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## **Amendments**

The protocol was amended on the 17 July 2017. The changes are as follows:

Page 2: The addition of the dates where members of the evaluation team have been PI.

Page 2: Protocol authorship

Page 9: The removal of NatCen from the protocol who were going to conduct the post-testing however this has since been delivered by the evaluation team.

## **EVALUATION SUMMARY**

<b><u>Evaluation Summary</u></b>	
<b>Age range</b>	Nursery children aged three-four years (early years)
<b>Number of children</b>	1200
<b>Number of nurseries</b>	120 nurseries
<b>Design</b>	Two armed (one-year) cluster randomised controlled trial (random allocation at the level of nursery)
<b>Primary outcome</b>	Maths attainment as measured by a maths assessment at the start and end of nursery

### **Independent Evaluation of the Maths Champions Programme**

#### **A two-arm 1 year cluster randomised controlled trial**

#### **TRIAL PROTOCOL**

##### **Chief Evaluators:**

- Hannah Ainsworth (July 2015-October 2015; January 2017-March 2018)
- Victoria Menzies (July 2015-October 2016; October 2017-March 2018)
- Professor David Torgerson (November 2015- December 2017),
- Dr Lyn Robinson-Smith (November 2016 – September 2017)

##### **Protocol Version: 3**

**Protocol Date:** 07/07/2017

**Funder:** Education Endowment Foundation

**Authorship:** Victoria Menzies, Professor David Torgerson, Dr Lyn Robinson-Smith, Professor Carole Torgerson, Louise Gascoine, Louise Elliot, Caroline Fairhurst, Hannah Ainsworth,

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## **BACKGROUND**

### **SIGNIFICANCE**

Research suggests that early mathematics achievement is correlated with both achievement in mathematics and general educational attainment in later life (e.g. Duncan *et al.* 2007; Jordan et al, 2009) emphasising the importance of early maths intervention. Attendance at pre-school and quality of pre-school provision have been shown to predict children’s scores on maths and reading assessments at Key Stage 1 (Sylva *et al.* 2004), maths and science achievement at Key Stage 2 and 3 (Sammons *et al.* 2011) and quality of GCSE results (Sylva *et al.* 2014). Sylva *et al.* (2014) also found that quality of pre-school had a stronger influence on the GCSE Maths and English scores of children whose parents had lower qualification levels indicating that high quality early numeracy education at pre-school can have long lasting effects which may help to narrow the gap in achievement throughout life.

Maths Champions is a one-year programme developed by the National Day Nursery Association (NDNA) with the aim of improving the knowledge, skills and confidence of nursery practitioners in order to improve the quality of maths provision within their setting. The current evidence base for the ‘Maths Champions’ intervention is fairly weak. A two-year pilot of the programme funded by DfE indicated that the programme has increased practitioner confidence and skills in delivering numeracy in nurseries (as reported by the developer). We therefore propose to conduct a robust effectiveness RCT of Maths Champions, following a pilot study of the intervention. The Maths Champions programme will be audited in line with current evidence-based guidance of teaching early years’ maths (e.g. Frye *et al.*, 2013; Williams, 2008). Further development of the intervention along with a theory of change model during a development/pilot year (piloting the trial processes) should allow the programme to be specified more clearly in readiness for a definitive trial. For the main impact trial, the study design will adopt a two armed cluster randomised controlled trial with randomisation at the nursery level. In total, 120 private, voluntary and independent (PVI) nursery settings will be recruited by NDNA and supported by the evaluation team. Although all children within the nursery will receive the intervention, the primary outcome of the evaluation will focus on the mathematical attainment of children who are aged three at the start of the intervention, due to attend school in September 2017 and attend nursery for a minimum for 15 hours per week. The quality of provision and levels of staff qualification within PVI settings has been found to be lower than that of integrated centres and schools (Mathers & Smees, 2014), with many nursery practitioners not having higher than level 2 qualifications (APPG Maths & Numeracy, 2014). The Maths Champions programme may therefore support and enhance the knowledge of staff in these settings to be able to deliver higher quality numeracy education.

### **INTERVENTION**

The Maths Champions programme itself, and most associated resources and training, are based online. Within each nursery, the Maths Champions programme is delivered by a dedicated “Maths Champion”; the setting’s graduate practitioner (being a graduate is a prerequisite to being a Maths Champion). Using the programme resources and training available online, the role of the Maths

Champion is to support non-graduate practitioners within their setting to evaluate their current practice, assess their current level of mathematical knowledge and skills, develop knowledge and understanding, and confidence in teaching maths.

The programme starts with two online courses to support the setting's graduate in becoming a Maths Champion. These are intended to help the Maths Champion evaluate their practice and measure the impact of all they do and give them the skills to mentor and lead the team in the programme. Each course takes around two hours. Once completed, the Maths Champion then works with a team of non-graduate practitioners within their settings; whilst not everyone in the setting needs to participate, it is essential that those practitioners working with children aged three or above do, as this is the target group of the evaluation.

The Maths Champion then evaluates the nursery's current practices, using audit tools provided online. This includes tools to gauge:

- Staff confidence: self-reported confidence levels in teaching Maths using a questionnaire
- Current staff mathematical ability: using a BKSb diagnostic tool (or equivalent) to identify the areas of strength and challenge within each practitioner's mathematical knowledge and understanding. Non-graduate practitioners are to be supported by the Maths Champion throughout the course of the intervention to develop their mathematical skills, and complete sections of the BSKB course online throughout the year.
- Current child ability: using a tracker for staff to record how many children in their groups are at the emerging, expected or exceeding stage of maths in relation to the Early Years Foundation Stage (EYFS) development matters statements.

The purpose of the audit is to identify to the Maths Champion the areas of the maths learning environment that need improvement from which they will develop their setting's 'action plan'. Throughout the course of the year, the Maths Champion and non-graduate practitioners will be encouraged to utilise the online resources that are focused around activities to incorporate numeracy concepts within play and to encourage interaction around maths. The Maths Champion has a log-in to the Maths Champion's website that allows them to access all parts of the programme. These resources are reinforced by short monthly webinars with focused themes, to help the Maths Champion and non-graduate practitioners implement them into their everyday practice. Webinars are live each month, but are recorded and can be watched at a later date. In addition, the Maths Champion is required to complete a further three online courses throughout the year which they are expected to disseminate to their team, which focus on:

- (1) Understanding on how to observe, assess and plan maths sessions and connect it to other aspects of learning
- (2) Teaching numbers to different ages and stages of progression
- (3) Shape, space and measure

Towards the end of the programme, the outcomes audit is conducted by the Maths Champion. This includes the reassessment of staff confidence levels, mathematical skills (through the BKSb), settings and resources audit, and child ability.

## **RESEARCH PLAN**

### **RESEARCH QUESTIONS**

1. What is the impact of the Maths Champions intervention on the mathematical development and skills of children aged three and four years? [Primary outcome]
2. How effective is the Maths Champions intervention at improving nursery practitioners' confidence in supporting children's maths development? [Secondary outcome 1]
3. What is the impact of the Maths Champions intervention on the mathematical practice of settings as evaluated using ECERS 3 and ECERS E (Maths)? [Secondary outcome 2]
4. What is the impact of the Maths Champions intervention on the literacy development and skills of children aged three and four years? [Secondary outcome 3]
5. What is the impact of the Maths Champions intervention on the development of phonological awareness skills of children aged three and four years? [Secondary outcome 4]

### **DESIGN**

The evaluation of the Maths Champions intervention will be implemented in two phases: (1) the pilot study, and (2) the main trial.

#### *Pilot Study*

The primary aim of the pilot study is to trial aspects of the research methodology, with particular regards to the eligibility, consent and follow-up of children within the PVI settings.

The objectives are to:

(1) Gauge how many children within each setting fulfil the eligibility criteria, that is, being three years old at the start of the intervention, due to attend school in September 2016 and attend nursery for a minimum of 15 hours per week. These preliminary data will help us understand how many children within each setting may be eligible for the main trial.

(2) Develop and gauge response to a three-stage parental/carer consent process to estimate the proportion of parents who are willing to provide opt-in consent for:

- (i) Their child to participate in the baseline and outcome assessments (ASPECTS, described below)
- (ii) The evaluation team to contact them by telephone or email to collect school destination data
- (iii) The linking of their child's data to the NPD.

Children are not assigned a Unique Pupil Number (UPN) until they reach primary school; however, the child's name, date of birth and school destination is sufficient for linkage to the National Pupil Database (NPD). It is anticipated that school destination data for each child will be collected from nurseries; however, in the event that these data are unavailable, the evaluation team will contact parents/carer via email or telephone Nursery staff who will distribute the research information sheet

(see Appendix A) and consent forms (see Appendix A) to parents for completion. The three stage consent requires parents to opt-in and consent to each: ASPECTS, follow-up, long term tracking.

(3) Trialling of the staff training and their collection of child attainment data using ASPECTS.

Each nursery will be requested to select one member of staff to test all children at baseline (prior to randomisation), and that this adult participates in necessary training administered by the evaluation team via webinar (lasting no longer than one hour). Within each nursery, testing will be conducted on a random sample of approximately ten children who meet the eligibility criteria and whose parents have provided the relevant consent, in order to keep the testing burden on the nurseries to a minimum. A member of the evaluation team will visit each nursery on the day of testing, to observe the assessment being delivered.

(4) Pursue an NPD request using data available (child name, date of birth, school destination, home postcode) to gather and track long-term educational outcomes.

The number of pupils whose data could be linked via NPD will be collected. The pilot study does not require the educational data associated with this process, it is the feasibility of long-term tracking and the matching process that is being explored at this point. Therefore long-term tracking will not be conducted on the pilot sample.

(5) Trial the intervention feedback survey to inform the process evaluation:

(i) The Maths Champion's team perceptions of the intervention within their settings

The pilot phase will take place during February 2016 – April 2016, in six PVI nurseries in which the NDNA's Maths Champion programme is already established. It is estimated that there are approximately 60 nurseries that are currently implementing Maths Champions in the UK. NDNA will make the initial contact with the nurseries, using an information sheet provided by the evaluation team (see Appendix A). Nurseries interested in participating in the pilot study will be requested to contact the evaluation team for further information or to sign up. For participating in the pilot study, nurseries will receive a £250 Amazon voucher.

### **Main Trial**

We propose a pragmatic two armed cluster randomised controlled trial. Nurseries will be randomly allocated into one of two groups on a 1:1 ratio:

- Intervention – nurseries allocated to receive the Maths Champions intervention (a one year intervention); or
- Control – nurseries allocated to continue with usual nursery provision.

Minimisation will be undertaken to ensure nurseries across the two groups are balanced on size, type of nursery and one or more graduates. This will be undertaken by an independent study statistician to ensure that the allocation is concealed.

## **PARTICIPANTS (NURSERIES AND CHILDREN)**

Eligible nurseries should be PVI nurseries whose child population includes children who are three years old and located in areas of high deprivation (less than 40% in accordance with the Indices of deprivation). Eligible nurseries should not have previously been involved with the Maths Champions intervention. Nurseries will only be eligible to take part in the study if they agree to all of the study requirements outlined in the Memorandum of Understanding with Nurseries (Appendix

B). The trial nurseries will be recruited by NDNA, supported by the evaluation team at Durham and York. In total, 120 nurseries (to ensure that the trial is sufficiently powered with a low level of nursery-level attrition) will take part in this trial (60 in each arm). NDNA ceased registration for the Maths Champions intervention in December 2015, to ensure capacity is sufficient to support the project. NDNA will begin recruitment in February 2016 with regional events.

