	Maths attainment at end of Y1 (Cohort 1 only)
	measure (instrument, scale, source)	British Ability Scales 3 Early Number Concepts (BAS3 ENC) 0-35, GL Assessment. Collected by blinded evaluation team research assistants.
Secondary outcome(s)	variable(s)	**Cohort 1** (YR 21-22, Y1 22-23) Self-regulation at end of YR and end of Y1. PSED at end of YR and end of Y1. Routinely collected maths, self-regulation, PSED, and general attainment at the end of YR. **Cohort 2** (YR 22-23) Maths attainment at end of YR. Self-regulation at end of YR. Child PSED at end of YR.

	Routinely collected maths, self-regulation, PSED, and general attainment at the end of YR. **<u>Teachers</u>** Teacher confidence (in teaching children maths), during intervention and at the end of intervention (YR and Y1 teachers).
measure(s) (instrument, scale, source)	**Maths Attainment** British Ability Scales 3 Early Number Concepts (BAS3 ENC) 0-35, GL Assessment. Collected by blinded evaluation team research assistants. **Self-Regulation** Children's Self-Regulation and Social Behaviour Questionnaire (CSBQ), 17-items yielding 3 self-regulation subscales: Cognitive, Behavioural and Emotional. Collected by nominated YR and Y1 teachers. **PSED** CSBQ, 34-items yielding 7 subscales: Sociability, Prosocial behaviour, Externalising problems, Internalising problems, Cognitive self-regulation, Emotional self-regulation, Behavioural self-regulation. Collected by nominated YR and Y1 teachers. **Routinely collected maths, self-regulation, PSED, and general attainment at the end of YR.** Early Years Foundation Stage Profile (EYFSP) data collected by teachers at the end of Reception accessed from the National Pupil Database (NPD). • Maths (Number ELG and Numerical Patterns ELG, combined.) • Self-Regulation ELG • PSED (Self-Regulation ELG, Managing Self ELG and Building Relationships ELG combined). • General Attainment (All 17 EYFSP ELGs average total point score and (if available) whether Good Level of Development has been 'met'. **Teacher confidence: Maths** Adapted 'Early Math Beliefs and Confidence Survey' by Chen *et al*.

		(2014). Only subscale: Confidence in Helping Children Aged 4-6 Learn Maths;
Baseline for primary outcome	**variable**	Maths attainment at start of YR (Cohort 1 only)
	measure (instrument, scale, source)	British Ability Scales 3 Early Number Concepts (BAS3 ENC) 0-35, GL Assessment. Collected by blinded evaluation team research assistants.
Baseline for secondary outcome	**variable**	**Cohort 1** (YR 21-22, Y1 22-23) Self-regulation at start of YR. PSED at start of YR. **Cohort 2** (YR 22-23) Self-regulation at start of YR. PSED at start of YR. **Teachers** Teacher confidence (in teaching children maths) at baseline (YR and Y1 teachers).
	measure (instrument, scale, source)	**Self-Regulation** Children's Self-Regulation and Social Behaviour Questionnaire (CSBQ), 17-items yielding 3 self-regulation subscales: Cognitive, Behavioural and Emotional. Collected by nominated YR and Y1 teachers. **PSED** CSBQ, 34-items yielding 7 subscales: Sociability, Prosocial behaviour, Externalising problems, Internalising problems, Cognitive self-regulation, Emotional self-regulation, Behavioural self-regulation. Collected by nominated YR and Y1 teachers. **Teacher confidence and beliefs: Maths** Adapted 'Early Math Beliefs and Confidence Survey' by Chen *et al*. (2014). Only subscale: Confidence in Helping Children Aged 4-6 Learn Maths;

Randomisation

Schools will be randomised after child recruitment and baseline data collection have been completed in that school. Randomisation may be carried out in batches (groups of schools that are ready to be randomised at that time) to avoid delays in programme induction and to maximise programme delivery for as many schools as possible. All schools (and the delivery team) will be informed of their random allocation as soon as possible via a letter emailed to the school contact.

A statistician at York Trials Unit, will randomise schools to either the intervention or control arm, using a 1:1 allocation ratio. Schools allocated to the intervention arm will be offered the TEEMUP PD programme; schools allocated to the control arm will continue with usual provision for the duration of the evaluation (these schools will be offered the TEEMUP PD programme at a much-reduced price (to be confirmed) on completion of the evaluation, if the intervention is found to be beneficial).

Minimisation is a way of allocating schools to one of the trial arms whilst maintaining the best possible balance across the minimisation factors (Hewitt et al. 2006). A dedicated computer program, MinimPy (Saghaei and Saghaei, 2011), will be used for randomisation via minimisation using the factors:

- School geographical location - initially Peterborough, Norwich, Newmarket/Bury St Edmunds, Milton Keynes, Oxford and Barnet (locations may change dependent on school recruitment) - for logistical reasons, to ensure a balanced spread of intervention and control schools in each area.
- School deprivation level - the percentage of pupils eligible (ever-6) for free school meals (FSM) in the school (latest available data; dichotomised at the median for recruited schools in the first batch to be randomised) - to ensure balance between the randomised groups, since this school characteristic and individual child deprivation may moderate outcomes.
- School English as an Additional Language (EAL) level - the percentage of pupils identified as having EAL in the school (latest available data; dichotomised at the median for recruited schools in the first batch to be randomised) - to ensure balance between the randomised groups, since this school characteristic and individual child EAL status may moderate outcomes.

NB. baseline for primary outcome (BAS3 ENC) will not be used in the minimisation. We cannot use baseline scores, as although this assessment will be completed before randomisation, scores will not be confirmed before randomisation (due to time taken to mark and verify scores). Baseline score will be included as a covariate in the analysis so it is not necessary to additionally specify this as a minimisation factor.

Participants

Schools

The delivery team will lead on the recruitment of schools, Recruitment will begin in January 2021 and planned recruitment strategies include: emails to schools in recruitment areas; marketing through social media channels; promotion via sector press and public relations work; and working with contacts in targeted local authorities and providing them with recruitment materials to facilitate recruitment at a local level.

Initial information about the project will be provided in the form of the Study Information Sheet (SIS, see Appendix C) and link to the study website (https://oxfordteemup.web.ox.ac.uk/home), as well as having direct communication with the delivery team. Schools who are interested in participating will be requested to return a completed Expression of Interest form (EOI, see Appendix D) to the delivery team who will check their eligibility (listed below).

Once eligibility has been confirmed, the delivery team will email each school a Memorandum of Understanding (MoU, see Appendix E), which provides full details relating to a school's involvement within the trial, and a Data Sharing Agreement (DSA) between the school and the University of York. Schools willing to participate will return a completed and signed MoU and DSA to the delivery team who will forward on to the evaluation team. As a thank you for participation and in recognition of the additional work required of schools, all schools (i.e., both intervention and control) will receive £250 (bank transfer from the evaluation team) after recruitment and baseline assessment are complete, and £500 (bank transfer from delivery team) after final assessments.

School inclusion criteria

- State primary and infant schools.
- Schools located in the East of England and bordering local authorities (initial target area for recruitment – may be broadened if required).
- Schools who have a reception cohort size ideally greater than 20 (excluding children where English is an Additional Language (EAL) and/or Special Educational Needs (SEN) are a barrier to participation, explained further below).
- Schools willing to nominate one YR teacher and at least one Y1 teacher (who are fulltime or majority time), who will participate in the Oxford TEEMUP PD if their school is randomly allocated to the intervention group.
- Schools who anticipate that nominated YR and Y1 staff will remain teaching the same year groups over the duration of the study.
- Schools that can commit to keeping participating children in classes taught by nominated YR and Y1 teachers.
- Generally, schools with more than 7% of children who have ever been eligible for FSM (soft recruitment target, starting with schools with more than 15% children ever FSM).
- Schools that agree to all requirements outlined in the SIS and MOU and sign a DSA.

School exclusion criteria

- Schools in a multi-academy trust (MAT), where another school in the MAT is taking part in TEEMUP (only 1 school per MAT will be eligible for TEEMUP to minimise the risk of contamination).
- Schools already taking part in a YR or Y1 substantial PD-related research study.
- Schools already taking part in an EEF-funded trial in the early years or KS1 (for example the White Rose maths trial or Maths Champions II trial).
- Special Educational Needs and Disabilities (SEND) schools.
- Private schools.

For clarity, schools with the following criteria/characteristics will be eligible for TEEMUP:

- Schools signed up or planning to sign up to trial/pilot the new ELGs.

- Larger schools (e.g., 3 class entry) will be considered for inclusion on a case-by-case basis.
- Infant only schools.
- Participating schools (allocated to TEEMUP or control) will be able to adopt other KS1 maths interventions (including PD) during the duration of the project, as part of business as usual. Details on this will be collected at various time points throughout the trial via school surveys.

Children

Child inclusion criteria

Cohort 1

- Children aged 4 to 5 years, starting YR in September 2021.
- Children in class of nominated YR teacher.
- Children who complete the trial baseline assessment (BAS3 ENC).

Cohort 2

- Children aged 4 to 5 years, starting YR in September 2022.
- Children in class of nominated YR teacher.
- [NB. There is no BAS3 ENC baseline assessment for this cohort].

Child exclusion criteria

- Children are not eligible to take part in the trial if teachers consider them to have significant SEND or EAL where an extreme language barrier exists or they are new to English, which would prevent them from accessing the assessment and/or cause distress through completing the assessment. Excluded children in participating intervention schools will still experience the intervention.

In September-October 2021, recruited schools will be asked to provide the number of children in their school who meet the first two eligibility criteria for Cohort 1. The evaluation team will then provide each school with electronic and paper copies of parent/carer information sheets (PIS) and withdrawal forms (see Appendix F) and ask that they be distributed to the parents/carers of all eligible children at the school. The PIS will inform parents/carers about the trial, what it means for their child to take part and how to withdraw their child if they do not want them to take part. In addition to distributing paper and electronic versions of the trial PIS and withdrawal forms, schools will be strongly encouraged to use all of their usual communication channels to ensure information about the research is disseminated to all relevant parents/carers (e.g. letter, email, text, school newsletter).

Parents/carers will have a 2-week window to withdraw their child from the evaluation elements of the project (data sharing and assessments) by completing and returning the withdrawal form to the school or contacting the school and expressing this wish verbally. Schools should complete a withdrawal form on behalf of any parent/carer expressing this wish to the school through another channel (such as phone call or in person conversation). Schools will be advised that they are not to send the research team information about pupils whose parents/carers have chosen to withdraw them from the trial. Schools will securely store returned withdrawal forms on-site for the duration of the project and will be instructed to ensure any such children are removed from lists of participating pupils before secure

transfer to the evaluation team. Schools will be made fully aware of their responsibilities around this and data sharing in general in the MOU and the DSA. The evaluation team will put in place a Study Specific Procedure to detail the actions that will be taken should the evaluation team believe they have been passed details for children who have been withdrawn by parents/carers, or passed details for children whose parents/cares have not been informed about the study. For participating pupils (i.e., those whose parents/carers have not chosen to withdraw them from the evaluation), the school will securely transfer their details to the evaluation team using the University of York secure DropOff service (the evaluation team will provide schools with full guidance on how to do this). This process will be repeated in September-October 2022 to recruit pupils for Cohort 2.

We will aim to assess at least 15 children (and more where possible) with the BAS3 ENC at baseline and post-test for Cohort 1, and at outcome only for Cohort 2. The following assessment sampling process will take place prior to baseline assessment for Cohort 1 and prior to outcome assessment for Cohort 2. In cases where a school has more than 15 eligible children, purposive and random sampling will be performed. A key priority for the funder of this trial, the EEF, is raising the attainment of disadvantaged children (i.e., those eligible for FSM); therefore, a sub-group analysis will be conducted to explore the impact of TEEMUP PD on children eligible for FSM. In order to ensure a sufficient sample size to conduct this exploratory analysis, in cohorts where there are 3 or fewer children eligible for FSM, all these children will be included in the trial sample for assessment and then the remaining eligible children will be randomly ordered for assessment. In cohorts with more than 3 children eligible for FSM, 3 children eligible for FSM will be randomly sampled from the FSM group for assessment, and then all remaining children (FSM and non-FSM) will be randomly ordered for assessment. Research assistants completing the BAS3 ENC will be advised to work their way through the provided list, starting with the child who is first on the list (up to 3 children eligible for FSM will appear first), and continue until the assessment has been completed for 15 (or more) children. If a child is absent on the day of baseline BAS3 ENC testing, the research assistant will assess the next available child from the randomly ordered list, or the next available FSM child if one of the first three are absent (NB. the FSM status of children will not be disclosed on the randomly ordered lists; research assistants will be blinded to children's FSM status). Once the first 3 assessments are complete, research assistants will revert to assessing children in order of the list. This process will also serve to prevent unconscious assessor bias during data collection. When research assistants revisit the school to complete the post-test with Cohort 1, they will only complete assessments with children who were assessed at baseline. The group of 15 cohort 1 children (or more), per school, for whom baseline assessments are completed will form the randomised evaluation group. The randomly ordered list will be provided to nominated teachers to enable them to conduct the CSBQ for the relevant children for each cohort at each time point.

Sample size calculations

For the primary analysis, we will compare BAS3 ENC scores at the end of Y1 for Cohort 1 between the intervention and control groups, adjusting for baseline BAS3 ENC score measured when the children are at the start of YR (see Statistical analysis section for further details). Therefore, for the sample size for the primary analysis, we make the following assumptions: a school-level intracluster correlation (ICC) of 0.15; 15 children per school (at randomisation); a baseline and outcome testing correlation of 0.6 and 1:1 allocation at school level. The ICC and pre to post-test correlation can be justified based on the following previous EEF-funded trials, though these do differ slightly in the age of the population to this

trial. The 1stClass@Number evaluation in Year 2 children found an ICC of 0.22 for its primary outcome of the Quantitative Reasoning Test (Nunes *et al.*, 2018) with a pre-post correlation of 0.29 (sample restricted to those struggling with maths) but 0.63 for the whole sample which better reflects our population; for the secondary outcome of Key Stage 1 Maths, the ICC was 0.15 with a pre-post correlation of 0.26 for the restricted sample but 0.63 for the whole sample. The Mathematical Reasoning evaluation in Year 2 children found an ICC of 0.11 for its primary outcome of the GL Assessment Progress Test in Maths with a pre-post correlation of 0.58 (Stokes *et al.*, 2018). The Maths Champions trial in early years, in the year before children started primary school, found an ICC of 0.17 for its primary outcome of the CEM ASPECTS assessment in Maths with a pre-post correlation of 0.59 (Robinson-Smith *et al.*, 2018).

Based on 100 schools (i.e.,1500 children), we would have 80% power to show an effect size of 0.21 of a standard deviation between the control and the intervention groups in the primary analysis, allowing for 15% attrition at the child level at post-test. The trial aims to recruit 106 schools to allow for some school level attrition without compromising the MDES.

Based on the sampling strategy, we might conservatively assume that we will achieve an average of 3 FSM children per school (300 from 100 schools). Assuming a baseline and outcome testing correlation of 0.6, an ICC of 0.15 and 15% attrition at the child level, with 100 schools we would have 80% power to show an effect size of 0.31 in the FSM subgroup for Cohort 1.

Table 4: Sample size calculations

		OVERALL	FSM
Minimum Detectable Effect Size (MDES)		0.21	0.31
Pre-test/ post-test correlations	level 1 (child)	0.6	0.6
	level 2 (school)	N/A	N/A
Intracluster correlations (ICCs)	level 2 (school)	0.15	0.15
Alpha		0.05	0.05
Power		0.8	0.8
One-sided or two-sided?		Two	Two
Average cluster size		15	3
Number of schools	Intervention	50	50
	Control	50	50
	Total	100	100
Number of children	Intervention	750	150

	Control	750	150
	Total	1500	300

Outcome measures

Primary outcome

Maths attainment: The BAS3 ENC will be the primary baseline and outcome measure (Elliot and Smith, 2011). BAS3 ENC comprises 30 items and is designed to measure young children's knowledge and application of concepts of number and quantity (concepts of measurement are not included) between the ages of 3-7 years old. It assesses the following skills and concept:

- rote number counting
- counting objects
- matching and classifying by qualitative attributes and by number
- comparison sets by concepts (e.g., more, less)
- recognising number names and numerals
- recognising ordinal relationships, e.g., first, second, third
- understanding numerical order
- basic addition and subtraction
- counting by tens and recognising place value of tens and ones.