Children who are three years old at the start of the intervention and due to start school in September 2017 and attending nursery for a minimum of 15 hours per week will be eligible to participate in the testing. The age and minimum number of hours will ensure that children are in the nursery long enough to receive three (academic) terms of the intervention. Parents/carers of eligible children will be informed of the evaluation via letter passed on to them via the nursery (Appendix B). Parents/carers will be required to give opt-in consent for their child to participate in the baseline and outcome testing (see Appendix B). Parents will also be requested to provide opt-in consent to be contacted should school destination data for their child not be available from the nursery, and also for long term tracking of their child's educational attainment via the NPD. Parents/carers may choose to opt-in to the assessment, but not to the follow-up or for their child's data to be linked to the NPD for the long-term tracking of their educational outcomes. All nurseries (both intervention and control) will receive £500 for taking part in the research (provided directly from NDNA).

## **OUTCOME MEASURES**

### *Primary Outcome*

The proposed primary outcome in the main trial is maths attainment at the end of nursery measured using the 'Assessment Profile on Entry for Children and Toddlers' (ASPECTS) assessment produced by the Centre for Evaluation and Monitoring at Durham University. Participating children will be assessed by the ASPECTS at baseline (prior to their nursery being randomised) and follow-up a year later. ASPECTS has been specifically designed for children aged between three and five years old (36 to 60 months) and is aligned with crucial elements of the EYFS Prime and Specific areas of Learning and Development. ASPECTS adopts a computer adaptive design (meaning that the questions posed to children vary in complexity depending on their previous responses) to establish an objective baseline for the key educational areas including maths, language and phonological awareness. The assessment that is carried out by a practitioner working with one child at a time. The assessment begins by asking the child to write his/her name, which is scored by the practitioner against examples. Following that activity, the software presents a story to the child. Sound files are used to read the story and ask questions, thus standardizing the method of administration. The assessment is adaptive and so questions are selected on the basis of a child's correct and incorrect answers. All children experience the same story but the range of questions will be different, depending on their responses. Rasch measurement has been used to estimate the item difficulties. The items are placed into categories and as soon as a child has made a certain number of mistakes in a category, they are not presented with more difficult questions of that type (Tymms & Merrell, 2012). The early literacy and mathematics assessment typically takes approximately 10 – 12 minutes per child. In terms of early maths, ASPECTS measures a child's ideas about maths, digit identification, number problems, shapes and counting. The ASPECTS assessment includes reassessment at the end of nursery; therefore it is a suitable baseline and outcome measure for this evaluation.

Limitations of testing in the early years are the young age and temperament of children who may or may not be responsive at the time of testing, potentially leading to missing data. To minimise this



issue, we will try to ensure that the child is familiar with the adult who administers the baseline assessment, when they are very young (three years old) and at outcome assessment the child can be accompanied by a familiar adult if necessary. We propose that each nursery selects one member of staff to test all children at baseline (prior to randomisation), and that this adult participates in necessary training administered by the evaluation team via webinar. Within each nursery, testing will be conducted on approximately ten children who meet the eligibility criteria and whose parents have provided the relevant consent, in order to keep the testing burden on the nurseries to a minimum. If there are less than ten children per setting, all eligible children will be tested, If there are more than ten eligible children either all or a randomly selected group will be tested (the pilot will determine which of these options is the better approach of the two). The evaluation team will visit 10% of nurseries (randomly selected) to oversee the assessment process, to check and ensure consistency. To reduce possible bias, ASPECTS outcome data will be collected by independent, blinded practitioners who will be trained to deliver the assessment by the evaluation team. The evaluation team will liaise with nursery staff to arrange a suitable date for them to visit the nursery for retesting the children who completed the assessment at baseline. In the current budget, there is scope for the independent practitioners to revisit 70% of nurseries to gather missing outcome data should some children be absent on the first data collection date.

### **Secondary Outcomes**

Secondary outcomes include reading and phonological awareness scores, also gathered using ASPECTS.

A measure of practitioner confidence, gathered via a short survey will be developed during the pilot study.

The Early Childhood Environmental Rating Scales 3(ECERS-3) and the Early Childhood Environmental Rating scale (ECERS-E) will be collected at the nursery level at the end of the trial in both intervention and control groups. Both of these scales are designed to give a snapshot of provision within a setting on a particular day. ECERS-3 consists of 35 items organised into six subscales: (1) space and furnishings, (2) personal care routines, (3) language and literacy, (4) learning activities, (5) interaction, and (6) programme structure. The collection of ECERS-E data will focus on the following maths subscale including (1) counting and application of counting, (2) reading and representing simple numbers, (3) shape, (4) sorting, matching and comparing. The collection of these data requires a full day's observation within each nursery setting which will be conducted by and subcontracted to company A+ Education Ltd who will subsequently provide the data to the evaluation team for analysis.

## **SAMPLE SIZE CALCULATIONS**

We make the following assumptions: an intra cluster correlation of 0.19 (from ECC evaluation, Torgerson et al 2011) and 10 children per nursery with a pre and post-test correlation of 0.70. Based on 120 nurseries (i.e., 1200 children) we would have 80% power to show an effect size of 0.20 of a standard deviation between the control and intervention groups, allowing for 10% attrition at the child level.

## **ANALYSIS PLAN**

A detailed Statistical Analysis Plan (SAP) will be produced prior to the completion of data collection. A summary of the proposed analyses is presented below.

All analyses will be conducted on an intention to treat basis, using two-sided significance at the 5% level. Nursery, practitioner and child level baseline data will be summarised descriptively by treatment group. No formal comparison of baseline data will be undertaken.

All outcome data will be summarised descriptively by trial arm. Effect sizes based on the difference between the groups at the post-test will be presented as Hedges' *g* with 95% confidence intervals. The intra-cluster correlation coefficient (ICC) for the ASPECTS at the post-test will be presented.

### **Primary Analysis**

The primary analysis will investigate any difference in the ASPECTS numeracy assessment between the two groups. The analysis will take the form of a linear regression model with child as the unit of analysis using the Huber-White sandwich estimator (robust standard errors) to account for the potential clustering within nurseries. The model will adjust for group allocation and baseline assessment to be decided before the analysis and detailed in the SAP.

### **Secondary Analysis**

Language and phonological awareness scores from the ASPECTS will be analysed in the same way as the primary outcome.

The total mean score for ECERS-3, and the maths subscale score for the ECERS-E will be compared between the nurseries in the two groups using linear regression. We won't have a baseline value for the nurseries to include in the analysis but we will consider adjusting for other nursery level factors, such as class size, mean childcare qualification level of staff and percentage of non-white British children, which have previously been seen to be predictive of the maths sub-score of ECERS-E (Mathers *et al.* 2011).

Practitioner confidence following the intervention will be summarised descriptively by trial arm.

### **Subgroup analyses**

Subgroup analyses looking at dosage (e.g. number of days a child attends nursery), children that are eligible for the Early Years Pupil Premium and socioeconomic factors will be considered and detailed in the SAP. These will be informed from the pilot study.

A Complier Average Causal Effect (CACE) analysis will also be considered to account for compliance/engagement of the nurseries with the intervention.

## **IMPLEMENTATION AND PROCESS EVALUATION METHODS**

Research questions for the process evaluation will be informed by the Theory of Change/Logic model of the Maths Champions programme during the pilot/development year. This will ensure that the developer and evaluator have a shared understanding of the intervention and how different aspects of the intervention are expected to lead to outcomes.

### **Suggested Research Questions**

1. To what extent are the nurseries involved engaging with and delivering the intervention?
2. To what extent have nursery practitioners changed their practice from the beginning to the end of the intervention?
3. Is fidelity to the intervention being maintained?
  - a. Are nominated staff accessing the available training and materials?
  - b. Are the different aspects of the intervention being completed?
4. What are the different stakeholder viewpoints on the intervention?
  - a. Nursery practitioners involved as Maths Champions
  - b. Other nursery practitioners (not Maths Champions)

- c. Nursery leadership
- d. Parents (if relevant)
- 5. How is the intervention disseminated within the nurseries to other staff?
- 6. How effective and appropriate are the level of support and training?
- 7. What are the key success factors required for the Maths Champions intervention to work well?
- 8. What are the barriers to successful delivery of the intervention?
- 9. What areas of the programme could be further developed following completion of the project?
- 10. What is the acceptability of the intervention and does this differ depending on the experience or qualifications of the staff involved?

### Process evaluation design

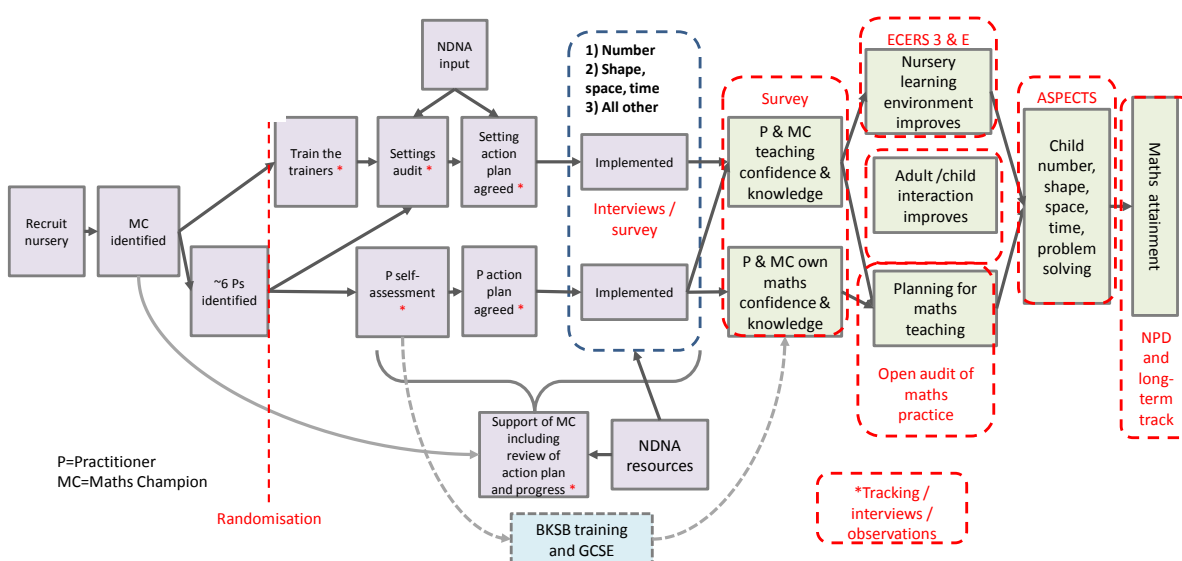
The process evaluation will take place over the full year of the main trial and will monitor implementation fidelity, the processes involved for settings in implementing the intervention, and the perceptions of relevant stakeholders. Tracking data automatically collected by NDNA will be used to track implementation fidelity and access to all aspects of the online programme throughout the year. A practitioner survey at the end of the year will also allow the collection of quantitative implementation fidelity data.

To investigate the processes involved in implementing the intervention we will also a multiple case study design with both longitudinal and cross-sectional aspects. For two settings we will closely follow the processes involved in implementing the Maths Champions intervention and how changes in practice occur through over the course of the intervention through visits at three time points during the year. Four additional settings will be involved in the cross-sectional aspects with one visit to each setting to elicit observation data and perceptions of stakeholders at set times allowing comparisons to be made between settings at specific time points.

### Development of a Theory of Change (ToC) and Logic Model

The ToC, developed by University of Oxford with NDNA, presents different aspects of the intervention which are expected to lead to changes in outcomes (causal assumptions), see Appendix C. The Logic model below has been developed to help identify key questions for the process evaluation in conjunction with the NDNA.

**Figure 1: Maths Champions Logic Model**



### *Monitoring of Access to Intervention Training and Resources*

Website access at setting level by nursery staff will be tracked and recorded to monitor how often Maths Champion practitioners and other nursery practitioners are accessing the online training and resources. These data will be provided by NDNA. In addition, NDNA will provide the evaluation team with data that ascertains if the Maths Champion has completed baseline and endpoint audits, if the Maths Champion has completed the initial and follow on training and monthly webinar attendance.

### *Feedback Surveys of Nursery Practitioners*

Staff involved in delivering the intervention will be requested to complete a paper survey to capture resource usefulness acceptability, intervention delivery (support from Maths Champion; access ease, how useful was information), and perceived impact of the intervention. These surveys will be developed and piloted during the pilot study among settings who have already completed the Maths Champions programme. For the main trial these would be delivered at the end of the year. As a means of increasing response rate, the surveys will be distributed to staff by and returned to the on-site ECERS/A+ researcher who is attending the nursery to collect child attainment outcome data. Full details will be confirmed at the end of the pilot study, added to the protocol and recirculated prior to the beginning of the main trial.

### *Case Studies*

Case studies will be conducted in 10% of intervention nurseries (n=6). Two nursery settings will be selected to participate in in-depth case studies. Here the evaluation team will visit the nursery a total of three times: once at the beginning, once mid-way through the intervention and once at end of the intervention. A further two nurseries will be selected to participate in cross-sectional case studies. Here, the evaluation team will visit these two nurseries mid-way through the intervention. These four nurseries will be chosen at random at the beginning of the trial, and will be replaced (at random) if drop-out occurs. Towards the end of the project, two nurseries where the intervention is perceived as being successful both in delivery and impact, will be selected to participate in a case study visit.

All case study visits will include interviews with Math Champions, interviews with nursery leadership, interviews or focus groups with practitioners. These interviews will provide a more rounded perspective of the intervention within each setting and will explore how the intervention was used and adapted in individual circumstances, including any barriers that may have been faced. During all of these visits, the evaluation team will also conduct observations of nursery practice where maths activities are being undertaken.

### *Interviews with the Developer*

Interviews with key staff will be conducted at the end of the pilot stage and at the end of the main trial intervention delivery to discuss further development of/changes to the programme, perceived impact, implementation fidelity including potential barriers and future plans.

### *Economic Evaluation*

Data on intervention costs will be collected from NDNA as well as from nurseries participating in the case studies, through interviews as part of the process evaluation, and will be used to conduct a cost evaluation in line with recent guidance from the EFF.

## **ETHICS AND REGISTRATION**

Each of the participating institutions will ensure ethics clearance within their institution.

Opt-in consent will be sought from the Nursery Setting Manager to take part in the overall trial. Parental opt-in consent will be sought for collecting and using child data for the trial. Opt-in consent will be sought from nursery practitioners for observations, interviews and surveys.

The Evaluation team will register the trial with ISRCTN ([www.controlled-trials.com](http://www.controlled-trials.com)) once the protocol is agreed.

## **CONFLICT OF INTEREST**

The evaluation team highlighted to EEF a possible conflict of interest arising from the academics at the University of Oxford supporting NDNA in developing the intervention whilst also being contracted by EEF (through A+ Education Ltd) to collect outcome data (ECERS-3, ECERS-E) to be used within secondary analyses as part of the independent evaluation. As the data collected through ECERS-3 and ECERS-E will form a secondary outcome, measures will be put in place to minimize bias, e.g. a process will be developed between the evaluators and A+ Education Ltd researchers to ensure blinding and data will be transferred to the York/Durham team to be analysed independently.

## **PERSONNEL**

The proposed evaluation team includes members of The York Trials Unit, University of York panel of evaluators, and members of the Durham University panel of evaluators. The York Trials Unit would be the contractual lead on the project. This exceptionally strong team includes:

### **Hannah Ainsworth (York Trials Unit, University of York)**

Hannah Ainsworth is an experienced education and health care trial manager. She has been co-investigator and/or trial manager on around 16 trials evaluating a variety of education and health interventions. She was the trial manager for the three trials in the *Every Child Counts* evaluation. She will be joint principal investigator and trial manager of this evaluation. She will oversee the impact, process and cost evaluation elements, contributing expertise to the design and conduct of this evaluation as well as to the writing of the final report. She will undertake all trial management responsibilities.

Hannah is on maternity leave from November 2015 – November 2016.

### **Vic Menzies (CEM, Durham University)**

Vic Menzies is an experienced education trial coordinator and researcher with a particular focus on maths development and learning. She led on the intervention development of the Durham Shared Maths project as well as coordinating the large scale trial, and has managed or co-investigated three EEF funded evaluations. She has conducted research work looking at the development of maths skills on starting school in Scottish and Chinese schools and has experience of working in nurseries in the UK and in Canada. She will be joint principal investigator of this evaluation. She will oversee the evaluation work done at CEM, contribute expertise to the design and conduct of the evaluation and lead on the process evaluation.

### **Dr Lyn Robinson (CEM, Durham University)**

Lyn Robinson is a Research Associate with experience of leading and delivering trials, including those funded by the EEF. Her expertise lies in conducting research in early years settings, developing and delivering CPD training (as part of the EEF funded Literacy Octopus trial) for learning and assessment. She is named co-investigator, but will be acting Principle Investigator during the trial. Lyn will contribute to management of the design and conduct of the evaluation, as well as lead the training and coordination of staff in the baseline and outcome assessment. Lyn will undertake all trial management responsibilities.

**Professor David Torgerson (York Trials Unit, University of York)**

David Torgerson is an experienced trial methodologist and Director of the York Trials Unit. He has worked on numerous randomised trials including many in education and the social sciences. He will be a co-investigator of this evaluation, supporting the design and conduct of the proposed evaluation including the economic evaluation and contributing to the writing up of the final report. In Hannah Ainsworth's period of maternity leave, David will assume the role of joint Principal Investigator.

**Professor Catherine Hewitt (York Trials Unit, University of York)**

Catherine Hewitt is a senior trial statistician with experience working on numerous randomised controlled trials, including educational trials. She will be a co-investigator of this evaluation, providing input and support into the trial statistical analysis.

**Caroline Fairhurst (York Trials Unit, University of York)**

Caroline Fairhurst is a statistician, currently supporting a number of trials within the York Trials Unit. She will be a co-investigator of this evaluation contributing to the design and conduct of the trial and undertaking the statistical analysis.

**Professor Carole Torgerson (School of Education, Durham University)**

Carole Torgerson is an educational trials design and methods expert and an educationalist. She has undertaken over 25 systematic reviews of randomised controlled trials and has been lead or co-investigator on around 15 trials evaluating a variety of education and health education interventions. She will be a co-investigator of this evaluation, contributing expertise to the design and conduct, as well as to the writing of the final report.

**Louise Elliott (York Trials Unit, University of York)**

Louise Elliott is an experienced data manager and has worked on a number of education trials. She will be responsible for creating systems/databases for the secure collection and storage of trial data, along with the preparation of the dataset for analysis.

**Louise Gascoine (York Trials Unit, University of York)**

Louise will liaise between Durham and York to ensure the smooth transfer of data and co-ordination of the impact seen in respect of trial management. She will contribute expertise to the education policy and practice background to the trial as well as to the rigour of its design and conduct. She will also contribute to the writing of the final report.

**Dr Kerry Bell (York Trials Unit, University of York)**

Kerry Bell is an experienced trial manager and has worked on a number of pragmatic randomised controlled trials. Most recently she has worked on the Family Nurse Partnership study supporting teenage mothers. Alongside Louise, she will be involved with ensuring smooth transfer of data and co-ordination of the impact seen in respect of trial management. She will contribute to the writing of the final report.

**Administrator (TBA)**

An administrator will be appointed to work 50% on the project and be based in Durham. They will facilitate the administration of ASPECTS and liaise with settings for visits for data collection purposes. They will also assist with the collection of school destination data from parents.

**RISKS**

The main anticipated risks along with the mitigation considerations are presented in the following table.

Risks	Assessment		Mitigation
	Likelihood	Impact	
Nursery setting recruitment	Low/Medium	High	NDNA will be primarily responsible for recruitment, with the evaluation team offering supporting guidance.
Possibility of attrition for those nurseries that agree to enter	Low/Medium	Medium	All nurseries will be provided with a financial contribution of £500 to acknowledge the time and resources required to take part in the trial (this will be provided by NDNA). Nurseries will sign up to MoU informing them of all aspects of the trial. Nurseries will be in constant contact with NDNA throughout the trial.
Low number of eligible children within each setting	Medium	High	Data collected throughout the pilot study will inform the team on the likely proportion of children within each setting who are eligible for the trial.
Low parental/carer opt-in consent rate to ASPECTS testing	Medium	Medium	Evaluation team will provide detailed information to both nursery staff and parents with regards to the ease of children conducting the assessment and will be highlighting the confidentiality of child data. Parents will have the opportunity to contact the evaluation team should they have questions which cannot be answered by the nursery staff.
Low parental/carer opt-in consent rate to follow-up and long-term teaching	Low/medium	Low/medium	Evaluation team will provide detailed information to both nursery staff and parents highlighting the confidentiality of child data. Parents will have the opportunity to contact the evaluation team should they have questions which cannot be answered by the nursery staff.
School destination data unavailable from nursery	Low	Low	Data will be collected from parents through follow-up contact (telephone or email), providing consent for this has been gained.
Unable to follow-up parents for school destination data	Medium	Low/medium	If parental/career consent has been gained, existing pupil data may be sufficient to link NPD, so an attempt will be made.
Refused Access to NPD	Low	Low	Data will be collected directly from destination schools.
Missing outcome data (ASPECTS)	Medium	High	All attempts will be made to ensure data collection is arranged at a day where the majority of children who need to be tested are scheduled to attend nursery. We have costed into the budget to revisit 70% of nurseries to collect data from children who were absent on the first data collection day.
Researcher Loss (illness etc)	Medium	Medium	Each institution has a large department with numerous researchers to take on. Senior staff can stand in if necessary.
Administration of data	Low	High	Both institutions involved in the evaluation will agree to follow a data management

			plan registered online which details the acceptable processes for transferring and storing data as well as which data will be stored and used by each party. All processes specified will comply with the policies of the three institutions.
Management of the trial & the evaluation/test data			Clear protocols in place for communication between all three teams so that all teams are informed about any communication with nurseries. Regular and frequent communication between teams on milestones.