The assessment is administered by a trained adult who predominately asks the child questions about pictures presented in a stimulus booklet. The child answers questions by pointing, counting aloud, or saying a number. None of the answers require extended verbal responses from the child. The assessment should take 5-10 minutes per child to complete. As well as indicating knowledge of the skills and concepts listed above, higher BAS3 ENC scores may also be indicative of a child's verbal comprehension, basic language concepts, visual perception and analysis of pictures and integration of visuals and verbal conceptual information. A low BAS3 ENC score may reflect a poor knowledge of the above skills and concepts listed above, and/or expressive language difficulties, including a reluctance to speak (Elliott & Smith 2011).

BAS3 ENC will be administered in all schools by independent research assistants blind to group allocation, who will have received training from a psychologist and the evaluation team. All RAs will have an enhanced Disclosure and Barring Service check and undergo relevant safeguarding and data protection training. Assessment results will be recorded 'live' electronically where possible, with paper collection available as back up. We will advise schools that a familiar staff member should be available to chaperone the assessment conducted by the research assistant to ensure the child feels comfortable.

Cohort 1 will complete the BAS3 ENC twice with an RA, once at baseline in October/November 2021 and again for outcome assessment in June/July 2023. Cohort 2 will complete the BAS3 ENC with an RA once in June/July 2023 for outcome assessment only. The evaluation team will liaise with schools to arrange convenient times for RAs to visit the school and complete the assessments. Where possible, baseline assessment dates will be booked in advance prior to the start of the 2021-22 academic year.

Secondary outcomes

Child Self-Regulation and Social Behaviour Questionnaire

The CSBQ developed by Howard & Melhuish (2017) will be implemented to collect data on children's (1) self-regulation, that is a child's ability to control their own thoughts, behaviour, reactions, and interactions, and (2) PSED overall. The CSBQ is a 34-item questionnaire pertaining to children's everyday behaviours related to social and emotional development and self-regulation. The CSBQ yields seven subscales that all contain at least five items:

1. Cognitive self-regulation (items 5, 6, 8, 12, 18)
2. Emotional self-regulation (items 2, 10, 11, 14, 23, 26)
3. Behavioural self-regulation (items 7, 13, 15, 29, 30, 31)
4. Sociability (items 1, 4, 9, 16, 22, 27, 32)
5. Prosocial behaviour e.g., sharing, showing empathy (items 15, 19, 24, 27, 30)
6. Externalising problems e.g., being antisocial (items 3, 20, 23, 26, 28)
7. Internalising problems e.g., being anxious or depressed (items 17, 21, 25, 33, 34)

For each item, the respondent is asked to evaluate the child's frequency of target behaviours on a five-point scale (1 = 'not true' to 3= 'partly true' to 5 = 'very true') and it takes around 5 minutes to complete per child. The items are either positively worded, e.g., "persists with difficult tasks" and "chooses activities on their own", or negatively worded, e.g., "Regularly unable to sustain attention" and "Not able to sit still when necessary". The items are scored whereby the higher the child score on these scales, the more they show these behaviours. For subscales 1-5, scores on negatively-worded items are reversed prior to analysis. For subscales 6-7, negatively-worded items are not reversed before analysis, therefore the higher the children score on these scales, the more they show Externalising and Internalising Problems. The seven subscale scores are obtained by taking the average of the component item scores (first reversing any relevant score). Higher scores for all subscales indicate a more favourable outcome. Cronbach's alphas for each subscale are as follows: sociability = 0.74, internalizing = 0.78, emotional self-regulation = 0.83, cognitive self-regulation = 0.87, externalizing = 0.88, prosocial = 0.89, and behavioural self-regulation = 0.89. The CSBQ subscales have internal consistency ranging from 0.74 to 0.89, and concurrent validity in the range of 0.48 to 0.81 (Howard and Melhuish 2017).

To assess self-regulation, we shall use a single overall index of children's self-regulatory capacities that represent the mean of the CSBQ's three subscales of cognitive self-regulation, emotional self-regulation, and behavioural self-regulation.

To assess PSED, we will consider each of the seven CSBQ subscales separately.

For Cohort 1, we will ask teachers to complete the CSBQ at the start and end academic year 2021 (October-November 2021 and June-July 2022) and again with the same children at the end of Y1 (June-July 2023). We will also ask the participating YR teacher to complete the CSBQ at the beginning and at the end of the academic year for relevant children in their 2022-2023 cohort (Cohort 2). Nominated teachers will be asked to complete the CSBQ for a minimum of 15 participating children within each cohort (who have/will complete the BAS3 ENC) at the specified time-points throughout the trial. The evaluation team will securely provide teachers with a list of the participating children for whom they should complete the CSBQ. Where possible, we would like teachers to complete the CSBQ for all participating children, and not just the ones that were assessed for BAS3 ENC. Some teachers may be requested to complete the CSBQ for >15 children if they return the CSBQ results prior to

BAS3 ENC; this will ensure CSBQ data is available for all children who complete the BAS3 ENC. Teachers will be requested to complete and securely return the CSBQ data electronically; however, teachers can request to complete CSBQ on paper if it proves to be more convenient and the evaluation team will arrange for a courier to collect and return the paper questionnaires to York Trials Unit.

Early Years Foundation Stage Profile

The EYFSP is an observational measure completed by teachers when children are in the Summer term of YR (Standards and Testing Agency, 2018). Relevant EYFSP data will be collected from the National Pupil Database (NPD), via the Office for National Statistics Secure Research Service (ONS SRS). Schools and parents/carers are made aware about this data 'matching' in the MOU and PIS. The EYFSP measures 17 ELGs whereby the teacher assigns the child as being 'emerging' or 'expected' for each (DfE 2020). It should be noted that the EYFSP is currently undergoing revision, with the aim for schools to use the new framework on a statutory basis from September 2021 (i.e., the year the effectiveness trial cohort will be recruited; Department for Education, 2019c). This analysis will align to the EYFSP content at the time, however the ELGs of interest are noted below from current published guidance (DfE 2020).

Mathematics Early Learning Goals

Number: "Children at the expected level of development will: have a deep understanding of number to 10, including the composition of each number; subitise (recognise quantities without counting) up to 5; and automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts" (DfE 2020, - p14).

Numerical Patterns: "Children at the expected level of development will: verbally count beyond 20, recognising the pattern of the counting system; compare quantities up to 10 in different contexts, recognising when one quantity is greater than, less than or the same as the other quantity; and explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally" (DfE 2020, - p14).

ELG Number and Numerical Patterns will be combined and analysed as a categorically outcome (expected level met for both ELGs).

Self-Regulation Early Learning Goal

Self-Regulation: "Children at the expected level of development will: show an understanding of their own feelings and those of others, and begin to regulate their behaviour accordingly; set and work towards simple goals, being able to wait for what they want and control their immediate impulses when appropriate; and give focused attention to what the teacher says, responding appropriately even when engaged in activity, and show an ability to follow instructions involving several ideas or actions" (DfE 2020, - p12).

The outcome will be analysed as a categorical variable.

Personal, Social and Emotional Development Early Learning Goals

Self-Regulation: "Children at the expected level of development will: show an understanding of their own feelings and those of others, and begin to regulate their behaviour accordingly;

set and work towards simple goals, being able to wait for what they want and control their immediate impulses when appropriate; and give focused attention to what the teacher says, responding appropriately even when engaged in activity, and show an ability to follow instructions involving several ideas or actions" (DfE 2020, - p12).

Managing Self: "Children at the expected level of development will: be confident to try new activities and show independence, resilience and perseverance in the face of challenge; explain the reasons for rules, know right from wrong and try to behave accordingly; and manage their own basic hygiene and personal needs, including dressing, going to the toilet and understanding the importance of healthy food choices" (DfE 2020, - p12).

Building Relationships: "Children at the expected level of development will: work and play cooperatively and take turns with others; form positive attachments to adults and friendships with peers; and show sensitivity to their own and to others' needs" (DfE 2020, - p12).

ELGs Self-Regulation, Managing Self and Building Relationships will be combined and analysed as a categorically outcome (expected level met for all 3 ELGs).

General Attainment/Development

Additionally, the current EYFSP provides a general measure of good development (at this point in time it is unclear whether this measure will be available in the new statutory framework). This is defined in the EYFSP 2019 handbook as: "*Children are defined as having reached a good level of development at the end of the EYFS in the reception year if they have achieved at least the expected level for the ELGs in: the prime areas of learning – personal, social and emotional development, physical development, and communication and language; and the specific areas of mathematics and literacy*". (DfE 2019, - p27).

The outcome will be analysed as a categorical variable.

We will also consider the average total point score for the 17 ELGs, each assigned a score of 1 for Emerging and 2 for Expected.

Teacher confidence: Maths

Teacher confidence (in teaching children maths)will be assessed using an adapted short survey 'Early Math Beliefs and Confidence Survey' by Chen *et al.* (2014). Increasing teacher's confidence in teaching maths is a key focus of the TEEMUP PD. We will request for the survey to be completed by all nominated R and Yr1 teachers in each school. The survey will be completed at baseline in September/October 2021, in June/July 2022, and in June/July 2023. The original survey consists of three subscales: Beliefs about Children Aged 4-6 and Maths (5 items); Confidence in Helping Children Aged 4-6 Learn Maths (11 items); and Confidence in Own Maths Abilities (9 items). However only the second subscale: Confidence in Helping Children Aged 4-6 Learn Maths (11 items) will be used. Teachers will be asked to rate their agreement with each item on a Likert scale, from strongly disagree to strongly agree. Each item is scored from 1 to 5.Scores for items in the subscale will be summed to produce a summary score (Confidence in Helping Children Aged 4-6 Learn Maths: scored from 11 to 55).

Compliance

All elements of compliance and fidelity will be collected and summarised as part of the IPE. As part of the impact evaluation, there will be a Complier Average Causal Effect (CACE)

analysis (Dunn, Maracy and Tomenson, 2005; Hewitt *et al*. 2006), conducted on the primary outcome of maths attainment on Cohort 1 and Cohort 2. These CACE analyses will aim to obtain a treatment effect estimate among 'compliers', which may differ from the primary, intention to treat analysis.

Current EEF guidance for IPE evaluations (Education Endowment Foundation, 2019) defines compliance and fidelity in the following way:

- Compliance: the extent to which the critical ingredients of the intervention are delivered to and/ or received by the target participants.
- Fidelity: the degree to which the intervention is delivered as intended or prescribed

For the purposes of defining 'compilers', in this particular trial, we are not differentiating between compliance and fidelity, but seeking to capture information on both compliance and fidelity within one measure. Other elements of the IPE will seek to comment on and explore compliance and fidelity as separate constructs where possible.

We have therefore outlined a clear and measurable definition that can be used to classify schools (or teachers) as 'compliers', or otherwise. This is based on the components of the intervention as outlined in the logic model. The measure of compliance must be such that we are confident it can be obtained for every intervention school. As suggested by the EEF analysis guidance, we propose to define two thresholds for compliance to conduct two CACE analyses for **good** compliance, and **at least minimal** compliance.

The intended duration of intervention is 16 months. This will start on the day the delivery team make contact to begin the TEEMUP PD programme and end when final outcome assessment occurs, or when the school expresses a desire to no longer implement/engage with the TEEMUP PD programme or when the delivery team withdraw their support, whichever is sooner. During this active implementation period the DT expect evidence of the 'core' elements of the TEEMUP PD programme to be completed/implemented.

Cohort 1:

Compliance will be measured at the school-level, since the impact of the intervention will depend on engagement of both the Reception and Year 1 teachers that the children in Cohort 1 have been taught by. Each teacher in the intervention arm will be assessed for their compliance with the intervention.

A school will be classed as having good compliance if they fulfil all of the following core criteria in Table 5.

Table 5: Cohort 1 CACE analysis GOOD compliance 'core' criteria

GOOD compliance 'core' criteria	Data collection by/from
TEEMUP trained YR and Y1 teachers complete 7 of the first 9 core training sessions, at least by watching recorded sessions. (NB. Attendance/watching final half day session is not required for compliance), and the TEEMUP trained YR teacher/s remains at the school and teaching Reception during the majority (>50%) of the 2021/2022 academic year and TEEMUP trained Y1 teacher/s remains at the school and teaching Y1 for the majority (>50%) of the 2022/2023 academic year.	Attendance at training collected by DT (Delivery Team) via attendance registers/training completion records for each school and shared with ET.

	Teachers and teacher changes collected by ET (Evaluation Team) directly from schools at the end of each academic year, and by DT through PD. Lists shared and cross referenced between the two teams.
The school hosts 3 face to face visits from a mentor/coach, at least 2 of which teachers should be well prepared for (DT will define 'preparedness', which will consist of two elements: Ensuring there is time during the meeting to 1. review existing change plans and write/agree new ones; and 2. gather evidence of changes made relating to previous agreed actions and/or TEEMUP PD.	Collected by DT mentor records for each school and shared with ET
A minimum of 8 school logins to the online knowledge base over the course of the whole intervention period.	Automated data held by DT team shared with ET or self-reported data from teachers collected by DT and shared with ET.
>75% or at least 15 children, whichever is lower (e.g. 12 or more of 15, and 15 or more of 22) of children in the evaluation (Cohort 1 Reception children for whom a baseline BAS3 ENC assessment was conducted) move to a Year 1 class being taught maths by a TEEMUP trained Y1 teacher in the 2022/2023 academic year.	ET
The school's TEEMUP mentor considers the school to have been 'good' compliers, i.e. the school can provide sufficient evidence of change in practice resulting from TEEMUP training/resources. The mentors will assess evidence of change in practice on a scale of 0-3 with 0=no change, 1=minimal change, 2=good change, and 3=excellent change. A school must score at least 2 to be classed as a good complier.	Collected by DT mentor records for each school and shared with ET

A school will be classed as having **at least minimal compliance** if they fulfil all of the following criteria detailed in Table 6.

Table 6: Cohort 1 CACE analysis MINIMAL compliance criteria

MINIMAL compliance criteria	Data collection by/from
TEEMUP trained YR and Y1 teachers complete 5 of the first 9 core training sessions, at least by watching recorded sessions. (NB. attendance/watching final half day session is not required for compliance) and a TEEMUP trained Y1 teacher/s remains at the school and teaching Y1 for the majority (>50%) of the 2022/2023 academic year.	Attendance at training collected by DT (Delivery Team) via attendance registers/training completion records for each school and shared with ET. Teachers and teacher changes collected by ET (Evaluation Team) directly from schools at

	the end of each academic year, and by DT through PD. Lists shared and cross referenced between the two teams
The school hosts 2 face to face visits from a mentor/coach, at least 1 of which teachers should be well prepare for (DT will define 'preparedness' which may include class cover arranged, an appropriate meeting place organised, read through questions provided by DT prior to meeting and prepared to answer them).	Collected by DT mentor records for each school and shared with ET
A minimum of 4 school log-ins to the online knowledge base over the course of the whole intervention period.	Automated data held by DT team shared with ET or self-reported data from teachers collected by DT and shared with ET.
>50% or at least 11 children, whichever is lower (e.g. 8 of 15 children, or 11 of 22) of children in the evaluation (Cohort 1 YR children for whom a baseline BAS3 ENC assessment was conducted) move to a Y1 class being taught maths by a TEEMUP trained Y1 teacher in the 2022/2023 academic year.	ET

Cohort 2:

Compliance will be measured primarily at the teacher-level, since the impact of the intervention will depend on engagement of the Reception teacher only for Cohort 2. Each Reception teacher in the intervention arm will be assessed for their compliance with the intervention.

A YR teacher will be classed as having good compliance if they fulfil all of the core criteria in Table 7 and the school's TEEMUP mentor considers the school to have been at least 'good' compliers, i.e. the school can provide sufficient evidence of change in practice resulting from TEEMUP training/resources.