## **TIMELINE**

DATE	TEAM	ACTIVITY
01/10/2015	ALL	Project Starts
10/15 to 02/16	ALL	Protocol Development and Ethics
10/15 to 06/16	NDNA, UoO*	Intervention Development
01/16 to 04/16	Evaluation team	Piloting Evaluation Procedures
01/16 to 05/16	NDNA (Supported by the evaluation team)	Recruit Nursery Settings
06/16	Evaluation team (Durham)	Baseline Data Collection
06/16	Evaluation team (York)	Randomisation
07/16	NDNA	Intervention Begins
09/16	Evaluation team	Case Studies (in-depth, first visit)
01-02/16	Evaluation team	Case Studies (in-depth, second visit; cross-sectional, only visit)
05/16	Evaluation team	Case Studies (in-depth, final visit; cross-sectional, only visit)
06-07/17	Evaluation team (subcontractors A+ Education Ltd,)	Primary and Secondary Outcomes Collected
07/17	NDNA	Intervention Ends
08-09/17	Evaluation team	Parental/Guardian Follow-up on Child School Destination
09/17 to 12/17	Evaluation team	Analysis and Report Writing
12/17	Evaluation team	Draft Report
	Evaluation team	Final Report
01/18 to 03/18	Evaluation team	Pupil Matching Reference (PMR) numbers for Long Term Follow-up collected from NPD
	ALL	Project End Date

\*University of Oxford (UoO)

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**APPENDIX A**  
**PILOT STUDY DOCUMENTATION**

## **MATHS CHAMPIONS PILOT STUDY**

### **RESEARCH INVITATION:**

### **INFORMATION FOR NURSERIES**

The Education Endowment Foundation is funding a large research project to evaluate the Maths Champions programme developed by the National Day Nursery Association (NDNA). This project will work with 120 nursery settings and will start in summer 2016. The team responsible for the research are from the University of York and Durham University. Before starting this large project, we would like to understand the best way to collect some of the information we will require from nurseries, parents and children. To do this, we are seeking six nurseries to work with us as part of a pilot study. We are contacting you because your nursery has already participated in or is currently participating in the Maths Champions programme. This information sheet gives you more information about what being involved in the pilot study would mean for you and your nursery.

#### **WHAT DOES TAKING PART IN THE PILOT STUDY INVOLVE?**

As part of the pilot study we would like you to share information with us on the age and attendance of children in your nursery. This will enable us to estimate how many children fit certain criteria within nursery settings.

We would also like you to conduct a short assessment called ASPECTS with some of the children (maximum of ten) within your nursery. These children must be aged three, due to attend school in September 2016 and attend nursery for at least 15 hours each week. Children complete ASPECTS with an adult and it usually takes around 15 minutes. Children tend to enjoy using ASPECTS as the computer tells a story and then asks the children to answer questions about it. In preparation for using ASPECTS, we will provide a one-hour training session via webinar. This information will help us to understand the best way to prepare nursery staff to conduct ASPECTS and identify any practical issues that may arise, in preparation for the larger project. Further information on the ASPECTS assessment can be found here: <http://www.cem.org/early-years>

Before using ASPECTS, we would like you to distribute and collect consent forms from children's parents/guardians. We will provide you with an information sheet and a consent form to give to parents/guardians. Parents/guardians do not have to consent to their children taking part in the ASPECTS assessment if they do not want to.

To help us understand nursery practitioners' experiences of the Maths Champions programme, we have developed a questionnaire. We would like practitioners involved in the programme in your nursery to complete this questionnaire so that we can ensure we have included the right kind of questions. The questionnaire will take no longer than 15 minutes for practitioners to complete.

On the day you use ASPECTS with the children, a member of the project team will come along to the nursery to ask you and the nursery staff about conducting ASPECTS, gathering parent/guardian consent forms and completing the questionnaire.

## **WHAT DO YOU GET FOR TAKING PART IN THE PILOT STUDY?**

For taking part in the pilot study, your nursery will receive a £250 Amazon voucher by way of reimbursement for the time your nursery has spent. We also hope that participating in the pilot will provide useful feedback for the nurseries, as you will be provided with the data generated from your children's ASPECTS assessments.

## **DATA PROTECTION**

All data collected during research project will be stored securely, treated confidentially and used only for research purposes. Any information collected about the nursery and children within it will be analysed anonymously and will not be identified in any report. For the purpose of the study, information provided will be linked with the National Pupil Database (held by the Department for Education), other official records, and shared with NDNA, the Department for Education, Education Endowment Foundation (EEF), EEF's data contractor FFT Education and in an anonymised form to the UK Data Archive.

## **WHO ARE THE PROJECT TEAM?**

A research team from the University of York and the Centre for Evaluation and Monitoring (CEM) at Durham University have been asked to see how effective the Maths Champions programme is by the Education Endowment Foundation, an organisation that funds research into education.

## **YOUR NURSERY IS INTERESTED IN TAKING PART: NEXT STEPS**

If your nursery would like to participate in the pilot for the MC evaluation, please return a signed [MC\_Nursery Consent Form\_Pilot Study\_v1] to the evaluation team, contact details below, as soon as possible.

## **CONTACT DETAILS**

For further information please contact Dr Lyn Robinson (Project Researcher, Durham University) on 0191 334 4197 or by email [mathschampionsevaluation@cem.dur.ac.uk](mailto:mathschampionsevaluation@cem.dur.ac.uk)

## MATHS CHAMPIONS PILOT STUDY

### NURSERY CONSENT FORM

To be completed by the nursery manager. Please tick each box, sign and provide information below.

- I confirm that I have read and understood the Maths Champions Pilot Study information sheet and have had the opportunity to ask questions.
- I agree to distribute information sheets and consent forms to parents, and return completed forms to the research team. The research team will provide the relevant documents to do this.
- I agree to assign one member of nursery staff to assist children in completing the ASPECTS assessment during March 2016 (15 minutes per child). I understand that this will require the staff member to participate in a training session via webinar that will last one hour.
- I agree to send the research team the child information required as detailed in the information sheet. The project team will only use any information gathered in this project for research purposes as described.
- I understand that members of the project team will visit the nursery in order to observe ASPECTS, to talk to nursery staff and request staff complete the practitioner questionnaire. Consent will be sought from those involved prior to observation or interview.
- I understand that by agreeing to take part in this project the nursery will receive £250 in Amazon Vouchers for completing the practitioner questionnaires, gathering of parental/guardian consent, delivery of ASPECTS assessment to children and providing the required child information.
- I understand that all child and practitioner data will be kept confidential and that no material which could identify the nursery or individual children or practitioners will be used in any reports of this evaluation.
- I understand what is involved in and consent to the nursery taking part in the above study.

Nursery Manager's name: \_\_\_\_\_ Date \_\_\_\_\_

Nursery Manager's signature: \_\_\_\_\_

Email address: \_\_\_\_\_

Nursery name: \_\_\_\_\_ Nursery postcode: \_\_\_\_\_

## **MATHS CHAMPIONS PILOT STUDY**

### **INFORMATION FOR PARENTS/GUARDIANS**

Your child's nursery has signed up to take part in a pilot study to help us (the project team) understand the best way to collect some information on children's math skills. Doing so will help us to develop a large, research project called 'Maths Champions'. This information sheet gives you more detail about what being involved in the pilot study means for you and your child.

#### **WHAT DOES THE PILOT STUDY INVOLVE?**

As part of the pilot study, we (the project team) would like your child to take part in a short assessment while they are at nursery called ASPECTS which tells us about your child's maths and vocabulary skills. We would like your child to take part in ASPECTS during February/March 2016. This will help us to understand the best way to prepare nursery staff to collect this type of information through ASPECTS. Children complete ASPECTS with an adult and it usually takes around 15 minutes. Children tend to enjoy using ASPECTS as the computer tells a story and then asks the children to answer questions about it but if your child does not want to take part in the ASPECTS on the day, they do not have to.

Once children reach school, their educational outcomes can be tracked using a national database (called the National Pupil Database (NPD) which is held by the UK's Department for Education). To do so, researchers need to know which school children attend once they leave nursery. We would like to collect the details of which school your child attends in September 2016 from your child's nursery, but if they do not have this, we would like to contact you to find out. It is important to note that in the context of this pilot study, we will not track your children's educational outcomes using the NPD, rather we are checking to see if our administration processes would allow us to do so in preparation for the large future research project.

#### **DATA PROTECTION**

All data collected during the research project will be stored securely, treated confidentially and used only for research purposes. Any information collected about your child will be analysed anonymously and will not be identified in any report. None of the information we collect will affect your child's place at nursery. For the purpose of the study, information provided will be linked with the National Pupil Database (held by the Department for Education), other official records, and shared with NDNA, the Department for Education, Education Endowment Foundation (EEF), EEF's data contractor FFT Education and in an anonymised form to the UK Data Archive.

#### **WHO ARE THE PROJECT TEAM?**

The Maths Champions programme is being delivered by the National Day Nursery Association (NDNA). A research team from the University of York and the Centre for Evaluation and Monitoring (CEM), Durham University have been asked to see how effective the MC programme is by the Education Endowment Foundation (EEF), an organisation that funds research into education.

## **WHAT DO I NEED TO DO NEXT?**

If you are happy for your child to take part in the pilot study, please sign and return the attached consent form to your child's nursery. If you do not want your child's information to be collected and used, do not sign the consent form.

## **WHERE CAN I GET FURTHER INFORMATION?**

Further information on the Maths Champions programme can be found here:

[http://www.ndna.org.uk/NDNA/Community/Maths\\_Champions.aspx](http://www.ndna.org.uk/NDNA/Community/Maths_Champions.aspx)

Or you can contact Jo Baranek from NDNA on 07881 951 713 or by email [jo.baranek@ndna.org.uk](mailto:jo.baranek@ndna.org.uk)

Further information on the ASPECTS assessment can be found here: <http://www.cem.org/early-years>

Or for information about the research evaluation more generally you can contact Dr Lyn Robinson (Project Researcher, CEM, Durham University) on 0191 334 4197 or by email

[mathschampionsevaluation@cem.dur.ac.uk](mailto:mathschampionsevaluation@cem.dur.ac.uk)

# MATHS CHAMPIONS (PILOT STUDY)

## PARENT/GUARDIAN CONSENT FORM

If you are happy for your child to participate in this research study, please read each of the following statements and if you agree to them ***initial the boxes*** and provide the necessary information on the following sheet and return to the nursery.

I confirm that I have read and understood the information sheet (MC\_Parent/Guardian Information Sheet\_Pilot Study\_v1) about the evaluation of the Maths Champions Pilot Study and have the contact details of the people I need to ask if I have any questions.

I understand that information about my child collected as part of this research will be stored securely, treated confidentially and used only for research purposes. Information about my child will be analysed anonymously and that my child's name will not be used in any research reports or publications.

I agree for my child to take part in the ASPECTS assessment while they are at nursery.

I understand that I can withdraw my child from the research study at any time by contacting the research team.

I agree for the nursery to provide the research team with details of which school my child attends in September 2016 along with gender and date of birth to be used for research purposes only.

If the nursery does not have information of my child's school, I agree to be contacted in the autumn 2016 to confirm which school my child is attending.

I understand and agree that, for the purpose of the study, information collected about my child will be linked with the National Pupil Database (held by the Department for Education), other official records, and shared with the NDNA team, the Department for Education, Education Endowment Foundation (EEF), EEF's data contractor FFT Education and in an anonymised form with the UK Data Archive.

I understand that the information collected from the National Pupil Database will include ethnicity data.

Child's Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Telephone number: \_\_\_\_\_



Contact email: \_\_\_\_\_

Parent/Guardian name: \_\_\_\_\_

Parent/Guardian signature: \_\_\_\_\_

Date: \_\_\_\_\_

***Thank you for your time***

**APPENDIX B**  
**MAIN STUDY DOCUMENTATION**

# Maths Champions Research Invitation

Maths Champions enlists graduates in early years settings to the challenging task of empowering their teams to really bring maths to life. Having fun with numbers - counting, measuring distances, calculating weights and measures - opens up a whole new world of excitement and curiosity for preschool children and sets a great precedent for their educational journey ahead. Many practitioners think they can't do maths, but Maths Champions aims to show them that, yes, they can! When practitioners are excited, empowered and motivated, settings are in a great place to provide the best possible opportunities for the children and achieve better outcomes all round. By taking part in the research, your setting will help us to understand the difference Maths Champions makes to children's maths outcomes and improved nursery practice.