Table 7: Cohort 2 CACE analysis GOOD compliance 'core' criteria

GOOD compliance criteria 'core' criteria	Data collection by/from
TEEMUP trained YR teacher/s completes 7 of the first 9 core training sessions, at least by watching recorded sessions. (NB. attendance/watching final half day session is not required for compliance) and the TEEMUP trained YR teacher/s remains at the school and teaching Reception for the majority (>50%) of the 2022/2023 academic year.	Attendance at training collected by DT via attendance registers/training completion records for each school and shared with ET Teachers and teacher changes collected by ET directly from schools at the end of each academic year,

	and by DT through PD. Lists shared and cross referenced between the two teams
The school hosts 3 face to face visits from a mentor/coach, at least 2 of which the YR teacher should be well prepared for (DT will define 'preparedness' which may include class cover arranged, an appropriate meeting place organised, read through questions provided by DT prior to meeting and prepared to answer them). It is acceptable for these visits to be conducted with different teachers (if there is a change in YR teacher in the school between 2021/2022 and 2022/2023), provided at least 2 are conducted with a TEEMUP trained teacher.	Collected by DT mentor records for each school and shared with ET
A minimum of 8 school log-ins to the online knowledge base over the course of the whole intervention period.	Automated data held by DT team shared with ET or self-reported data from teachers collected by DT and shared with ET.
School's TEEMUP mentor considers the school to have been 'good' compliers, i.e. the school can provide sufficient evidence of change in practice resulting from TEEMUP training/resources. The mentors will assess evidence of change in practice on a scale of 0-3 with 0=no change, 1=minimal change, 2=good change, and 3=excellent change. A school must score at least 2 to be classed as a good complier.	Collected by DT mentor records for each school and shared with ET

A Reception teacher will be classed as having **at least minimal compliance** if they fulfil all of the following criteria as detailed in Table 8.

Table 8: Cohort 2 CACE analysis MINIMAL compliance criteria

MINIMAL compliance criteria	Data collection by/from
TEEMUP trained YR teacher/s completes 5 of the first 9 core training sessions, at least by watching recorded sessions. (NB. attendance/watching final half day session is not required for compliance) and the TEEMUP trained YR teacher/s remains at the school and teaching Reception for the majority (>50%) of the 2022/2023 academic year.	Attendance at training collected by DT via attendance registers/training completion records for each school and shared with ET Teachers and teacher changes collected by ET directly from schools at the end of each academic year, and by DT through PD. Lists shared and cross referenced between the two teams

The school hosts 2 face to face visits from a mentor/coach, at least 1 of which YR teacher should be well prepare for (DT will define 'preparedness' which may include class cover arranged, an appropriate meeting place organised, read through questions provided by DT prior to meeting and prepared to answer them). It is acceptable for these visits to be conducted with different teachers (if there is a change in YR teacher in the school between 2021/2022 and 2022/2023) as long as at least one of these mentor meetings is with the trained YR teacher.	Collected by DT mentor records for each school and shared with ET
A minimum of 4 school log-ins to the online knowledge base over the course of the whole intervention period.	Automated data held by DT team shared with ET [RL4] or self-reported data from teachers collected by DT and shared with ET.

Analysis

Analysis will follow the EEF's (2018) most recent guidance and will be detailed in a Statistical Analysis Plan (SAP), produced within three months of randomisation of schools. A summary of the proposed analyses is presented below. The trial statistician will not be blind to group allocation.

Analyses and summaries will be presented separately for the two cohorts. All analyses will be conducted on an intention to treat basis, using two-sided significance at the 5% statistical level. A CONSORT diagram will be produced to show the flow of schools and children through the trial.

The number of children identified as eligible for the evaluation, and the numbers actually assessed at baseline and post-test will be reported with reasons for non-participation given where available. School, teacher, and child-level baseline data will be summarised by arm and presented descriptively, as randomised, and as included in the primary analysis (if different). No formal comparison of the baseline data will be undertaken, except for a comparison of the difference in prior attainment (BAS3 ENC and CSBQ scores, as appropriate) between the groups, reported as the Hedge's g effect size, with a 95% confidence interval (CI). All outcome data will be summarised descriptively by trial arm for each assessment point. Effect sizes based on the adjusted difference between the groups at the outcome assessment point will be presented as Hedges' g for continuous outcomes, and risk ratios for dichotomous outcomes, with their associated 95% CI and p-value.

Cohort 1

BAS3 ENC

The correlation between baseline and outcome BAS3 ENC scores will be presented. The observed ICC for BAS3 ENC scores associated with school (both baseline and outcome assessment) will be presented with a 95% CI.

Maths attainment for children in the intervention group and those in the control group will be compared using a mixed effects linear regression model at the child-level. Group allocation, baseline BAS3 ENC score, and the minimisation factors (geographical location of school, FSM and EAL) will be included as fixed effects in the model, and school as a random effect. Whilst FSM and EAL will be used as aggregate measures at the school level in the minimisation, we shall include pupil level indicators of FSM and EAL in the analysis model, since these are more granular measures and so likely to correlate better with the outcome than the school-level data.

Subgroup analyses looking at FSM eligibility will be considered (for example based on individual pupils eligible for FSM and/or based on schools with high percentages of children eligible for FSM) and detailed in the SAP. Gender will be explored using subgroup analysis as there are differences in maths attainment between genders during the early years, with a higher proportion of girls achieving the expected level of development in mathematics than boys (Department for Education, 2019b). It is best practice to keep subgroup analyses to a minimum but we will consider whether conducting a sub group analysis of schools taking/not taking part in the National Centre for Excellence in the Teaching of Mathematics (NCETM) Maths Hubs Programme may be useful and justifiable, this will be detailed in the SAP.

A CACE analysis will be considered to account for compliance/engagement of the nurseries with the intervention. Two CACE analyses (Dunn, Maracy and Tomenson, 2005) for the primary outcome only will be conducted defining compliance of the schools as a dichotomous variable in the two ways described above. CACE analyses will be conducted at the pupil-level. These analyses will use a Two Stage Least Square (2SLS) approach with group allocation as the instrumental variable for the compliance indicator. Results for the first stage (which predicts the compliance indicator using the treatment allocation as instrumental variable alongside all other covariates included in the second stage) will be reported alongside i) the correlation between the instrument and the endogenous variable; and, ii) a F test.

CSBQ

CSBQ scores will be analysed via a mixed effects linear regression model incorporating both outcome time points for each child, adjusting for baseline CSBQ, location, FSM and EAL indicators, group allocation, time, and group by time interaction as fixed effects, and school and child as random effects to account for the repeated measures over time.

EYFSP

Categorical measures will be compared using a mixed effects logistic regression model at the child-level. Group allocation, baseline BAS3 ENC score, location, FSM and EAL will be included as fixed effects in the model, and school as a random effect. The continuous measure will be analysed as for the BAS3 ENC.

Cohort 2

BAS3 ENC

Individual baseline BAS3 ENC scores will not be available for Cohort 2. Therefore, we will consider the use of a lagged school-level measure of prior attainment for these children as follows. We will calculate the mean baseline BAS3 ENC score per school from Cohort 1 and calculate the correlation between this and the outcome for Cohort 2. We will conduct analyses

with and without including this measure as a school-level covariate in the analysis for Cohort 2.

The observed ICC for BAS3 ENC scores associated with school (outcome assessment only) will be presented with a 95% CI.

Maths attainment for children in the intervention group and those in the control group will be compared using a mixed effects linear regression model at the child-level. Group allocation, baseline BAS3 ENC score (school-level mean from previous year group), location, FSM and EAL will be included as fixed effects in the model, and school as a random effect. This analysis will be repeated omitting the BAS3 covariate.

Gender will be explored using subgroup analysis as there are differences in maths attainment between genders during the early years, with a higher proportion of girls achieving the expected level of development in mathematics than boys (Department for Education, 2019b). Any additional subgroup analyses will be detailed in the SAP.

A CACE analysis will be considered to account for compliance/engagement of the nurseries with the intervention. Two CACE analyses (Dunn, Maracy and Tomenson, 2005) for the primary outcome only will be conducted defining compliance of the schools as a dichotomous variable in the two ways described above. These analyses will use a Two Stage Least Square (2SLS) approach with group allocation as the instrumental variable for the compliance indicator. Results for the first stage (which predicts the compliance indicator using the treatment allocation as instrumental variable alongside all other covariates included in the second stage) will be reported alongside i) the correlation between the instrument and the endogenous variable; and, ii) a F test.

CSBQ

CSBQ scores will be analysed via a mixed effects linear regression model adjusting for baseline CSBQ, location, FSM and EAL as fixed effects, and school as a random effect.

EYFSP

Categorical measures will be compared using a mixed effects logistic regression model at the child-level. Group allocation, baseline BAS3 ENC score (school-level mean from previous year group), location, FSM and EAL will be included as fixed effects in the model, and school as a random effect. The continuous measure will be analysed as for the BAS3 ENC. This analysis will be repeated omitting the BAS3 covariate.

Teachers

Teacher confidence: maths Survey

Responses to items in the confidence survey will be summarised descriptively by trial arm. The summary score will be compared between the two arms using a separate mixed effects linear regression model, adjusting for the school level minimisation factors and pertinent teacher level factors as fixed effects, and school as a random effect.

Implementation and process evaluation

The implementation and process evaluation (IPE) will follow the EEF principles and guidance for undertaking process evaluations (Humphrey *et al.*, 2016; Education Endowment Foundation, 2019). The primary aims will be to evaluate fidelity of

implementation, facilitators and/or barriers to implementation, as well as to gather key stakeholders' perceptions of the intervention. The IPE will explore the programme theory and relationships between different components of the logic model with an aim to test its causal assumptions and inform intervention scale-up. This IPE will complement the impact evaluation by *explaining* any observed effect of the TEEMUP PD intervention on children's maths outcomes.

Research questions

The purpose of the IPE is to address the following questions:

1. Is fidelity to the TEEMUP PD being observed?

    1.1 Are participating teachers attending/accessing the available training?

    1.2 Are the different components of the TEEMUP PD materials and resources (e.g. reflective self-assessment scales, planning framework, use of formative assessments) being used as expected?

    1.3 Are participating schools engaging with the school's allocated TEEMUP PD mentor as expected?

    1.4 What are the barriers and/or facilitators to teachers engaging with the TEEMUP PD training and the mentor?

    1.5 What constitutes necessary conditions (enabling factors) for participating teachers and schools to engage with the intervention as intended?

    1.3 Do outcomes vary in line with compliance?

2. To what extent is the TEEMUP PD implemented as planned within schools?

    2.1 To what extent do teachers implement the TEEMUP PD in their teaching practice?

    2.2 Have teachers adapted the intervention to make it more suitable for them, if so, how?

    2.2 What are the facilitators and/or barriers to teachers implementing the TEEMUP PD?

    2.3 What are the necessary conditions for teachers to implement TEEMUP PD into practice?

3. What are different stakeholder viewpoints of the TEEMUP PD?

    3.1 What are teachers' perceptions on the usefulness and quality of the intervention as a whole and its components e.g., training, mentor support/visits, maths practice and BfL scales, resources/materials?

    3.2 What is the perceived impact of the TEEMUP PD on teacher's maths practice, teachers confidence in teaching children maths, and teachers confidence in their own maths abilities?

    3.3 What is the perceived impact of the TEEMUP PD on children's maths outcomes and self-regulation? Are there any perceived differential intervention benefits among disadvantaged children?

3.4 How can the TEEMUP PD programme be improved?

3.5 What is the perceived impact of the TEEMUP PD on teachers' practice and confidence in relation to children's self-regulation?

4. What is 'usual practice' in all schools and has this changed in schools that have received the intervention?

4.1 What is teacher's usual maths practice and has this changed in schools after receiving the TEEMUP PD?

4.2 How do teachers usually engage with children's families and the home learning environment and has this changed as a result of the TEEMUP PD?

4.3 How, if at all, do teachers work collaboratively within and across schools, and has this changed as a result of the TEEMUP PD?

4.4. How frequently, if at all, do teachers use formative feedback within their usual practice, and has this changed in schools that received the TEEMUP PD?

4.5 How frequently, if at all, do teachers use specific tools to reflect on their practice, and has this changed in schools that received the TEEMUP PD?

4.6 What is usual practice in relation to the transition between YR and Y1, and has this changed in schools that received the TEEMUP PD?

5. To what extent does the TEEMUP impact evaluation adhere to the proposed plan?

5.1 Does the child recruitment and assessment process adhere to the plans proposed in the protocol?

5.2. Any there any sample attrition effects? If so, how might that affect the estimates of the impact of the TEEMUP PD?

6. Is each stage of the intervention logic model supported by evidence and learning from the IPE?

6.1 On review, after experience of PD delivery, do the delivery team consider any changes to the logic model necessary?

7. What can be learned from the efficacy trial to inform an effectiveness trial?

Process evaluation methods

Usual practice surveys

All participating schools will be requested to complete surveys to capture usual practice at baseline (Autumn term 2021), mid-implementation (Autumn term 2022), and at the end of the trial (Summer term 2023). The surveys will be used to establish baseline practices and monitor schools over the duration of the trial to determine whether any changes to practice were made in control schools which may influence maths teaching and learning in YR and Y1, and to identify any unplanned changes to teaching personnel within YR and Y1. The head teacher/a member of SMT (someone who has an oversight of maths teaching/professional development across the school) and the nominated YR and Y1 teachers will be requested to complete the surveys. Surveys will be delivered via Qualtrics online survey software, with a paper version available on request.

Observations of TEEMUP PD training sessions

Observations of the face-to-face TEEMUP PD training session will allow the ET to gain an in-depth understanding of the intervention. They also offer the opportunity to conduct light-touch face-to-face interviews with: (1) participating YR and Y1 teachers and senior management to gauge perspective of engagement, responsiveness and quality of the PD, and inform fidelity, and (2) the delivery team to gain their feedback and reflections on delivery methods and materials. The ET will take notes during their observations which will provide important conceptual background information and enable them to capture important processes and insights into how the day ran. ET notes will be typed up as soon as possible after observation and included in the qualitative analysis. The ET plan to observe the following TEEMUP PD training:

- Full day Sessions 1 and 2 (scheduled for Spring 2022)
- Half-day Session 9 (scheduled for Spring 2022)
- Half-day Session 10 (scheduled for Summer 2023)

Case studies

Case studies will be conducted with a total of *n*=7 intervention schools. The case studies are scheduled to take place at various points throughout the trial and will involve semi-structured interviews with key school-based stakeholders e.g., nominated YR and Y1 teachers, non-participating YR and Y1 teachers and teaching assistants, a member of senior management, and their allocated TEEMUP PD mentor. For each case study site, we will also observe one in-school mentoring session (where possible we will try to coincide this in-school observation with an interview time-point). Interviews will be conducted at various time points throughout the two-year trial which we describe further below. Interviews will be conducted face to face or virtually, either via Zoom or over the telephone. If the evaluation team are not able to physically access a case site at an interview time points, data collection will be undertaken virtually so as not to cause delays. Informed consent will be sought from all participants prior to the interview at each time point. Topic guides for the interviews will be developed in line with key research questions and through reading relevant literature surrounding IPE, professional development and maths interventions, and discussions between the evaluation team and delivery team. We will undertake two types of case studies, longitudinal and 'by compliance'.

- **Longitudinal**: The purpose of the longitudinal case studies will be to follow a number of schools for the entirety of the TEEMUP PD journey. Carefully selected interview time-points offer opportunities for stakeholders to regularly reflect and feedback on the delivery of the TEEMUP PD, to chronologically capture any barriers, facilitators and adaptations during implementation, changes to usual practice, perceived impact, suggested improvements to the intervention. A total of *n*=4 intervention schools will be purposively selected based on the percentage of pupils within the school in receipt of FSM. Two schools will be randomly selected from those who have low-medium rates of FSM (0%-18%) and two schools will be randomly selected from those who have high rates of FSM (above 18%). The schools will be selected at the beginning of the trial and followed longitudinally throughout the full two years of programme delivery. These schools will be replaced if drop-out occurs with a willing school(s) of with similar FSM characteristics. These schools will be interviewed at four time points over the duration of the trial as follows.

(1) Spring term 2022. The focus of these interviews will include (but not be limited to): exploring teacher's usual practice; gauging teacher's experience of the PD training to date including the barriers, facilitators and costs relating to attendance; perceptions on the usefulness and quality of the training; teachers experiences of the evaluation, including the parent/carer pupil withdrawal process and baseline assessments for YR (cohort 1).