We are looking for privately-run nurseries that employ a graduate practitioner to take part in the Maths Champions research project. Maths Champions is delivered by the National Day Nurseries Association (NDNA), and is being independently evaluated through a randomised controlled trial by an evaluation team based in York Trials Unit at the University of York and the Centre for Evaluation and Monitoring at Durham University. This research trial is being funded by the Education Endowment Foundation (EEF).

## **What does the research project involve?**

In order to help us look at the difference that the Maths Champions makes, we need to compare nurseries that use the programme with those that don't, over the course of a year. We're asking nurseries at this point, to sign up to take part in the research project which includes both groups. After you sign up, you will be told whether your nursery will be part of the group that receives the Maths Champions programme for free or part of the group that continues with their practice as normal. Which group your nursery is in is decided at random by a computer and cannot be changed. This is an important aspect of the research project.

If your nursery is in the group that continues with your nursery's normal practice, your nursery will receive a financial incentive in exchange for taking part. You will be able to purchase the Maths Champions programme if you wish on completion of the project using this money.

Regardless of which group your nursery is in, the evaluation team (York/Durham University) will need to collect some information from your nursery. This will include questionnaires for nursery staff as well as assessing the Maths skills of those children who will be starting school the following year at the beginning and end of the project. In addition throughout the project, the evaluation team will ask to visit your nursery, to observe your daily practice and may ask to talk to your staff as part of the evaluation.

In order to collect this information on children's maths skills, we will require the nursery to gain consent from these children's parents/guardians. The evaluation team will provide the parent/guardian's consent and information forms and are happy to answer any questions or queries they may have.

## **What does the Maths Champions programme involve?**

The Maths Champions programme itself, and all associated resources, are based online. The programme within your nursery would be led by the graduate within your setting, with a team of practitioners, in particular those who work with children aged 3-4 years old.

The programme starts with two online courses to support your setting's graduate in becoming a 'Maths Champion'. These will help the Maths Champion to evaluate their practice and measure the impact in all they do, and also give them the skills to mentor and lead the team in the programme. Each course will take around two hours but can be completed in short sections.

The Maths Champion will then work with the team to evaluate the nursery's current practice, using audit tools provided, including providing details of their own and the nursery's three year olds' maths skills. At this stage, practitioners will also complete a short questionnaire to rate their confidence in maths. This information will help NDNA to create a tailored programme to support your setting.

From this point, the programme is made up of three main components:

- (1) The award-winning BKSB skills assessment tools which can help your team improve their own personal maths skills with 1-1 support from your setting's Maths Champion (taking around 10-15 minutes per month).
- (2) Three online courses throughout the year for the Maths Champion to gain information to pass onto practitioners.
- (3) An online resource bank providing maths ideas to build into the nursery's daily practice. These resources are reinforced by short monthly webinars available for your setting's Maths Champions team to take part in and view, with focused themes to help the team implement maths into their continuous provision and everyday practice.

Throughout the programme the Maths Champion will also receive tailored 1-1 support from NDNA.

Towards the end of the programme, your team will be asked to revisit initial audits to assess any changes in your setting as well as any improvement in the children's and staff's own maths skills.

For more information on the Maths Champions programme, visit [http://www.ndna.org.uk/NDNA/Community/Maths\\_Champions.aspx](http://www.ndna.org.uk/NDNA/Community/Maths_Champions.aspx) or contact NDNA below.

#### **Who should I contact for further information?**

For further information on the Maths Champions programme, please contact Jo Baranek from NDNA on 07881 951 713 or by email [jo.baranek@ndna.org.uk](mailto:jo.baranek@ndna.org.uk).

For further information on the independent evaluation of the Maths Champions programme, please contact Dr Lyn Robinson (Project Researcher, CEM Durham University) on 0191 334 4197 or by email [mathschampionsevaluation@cem.dur.ac.uk](mailto:mathschampionsevaluation@cem.dur.ac.uk).

# THE MATHS CHAMPIONS RESEARCH PROJECT

## PARENT/ GUARDIAN INFORMATION SHEET

Your child's nursery has signed up to take part in a research project to see if 'Maths Champions' (MC) improves children's maths skills. This information sheet gives you more detail about what being involved in the research project means for you and your child.

### WHAT DOES THE RESERCH PROJECT INVOLVE?

Maths Champions is a programme designed to improve how nursery staff support the development of maths through activities and play in the pre-school environment. The research project aims to find out if the programme improves children's maths by comparing nurseries that use the MC programme (group 1) with those who do not (group 2). When your child's nursery signed up to the research project, they agreed to be randomly allocated to either of these groups, i.e. the group that receives the MC programme, or the group that does not and continues with their usual maths activities.

Regardless of which group your child's nursery is allocated to, we (the research team) would like your child to take part in a short assessment while they are at nursery called ASPECTS which tells us about your child's maths and vocabulary skills. We would like your child to take part in ASPECTS once during June 2016, and once during June 2017. This information will help us to see how children's maths skills have changed during their time at nursery. Children complete ASPECTS with an adult and it usually takes around 15 minutes. Children tend to enjoy using ASPECTS as the computer tells a story and then asks the children to answer questions about it but if your child does not want to take part in the ASPECTS on the day, they do not have to.

Following their time at the nursery, we would also like to see how children's maths skills develop once they go to school. To do this, we need to know what school your child will attend in September 2017. We would like to collect this information from the nursery, but if they do not have this, we would like to contact you to find out. With this information, we will use a national database (called the National Pupil Database which is held by the UK's Department for Education) to follow your child's educational outcomes in the future.

### DATA PROTECTION

All data collected during research project will be stored securely, treated confidentially and used only for research purposes. Any information collected about your child will be analysed anonymously and will not be identified in any report. None of the information we collect will affect your child's place at nursery. For the purpose of the study, information provided will be linked with the National Pupil Database (held by the Department for Education), other official records, and shared with NDNA, the Department for Education, Education Endowment Foundation (EEF), EEF's data contractor FFT Education and in an anonymised form to the UK Data Archive.

### WHO ARE THE PROJECT TEAM?

The Maths Champions programme is being delivered by the National Day Nursery Association (NDNA). A research team from the University of York and from the Centre for Evaluation and Monitoring (CEM), Durham University have been asked to see how effective the MC programme is by the Education Endowment Foundation (EEF), an organisation that funds research into education.

### WHAT DO I NEED TO DO NEXT?

If you are happy for your child to take part in the Maths Champions Evaluation, please sign and return the attached consent form to your child's nursery. If you do not want your child's information to be collected and used, do not sign the consent form.

### WHERE CAN I GET FURTHER INFORMATION?

Further information on the Maths Champions programme can be found here:

[http://www.ndna.org.uk/NDNA/Community/Maths\\_Champions.aspx](http://www.ndna.org.uk/NDNA/Community/Maths_Champions.aspx)

Or you can contact Jo Baranek from NDNA on 07881 951 713 or by email [jo.baranek@ndna.org.uk](mailto:jo.baranek@ndna.org.uk)

Further information on the ASPECTS assessment can be found here: <http://www.cem.org/early-years>

Or for information about the research evaluation more generally you can contact Dr Lyn Robinson (Project Researcher, CEM, Durham University) on 0191 334 4197 or by email

[mathschampionsevaluation@cem.dur.ac.uk](mailto:mathschampionsevaluation@cem.dur.ac.uk)

# THE MATHS CHAMPIONS RESEARCH PROJECT

## PARENT/GUARDIAN CONSENT FORM

If you are happy for your child to participate in this research study, please read each of the following statements and if you agree to them ***initial the boxes*** and provide the necessary information on the following sheet and return to the nursery.

I confirm that I have read and understood the information sheet (MC\_Parent/Guardian Information Sheet\_Main Trial\_v1) about the evaluation of the Maths Champions Pilot Study and have the contact details of the people I need to ask if I have any questions.

I understand that information about my child collected as part of this research will be stored securely, treated confidentially and used only for research purposes. Information about my child will be analysed anonymously and that my child's name will not be used in any research reports or publications.

I agree for my child to take part in the ASPECTS assessment while they are at nursery.

I understand that I can withdraw my child from the research study at any time by contacting the research team.

I agree for the nursery to provide the research team with details of which school my child will attend in September 2017 along with gender and date of birth to be used for research purposes only.

If the nursery does not have information of my child's school, I agree to be contacted in the autumn 2017 to confirm which school my child is attending.

I understand and agree that for the purpose of the study, information collected about my child will be linked with the National Pupil Database (held by the Department for Education), other official records, and shared with the NDNA team, the Department for Education, Education Endowment Foundation (EEF), EEF's data contractor FFT Education and in an anonymised form with the UK Data Archive.

I understand that this information collected from the National Pupil Database will incorporate data including ethnicity.

Child's name: \_\_\_\_\_  
\_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone number: \_\_\_\_\_

Contact email: \_\_\_\_\_

Parent/Guardian name: \_\_\_\_\_

Parent/Guardian signature: \_\_\_\_\_

Date: \_\_\_\_\_

***Thank you for your time***



**APPENDIX C**  
**THEORY OF CHANGE**

### Brief introduction to Theory of change

A well articulated theory of change has been seen as an effective way to an intervention's success allows the programme developers to describe in detail the rationale behind the development of their intervention, the theoretical framework that underpins their work, and to identify the potential causal links that might be bringing change to the agreed outcomes as a result. Such a document can be used at different phases of an intervention with the necessary amendments: at the strategic development; at the implementation of the intervention and at the programme's evaluation. When comparing a theory of change for strategy and that for evaluation there is an expected change of focus. The table below allows the reader to see that a different structure would be needed when writing these two. The current document will be written based on the aims of change for strategy in the hope that it will support the evaluation team as much as possible in having a clear understanding of the intervention under focus. It will address also the implementation characteristics of the programme as this is important for the holistic representation of the model used.

<b>Theory of change for strategy</b>	<b>Theory of change for evaluation</b>
Focusing on the goal	Understanding all your outcomes
Showing the causal links	Making sure that outcomes are realistic
Revealing hidden assumptions	Understanding how outcomes are connected
Basing the strategy on evidence	Understanding progress towards the final goal
Using the views of stakeholders	

Table 1: Theory of change for strategy and evaluation based on information from Kail & Lumley (2012)

Kail and Lumley (2012) stated that:

*A theory of change shows a charity's path from needs to activities to outcomes to impact. It describes the change you want to make and the steps involved in making that change happen. Theories of change also depict the assumptions that lie behind your reasoning, and where possible, these assumptions are backed up by evidence (p. 3)*

### Structure of this document

The following document attempts to articulate, as close as possible, a theory of change model that underpins the Maths Champions (MCs) Intervention programme as offered by the National Day Nursery Association (NDNA). The document has four sections.

The first one will provide a brief description of the actual intervention programme focusing on a) the individual components of the intervention; b) the models of delivery and c) the intended outcomes of the intervention for both adults and children, and potentially for the quality of the classroom environment.

The second section will address briefly what we know from theory and empirical research studies about the different components of professional development, focusing specifically on those employed by MCs.

The third section will address briefly what we know from theory and previous research on children's early mathematical development.

Finally, the last section will describe in detail the logic model of MCs as agreed with EEF and explain why NDNA has put in place this particular model and what is expected to change.

### Section 1: A brief description of the intervention Maths Champions

The National Day Nursery Association (NDNA) have a vision “For all children and families to flourish through excellent early years care and learning” and a mission “To lead and empower the sector so that nurseries and the early years workforce deliver sustainable, high quality care and learning” (NDNA, personal communication, Feb 2016).