(2) Autumn term 2022. The focus of these interviews will include (but not be limited to): understanding teacher's plans (if any) for integrating the TEEMUP PD into their practice for the upcoming academic year and explore any facilitators and barriers to implementing the TEEMUP PD within practice; planned engagement with the school's allocated mentor; exploring any changes to teacher's usual practice in relation to the YR to Y1 transition; gauging teacher's experience of the pupil withdrawal process for YR (cohort 2); and collecting relevant cost data.

(3) Spring 2023. The focus of these interviews will include (but not be limited to); exploring engagement with and the usefulness/quality of mentor support/visits; gauging fidelity and implementation of TEEMUP PD resources/materials/mentor within the teacher's practice and associated barriers, facilitators and adaptations; any changes to teacher's usual practice; and collection of relevant cost data.

(4) Summer term 2023. The focus of these will include (but not be limited to): the usefulness and quality of final TEEMUP PD training session; final reflections on the intervention in its entirety and identification of any improvements that could be made to the TEEMUP PD that would facilitate high fidelity and implementation; exploring any changes to usual practice, particularly those that will be continued beyond the context of the trial; capturing stakeholders perceptions of any perceived impact of the intervention on children's outcomes; understanding experiences relating to the pupil post-testing period (Cohort 1 and 2); and the collection of relevant cost data.

- **By compliance:** The purpose of the 'by compliance' case studies are to help unpick what the necessary conditions (enabling factors) are for participating teachers and schools to engage with and implement the intervention as intended, and understand how compliance may impact on outcomes. Three schools will be identified using the CACE criteria available at the end of academic year 2021-22 to participate in interviews during Autumn term 2022 and Summer term 2023. Using the CACE criteria, two schools will be chosen at random from the pool of schools who identified as having 'good' compliance with the TEEMUP PD, to provide examples of 'best practice', and one school will be chosen at random from the pool of schools where the criteria indicate they have not had 'good' compliance with the TEEMUP PD. These schools will be replaced if drop-out occurs with a school of similar compliance rating. Below we briefly describe the focus of the interviews at each time-point.

  (1) Autumn term 2022 interviews will explore: teachers' experience of and reflections on the TEEMUP PD training including the barriers and facilitators to attendance; previous and planned engagement with the mentor support/visit; plans for implementing TEEMUP into future practice (e.g. the any learnings from

training and other components); the support for TEEMUP PD within the wider school context.

(2) Summer term 2023 interviews will explore: stakeholder's final reflections of the intervention in its entirety and identification of the barriers and facilitators that have enabled/would enable schools to deliver and implement the TEEMUP PD with high fidelity; any changes to practice; stakeholders perceived impact of the TEEMUP PD; improvements to the TEEMUP PD; experiences relating to the evaluation elements of the trial.

Surveys (intervention delivery)

All participating YR and Y1 teachers whose schools have been randomly allocated to receive the intervention will be requested to complete a questionnaire at two-time points; Summer term 2022 and Summer term 2023. The questionnaires will complement the in-depth interview data (listed above) and aim to gauge fidelity and implementation including barriers and facilitators to engaging with and delivering the intervention, stakeholders viewpoints on the usefulness and quality of the TEEMUP PD, any perceived impact(s) of the intervention, and any changes to usual teaching practice resulting from receiving the TEEMUP PD. Questionnaires will be delivered via Qualtrics online survey software with a paper version available on request.

Monitoring data

The following monitoring data will be collected by the delivery team through administrative records and in-school mentor visits and shared with the evaluation team:

- Completion of teacher training workshop (whether face-to-face, online catch-up or absent)
- Frequency of 'core' and adhoc mentor sessions and additional support
- Number of log-ins to the online learning platform
- Evidence of changes to teaching including use of formative assessment processes and/or developmental progressions
- Use of maths practice scale, the BfL scale, website materials, home learning materials
- Evidence of nominated YR and Y1 teaching working together.

Child recruitment rate and child assessment completion rates will be recorded by the evaluation team.

These monitoring data will be descriptively summarised as part of the IPE, and also incorporated into the CACE analysis (where appropriate).

Interviews with the delivery team

In-depth semi-structured interviews with the delivery team will be conducted at two-time points, (1) Summer term 22 (mid-implementation), and (2) Summer term 23 (post-implementation). Within the interview the delivery team will be asked to discuss further development of/changes to the TEEMUP PD, perceived impact, implementation fidelity including barriers, future plans for the TEEMUP PD, lessons learnt that can inform an effectiveness trial and a review of the logic model. Informed consent will be sought from all participants prior to the interview.

Table 9: IPE design and methods of data collection and analysis overview

Research Methods	Data collection methods	Participants/data sources (type/number)	Data analysis	RQs	Implementation/logic model relevance
Usual Practice surveys	Online questionnaires (paper where needed)	Staff member with oversight of maths teaching and CPD plans All intervention and control schools	Descriptive statistics; content analysis	RQ4	Usual practice; monitoring practice
Observations	Observation notes; unstructured and semi-structured light-touch interviews	PD training sessions; attending YR/Y1 teachers and senior management; the delivery team Session 1, 2, 7 and 8	Inductive coding; thematic analysis; cross-case analysis	RQ1, RQ2, RQ3, RQ7	Understand delivery and the intervention; Inform fidelity, gauge perspectives of quality from participants (light-touch interviews), participant responsiveness, DT review of materials
Case Studies	Semi-structured interviews	E.g. participating and non-participating YR/Y1 teachers and teaching assistants; senior management; school's allocated TEEMUP PD mentor *Total schools n*=7 (*n*=4 longitudinal; *n*=3 by compliance_	Inductive coding; thematic analysis	RQ1, RQ2, RQ3, RQ4, RQ6, RQ7	stakeholders' viewpoints on the intervention, fidelity, implementation, programme adaptations, differentiation and barriers/facilitators to implementation, understand how on-treatment status may impact on outcomes; understanding any transfer of learning to HLE, collection of cost data
	Observations notes	Observation of in-school mentoring session involving mentor and relevant teachers *Total schools n*=7	Cross-case analysis	RQ1, RQ2, RQ3, RQ4	
Surveys [intervention delivery]	Online questionnaires, (paper where needed)	All nominated YR/Y1 in all intervention schools	Descriptive statistics; content analysis	RQ1, RQ2, RQ3, RQ4	Gather stakeholders' viewpoints on the intervention programme adaptations, differentiation and barriers/facilitators to implementation, understanding any transfer of learning to HLE, collection of cost data, usual practice (where applicable)
Monitoring data	Training attendance registers, mentor visit logs,	All intervention; control schools where relevant	Descriptive statistics; cross-case analysis	RQ1, RQ2, RQ5, RQ7	Fidelity, Participant responsiveness, Dosage

	mentor proformas, website analytics, trial recruitment and attrition rates				
Interviews	Semi-structured	Delivery team	Inductive coding; thematic analysis	RQ1, RQ2, RQ6, RQ7	Delivery, implementation, perceived impact, including actual barriers to and facilitators of delivery/implementation, future plans, adaptation of the programme, readiness for effectiveness trial, validation of logic model

Analysis

With permission from participants, all interviews will be audio-recorded and transcribed verbatim. Data organisation will be facilitated through the use of NVIVO. For case studies, each school will be treated as a case site and a pen portrait will be created to provide an overview of usual practice, delivery, fidelity, implementation, adaptations, barriers/facilitators etc.

To achieve a systematic approach to data analysis, all interviews will be analysed thematically following the stages outlined by Braun and Clarke (2006): detailed familiarisation; generating initial codes; searching for themes; reviewing themes; defining and naming themes and data reporting. We anticipate that initially we will analyse the transcripts inductively to develop a broad coding framework. Although the development of the coding framework will be iterative and refined throughout analysis, it will be used as a framework around which to code the remaining transcripts.

Surveys will be analysed using content analysis, descriptive statistics will also be presented.

Results from all IPE data collection methods (observations, interviews surveys, monitoring data) will be synthesised from the themes and presented as answers to the IPE research questions. Cross-case analysis will describe themes, similarities, and differences found within case study interviews and results will be presented where appropriate. Findings from the IPE will be used to explore the programme theory and relationships between different components of the logic model with an aim to test its causal assumptions and inform intervention scale-up. The IPE findings will help *explain* any observed effect of the TEEMUP PD intervention on children's maths outcomes.

Cost evaluation

The cost evaluation will follow the most recent guidance from the EEF.

All cost analyses will be conducted from the perspective of Education services (i.e., schools). The analysis will take a bottom-up costing approach to account for the individual costs of each constituent component of the TEEMUP PD programme at all stages.

The primary sources of cost are expected to be staff costs and the cost of resources, though there may be other costs such as travel expenses to attend training. These will be incurred at two key time points specifically, at training and during implementation.

The costs will be broadly classified into three main categories as follows:

- Pre-requisites – this will include cost items already accessible to school staff such as computers and physical space.
- Start-up costs – this will include the necessary components required to start the programme such as training costs.
- Recurring costs – this will include resources required for each year of the programme for example any printouts.

Cost data will be collected from relevant staff members by the evaluation team at different time-points throughout the trial. The collection of this data will be integrated into the IPE data collection methods. All nominated YR and Y1 teachers will be asked about specific cost-related data within the:

- Summer 2022 intervention delivery survey - this survey will capture the amount of time (staff working hours) spent completing the relevant training components of the programme, any start-up, prerequisites costs (e.g., computer or internet connectivity), unexpected or hidden costs associated with training. This will also capture any costs associated with the provision of cover staff.
- Summer 2023 intervention delivery survey- these surveys will capture the amount of time (staff working hours) involved in continuing to deliver the programme (e.g., the time spent accessing the website, liaising with the school's dedicated mentor and facilitating the mentor sessions; planning to implement core resources into practice), any recurring implementation costs (e.g., materials, print outs, resources), unexpected or hidden costs.

In addition to collecting data via surveys, in-depth cost data will be collected during case studies. Headteachers/senior management will be asked specific questions relating to the cost during interviews. This may be used to explain variations in costs between schools or to delve deeper into unexpected costs. Staff will be made aware in advance of questions relating to costs prior to interview(s) so they can prepare if necessary.

The total cost per school for a programme as implemented over three consecutive years, and the cost per-pupil-per-school-year will be presented. Costs will be estimated for the programme as it was implemented during the trial. Costs will be estimated using market values (i.e., not including any subsidies provided by the EEF for the purposes of the trial). Published unit costs will be utilised where possible, for example salary costs. Costs will be valued as per the year of analysis (expected 2023). Sensitivity analyses will be conducted to account for any uncertainty in the costing estimates. Sensitivity analyses will also be conducted to estimate the cost impact of variations to implementation delivery.

Ethics and registration

- Ethics approval has been granted from the University of York, Health Sciences Research Governance Committee on 18th November 2020 and from the University of Oxford, Department of Education Research Ethics Committee on 13th January 2020.
- A Memorandum of Understanding signed by Schools will cover the requirements of the project.

- Data Sharing Agreements will be put in place between the University of York and participating Schools.
- The trial's ISRCTN Registration Number 25478558, available to view here: https://doi.org/10.1186/ISRCTN25478558 .

Trial monitoring

Trial Management

The evaluation team will be the decision-making body who will be responsible for the day-to-day running and management of the trial. Led by the joint principal investigators (Robinson-Smith, Ainsworth, and Fairhurst) at York Trials Unit, it consists of all members of the evaluation team. The evaluation team will meet on a regular basis. Regular meetings will be held with the delivery team and representatives from the EEF as appropriate.

The trial will be sponsored by the University of York. York Trials Unit Standard Operating Procedures (SOPs) will be followed where applicable and the research team will be trained as appropriate. The University of York, for York Trials Unit, will obtain and hold public liability insurance cover for legal liabilities arising from the trial.

Child safeguarding

In the very rare circumstance that a child safeguarding issue is suspected, for example during data collection, a set procedure will be followed which will include contacting the trial principal investigators (Robinson-Smith, Ainsworth, Fairhurst). The child's school will be informed accordingly and the school's safeguarding policy and the University of York Safeguarding Policy will be followed. A detailed Study Specific Procedure will be written to detail these arrangements.

Complaints

Schools and parents/carers will be provided with the principal investigator's contact details and contact details of the Head of Department of Health Sciences (in which the York Trials Unit operates) should they wish to make a complaint about the conduct of the trial. Complaints will be dealt with by the principal investigators and the evaluation team will be informed.

Declaration of interests

The principal investigators (Robinson-Smith, Ainsworth, Fairhurst) declare no competing interests.

Access to data

The final anonymised trial dataset will be available to all evaluation and delivery team members if a formal request describing their plans is approved by the evaluation team. To ensure confidentiality, data dispersed to evaluation team members or delivery team members will be blinded of any identifying participant information.

Appropriate datasets will be provided to the EEF data archive manager and the Office for National Statistics Secure Research Service (ONS SRS) for 'matching' to NPD, archiving and long-term follow up purposes.

Publication and dissemination policy

The results of this trial will be submitted in a final report to the EEF, who will publish the report on their website. Articles for educational journals may be written and presentations given at relevant conferences. A detailed publication policy will be developed between the ET and DT.

Data protection

The University of York will be the Data Controller who also processes data. Data subjects are the participants in the evaluation, which includes children in participating Schools and staff members in Schools.

Personal data will be processed under Article 6 (1) (e) (*Processing necessary for the performance of a task carried out in the public interest*) and Special Category data under Article 9 (2) (j) (*Processing necessary for ... scientific ... research purposes)* of the General Data Protection Regulation (GDPR; 2018).

All participant data will be treated with the strictest confidence and will be stored in accordance with the GDPR. Identifiable information about participants will be shared by the evaluation team, with the DfE and ONS SRS who store all mandatory assessments children complete during their time in education within the National Pupil Database (NPD). With the information the evaluation team provides, the DfE/ONS SRS will 'match' children's details to their Early Years Foundation Stage Profile assessment (or equivalent) and provide the evaluation team with this information to conduct analyses. Further matching to the NPD and other datasets or administrative data may take place during subsequent research and/or after archiving.

At the end of the study data will be submitted to the Office for National Statistics Secure Research Service (ONS SRS) for archiving in the EEF data archive (managed by FFT Education) and will include data only individually identifiable to the Department for Education. Anonymous data may be kept indefinitely by the Evaluation Team, and will be shared with relevant researchers at the University of Oxford and potentially shared with other research teams.

Parents/carers will be informed about the research via an information sheet (Appendix F) sent on behalf of the evaluation team by Schools to parents/carers. Parents/carers will have the opportunity to withdraw their child/ren from the evaluation elements by returning a withdrawal form to their child's school. Schools will be responsible for securely storing returned withdrawal forms and ensuring withdrawn children are not included on participating lists shared with the evaluation team.

For the purposes of the research, the following details about participating children will be collected: child full name, date of birth, gender, UPN, FSM eligibility, EAL and SEN status, EYFSP (or equivalent) data, BAS3 ENC assessment, CSBQ assessment.

Schools will transfer personal data directly to York Trials Unit on an encrypted spreadsheet of participant details via the University of York's secure file transfer service (DropOff).

A unique trial identification number (Trial/Child ID) will be generated for each participant when their details are entered into the trial management system.

BAS3 ENC assessments will be recorded 'live' by RAs in survey software (Qualtrics), identified by Trial ID and DOB. A back up paper option will be available.

CSBQ assessments will be collected from teachers in survey software (Qualtrics), identified by Trial ID and DOB. A back up paper option will be available.

The trial management systems and trial data will be held on secure University of York servers with access limited to specified members of York Trials Unit staff. The dataset for statistical analysis will hold anonymised data. No Schools, staff members, or children will be identifiable in the report or dissemination of any results.

Electronic data and paper documents including identifiable personal child data will be securely archived and disposed of by York Trials Unit 5 years after the end of the study (2029). Identifiable personal data about adult data subjects (e.g., school staff) will be kept for 5 years after the end of the study (2029). Anonymised electronic data and paper documents will be kept indefinitely.

Data sharing agreements will be put in place with participating Schools before data transfer.

The University of York's data protection policy is publicly available at: https://www.york.ac.uk/records-management/dp/

Personnel

Evaluation team

Dr Lyn Robinson-Smith, York Trials Unit, University of York is a research fellow (trial manager) with experience of leading and delivering large trials, particularly in the early years. She is the joint principal investigator and will lead the IPE and have oversight of the trial. From August 2022 Lyn will lead the impact evaluation.