Maths Champions was developed in response to the continuing need for support of the early years workforce both in their content knowledge of subject teaching as well as in the teaching strategies they can employ. Many early years professionals working in diverse settings lack training, especially in mathematics, or they do not feel confident about their own mathematical skills. Maths Champions was initiated to address:

- i. The confidence and knowledge of practitioners who need to 'teach' mathematics in early years settings
- ii. And, as a subsequent outcome, to develop young children's engagement and knowledge of mathematical skills

In order to achieve these two broad goals NDNA enlists interested graduates in early years settings to be supported in order to empower their own teams in the settings when working with maths.

The Maths Champions programme itself, and all associated resources, are based online. The programme within each nursery is designed to be led by the graduate within the setting, with a team of practitioners; in particular those who work with children aged 3-4 years old.

The programme starts with two online courses to support the setting's graduate in becoming a 'Maths Champion'. These courses aim to help the Maths Champion evaluate their practice and measure the impact in all they do, and also give them the skills to mentor and lead the team in the programme. Each course will take around two hours but can be completed in short sections.

The Maths Champion will then work with their own team to evaluate the nursery's current practice, using audit tools provided, including providing details of their own and the nurseries three year olds' maths skills. At this stage, practitioners are also asked to complete a short questionnaire to rate their confidence in maths. This information helps the NDNA to create a tailored programme to support each setting.

From this point, the programme is made up of three main components:

- (4) The award winning BKSB skills assessment tools which aims to help the team in each setting to improve their own personal maths skills with 1-1 support from the setting's Champion (taking around 10-15 minutes per month).
- (5) Three online courses throughout the year for the Maths Champion to gain information to pass onto practitioners.
- (6) An online resource bank providing maths ideas to build into the nursery's daily practice. These resources are reinforced by short monthly webinars available for the participating setting's Maths Champions team to take part in and view with focused themes to help the team implement maths into their continuous provision and every day practice.

Throughout the programmes the Maths Champion also receive tailored 1-1 support from NDNA.

Towards the end of the programme, the team in each setting is asked to revisit initial audits to assess any changes in the setting as well as any improvement in the children and staffs own maths skills.

## **Section 2: Short review of evidence on professional development**

### ***Skills of early years professionals***

For the context of the current study an Early Years Educator shall be used to refer to anyone (qualified or not) who works with children in settings providing early childhood education. An early years teacher and early years professional are accepted to be graduate roles (with either Qualified Teacher Status (QTS) or Early Years Professional Status (EYPS) respectively) (Nutbrown, 2012).

It is well known that the training of early years professionals in England leaves a lot to be desired. We know however from research evidence that a number of factors can influence the quality of provision in early years setting and the children's experiences and learning.

### ***Influences on the quality of early years provision***

Many factors have been identified as influencing the quality of provision that EY settings are able to deliver. These factors act at different levels of the organisation; the setting level characteristics; the classroom level characteristics and, most importantly for the needs of this study, the staff level characteristics. Holbrooke summarised these by providing research evidence in her doctoral thesis (work in progress, 2015):

#### *Setting-Level Characteristics*

One of the most frequently identified setting-level characteristics is the sector of the providers, with the maintained sector consistently identified as offering higher quality than the private, voluntary and independent sector (Hansen, 2012; Mathers et al, 2007). This supports the current focus of the Maths Champions programme on the PVI sector.

The introduction of the Early Years Foundation Stage (EYFS) in 2008 was intended to improve consistency and was the first time settings from all sectors were required to meet the same minimum standards.

#### *Classroom-Level Characteristics*

The second most important influence on overall quality (after sector) has been identified as the group size, with larger groups being of higher quality (Mathers et al., 2007). However, elsewhere, from an analysis of case studies, Sylva et al. (2004) identify the 'quality of adult-child verbal interactions' (p. vi) as one of six practices that are particularly important for pre-school-aged children. This evidence suggests that in settings with a lower child-to-adult ratio, where each child may engage in more verbal interactions with adults, the overall quality may be higher. This is important for the Maths Champions programme as it aims, amongst other things, to enhance quality of interactions.

#### *Staff-Level Characteristics*

Historically the early years workforce has endured low status and poor pay. The levels of qualification and experience have traditionally been diverse, and until recently the majority of staff have been qualified at level-3 or below. The Maths Champions programme targets graduates to utilise research evidence. International research has shown that, outside of inter sector differences, child-to-adult ratios and levels of staff qualification are two of the best predictors of the overall measured quality of a setting (Mathers & Sylva, 2007; Phillips et al., 2000). In England a recent Independent Review (Tickell, 2011) identified a qualified workforce as essential for raising the quality of early years education and closing the achievement gap caused by disadvantage. Nutbrown (2012) added weight to this argument by reporting that level-2 childcare qualifications do not require sufficient skills for working in the early years sector at all. There is substantial evidence that quality is positively correlated with child outcomes and also with higher levels of staff qualification, in particular the presence of a graduate (Siraj-Blatchford, Taggart, Sylva, Sammons, & Melhuish, 2008) in the setting. (Holbrooke, 2015, doctoral thesis, work in progress).

One of the suggestions of the EYFS review by Evangelou et al (2009) was to promote a skilled workforce through professional training; the review emphasised:

The importance of effective practitioner staff development in recognising and responding to situations where the six domains of development (including the use of ICT) can be enhanced 'on the spot' (Evangelou et al. 2009, p.81).

### ***Characteristics of effective professional development: content and strategies***

#### **Content of professional development**

Effective professional development shares a core set of characteristics according to Desimone (2009); content focus; active learning; coherence; sustained duration and collective participation (p. 468). In this document, the characteristics of active learning and collective participation will be considered as a strategy of professional development employed by the Maths Champions programme. The current evaluation study, which utilises a RCT will offer rigorous evidence and will test experimentally the importance of all the components of the professional development as a package. We will still need to know how practitioners vary in their participation to the programme.

Desimone (2009) puts forward a number of important questions; when and if the programme is implemented well, does the new content or pedagogy learned in professional development improve student learning? (p.468). In the case of Maths Champion, student learning can be seen both as the learning of the professional, as they aim to enhance their own mathematical skills, as well as that of the children. A second question (ibid) posited is how well do the professional development activities elicit improvements in teacher knowledge and instruction? Will the model of change work for all participating professionals or for those who showed higher implementation fidelity?

#### ***Content employed for professional development by the Maths Champions programme***

##### **Content**

Maths Champions is a content focused intervention and this can be seen through three components: firstly, the 'train the trainer' course, which provides new skills in supporting the Champion's teams through coaching and mentoring. The second component is through offering training to Maths Champion on how to evaluate their practice and how to measure impact. They do this by teaching the Champions methods for looking at what they currently do, how to improve this, and measure the impact, backed up with the use of practical exercises (audit tools) so they can see this in practice.

Champions and members of staff all have access to online training materials on what maths is and the different methods of teaching this subject matter. This includes information about the different stages of mathematical development of children and their trajectories. They also receive support through the resource bank with ideas and methods for teaching children how to develop number sense and understanding of shapes, space and measure; these are additionally backed up with themed webinars.

##### **Coherence**

All the elements of the programme on offer are backed up with 1-1 support from NDNA and monthly themed webinars that address both practice and the continuous professional development of practitioners. There is clear coherence throughout the programme. This starts with setting the scene and evaluating their practice which leads into the audit tool completion. This in turn is followed by support for individual settings which is based on them using the resources available in the resource bank, backed up with the individual training courses for the

practitioners on the overall maths subject and individual “number” and “shape, space and measure” aspects of the EYFS.

There is also evidence of clear coherence in the staff skill development aspect of the programme when they are using the BKSB – initial skills assessment. They do so by supporting practitioners to understand why this is essential, followed up with individualised skill development that goes hand in hand with 1-1 support from their Champions in their supervisions.

### **Sustained duration**

There is evidence of clear sustained duration throughout the year of the programme; as well defined and time bound steps are put in place to ensure that practitioners get the most out of the programme. These include the introduction section of initial training and self-evaluation of starting position, the middle section of the intervention, the teaching and support of using all the resources / training / webinars etc, and the final section of re-evaluating and future planning.

The majority of the programme takes place with the children in their daily work and practice, this enables the setting to participate more actively and sustain their involvement as this is just their 'normal' role within the setting. All elements of the programme are backed up with 1-1 support from NDNA and monthly themed webinars supporting both practice and own CPD.

### ***Strategies employed for professional development by the Maths Champions programme***

A number of promising approaches to support professional development in diverse early years settings have been reviewed by Powell, Diamond and Cockburn (2014). As there is a current emphasis on supporting professionals within their daily practices their review delineated diverse models and strategies and of course their potential effectiveness on PD. The strategies reviewed are the creation of Professional Learning Communities, Coaching and the use of Technological Innovations. In addition, the strategies of collective participation and active learning will be discussed in this document. Powell, Diamond and Cockburn (2014) completed their review by addressing the topic of variation in PD implementation and engagement. Having reviewed their paper it becomes evident that Maths Champions uses many strategies to implement their programme and to enhance professionals' confidence and knowledge in mathematics, as well as to drive children's outcomes.

### **The creation of Professional Learning Communities**

Vescio, Ross and Adams (2008) posited that:

*a professional learning community in the field of education typically consists of a small group of educators and other stakeholders who meet regularly to work collaboratively on instructional or curriculum changes aimed at improving student learning (p. 386).*

The Maths Champions programme capitalises this idea of the creation of a learning community by training a graduate and by facilitating the collaborative work within settings of the practitioners. Although research on the effectiveness of the Professional Learning Communities as a model of delivery is limited there are studies that show positive effects on teachers' knowledge of vocabulary instruction. By using such a model for the implementation, Maths Champions aim to create a knowledge base of best practice and to develop the experiences of the professionals in a non-threatening environment.

**Collective participation** The Maths Champion is advised to work with all or key members of their team to improve their practice using the resources and information provided by NDNA. NDNA are also actively involved in the setting using the regular contact, data and information provided by the setting, or by visiting the setting (in some cases) and working alongside the Champion and

practitioners in supporting their development. Maths Champions are encouraged to share their practice with the other Champions via the Facebook page and resource bank; giving them the platform to be more actively involved in the intervention by supporting each other. This is also reflected in the webinars where they can share ideas and challenges and discuss how to overcome these.

### **Active learning**

The Maths Champion programme uses interactive and constructive feedback throughout. This is offered from the NDNA to the Champions in 1-1 support, and from the Champions to their practitioners in the supervision sessions. The availability of a Facebook page allows both Champions and practitioners to share experiences. Champions can also use the ideas discussed in staff meetings or webinars internally to support whole staff training. They can use the observations of practice in supervisions to focus on the programme and their own individual maths development. In addition, they can use the evaluation of activity boxes on the activity idea sheets to assess how well the teaching or activity went and how to extend this further or develop the teaching method to adapt to children's needs

### **Coaching**

Coaching is another strategy that Maths Champions is using to support the professionals participating in their intervention programme. This is implemented when the work is offered directly to practitioners or a team and it becomes highly individualised to meet their needs. This is the role of the graduate who has additional support from Maths Champions to work with their team.

### **Technological Innovations**

A final strategy reviewed in the paper by Powell, Diamond and Cockburn (2014) is the use of technological innovations. Maths Champions capitalise on this as the majority of the ongoing support is online or via webinars and the materials are all available online. This allows the practitioners to work with the material at their own pace. Maths Champions has created a web-based forum that allows practitioners to share material and information as well as to upload their own resources and ideas. Although webcams are not used in classroom settings to observe how practitioners are implementing the Maths Champions material; this is a possibility for tailored individual feedback.