Hannah Ainsworth, York Trials Unit, University of York is an experienced education and health care trial manager. She is the joint principal investigator and will lead the impact evaluation and have oversight of the trial until August 2022

Professor Carole Torgerson, Department of Education, University of York is an expert in RCT design and conduct and has been the principal investigator or a co-investigator on over 25 RCTs. She will contribute to the overall design and conduct of the evaluation.

Professor David Torgerson, York Trials Unit, University of York is the Director of York Trials Unit and has worked on numerous RCTs, including many in education and the social sciences. He will support the design and conduct of the trial.

Caroline Fairhurst, York Trials Unit, University of York is a senior statistician, currently supporting a number of trials, including several EEF-funded trials, within York Trials Unit. She will contribute to the overall design, oversee the statistical aspects, and take responsibility for archiving data with the FFT. From August 2022, Caroline will be joint principal investigator having oversight of the impact evaluation and the overall trial.

Kalpita Baird (previously Joshi), York Trials Unit, University of York is a statistician, currently supporting a number of trials, within York Trials Unit. She will undertake the randomisation and statistical analysis.

Dr Katie Whiteside, York Trials Unit, University of York has worked on a number of RCTs evaluating education and health care interventions. Katie will support the trial coordinator for the evaluation, manage trial data and will contribute to writing the final report.

Dr Jess Hugill-Jones, York Trials Unit, University of York has worked on a number of RCTs evaluating education and health care interventions. She has a background in Psychology and is an experienced Primary School teacher. Jess will be a trial coordinator for the evaluation until July 2021.

Dr Heather Leggett, York Trials Unit, University of York is an applied researcher in the York Trials Unit with experience of conducting quantitative and qualitative research across a range of projects in public health and education. Heather will oversee many aspects of the IPE data collection, analysis and report writing.

Emma Standley, York Trials Unit, University of York will complete aspects of the IPE data collection, analysis and report writing.

Dr Kerry Bell, York Trials Unit, University of York is an experienced economist and trial manager with substantial experience of trials within an educational context. She will undertake the cost evaluation including the development of data collection tools and facilitate training of the BAS3 ENC with research assistants She will also contribute to the final report.

Louise Elliott, York Trials Unit, University of York has worked on a number of RCTs evaluating interventions. Louise will be a trial coordinator for the evaluation and will manage trial data until August 2022.

Rachel Carr, York Trials Unit, University of York has a background in Health Psychology and has experience in varied trials, including those involving children and parents, and health behaviours during the postpartum period. Rachel will be trial coordinator for the evaluation from August 2022, and will contribute to writing the final report.

Imogen Fountain, York Trials Unit, University of York will be a Trial Support Officer for the evaluation.

Delivery team

Professor Iram Siraj, Department of Education, University of Oxford is an expert in early childhood and primary education. She is principal investigator of the TEEMUP study and has led a number of longitudinal studies and RCTs looking at the effects of early education and interventions on long-term developmental outcomes. She leads the DT and worked on development of the TEEMUP PD, the TiDIER and Logic model and CACE analyses criteria.

Professor Edward Melhuish, Department of Education, University of Oxford is an expert on longitudinal studies, child development and evaluation of interventions. He is a co-investigator on the TEEMUP study. Previous work has included longitudinal studies, and evaluation studies that have had an impact on policy in the UK and other countries. He is a consultant to WHO, EU, OECD and several research councils internationally.

Dr Denise Kingston, Department of Education, University of Oxford is a specialist in children's development, socialisation and inclusion, with a background in educational psychology. Her current interests and research focus on effective professional development and early childhood pedagogy and practice, including early mathematics. She is the senior researcher, project manager and co-investigator on the TEEMUP study.

Mrs Judy Barrett, Department of Education, University of Oxford is the DT administration manager and leads on the liaison and recruitment of schools, the development of the website and administration and support for the DT and DT data.

Risks

Table 10: Risks

Risk	Detail/Preventative measure	Likelihood
Insufficient schools recruited	• The evaluation team will work with the delivery team to support their efforts for school recruitment. • Long period of trial recruitment. • Financial incentives provided to participating schools (£250 after baseline assessment (from evaluation team), £500 after outcome assessment (from delivery team). • Soft school inclusion criteria during recruitment.	Medium
Insufficient children recruited	• Request schools to provide the total number of children who are eligible to participate and distribute information packs to parents/carers of all eligible children (rather than self-selecting parent/carers to approach). • Soft school inclusion criteria (schools who have a reception cohort size ideally greater than 20 (excluding children with EAL and/or SEN)). • Provide guidance and support to school staff so that they feel confident speaking to parent/carers about the trial. • Provide parent/carers with transparent information about the trial/TEEMUP programme and assure parents/carers of confidentiality of data and their own and their child's anonymity in trial reports (via user-friendly information sheets).	Medium
Missing baseline data	• Baseline measures selected to involve minimal burden on schools.	Medium

	• School characteristics, current practices survey, participating child details, and completion of child baseline assessments will be required as a condition to be randomised. • The first School incentive payment (£250) will be paid after the completion of baseline data collection.	
Tight timeline for school randomisation	• Due to the tight timeline between baseline assessments and randomisation needing to take place, randomisation will take place in batches (of schools who have completed baseline assessments), to adhere as close as possible to the timeline and allow maximum time for schools planning attendance at PD sessions.	Low
High attrition among schools	• The randomised controlled trial model will be explained to schools during trial requirement. • The value of control schools will be explained in initial discussions and during data collection points. • Aim to over recruit (106 schools) to allow for some school level attrition. • Delivery team and evaluation team to develop good relationship with schools through regular contact. • EEF prepare a letter to schools to encourage them to remain in the trial, in the event of withdrawal requests.	Low
Missing outcome data / high attrition among children	• Schools encouraged to from the outset to keep participating children in classes taught by nominated YR and Y1 teachers. • The second school incentive payment (£500) will be paid after the completion of outcome data collection. • Mop-up visits by research assistant will be arranged to collect data from children who were absent during first outcome-assessment visit.	High
Cross-over	• Children may move from an intervention school to a control school or vice versa. Children's data will be analysed as per the original assignment (ITT).	Low
School staff turnover	• Schools will be asked to 'nominate' participating staff at sign up. • Schools will be asked to ensure as far as possible nominated staff remain teaching same year groups for period of evaluation, as condition of participation.	Low

	• DT will endeavour to 'catch up' new staff with TEEMUP PD in intervention schools.	
Potential Impact of Covid-19 Baseline/outcome assessment Intervention delivery	• Ensure all research staff are trained in Covid-19 safety procedures for face-to-face data collection. • Covid-19 restriction may mean ET are unable to visit schools to conduct baseline/outcome assessments. • Training teachers to complete BAS3 ENC assessments will be considered • Alternative baseline assessment measuring maths skills will be considered. • DT will pivot to online delivery of training and mentor support.	Medium

Timeline

Table 11: Timeline

Dates	Activity	Staff responsible/ leading
Nov 19 –	Set up	All
Jan-Nov 20	Ethical application	ET
Mar 20-Jan 21	Disruption due to Covid-19	-
Nov 19–May 21	Protocol development	ET
Jan 21–Aug 21	School recruitment	DT
Sep–Oct 21	Disseminate trial information to P/Cs of Cohort 1, allow 2-week withdrawal window, schools provide participation lists to ET	ET
Oct-Dec 21	Baseline assessments completed (BAS3 ENC, CSBQ) with children in cohort 1, and start point Confidence surveys and IPE usual practice surveys with school staff	ET
Oct 21	Batch randomisation begins	ET
Jan 22- Jul 23	TEEMUP PD programme delivery and collection of monitoring data	DT
Jan–Jun 22	IPE observations of TEEMUP PD face-to-face training	ET
Mar-Apr 22	IPE longitudinal case study interviews	
May-Jul 22	Intermediate outcome assessments with children and mid-intervention confidence surveys with school staff	ET
Jun-Jul 22	IPE surveys (intervention delivery)	ET

Jun-Jul 22	IPE developer interview	ET & DT
Sep-Oct 22	Disseminate trial information to P/Cs of Cohort 2, allow 2-week withdrawal window, schools provide participation lists to ET	ET
Sep-Oct 22	IPE Usual practice surveys IPE longitudinal case study interviews	ET
Feb-Mar 23	IPE longitudinal case study interviews	ET
May-Jul 23	Outcome assessments with children and post-intervention confidence surveys with school staff	ET
Jun-Jul 23	IPE usual practice surveys IPE post-surveys (intervention delivery) IPE longitudinal case study interviews	ET
Jul 23	Submission of NPD request for EYFSP data for Cohort 1 and Cohort 2	ET
Aug 23	IPE developer interview	ET & DT
Aug 23- Jan 24	Data analysis, report writing	ET
Jan 24	Submit draft impact and IPE report to EEF	ET
Jun 24	Final Report and data uploaded to EEF data archive, updating of ISRCTN trial registry with results. Submission of final statement of spend to EEF.	ET

ET = Evaluation team, DT = Delivery team, EEF = Education Endowment Foundation

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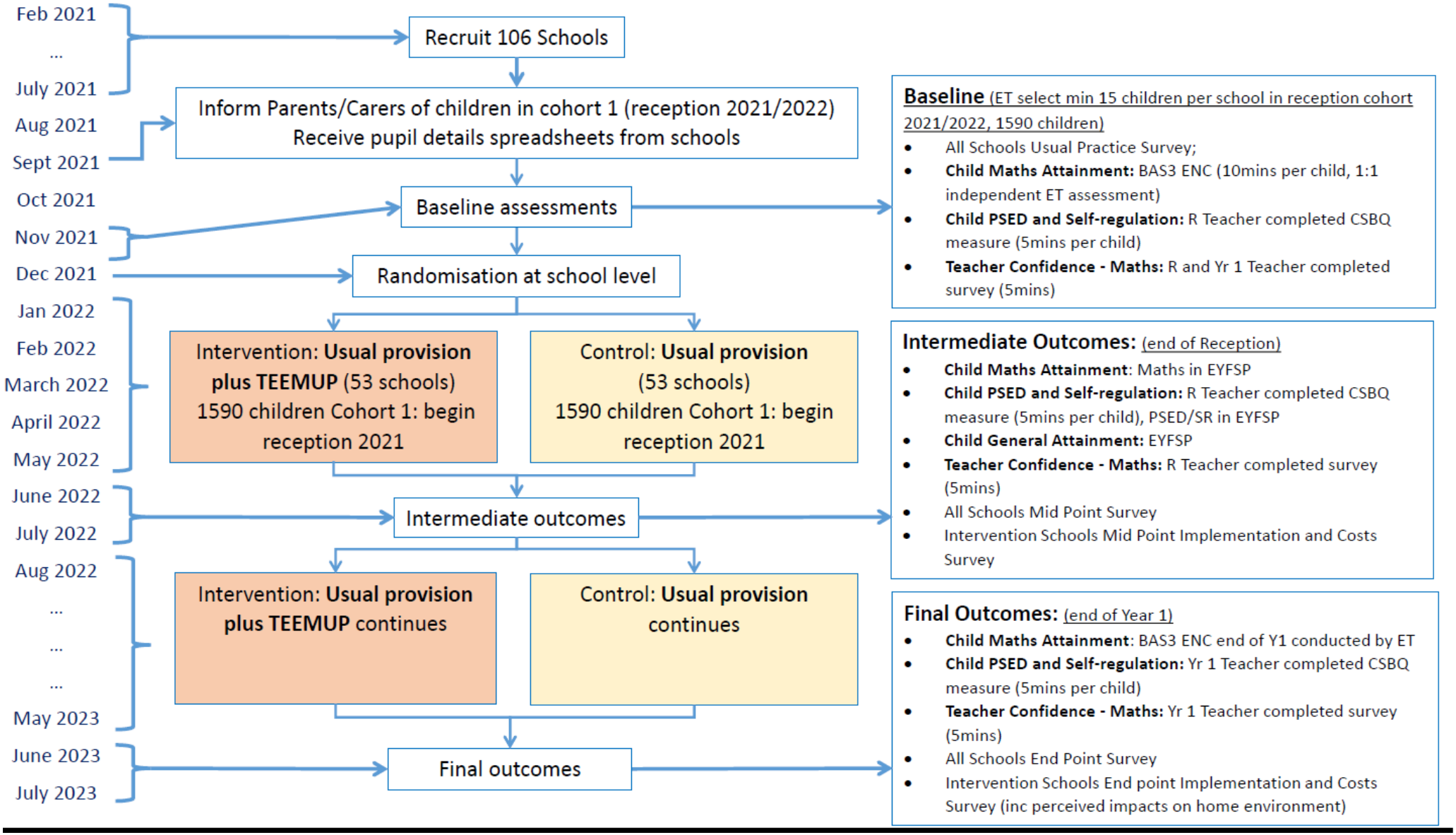
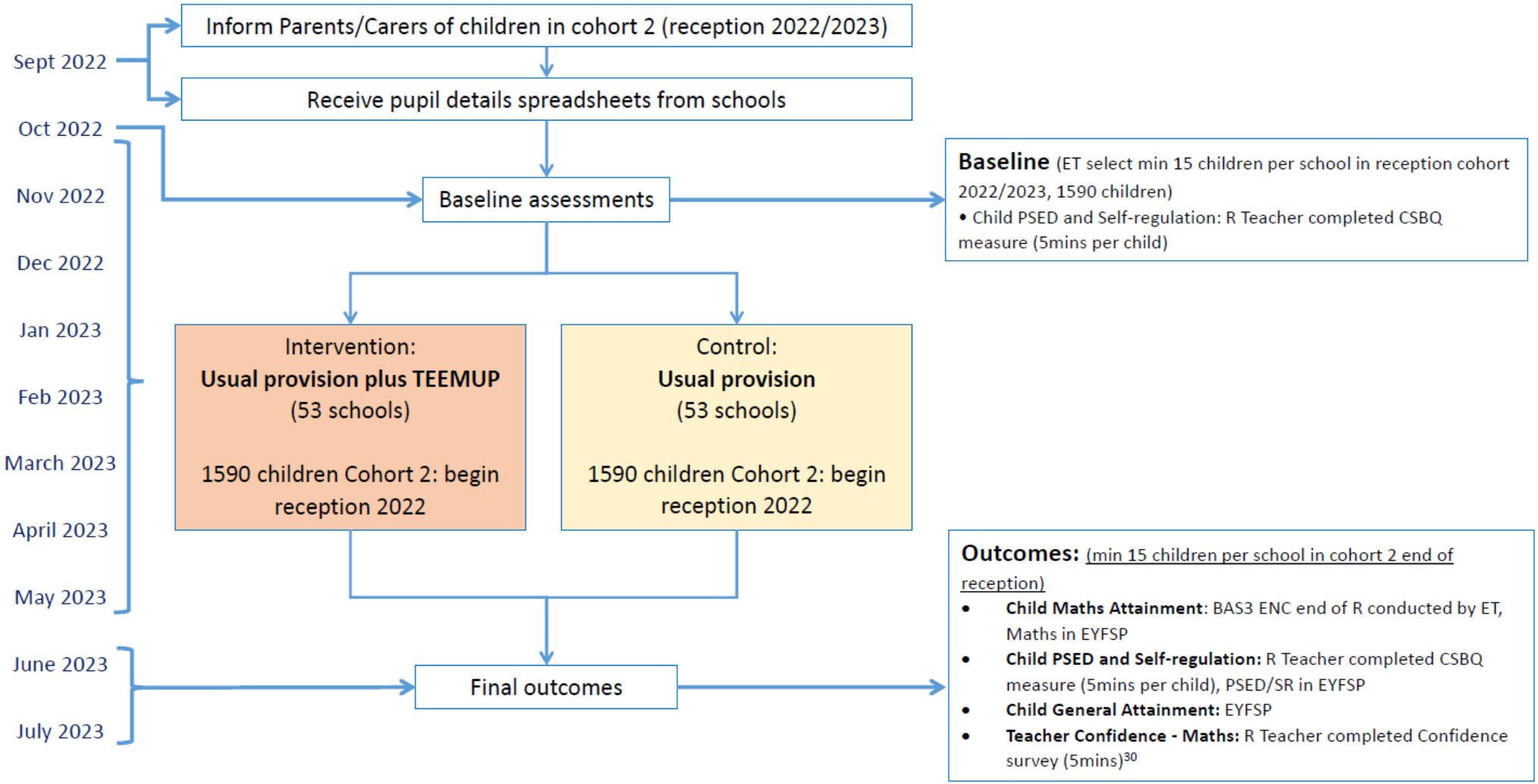
Appendix A: Trial Design Diagram Cohort 1



Appendix B. Trial Design Diagram Cohort 2



Appendix C. Study Information Sheet

Teaching Effective Early Mathematics and Understanding in Primary (TEEMUP) Schools Study

Did you know young children's early maths achievement and self-regulation are powerful predictors of later life success? Poor early years maths knowledge is linked to a greater likelihood of poor life outcomes.

Schools' Information Sheet

TEEMUP is a 2-year study, centred on evidence-based professional development (PD) designed to support the mathematical outcomes of children in YR and Y1. The Oxford TEEMUP PD delivery team is led by Prof. Iram Siraj, Dr Denise Kingston and Prof. Edward Melhuish, with ethical approval from Oxford University. It provides PD for a minimum of 1 teacher from YR *and* Y1 (with an optional 3rd member of staff) and involves 3 components: face-to-face workshops; an online 'knowledgebase' (with additional resources, materials and discussion forums); and coaching and mentoring offered in schools.

The Oxford TEEMUP PD is being independently evaluated by York Trials Unit (YTU) at the University of York. The study is funded by the Education Endowment Foundation (EEF). We are looking for **100 state-funded primary schools in the East of England and bordering local authorities** to participate in the study, which is evaluating whether the Oxford TEEMUP PD improves children's mathematical and self-regulation outcomes in YR and Y1.

TEEMUP *with us!*

What are the benefits for my school?

- 50 schools will have access to the Oxford TEEMUP PD for FREE during the project; 50 schools will be offered the PD at a much-reduced price at the end of the project, if it is successful.
- Teachers will be supported to enhance the mathematical *intent, implementation* and *impact* of mathematical teaching in their classrooms (Ofsted 2019).
- All schools who take part receive £750.

About the Professional Development

The Oxford TEEMUP PD is evidence-based and has already shown positive improvements in practice and child outcomes in other trials. It allows teachers to:

- explore best practice in mathematics teaching,
- work together to support transitions into and across classrooms,
- effectively engage the home in their children's education,
- build their mathematical confidence, knowledge and understanding,
- explore novel techniques to strengthen children's self-regulation,
- and effectively self-evaluate, plan for improvement and monitor their own and children's progress.

What does the Professional Development involve for participating teachers?

Teachers will receive specialist training from the Oxford TEEMUP PD team in how to support children's mathematics and self-regulation. Teachers will be offered:

- **2 full days (9.30-16.00) and 8 half day (14.00-17.45) face-to-face workshops.** Two consecutive days followed by 7 half day sessions once a fortnight in Spring 2022, allowing time between sessions to use the new ideas and activities and involve other staff within their team. The final follow-up workshop will be offered in 2023.
- **Specialist coaching/mentoring in schools.** Following the workshops, this will provide needs-based support for implementing changes, adapting the approaches to suit the school's context and children/families, and getting other staff (e.g. Teaching Assistants) involved.

- **Dedicated knowledgebase.** The Oxford TEEMUP PD online platform will extend PD learning by offering practical teaching resources, background materials, and information and ideas to support families at home.

What will we ask the 100 schools to do?

Half of the schools will be chosen at random to receive the Oxford TEEMUP PD for **FREE** from **January 2022**. The other 50 schools will continue as normal, forming the important 'control group' and will be offered the PD at a much-reduced price at the end of the study, if the PD is successful. Randomly selecting schools to initially receive the Oxford TEEMUP PD is the best way to find out the impact it has on children's attainment.

ALL schools will be expected to:

- Agree and sign the Memorandum of Understanding (MoU).
- Share information about the project with YR parents (2021 cohort and 2022 cohort) and offer them the chance to withdraw their child from data collection during the study.
- Share school and child information with the evaluation team.
- Collaborate with the YTU Evaluation Team to complete short mathematical assessments in October/November 2021 with YR, and in June 2023 with the same children (now Y1) and also the next cohort of children nearing the end of YR. YTU researchers will carry out this short assessment with at least 15 children in each year group. Class teachers will be asked to complete a short survey on social development and self-regulation for these same children at 4 time points during the 2 years (in line with table below).
- Staff will also be asked to complete a short questionnaire and some staff will be invited to take part in a discussion with the Evaluation Team.

Researchers will <u>not</u> be evaluating your school, teaching staff, or the individual children in the class. No individual children, teachers or schools will be named in the report arising from the study. The researchers are evaluating the TEEMUP PD and their role is to assess how successful it is in helping teachers to improve their practice and in improving children's outcomes.

What is the timetable?

<table>
<tr><td>School Term</td><td>Recruitment</td><td>All Schools: Preparation and grouping</td><td>TEEMUP PD group Or Control group</td><td>All schools: Assessments by YTU Evaluation Team &/or class teachers</td></tr>
<tr><td>Present-June 2021</td><td>100 schools sign up</td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">Autumn 2021</td><td rowspan="2"></td><td>YR parents informed & can withdraw child from evaluation elements</td><td rowspan="3"></td><td></td></tr>
<tr><td></td><td>YR (YTU& class teachers)</td></tr>
<tr><td>All schools receive £250</td><td>Schools informed of random allocation</td><td></td></tr>
<tr><td>Spring 2022</td><td></td><td></td><td rowspan="2">PD Workshops for 50 schools. Control group 'business as usual' (50 schools).</td><td></td></tr>
<tr><td>Summer 2022</td><td></td><td></td><td></td></tr>
</table>

			PD Coaching and mentoring plus one workshop for 50 schools.	
				YR (class teachers only)
Autumn 2022		YR parents informed / can withdraw child from evaluation elements	Control group 'business as usual' (50 schools).	YR (class teachers only)
Spring 2023				
Summer 2023				
	All schools receive £500			YR & Y1 (YTU & class teachers)
Post study			Control schools offered PD at reduced price	

Appendix D. Expression of interest

Teaching Effective Early Mathematics and Understanding in Primary schools (TEEMUP) study - Expression of Interest

Thank you for your interest in the TEEMUP study, details of which can be found in the School Information Sheet (attached).

We are currently accepting expressions of interest from schools which meet the following criteria:

- Primary or Infant Schools who are state funded
- Schools located in the East of England and bordering local authorities
- Schools who have a reception cohort size ideally greater than 20 (excluding children with EAL who are new to English and/or SEN).
- Schools willing to nominate one Reception teacher AND at least one Year 1 teacher (who are fulltime or majority time), who will participate in the Oxford TEEMUP PD, if allocated to the intervention group.
- Schools who anticipate participating staff will remain teaching the same year groups, i.e. will stay teaching YR or stay teaching Y1, over the duration of the study.
- Schools who can commit to keeping participating children in classes taught by participating YR and Y1 teachers.
- Schools who are NOT already taking part in a Reception or Year 1 substantial PD related research study, such as EEF trial of White Rose Maths or Maths Champions II.

If your school meets **all** these criteria and you would like to be considered for the study, please complete the attached form *electronically* (as a word or other editable document) and email to OxfordTEEMUP@education.ox.ac.uk.

From late April/early May 2021, we will invite selected schools to complete the formal Memorandum of Understanding to sign up to the study. If the study is oversubscribed, the selection procedure will consider geographical spread of schools and school characteristics.

If you have any questions or comments please feel free to contact us on the above email or give us a quick ring on 01865 274180 (Denise Kingston, project manager) or 01865 274374 (Judy Barrett, research administrator) and we will be delighted to discuss the study with you.

Thank you for your interest and support in improving children's early mathematical understanding – we look forward to receiving your expression of interest.

The Oxford TEEMUP Team

TEEMUP – Expression of Interest Eligibility Form

Please confirm the following:

- ☐ We are a state funded primary or infant School.
- ☐ We are a School located in the East of England or bordering local authority.
- ☐ We have a reception cohort usually greater than 20 (excluding children with EAL who are new to English and/or SEN).
- ☐ We are willing to nominate one Reception teacher AND at least one Year 1 teacher (who are fulltime or majority time), who will participate in the Oxford TEEMUP PD, if allocated to the intervention group.
- ☐ We anticipate participating staff will remain teaching the same year groups, i.e. will stay teaching YR or stay teaching Y1, over the duration of the study.
- ☐ We can commit to keeping participating children in classes taught by participating YR and Y1 teachers.
- ☐ We usually have more than 7% children ever eligible for FSM across our school cohort.
- ☐ We are NOT already taking part in a Reception or Year 1 substantial PD related research study.
- ☐ We are NOT already taking part in an EEF funded evaluation in the early years of KS1 e.g. EEF trial of White Rose Maths or Maths Champions II.

Please supply the following information: *

School name	
School postcode	
School URN	
Headteacher name	
School full address	
School telephone number	
Name of SMT/SLT contact for TEEMUP study	
SMT/SLT contact role	
SMT/SLT contact telephone number	
SMT/SLT contact email address	
Expected total no. of YR children Autumn 2021	
How many pupils might you expect to be EAL and/or SEN in YR?	
How many might you expect to be eligible for FSM in YR?	
Expected number of YR classes in 2021	
Do you expect most YR children to be fulltime by Oct '21?	
Will your nominated YR & Y1 teachers both be fulltime? If not, please give details	
Will all children in YR remain in the same class together when they move to Y1?	
Will it be possible for children taught by the nominated YR teacher in 2021-22 to be taught by the nominated Y1 teacher in 2022-23?	
Do you have mixed year group teaching in Nursery/YR/Y1/Y2? If so, please give details	

If applicable, name of multi-academy trust that you belong to / are planning to join	
Current total of pupils on school roll	

Current % of children eligible for and claiming FSM across the school *

Range	**0-10%**	**10%-15%**	**15%-20%**	**20%-30%**	**30%+**
Put 'X' in relevant box					

Current % of children with EAL across the school *

Range	**0-10%**	**10%-15%**	**15%-20%**	**20%-30%**	**30%+**
Put 'X' in relevant box					

Please add any comments/supporting information here should you wish, especially if you feel anything you have reported is not wholly accurate / representative of your future situation (it is fine to go over one page!)

Appendix E. Memorandum of Understanding

TEEMUP MoU v2.2 20210324

Teaching Effective Early Mathematics and Understanding in Primary schools (TEEMUP) Study

Detailed Information for Schools

What is the TEEMUP Study about and why is it important?

We are looking for approx. 100 schools (state-funded) to take part in a research study evaluating the TEEMUP professional development programme!

Did you know young children's early maths achievement and self-regulation are powerful predictors of later life success? Poor early years maths knowledge is linked to a greater likelihood of poor life outcomes. In response to this, Professor Iram Siraj, Dr Denise Kingston, Professor Edward Melhuish and Mrs Judy Barrett from Oxford University have developed the Oxford TEEMUP Professional Development (PD). This is a 2-year specialist programme designed to augment teachers' understanding and practice in Reception and Year 1 and support children's early mathematics and self-regulation.

The Oxford TEEMUP PD allows teachers to explore best practice in mathematics teaching, work together to support transitions into and across classrooms, effectively engage adults in the child's home in their children's education, and build their mathematical confidence, knowledge and understanding. Teachers will be supported to enhance the mathematical *intent, implementation* and *impact* of mathematical teaching in their classrooms *(Ofsted 2019)*. Teachers will learn how to self-evaluate, plan for improvement and monitor their own and the children's progress.

The timeline for the Oxford TEEMUP PD programme is outlined in the table below. There will also be a website with supporting resources and additional materials available for participating teachers.

The PD	Sessions	Timings
Introductory workshops	2 consecutive full days – 9.30 to 16.00	January 2022
Practice, intent and implementation workshops	7 fortnightly half days – 14.00 to 17.45	February to May 2022
Individual coaching and mentoring visits, supporting PD implementation.	Half a day school visit – coaching and mentoring	At least once each term (Summer 2022, Autumn 2022 & Spring 2023)
Practice, implementation and impact workshop	Half day, timings tbc	Spring 2023

The TEEMUP PD is based on previous research that has shown positive improvements in practice and child outcomes (see https://ro.uow.edu.au/sspapers/4286/). Based on these findings, the Education Endowment Foundation (EEF),

who are the government-designated 'What Works Centre for Education', have funded this study to look further at the impact the Oxford TEEMUP PD may have on children's outcomes.

What does your school get for taking part?

- Participation in important research that aims to improve the evidence base surrounding early maths teaching.
- £750 cash: to support your school taking part in the research and as a small thank you for your participation. Your school will receive the first payment of £250 following the completion of the first child assessments taking place in October/November 2021 and the final payment of £500 after the final assessments (due to take place June/July 2023).
- A 50% random chance of receiving the Oxford TEEMUP PD, meaning FREE professional development training for up to 3 teachers in your school for two academic years, 2021-2022 and 2022-2023 (further details provided below).
- If your school is not allocated to receive the PD during the trial period, you will be offered the TEEMUP PD at the end of the project, if found to be effective.

Who can take part in the study?

- Primary or Infant schools who are state funded.
- Schools located in the East of England and bordering local authorities.
- Schools who have a reception cohort size ideally greater than 20 (excluding children with EAL who are new to English and/or SEN).
- Schools willing to nominate one Reception teacher AND at least one Year 1 teacher (who are fulltime or majority time), who will participate in the Oxford TEEMUP PD, if allocated to the intervention group.
- Schools who anticipate participating staff will remain teaching the same year groups, i.e. will stay teaching YR of stay teaching Y1, over the duration of the study.
- Schools who can commit to keeping participating children in classes taught by participating YR and Y1 teachers.
- Schools who are NOT taking part in other Reception or Year 1 substantial PD related research, such as EEF trial of White Rose Maths or Maths Champions II.

Which teachers in my school can take part in the study?

Schools are to nominate one Reception class teacher (not nursery teachers) and at least one Year 1 teacher (up to 3 members of staff are welcome), with the intention that the children in the participating Reception teachers' class then become the class of the participating Year 1 teacher in the second year of the study.

There should be no upcoming or anticipated year group changes for nominated teachers for the duration of the study (academic years 2021-2022 to 2022-2023). In other words, nominated teachers need to agree to teaching the same year group (either year 1 or reception) for 2 academic years.

What will taking part in the study involve?

We would like your school to complete the activities below. This is regardless of whether or not your school is randomly chosen to participate in the Oxford TEEMUP PD (see box below).

As part of the research project, half the schools will be allocated at random to receive the Oxford TEEMUP PD for FREE (referred to as the 'intervention group').

The other half of the schools will continue as normal and form the important 'control group'.

Randomly allocating which schools receive the programme is essential, as it is the best way to find out the impact the Oxford TEEMUP PD has on children's attainment.

This type of research is called a randomised controlled trial.

You will find out which group your school has been allocated to in November/December 2021, after the first assessments are complete.

1. **Ensure parents/carers of reception children in 2021-22 and 2022-23 are fully informed about the research.** This will include providing information about the research via the school's usual means of communication e.g. newsletters, emails and/or texts to parents/carers. In addition, the Evaluation Team will produce an information sheet for parents/carers which the school should distribute to parents/carers in paper and/or electronic form via email.

2. **Collect withdrawal information from parents/carers**. The information sheet for parents/carers will explain the study and give parent/carers the option to withdraw their child from taking part in the study, e.g. the sharing of their child's information with the research team (see point 3) and participating in assessments (see point 4). *All children will receive learning from the Oxford TEEMUP PD via their teachers own participation in the PD, if your school is randomly chosen to receive it, but parents/carers can withdraw their child from taking part in assessments linked to the evaluation.*

   Parents/carers can withdraw their children from the evaluation by (1) returning a withdrawal form to the school which will be included with the information sheet or, (2) informing the school in person, by phone or email. If the school is informed about a withdrawn child, they **must keep a written record of this. The Evaluation Team only require the number of pupils who have been withdrawn from the research during the recruitment process. Schools should NOT share personal details of withdrawn pupils with the Evaluation Team.** Parent/carers can choose to withdraw their child at any point throughout the research; in such situations, please inform the Evaluation Team. The Evaluation Team will provide your school with further information on the withdrawal process.