What Maths Champions do not know, but the current evaluation will afford them to understand, is the level of implementation fidelity to the programme, something that cannot be underestimated especially when an intervention is reaching so many settings and professionals as MCs does.

Additional strategies used by NDNA and acknowledged in the literature are the following: needs assessment of the participants; ongoing support from NDNA; opportunities for participants to engage in active learning; and in-class mentoring; activities that are integrated in the daily curriculum; sustained collaboration with opportunities for follow-up; differentiated coaching to address the individuals needs of graduates and of each practitioner. There is clear collegiality between professionals, graduates and the administrators of the intervention programme.

### **SECTION 3: Short review on evidence re children's mathematical development**

*Children must be supported in developing their understanding of Problem Solving, Reasoning and Numeracy in a broad range of contexts in which they can explore, enjoy, learn, practise and talk about their developing understanding. They must be provided with opportunities to practise and extend their skills in these areas and to gain confidence and competence in their use. EYFS, p.61*  
[http://www.standards.dfes.gov.uk/eyfs/resources/downloads/card4\\_7.pdf](http://www.standards.dfes.gov.uk/eyfs/resources/downloads/card4_7.pdf)

Mathematics is one of the specific areas of development according to the Statutory Framework for the Early Years Foundation Stage. It involves providing children with opportunities to develop and improve their skills in counting, understanding and using numbers, calculating simple addition and subtraction problems; and to describe shapes, spaces, and measures.

In particular it details the aims for numbers and shape, space and measures as follows:

#### **Numbers:**

Children count reliably with numbers from 1 to 20, place them in order and say which number is one more or one less than a given number. Using quantities and objects, they add and subtract two single - digit numbers and count on or back to find the answer. They solve problems, including doubling, halving and sharing.

#### **Shape, space and measures:**

Children use everyday language to talk about size, weight, capacity, position, distance, time and money to compare quantities and objects and to solve problems. They recognise, create and describe patterns. They explore 12 characteristics of everyday objects and shapes and use mathematical language to describe them. [http://www.foundationyears.org.uk/files/2014/07/EYFS\\_framework\\_from\\_1\\_September\\_2014\\_\\_with\\_clarification\\_note.pdf](http://www.foundationyears.org.uk/files/2014/07/EYFS_framework_from_1_September_2014__with_clarification_note.pdf) (Accessed 09/02/2016).

A review of the research evidence on children's development was written in 2009 by Evangelou, Sylva, Wild, Glenny and Kyriacou; its aim was to consider the original sources as well as their critical reviews and to feed back to the EYFS review team. The information below summarises the section written by Dr Alison Price from the Review (Evangelou et al, 2009, pp 35-39) on problem solving, reasoning and numeracy.

### **Recognising number ('Numerosity')**

Wynn's (1998) research into babies' understanding of numerosity demonstrated that children in their first year of life are sensitive to number, able to recognise 'how many' without counting (known as subitization) and recognise the difference between sets of objects and even reason about changes in numerosity. While there has been research confirming Wynn's findings (Feigenson, 2004; Chen, 2009), others have challenged the suggestion of an innate verbal counting mechanism (LeCorre & Carey, 2007), which may be based on spatial representation rather than a pre-counting (Lecuyer, 2004) and counting. Cappelletti et al. (2007, see also Halberda & Feigenson, 2008) therefore propose two levels of evolution of numerosity: '*the biological evolution of elementary, non-symbolic numerical abilities*' and '*the cultural evolution of higher level symbolic mathematics*' which includes counting and calculation (p.74). Baroody et al. (2006, p.196) suggest that toddlers 'may benefit from seeing a variety of examples and non-examples of the intuitive numbers' (1- 3), and from encounter with quantities arranged to form different recognisable number patterns. Research indicates both starting from the child in terms of offering meaning and language for small number in subitization contexts and also the cultural necessity to teach counting (Benoit et al., 2004), cardinality and ordinality (Rips et al., 2006).

### **Counting, cardinality and one to one correspondence**

The key principles of counting identified by Gelman and Gallistel in 1978 still form the core understanding of children's counting development. However recent research highlights two aspects of counting which may need attention in early years setting. The first is the 1:1 principle of counting notes the matching of one number word to each object. However, as Thompson (2008) and others have noted there is little or no evidence of transfer from object to object matching to object to word matching. The idea that number words and written symbols (Rogers, 2008; Lipton & Spelke, 2006) represent quantity rather than being a function of counting and the relationship between consecutive counting numbers as representing one more or one fewer (Sarnecka & Carey, 2008) could have greater emphasis in the early years curriculum. Rather than focussing on matching sets of objects by 1:1 correspondence, more could be made of recognising equivalence, greater than and less than when comparing sets (Sophian, 2007) to encourage logico-mathematical reasoning (Nunes, 2007). The second relevant aspect of counting relates to the cardinal principle, in that the count word assigned to the final object indicates the cardinality (how many) of the whole set.



## Calculation

Calculation builds on and draws upon early understanding of number and counting (Baroody et al., 2006). Understanding of calculation appears to be developed in two ways – one based on the innate understanding of number and the other on counting. This early understanding needs to be related to the use of counting to solve calculation problems in the real world rather than just counting objects ‘because they are there’ (Muldoon et al., 2005). More could be done in the early years to develop knowledge of the counting words, forwards, backwards and from a given number other than one, in order to aid subsequent calculation strategies.

## Shape, space and measures

Understanding of the concept of shape seems to be, if not innate, then learned very early. From birth babies seem to be able to distinguish between open and closed geometric shape (Turati et al., 2003), three month old babies can be shown to already distinguish between different three dimensional shapes (Poirer et al., 2000) and babies at around five months can be taught to identify the irregular angle in an isosceles triangle (Lourenco, 2008). Similarly, Shusterman et al. (2008) found children able to use ideas of angle and distance to solve mapping problems.

## The role of language in mathematic learning

Children in foundation settings can be seen to use a range of mathematical language during play (Coltman, 2006). Story books also offer a context for mathematical discussion (Anderson et al., 2004; Casey & Young, 2004; Van den Heuvel-Panhuizen, 2008). However, Diaz (2008) found that early years practitioners were often unresponsive to the range of mathematic utterances during block play indicating the need for staff development in recognising and responding to mathematics in play situations (see also Morton, 2003).

## Pedagogy

Research into children’s cognitive development should not, however, dictate curriculum and pedagogy which could become over formalised. Aubrey (2003) reports on a European study which shows that beginning formal instruction at an early age does not improve subsequent mathematical achievement. However, appropriate provision is beneficial as shown by the EPPE project in England (Sammons et al., 2004) and in the Big Math for Little Kids project in the United States (Greenes et al., 2004; Ginsburg, 2006).

In a review of pedagogy for mathematics in the early years Gifford (2004, p.99) argues for a pedagogy:

*‘considering children’s mathematical learning in terms of cognitive, physical, social and emotional aspects. A range of cognitive processes, an emphasis on large-scale activity, and multisensory learning, concerns for children’s self esteem and agency in their own learning, diverse home experiences and supported pair and group situations’.*

The review reported a number of implications for early years practice with regards to the content of teaching mathematics in early years and the need for effective professional development. As these are directly relevant to the Maths Champions programme they are summarised below.

- The importance of problem solving in social context as the medium for mathematics learning in the early years over more formal mathematical tasks;
- The use of picture books as a context for problem solving and using mathematical language;
- Delaying formal mathematics, especially operating with symbols until children have appropriate conceptual development of number and number operations;
- The use of gesture in counting and cardinality.
- The importance of effective practitioner staff development in recognising and responding to mathematical situations and language when they arise.

### **What is teaching mathematics in early years?**

Ginsburg and Amit (2008) posited the need for early childhood mathematics education to become more prominent and to be implemented on a wider scale. This view is also expressed by the National Association for the Education of Young Children and of the National Council of Teachers of Mathematics, who confirmed that "...high-quality, challenging, and accessible mathematics education for 3- to 6-year-old children is a vital foundation for future mathematics learning. In every early childhood setting, children should experience effective, research-based curriculum and teaching practices" (National Association for the Education of Young Children and National Council of Teachers of Mathematics, 2002, p. 1). They summarised in their paper that:

*... although young children's thought is different from adults, they deal with mathematical ideas in everyday pay, are curious about the subject, know something about it, and can learn interesting mathematics when they are taught. .... Before formal schooling young children deal spontaneously and sometimes joyfully with mathematical ideas. These are the facts that early childhood teaching must recognise and take into account (p. 275)*

In their paper they showcased through one case study of a very able early years mathematics teacher *that teaching mathematics to young children is as complex as teaching to older children. All age levels [including the very young children] should be engaged in learning abstract mathematics. And relevant to MCs that the system of training early years professionals need to teach them mathematics in complex ways and to be helped to teach effectively (p. 284).*

### **The need for early years mathematics interventions**

The Quality of Childcare Settings in the Millennium Cohort Study (QCSMCS) was established to assess the quality of provision attended by a sample of the 10,000 Millennium children living in England. It aimed to explore the quality of the group childcare settings. It was found that the provision of Maths and Science was the weakest with mean scores of 3.2, just above the minimal scores, across the sample (Mathers, Sylva and Joshi, 2007). This gives evidence to support the need for tailored early childhood mathematics interventions.

A review of such interventions was written in 2011 by Clements and Sarama; they recognised that:

*Preschool and primary grade children have the capacity to learn substantial mathematics, but many children lack opportunities to do so. Too many children not only start behind their more advantaged peers, but also begin a negative trajectory in mathematics. Interventions designed to facilitate their mathematical learning during ages 3 to 5 years have a strong positive effect on these children's lives for many years thereafter (page 1).*

While acknowledging children's capacity they did not omit to acknowledge the poor skills of early years professionals and their misinformed view of what supporting children's mathematics is and how it can be achieved.

*Early childhood teachers often believe they are "doing mathematics" when they provide puzzles, blocks, and songs. Even when they teach mathematics, that content is usually not the main focus, but is embedded in a fine-motor or reading activity. Unfortunately, evidence suggests that such an approach is ineffective, owing to a lack of explicit attention to mathematical concepts and procedures along with a lack of intentionality to engage in mathematical practices (page 1).*

They concluded that evidence supports interventions that provide foundational and mathematical experiences in number, space, geometry, measurement, and the processes of mathematical thinking, giving thus space for interventions as Maths Champions develops further.

## **SECTION 4: Detailed description of the logic model**

Figure 1 describes the logic model as agreed between NDNA, EEF and the universities of Oxford who are supporting the intervention and the Universities of Durham and York who are carrying out the evaluation the

intervention. The W.K. Kellogg Foundation (2004, p.3) described five steps in the development of a logic model addressing: the resources or inputs, the activities, the outputs, the outcomes and the potential impacts (p.3).

**1. Factors / Resources or inputs** are resources and/or barriers, which potentially enable or limit program effectiveness. Enabling *protective factors* or *resources* may include funding, existing organizations, potential collaborating partners, existing organizational or interpersonal networks, staff and volunteers, time, facilities, equipment, and supplies. Limiting *risk factors* or *barriers* might include such things as attitudes, lack of resources, policies, laws, regulations, and geography (W.K. Kellogg Foundation, 2004, p.3).

### **What is Maths Champions as an intervention programme trying to improve?**

The intervention is trying to develop the teaching of mathematics while influencing four areas: the Maths Champions, the practitioners, the children and the offer of quality teaching in the participating settings. In particular:

#### **For the Maths Champions**

- To increase accessibility to CPD for a deeper knowledge of the importance of maths in early years
- To develop Champions' skills in teaching adults.
- To identify skills gaps and facilitate development in Maths to enable them to teach others.
- To enhance the ability for champions to understand the importance and to become able to self evaluate and measure impact within their own setting.
- To offer Champions a deeper understanding of developing children's everyday maths experiences based on early years theorists and research evidence

#### **For the practitioners**

- To increase accessibility to CPD for a deeper knowledge of the importance of maths in early years and to enable equal participation for nursery practitioners. The extension of this programme with EEF is to specifically focus on children based in the high deprivation areas of England.
- To identify practitioners skills gaps and facilitate development in Maths
- To develop practitioners' confidence to teach children maths; and for those who wish to, to progress and advance to further education. To offer practitioners a deeper understanding of developing children's everyday maths experiences based on early years theorists and research evidence. To offer a basic knowledge of what maths is and why it is important to learn maths from an early age. How this learning relates to preschool.
- To develop practitioners confidence in early years settings, in a non threatening environment.
- To ease access to personal development material to enable practitioners to quickly access high quality resources.

#### **For the children**

- To develop confidence in working with mathematics through everyday practice. To develop a holistic approach to raising opportunities and outcomes for children.
- To provide high quality resources to ensure that children have opportunities to develop maths skills within everyday play.

#### **For the early years settings**

- To improve the environment, the resources available, the teaching practice and how parents are involved in children's maths through play.
- To see the outdoor environment as a mean to facilitate children's maths development; and to integrate maths into daily play.

**2. Activities** are the processes, techniques, tools, events, technology, and actions of the planned program. These may include *products* – promotional materials and educational curricula; *services* – education and training, counselling, or health screening; and *infrastructure* – structure, relationships, and capacity used to

bring about the desired results (W.K. Kellogg Foundation, 2004, p.3). As these are described earlier on page 2, it is important to note factors that might influence the impact or factors that mitigate the risks for a non-successful implementation.

### Factors that might influence the impact

- Access to the internet, equipment and time within the setting to be able to maximise their opportunity to learning.
- Practitioners' skills in IT to enable access to webinars etc.
- The inability for the champion to break down fears of maths with practitioners
- Champions reluctance to complete diagnostic pre and post programme
- Practitioners not realising benefit of evaluation and impact course.
- Improvements in children's progress not demonstrated
- Disengaged practitioners from the programme
- An inability to develop the settings practice
- Lack of confidence in maths as a whole, impacting on children's opportunities with the setting
- Lack of confidence in applying learning
- No distance travelled for children's development

### Risk mitigation

- 1 - 1 NDNA telephone helpdesk for IT issues, short tutorials on how to access various resources, BKSB help desk and video tutorials
- 1 - 1 call included the need to integrate this programme into Supervisions.
- 1 - 1 support to develop confidences and allay fears.
- Clarity in induction of programme. 1 - 1 remote support and those at risk 1 -1 setting visits

3. **Outputs** are the *direct results* of program activities. They are usually described in terms of the *size and/or scope of the services and products delivered or produced* by the program. They indicate if a program was delivered to the intended audiences at the intended "dose." A program output, for example, might be the *number of classes taught, meetings held, or materials produced and distributed; program participation rates and demography; or hours of each type of service provided* (W.K. Kellogg Foundation, 2004, p.3).

### Recruitment to the programme

As can be seen from Figure 1 NDNA recruits and nurseries and identifies the Maths Champions within each as well as up to 6 practitioners that are willing and interested to participate in the programme.

### Implementation

This is followed by input from the NDNA on 3 different aspects: firstly by training the trainers, secondly by doing a setting's audit of current teaching practices and children's level of attainment, and thirdly by agreeing an action plan within each participating setting.

At the same period of time, the practitioners are filling in a self-assessment form and an action plan is agreed. There is continuous support of the MCs including a review of their action plans and any progress made. The MCs and the practitioners in this phase have access to online material and to webinars. They also carry out a BKSB training that is linked to their knowledge of mathematics.

### Evaluation

While the programme is implemented the evaluation team will explore the process of the programme implementation. This will take place via a number of interviews and surveys which will be carried out by the evaluation team. The survey will aim to capture two different things: the first is the levels of knowledge and confidence in teaching mathematics of both the MCs and the practitioners and the second is to gauge their own maths confidence and knowledge.

In addition, the quality of teaching and how the learning environment may change will be captured by the use of the ECERS 3 and the mathematics component of ECERS-E. These structured observations will provide evidence to whether the quality of adult-child interaction is also improving.

4. **Outcomes** are specific *changes in attitudes, behaviours; knowledge, skills, status, or level of functioning* expected to result from program activities and which are most often expressed *at an individual level* (W.K. Kellogg Foundation, 2004, p.3).

The intended outcomes are children's mathematical skills and knowledge as a direct result of work with their early years educators in the areas of number, shape, space, time and problem solving. Children's maths attainment will be linked to the National Pupil Database (NPD) to allow longitudinal tracking of their progress in mathematics.

5. **Impacts** are *organizational, community, and/or system level changes* expected to result from program activities, which might include improved conditions, increased capacity, and/or changes in the policy arena (W.K. Kellogg Foundation, 2004, p.3).

The impact of the intervention, if the evaluation deemed successful will be twofold: a) in the area of Professional Development of early years educators as a model of delivery will be tried and tested with a large sample. In addition, there is potential impact on the confidence of the participants in their personal knowledge and skills in mathematics and in their skills and knowledge of teaching mathematics to young children. The second area of potential impact is on children's outcomes as the results may show that MCs is an effective intervention that drives children's developmental trajectories. If successful the programme can be rolled out in early years settings

In particular the following impact is anticipated for Champions, practitioners and children:

#### **For the Maths Champions**

- More likely to access learning provision within a flexible delivery model and an opportunity to practice knowledge acquisition in the workplace
- Champions weaknesses identified and improvements demonstrated as a result of personal development plans.
- Champions increase confidence levels as a result of the entire intervention
- Champions able to effectively self evaluate practice and impact as a result of learning intervention.
- Accurate judgements made on settings offer opportunities for development tailored to their needs. Effective evaluations include all parties in the setting to enable all views to be seen and taken on board
- Champions have the skills to support practitioners in the workplace though a sound understanding of learning styles and preferences
- Champions have a grounded understanding of how children learn and how to deliver effective maths learning strategies in a nursery environment.

#### **For the Practitioners**

- Practitioners are able to see distance travelled and an improvement of the delivery of maths through play as a result of the intervention
- Results of own personal assessment via a range of interventions identifies areas for improvement.
- Champions' plans enable them to be confident in providing richer experiences for maths in the nursery and support practitioners to do the same
- Practitioners increase confidence levels as a result of the entire intervention and are encouraged to progress further to formal education
- An ability and confidence to deliver effective maths activities for children using play as a medium
- Results of own personal assessment via a range of interventions identifies areas for improvement.

#### **For the Children**

- Children embrace everyday maths with confidence. Environments and daily play activities facilitate maths that help children progress and exceed expected learning milestones.
- Children assessed as exceeding early learning goals in Number and Shape, Space and Measure through the delivery of age appropriate resources and effective adult child interaction and intervention.

- Children make improved progress in maths.

**For the Practice**

- Identification of areas requiring improvement, changes made to practice and environment, improved intervention and experiences for children.

It is hoped that this document describes the Maths Champions intervention programme in sufficient detail to support its further implementation and its imminent evaluation.

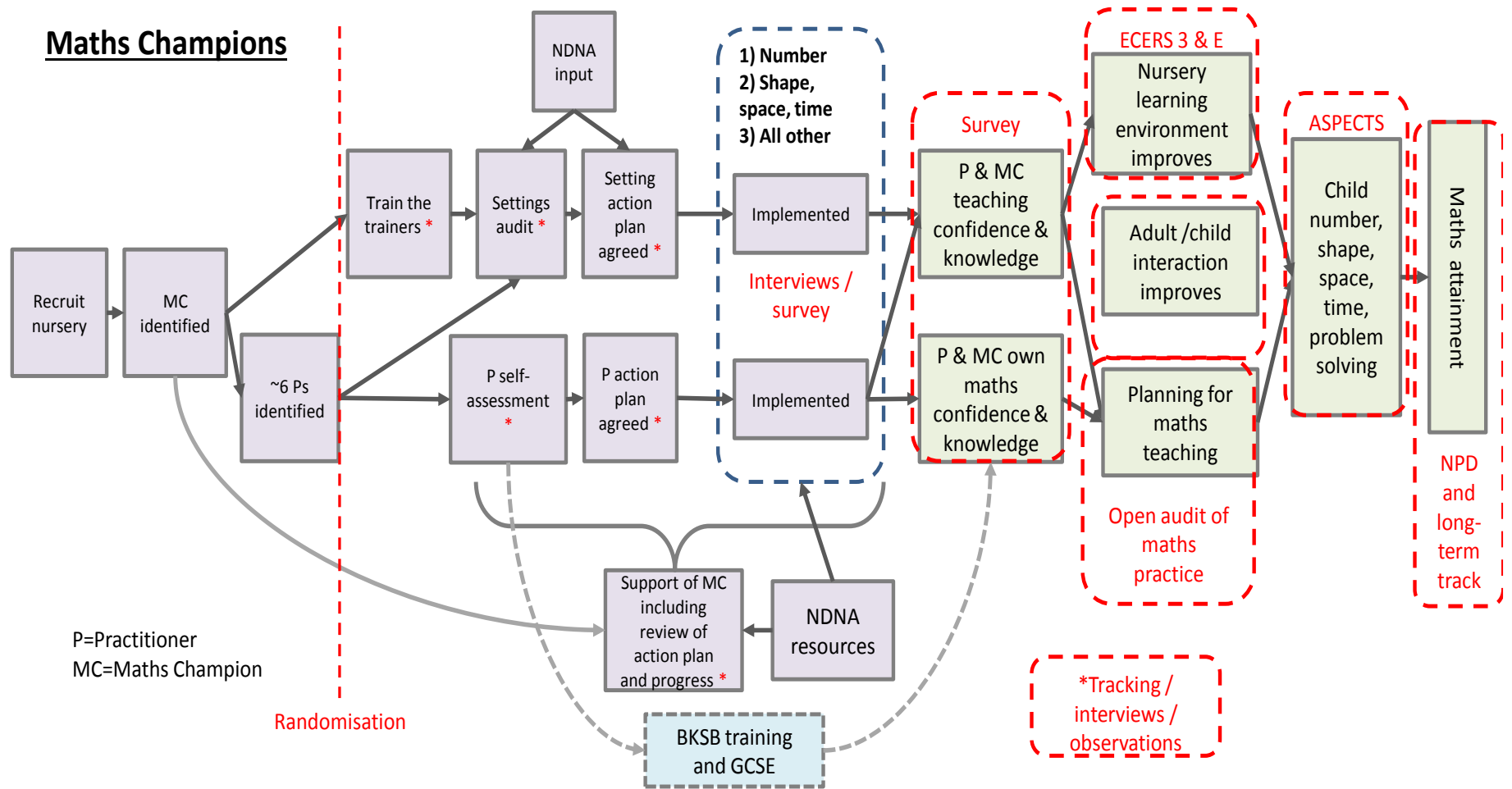


Figure 1: Maths Champions Logic Model: As designed by EEF

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