3. For both Reception cohorts (2021-22 and 2022-23) we will ask the school to securely share the personal details (including forename, surname, UPD, date of birth, gender, FSM status, EAL and SEN status) for all participating children **(NOT for those who have withdrawn)**. This information will be used to access participating pupils' Early Years Foundation Stage Profile assessments which are recorded in the National Pupil Database. A Data Sharing Agreement will be put in place with you detailing this. Please see the parent/carer information sheet for details on how we will collect, store, use and report children's data. We will provide your school with further information on the secure data sharing process.

4. In **October/November 2021 York Trials Unit, University of York, will send a Research Assistant(s) to your school** to complete an assessment called the British Ability Scales (BAS-3) Early Number Concepts assessment with at least 15 children in Reception to gauge their early maths skills. We will send another Research Assistant(s) to the school in June/July 2023 to complete the same assessment with the same children (now in Year 1) and relevant children now in Reception class. **Assessments will only be completed with children whose parents/carers have not withdrawn their child from the study**. Children with SEND and/or EAL, which may prevent them from accessing the assessment, do not have to participate in this aspect of the study. More information about the BAS-3 is provided below:

   - Children complete BAS-3 Early Number Concepts with an adult. It usually takes around 10 minutes. We aim to assess at least 15 children per class. Before visiting your school we will send you the names of pupils who we will aim to assess. A research assistant will be in your school for at least 1 day to do this.
   - Research assistants have DBS clearance, have completed data protection and safeguarding training, and are used to working with young children. They will follow any government and school guidance regarding COVID-19 safety measures.
   - An adult, who is familiar with the child (such as a TA) will need to be available to chaperone during the assessment to ensure children feel comfortable.
   - We will discuss with you the most suitable date/time for a research assistant to visit the school to conduct the assessments.
   - Further information on the BAS-3 Early Number Concepts can be found here: https://www.gl-assessment.ie/products/british-ability-scales-bas3/

5. We will also ask participating **teachers to complete the Children's Social and Behaviour Questionnaire (CSBQ)** to capture the social development and self-regulation skills of all relevant children within their class. The CSBQ takes <5 minutes per child to complete. We ask that this is completed by the participating teachers for a minimum of 15 participating children per cohort (or where possible all participating children) at the start of 2021 academic year (October/November 2021) and at the end (June/July 2022) and with the same children at the end of Year 1 (June/July 2023). We will also ask the participating Reception teacher to complete the CSBQ at the beginning and at the end of the academic year for relevant children in their 2022-2023 cohort. The Evaluation Team will securely provide you with a list of the children for whom you should complete the CSBQ.

6. Relevant teachers within your school will also be asked to complete some short questionnaires and may be asked to participate in one or two interviews or observations during the study (separate consent will be sought for interviews/observations).

Frequently asked questions

Who is running the TEEMUP study? The EEF appointed two teams of researchers to run the TEEMUP study: An 'Evaluation Team' from York Trials Unit (YTU) at the University of York to evaluate the impact of the Oxford TEEMUP PD, led by Principal Investigators Hannah Ainsworth (YTU) and Dr Lyn Robinson-Smith (YTU). The YTU team will be responsible for managing the assessment process and associated data collection. A 'Delivery Team' led by Principal Investigators Professor Iram Siraj, Dr Denise Kingston and Professor Edward Melhuish, supported by Mrs Judy Barrett, from Oxford University. The Delivery Team are responsible for the implementation of the Oxford TEEMUP PD and will not have access to the evaluation data during the study.

Has the study received ethical approval? The study has received ethical approval from the University of York Health Sciences Research Governance Committee and the Departmental Research Ethics Committee (DREC) at the Department of Education, Oxford University.

What will happen to data collected as part of the study? All information collected as part of this study will be processed and stored in accordance with the General Data Protection Regulation (2018) and the Data Protection Act (2018). A detailed data sharing agreement will be put in place between your school and the Evaluation Team.

Who will children's data be shared with and why? For the purposes of this study, will we use children's names when communicating with you in order to arrange BAS-3 assessments.

For the purposes of this study, for children whose parent/carers have not withdrawn them from the evaluation, identifiable information about children provided by the school will be shared with the Department for Education (DfE)/Office for National Statistics (ONS) Secure Research Service (SRS) in order to make use of routinely collected information in the National Pupil Database (NPD). In the future further matching to the NPD and other datasets or administrative data may take place during subsequent research and/or after archiving. There will be no international data transfers outside of the EU.

At the end of the study, data will be submitted to the Office for National Statistics Secure Research Service (ONS SRS) for archiving in the EEF data archive (managed by FFT Education) and will include data only individually identifiable to the Department for Education. Anonymous data may be kept indefinitely by the Evaluation Team, will be shared with relevant researchers at Oxford University and potentially shared with other research teams.

For further detailed information on how children's personal data will be collected, used, stored and reported, please read the parent/carer information sheet. All results will be anonymised so that no schools or individual children will be identifiable in the report or dissemination of any results.

Where can I find out the results of the TEEMUP study? At the end of the study a final report, which does not identify any individuals or schools, will be made publicly available on the EEF website (educationendowmentfoundation.org.uk), for anyone who is interested in the findings of the research.

Who do I contact if I have further questions?

Questions about the Oxford TEEMUP PD? Please contact University of Oxford:	Questions about the evaluation of TEEMUP? Please contact the Evaluation Team:
If your school would like to participate in the study, please read, complete, and sign the 'Memorandum of Understanding: School Agreement' (TEEMUP MoU v2.2 20210324**) and return this as soon as possible by email or post to the TEEMUP PD Delivery Team at Oxford University (see above for contact details).**	
Email: OxfordTEEMUP@education.ox.ac.uk Tel: 01865 274374/274180	Email: ytu-teemup@york.ac.uk Tel: 01904326823

TEEMUP STUDY: MEMORANDUM OF UNDERSTANDING SCHOOL

Below we summarise the requirements of schools taking part in the research study. This form is to be completed by the head teacher. Please read these carefully and, if you are happy to take part, please initial beside each statement and complete the relevant sections overleaf.

1. I confirm we have read the Detailed Information for Schools/Memorandum of Understanding (TEEMUP MoU v2.2 20210324) for the TEEMUP study. Initials
2. I confirm we will nominate a member of Senior Management/Leadership Team (SMT/SLT) who will act as a point of contact for the Evaluation Team and the Delivery Team. Initials
3. I confirm that the nominated teachers will remain teaching the same year group for the duration of the study (from September 2021- July 2023). Initials
4. I can confirm that the school will commit to keeping participating children in classes taught by participating YR and Y1 teachers. Initials
5. I confirm our school is committed to completing the TEEMUP PD if we are randomly allocated to follow the programme. I confirm we would keep all information/ideas related to the TEEMUP PD confidential until the end of the study. Initials
6. I agree to distribute information sheets to parent/carers, keep a record of children who have been withdrawn from the research project, and inform the Evaluation Team of the number of children who have been withdrawn. I understand that the school should not send the personal data of children who have been withdrawn to the Evaluation or Delivery Team. Initials
7. I agree to share with the Evaluation Team requested details about children, whose parents/carers have not returned a withdrawal form to the school (a data sharing agreement will be put in place by the Evaluation Team detailing the specifics of this). Initials
8. I agree to facilitate a visit(s) by research assistant(s) to complete, the BAS-3 assessment during October/November 2021 with relevant Reception children and in June/July 2023 with the same children (now Year 1) and the new children in Reception. Initials
9. I agree participating teachers will complete the CSBQ for participating children - in October/November 2021, June/July 2022, and in June/July 2023 for the first cohort of Reception children and in October/November 2022 and June/July 2023 for the second cohort of Reception children. Initials
10. I agree participating teachers and I will complete and return questionnaires about our school's 'usual' practice and experience of TEEMUP PD (if we are allocated to the PD group) and will consider participating in interview(s)/observation(s). Initials
11. I agree to notify the TEEMUP Delivery Team and the Evaluation Team, at the earliest opportunity, if the school has any issues which could affect the continuation of the TEEMUP PD within our school, if we are allocated to the PD group. Initials
12. I agree to still allow assessment data to be collected for the evaluation (where possible) if our school choses to withdraw from the TEEMUP PD (if allocated). Initials
13. **I agree for this school to take part in the TEEMUP study and accept the terms and conditions outlined in this Memorandum of Understanding (**TEEMUP MoU v2.2 20210324**).** Initials

School name: _____

School Address:_____

_____

_____

School URN:_____

School postcode:_____

School telephone number:_____

Head teacher name:_____

Head teacher signature: _____ Date: ____/____/_____

Head teacher email:_____

Name of nominated SMT/SLT member :_____

SMT/SLT member email: _____

SMT/SLT member telephone number: _____

Name of nominated Reception teacher:_____

Email:_____

Name of nominated Year 1 teacher:_____

Email: _____

Name of nominated additional staff member (optional): _____

Staff role: _____

Email: _____

Thank you for agreeing to take part in this study.
Please return this form to**: OxfordTEEMUP@education.ox.ac.uk**
or by post to the below address as soon as possible:
TEEMUP Delivery Team

Mrs Judy Barrett, TEEMUP Research Administrator

Department of Education, Oxford University

Appendix F. Parent/carer Information Sheet

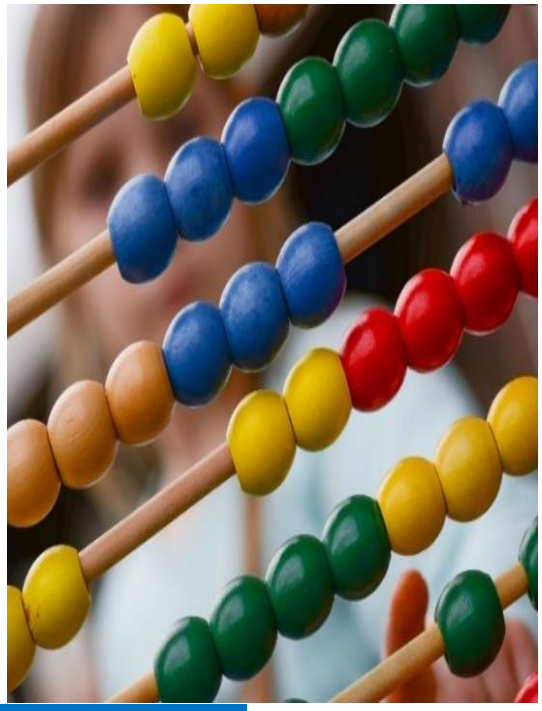
TEEMUP PIS Reception Cohort 1 2021-22_v3.1_20210824

Teaching Effective Early Mathematics and Understanding in Primary schools (TEEMUP) Study

INFORMATION FOR PARENT/CARERS

What is the TEEMUP study?

Your child's school is taking part in the 'Teaching Effective Early Mathematics and Understanding in Primary School' study, also known as the 'TEEMUP' study. This information sheet provides you with details about what the study will involve for you and your child.



Previous research tells us that maths is one of the areas where children perform least well and that children who don't have a good start in developing mathematical skills continue to be behind throughout life. TEEMUP is a teacher training programme that has been developed by a team at the University of Oxford with the aim of providing Reception and Year 1 teachers with further training on the best way to teach and support children to develop their maths skills.

How will we find out if the TEEMUP programme works?

The Education Endowment Foundation (EEF) have appointed an evaluation team from the University of York to run this study which will help to understand how TEEMUP teacher training may support children's mathematics progress.

To find out how well the Oxford TEEMUP programme works, Reception and Year 1 teachers at some participating schools will receive the training for the next two years and some schools will not. Which schools receive the programme is decided randomly by a computer. Your child's education will continue as normal in schools who are not selected to attend the training.

The evaluation team will compare assessments from children in schools that have used the teacher training programme with assessments from schools in schools that have not.

This type of research is called a randomised controlled trial.

What does the TEEMUP programme involve?

If your child's school is chosen at random to take part in the TEEMUP programme, it will be used in Reception and Year 1. Teachers will receive training from the Oxford TEEMUP programme providers.

From January 2022, the nominated teachers will attend training, receive support from a mentor, have access to online resources, and will work with other staff in the school to improve maths practice for all children, with lots of support from the training team at the University of Oxford.

You can ask your child's teacher any questions you may have about the TEEMUP programme. If you would like more information, please contact the Oxford TEEMUP team using the details at the end of this information sheet.

What does the study involve for my child?

We will ask your child's school to provide some details about your child, including their first name, surname, date of birth, gender, unique pupil number, English as an Additional Language status, Special Educational Need or Disability status and eligibility for Free School Meals/Pupil Premium status. None of the information collected about your child as part of this study will affect your child's place at school. The 'Frequently Asked Questions' section below tells you more about how we will use, store and share the information collected in the study.

We will send a research assistant(s) to your child's school to complete a short assessment with at least 15 children in October/November 2021 and again in June/July 2023 when they are in Year 1. Your child *may* be selected to complete the assessment with the research assistant. The assessment is part of the British Ability Scales-3 and is called Early Number Concepts. The assessment is very child-friendly; the research assistant asks the child questions, using props like counters, to assess their current understanding of maths. The assessment takes no longer than 10 minutes to complete. The research assistant will make the assessment fun for your child. An adult, who is familiar with your child (such as a TA) will be available to chaperone during the assessment to ensure your child feels comfortable. If, at any point, your child indicates that they do not want to continue then the research assistant can pause the assessment and come back to it later, or can stop the assessment altogether.

All research assistants who sit with your child to complete the assessment have:

- experience working with young children,
- completed safeguarding and data protection training, and
- undergone all the necessary checks including a recent Disclosure and Barring Service (DBS) certificate check.

We will also ask your child's teacher to complete a short questionnaire about your child's social skills at the start and end of Reception and again at the end of Year 1. This does not require your child to do anything, a teacher completes this based on their observations.

So that we can see if the TEEMUP programme results in any longer-term changes to education, we will also access your child's Early Years Foundation Stage Profile assessment (or equivalent). This assessment is collected by your child's reception teacher at the end of the first year of school. We will do this by applying to a government database which stores this information. We explain more about this in the FAQ section.

What do I need to do now?

If you are happy for your child to take part in the TEEMUP study, you do not need to do anything. The school will pass the relevant information to the evaluation team and we will arrange a time for a research assistant to visit the school and complete the assessments with the relevant children.

Your child does not have to take part in the study if you do not want them to. If you do not want your child's school to provide the evaluation team with information about your child and/or you do not want your child to take part in the assessments, you can withdraw your child from the study. To do this, simply return the attached withdrawal form to your child's school or communicate your wishes to the school via email, telephone, or in person by the date specified by your child's school. The school will make a note of your child's withdrawal and will ensure their data is not passed to the evaluation team and they are not assessed as part of this study. If at any time during the study you decide you no longer want your child to take part, please inform your child's school who will inform the evaluation team or you can contact the evaluation team directly, details below.

All children at schools which are randomly chosen to receive the TEEMUP programme will be involved in TEEMUP, as teachers will be using the programme within the school, even if you choose for your child not to take part in the assessment and data sharing elements of the study.

Frequently Asked Questions

THANK YOU FOR READING THIS INFORMATION

Is my child's participation in the study confidential? All participant data will be treated with the strictest confidence and will be stored in compliance with the General Data Protection Regulation (GDPR) and Data Protection Act 2018. We will not use your child's name or the name of participating schools in any report arising from the study.

Can we withdraw from the study? If you would prefer your child NOT to take part in any assessments as part of the study, or their data NOT to be processed as above, please return a completed withdrawal form to your child's school. Alternatively, you can inform your child's school (in person, by phone or by email). Your child's school will keep a record of your withdrawal for their reference.

If you are happy for your child to take part in the study, but then change your mind, you are free to withdraw your child from the study at any time during the course of the study (information already collected about your child will be retained). In this event, please tell your child's school who will communicate this with the Evaluation Team, or you can contact us directly using the contact details provided.

Questions or concerns: If you have any questions about this information sheet or concerns about how your child's data is being processed, please contact the evaluation team at ytu-teemup@york.ac.uk in the first instance. You may also contact the University of York's Data Protection Officer at dataprotection@york.ac.uk.

What is the Education Endowment Foundation (EEF)? The EEF is an independent charity founded in 2011 with funding from the Department for Education (DfE). Its aim is to build the evidence for what works in raising attainment. This means demonstrating the impact of its projects on children's attainment throughout school with some projects now also evaluating post 16 and early years attainment. For more information, visit: educationendowmentfoundation.org.uk/

Who will your child's data be shared with and why? For the purposes of this study, your child's school will share information about your child with the Evaluation Team. The Evaluation Team will use your child's name when communicating with their school and class teachers in order to arrange assessments.

For the purposes of this study, the Evaluation Team will share identifiable information about your child (e.g. full name, date of birth, unique pupil number, gender) with the DfE and ONS SRS who store all mandatory assessments children complete during their time in education within the National Pupil Database (NPD). With the information we provide, the DfE/ONS SRS will 'match' your child's details to their Early Years Foundation Stage Profile assessment (or equivalent), which is completed by their teacher at the end of the first year at school and provide us with this information. This will help us understand if the TEEMUP programme has effects on children's education. Further matching to the NPD and other datasets or administrative data may take place during subsequent research and/or after archiving.

At the end of the study data will be submitted to the Office for National Statistics Secure Research Service (ONS SRS) for archiving in the EEF data archive (managed by FFT Education) and will include data only individually identifiable to the Department for Education. Anonymous data may be kept indefinitely by the Evaluation Team, and will be shared with relevant researchers at the University of Oxford and potentially shared with other research teams.

Who is the Data Controller? For the purposes of this project, the University of York is the data controller as defined in the GDPR. Once the data has been submitted to the Office for National Statistics Secure Research Service (ONS SRS) for archiving in the EEF data archive and passed quality checks, the EEF holds data controller responsibility for the data.

How do we keep your child's data secure? We will provide detailed instructions to schools, so they can securely transfer information about your child to us. We will use Qualtrics Survey Software to collect assessment results and information from teachers on children's social skills. The University of York takes information security extremely seriously and has implemented appropriate technical and organisational measures to protect data. Access to information is restricted on a need-to-know basis and security arrangements are regularly reviewed to ensure their continued suitability. Further information about how we will use the information provided about your child can be found at: york.ac.uk/healthsciences/research/trials/trials-gdpr/

Under what legal basis do we process your child's personal data? Personal data will be processed under Article 6 (1) (e) (*Processing necessary for the performance of a task carried out in the public interest*) and Special Category data under Article 9 (2) (j) (*Processing necessary for ... scientific ... research purposes)* of the General Data Protection Regulation (2018).

How long will we keep your child's data? All individually identifiable data held by the evaluation team will be destroyed 5 years after the end of the study (2029). Data in the EEF's archive in the ONS SRS will include data only individually identifiable to the Department for Education (DfE); who are a government department responsible for children's services and education and is kept indefinitely for the purposes of future research.

What rights do you have in relation to your data and your child's data? Under the GDPR, you have a right of access to your data and your child's data, a right to rectification, erasure (in certain circumstances), restriction, objection or portability (in certain circumstances). Further information can be found at: york.ac.uk/healthsciences/research/trials/trials-gdpr/research-partcipants/

How do we select which children will take part in the assessments? We need to assess at least 15 children at the start of Reception class, and again at the end of Year 1. If the parents/carers of more than 15 children are happy for them to take part in the assessments, we will select children to be assessed.

Can I have my child's assessment results? If your child is selected and completes the assessments you can contact the evaluation team to obtain the results of your child's assessments if you wish. The evaluation team will be able to give you the 'raw' assessment scores and will not be able to provide any interpretation of them.

Right to complain: If you are unhappy with the way the University has handled your data or your child's personal data, you have a right to complain to the Information Commissioner's Office. For information on reporting a concern to the Information Commissioner's Office, see ico.org.uk/concerns. If you would like to make a general complaint about this study, you can contact Professor Patrick Doherty (patrick.doherty@york.ac.uk) (who is not directly involved in this study).

Has the evaluation received ethical approval? The University of York, Health Sciences Research Governance Committee is reviewing the ethical standards of this study. The study has received ethical approval from the committee for the aspects of the research detailed in this information sheet. The Department of Education Departmental Research Ethics Committee at the University of Oxford has also reviewed this study.

Where can I find out the results of the evaluation? The evaluation team have to produce a final evaluation report. This is due in Spring 2024 and will be published by the EEF on their website (educationendowmentfoundation.org.uk); this final report will not name any schools or individual children.

Who do I contact if I have further questions?

Questions about the Oxford TEEMUP programme? Please contact University of Oxford: Mrs Judy Barrett TEEMUP Research Administrator Department of Education, Oxford University 15 Norham Gardens Oxford OX2 6PY Email: OxfordTEEMUP@education.ox.ac.uk Tel: 01865 274374/274180	**Questions about the study?** Please contact the Evaluation Team: TEEM UP Evaluation Team York Trials Unit 1st Floor, ARRC Building University Of York YORK YO10 5DD Email: **ytu-teemup@york.ac.uk** Tel: 01904 326823

TEEMUP Study

PARENT/CARER CHILD WITHDRAWAL FORM

Your school is taking part in the TEEMUP study, which aims to improve the maths skills of children by providing teachers with further training.

If you DO NOT want your child to take part in any assessments as part of the study, and/or if you DO NOT want their data to be processed as outlined in the Information for Parents/Carers, please complete, sign and return this form to your child's school OR contact your school in person, or via email or telephone.

Your **child's** name: _____

Your **child's** date of birth: _____

Name of parent/carer: _____

Signature of parent/carer: _____

Date: _____

If you have any questions or would like further information please contact:**:**

Questions about the Oxford TEEMUP programme?	**Questions about the study?**
Please contact University of Oxford: Mrs Judy Barrett TEEMUP Research Administrator Department of Education, Oxford University 15 Norham Gardens Oxford OX2 6PY Email: OxfordTEEMUP@education.ox.ac.uk Tel: 01865 274374/274180	Please contact the Evaluation Team: TEEMUP Evaluation Team York Trials Unit 1st Floor, ARRC Building University Of York YORK YO10 5DD Email: **ytu-teemup@york.ac.uk** Tel: 01904326823

Teaching Effective Early Mathematics and Understanding in Primary schools (TEEMUP) Study

TEACHER CONFIDENCE– MATHS: SURVEY (adapted from Chen et al., 2014[1]

Your Confidence in Helping Children in Reception/Year 1 Learn Maths

a. Please indicate how confident you feel about helping children in Reception/Year 1 learn maths.

For each of the following statements, please cross one box which is most appropriate for you.

I am confident in my knowledge of:	*Strongly disagree*	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
what the children in my class know about maths when they enter	☐	☐	☐	☐	☐
reasonable maths goals for children in my class	☐	☐	☐	☐	☐
the best practices and strategies for helping children in my class learn maths	☐	☐	☐	☐	☐
national maths standards for children in my class	☐	☐	☐	☐	☐
of the best ways to assess children's maths knowledge and understanding throughout the year	☐	☐	☐	☐	☐

[1] Chen, J. Q., McCray, J., Adams, M., & Leow, C. (2014). A Survey Study of Early Childhood Teachers' Beliefs and Confidence about Teaching Early Math. *Early Childhood Education Journal*, *42*(6), 367-377.

b. Please indicate how confident you feel in your own ability to help children in your class learn maths.

For each of the following statements, please cross one box which is most appropriate for you.

I am confident in my ability to:	*Strongly disagree*	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
observe what children in my class know about maths	☐	☐	☐	☐	☐
incorporate maths learning into other areas of the curricula and school life	☐	☐	☐	☐	☐
plan activities to help children in my class learn maths	☐	☐	☐	☐	☐
further children's maths knowledge when they make spontaneous maths comments/ discoveries *Example: When child says "I have four blocks" asking child how many blocks he would have if you gave him one more*	☐	☐	☐	☐	☐
make sense of children's confusions when they learn maths *Example: Why a child thinks* ▽ *and* ◁ aren't the same shape	☐	☐	☐	☐	☐
translate assessment results into curriculum plans (i.e. turning assessments of children into next steps for learning)	☐	☐	☐	☐	☐

Thank you very much for sharing your experiences

Appendix H: Previous compliance definition

During the delivery of the intervention and with the experience this brings, the DT suggested some small changes to the compliance criteria and these are detailed in this version of the protocol and also in the SAP. Below we copy the original draft of the compliance definition for posterity. The most significant change is the removal of formal scoring of the 'evidence of change in practice' criteria as this was considered not to be operational in practice. Therefore, the mentors will use these criteria as a guide to judge whether the school has demonstrated good evidence of change in practice, and it is this judgment that will be used in the compliance assessment.

Previous compliance definitions:

A school will be classed as having **good compliance** if they fulfil all of the following core criteria detailed in Table 5, and at least 3 of 5 of the evidence of change in practice criteria detailed in Table 6:

Table 5: Cohort 1 CACE analysis GOOD compliance 'core' criteria

GOOD compliance 'core' criteria	Data collection by/from
The YR teacher remains at the school and teaching reception during 2021/2022 academic year and the Y1 teachers remains at the school and teaching Y1 in 2022/2023 academic year.	Collected by ET directly from schools at the end of each academic year
Both the YR and Y1 teachers complete 7 core training sessions, at least by watching recorded sessions. (NB. attendance/watching final half day session is not required for compliance).	Collected by DT via attendance registers/training completion records for each school and shared with ET
The school hosts 3 face to face visits from a mentor/coach, at least 2 of which teachers should be well prepare for (DT will define 'preparedness' which will include for example, class cover arranged, an appropriate meeting place, read through questions provided by DT prior to meeting and prepared to answer them).	Collected by DT mentor records for each school and shared with ET
A minimum of 8 school log-ins to the online website over the course of the whole intervention period.	Automated data held by DT team shared with ET or self-reported data from teachers collected by DT and shared with ET.

Table 6: Cohort 1 CACE analysis GOOD compliance 'evidence of change in practice' criteria

GOOD compliance 'evidence of change in practice' criteria	Data collected by/from

Both nominated teachers can provide evidence of the use of the maths practice scale, and how it impacted on their teaching. At least 10 evidenced uses by Reception teacher in 2021/2022 academic year. At least 10 evidenced uses by YR 1 teacher in 2022/2023 academic year. (10 uses because it relates more directly with primary outcome)	Collected via a standard proforma by DT during mentor support core visits, and shared with ET.
Both nominated teachers can provide evidence of the use of the BfL scale, and how it impacted on their teaching. At least 7 evidenced uses by Reception teacher in 2021/2022 academic year. At least 7 evidenced uses by YR and Y1 teacher in 2022/2023 academic year.	Collected via a standard proforma by DT during mentor support core visits, and shared with ET.
Reception teacher in 2021/2022 academic year and YR 1 teacher in 2022/2023 academic year can provide evidence of use of knowledge base materials etc. (including adaptations of these where appropriate) to support intent (planning), implementation and/or impact of teaching during child-initiated and/or adult-led sessions.	Collected via a standard proforma by DT during mentor support core visits, and shared with ET.
YR teacher in 2021/2022 academic year and YR1 teacher in 2022/2023 academic year can provide evidence of at least one use of formative assessment processes and/or developmental progressions (or their own adaptations of these) e.g., completed assessment table, changes in teaching content, processes, strategies etc. for individual children following assessment using developmental progression.	Collected via a standard proforma by DT during mentor support core visits, and shared with ET.
Reception teacher in 2021/2022 academic year and YR 1 teacher in 2022/2023 academic year can provide examples of using TEEMUP PD strategies to support HLE.	Collected via a standard proforma by DT during mentor support core visits, and shared with ET.

A school will be classed as having **at least minimal compliance** if they fulfil all of the following criteria detailed in Table 7.

Table 7: Cohort 1 CACE analysis MINIMAL compliance criteria

MINIMAL compliance criteria	Data collection by/from
The Y1 teacher remains at the school and teaching YR 1 in the 2022/2023 academic year.	Collected by ET directly from schools at the end of each academic year.

Both the Reception and Year 1 teachers complete 5 of 9 core training sessions, at least by watching recorded sessions. (NB. attendance/watching final half day session is not required for compliance).	Collected by DT via attendance registers/training completion records for each school and shared with ET.
The school hosts 2 face to face visits from a mentor/coach, at least 1 of which teachers should be well prepare for (DT will define 'preparedness' which will include for example, class cover arranged, an appropriate meeting place, read through questions provided by DT prior to meeting and prepared to answer them).	Collected by DT mentor records for each school and shared with ET
A minimum of 4 school log-ins to the online knowledge base over the course of the whole intervention period.	Automated data held by DT team shared with ET or self-reported data from teachers collected by DT and shared with ET.

Cohort 2:

Compliance will be measured at the teacher-level, since the impact of the intervention will depend on engagement of the Reception teacher only for Cohort 2. Each Reception teacher in the intervention arm will be assessed for their compliance with the intervention.

A Reception teacher will be classed as having **good compliance** if they fulfil all of the following core criteria detailed in Table 8, and at least 3 of 5 of the change in practice criteria detailed in Table 9.

Table 8: Cohort 2 CACE analysis GOOD compliance 'core' criteria

GOOD compliance criteria 'core' criteria	Data collection by/from
The Reception teacher remains at the school and teaching Reception in 2021/2022 and 2022/2023.	Collected by ET directly from schools at the end of each academic year
The Reception teacher completes 7 core training sessions, at least by watching recorded sessions. (NB. attendance/watching final half day session is not required for compliance).	Collected by DT via attendance registers/training completion records for each school and shared with ET

The school hosts 3 face to face visits from a mentor/coach, at least 2 of which the Reception teacher should be well prepared for (DT will define 'preparedness' which will include for example, class cover arranged, an appropriate meeting place, read through questions provided by DT prior to meeting and prepared to answer them).	Collected by DT mentor records for each school and shared with ET
A minimum of 8 school log-ins to the online knowledge base over the course of the whole intervention period.	Automated data held by DT team shared with ET or self-reported data from teachers collected by DT and shared with ET.

Table 9: Cohort 2 CACE analysis GOOD compliance 'evidence of change in practice' criteria

GOOD compliance 'evidence of change in practice' criteria	Data collection by/from
Reception teacher can provide evidence of at least 10 uses of the maths practice scale, and how it impacted on their teaching in the 2021/2022 academic year and in the 2022/2023 academic year.	Collected via a standard proforma by DT during mentor support core visits.
Reception teacher can provide evidence of at least 7 uses of the BfL scale, and how it impacted on their teaching in the 2021/2022 academic year and in the 2022/2023 academic year.	Collected via a standard proforma by DT during mentor support core visits.
Reception teacher can provide evidence of use of knowledge base materials etc. (including adaptations of these where appropriate) to support intent (planning), implementation and/or impact of teaching during child-initiated and/or adult-led sessions in the 2021/2022 academic year and in the 2022/2023 academic year.	Collected via a standard proforma by DT during mentor support core visits.
Reception teacher can provide evidence of at least one use of formative assessment processes and/or developmental progressions (or their own adaptations of these) e.g., completed assessment table, changes in teaching content, processes, strategies etc. for individual children following assessment using developmental progression, in the 2021/2022 academic year and in the 2022/2023 academic year.	Collected via a standard proforma by DT during mentor support core visits.
Reception teacher can provide examples of using TEEMUP PD strategies to support HLE in the 2021/2022 academic year and in the 2022/2023 academic year.	Collected via a standard proforma by DT during mentor support core visits.

A Reception teacher will be classed as having **at least minimal compliance** if they fulfil all of the following criteria as detailed in Table 10.

Table 10: Cohort 2 CACE analysis MINIMAL compliance criteria

MINIMAL compliance criteria	Data collection by/from
The Reception teacher remains at the school and teaching Reception in 2021/2022 and 2022/2023.	Collected by ET directly from schools at the end of each academic year
Reception teachers completes 5of 9 core training sessions, at least by watching recorded sessions. (NB. attendance/watching final half day session is not required for compliance).	Collected by DT via attendance registers/training completion records for each school and shared with ET
The school hosts 2 face to face visits from a mentor/coach, at least 1 of which reception teacher should be well prepare for (DT will define 'preparedness' which will include for example, class cover arranged, an appropriate meeting place, read through questions provided by DT prior to meeting and prepared to answer them).	Collected by DT mentor records for each school and shared with ET
A minimum of 4 school log-ins to the online knowledge base over the course of the whole intervention period.	Automated data held by DT team shared with ET[RL4] or self-reported data from teachers collected by DT and shared with ET.