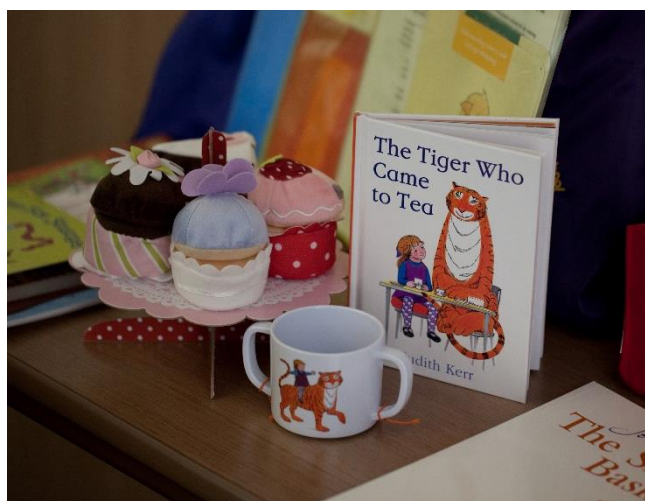


Report on Year 2 of 'Making Maths REAL'



Susan Soar
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Introduction

'Making Maths REAL' was developed as part of the innovations strand of DfE National Prospectus Grant Funding for the NCB Early Childhood Unit 'Making it REAL' literacy programme in 2013-2015. In 'Making it REAL' the ORIM¹ framework is used to plan and reflect on how parents help their children's early literacy development by providing Opportunities, Recognising children's achievements, Interacting and providing Models of literacy use. The intention of the innovations work was to explore how the ORIM framework could be applied to supporting children's learning and development in early mathematics.

In Year 1 of the DfE funded 'Making it REAL' programme a small group of early years settings were asked to explore using ORIM to support early mathematics by trialling some materials and approaches with parents, including using the ORIM framework with draft 'strands' of mathematics. Feedback from this work was drawn together with research evidence, resources and other examples to develop a set of materials for practitioners: 'Making Maths REAL'². This was published online in August 2014 and a link for the document was provided to all practitioners taking part in 'Making it REAL' literacy training in 2014-15.

This document reports upon the Making Maths REAL innovations work in Year 2 of the funded 'Making it REAL' programme.

¹ Nutbrown, C., Hannon, P. and Morgan, A. (2005) *Early Literacy Work with Families*. London: Sage.

² <http://www.ncb.org.uk/areas-of-activity/early-childhood/projects-and-programmes/>

The 'Making Maths REAL' approach

In 'Making Maths REAL' practitioners work with parents to enable them to support their young children's early mathematical development by providing Opportunities for mathematical development, Recognising children's achievements, Interacting and providing Models of mathematics (ORIM). The subject area of mathematics is broken down into three strands of mathematics, based upon ways in which young children might encounter and experience it in everyday life.

For the purposes of the 'Making Maths REAL' work the strands of mathematics are:

- **Environmental Maths:** *mathematics that a child might experience through packaging, labelling, signs, the built environment and the natural environment*
- **Everyday maths:** *mathematics that a child might experience through meaningful everyday experiences such as eating, drinking, moving, dressing and play*
- **Stories, songs and rhymes:** *mathematics that the child might experience through stories, songs and rhymes.*

Curricular elements of mathematics, such as shape or calculation, can be developed across the three strands. Project activities are designed to support mathematics within the early home learning environment and in the context of the family, including events for parents and children, home-learning resource packs and one-to-one engagement either in the setting or at home. A summary of research supporting this approach is set out in the 'Making Maths REAL' materials (see previous page).

Overview of the project work

The aims of the Making Maths REAL work in Year 2 of the programme were to:

- Carry out project work with families in order to further test the use of the ORIM framework and strands of mathematics to support young children's early mathematical development
- Use observational feedback from practitioners and parents to gauge the impact on children's learning and development in mathematics
- Evaluate the impact on parents' knowledge and confidence in supporting their child in early mathematics
- Gather feedback from practitioners.

Six project settings were recruited from amongst the settings trialling work in Year 1 of the programme. Settings including an infant and nursery school, a primary academy, an independent school, a maintained nursery school, a pre-school and a nursery.

The Year 2 project work began with a workshop in late September 2014, facilitated by Susan Soar (Senior Development Officer, NCB Early Childhood Unit) and Keith Phillips (NCB Associate trainer). The settings were asked to carry out at least two episodes of work with children from five families, including either a home visit with each family or a one-to-one session in the setting. They were also asked to gather pre- and post-project observational data on children's learning and development in mathematics and on parents' knowledge and confidence in supporting their child with early mathematics. Events and activities could also

be opened up to other families within the participating settings. The project work drew to a close in early February 2015.

The project work was funded as part of the Year 2 funding for Making it REAL (DfE National Prospectus Grant). The budget was £10,700, of which £6,000 was allocated as individual project grants of a thousand pounds for the six participating early years settings. There was no restriction placed on use of the grant funds beyond supporting the project work, however all the participating settings invested some of their funding in books and equipment that could also be used by future cohorts of parents and children.

The remaining budget was allocated to the costs of the initial project workshop (including travel and accommodation for project participants), training and development work carried out by the NCB Associate trainer and the costs of filming video footage at a project workshop.

The project activities

The project activities across six early years settings included 21 home visits, seven individual sessions with parents in the setting, seven group workshops or events (also open to other children and their parents) and the development of six libraries of resource packs.

The following list does not reflect the full range of activities undertaken by participating settings, but examples include:

- A 'Maths at home' workshop, including activities such as sorting 'washing' of large, medium sized and small items of clothing between three suitcases, washing and counting plastic cutlery and looking for numbers on packaging.
- A library of hand-made resource bags containing maths games and detailed mathematical concept resource sheets for parents. These were sent home each week and followed up by one-to-one sessions with parents in the setting.
- A series of learning packs, including ideas to support mathematical interaction around different topics. Examples included story books and puppets; door numbers, clocks and price-tags and a shopping list to buy and measure out ingredients to make playdough. Parents were provided with individual learning journals to record their children's progress, which were used to support dialogue with practitioners.
- A maths-focused visit to a tenpin bowling alley. Practitioners, parents and children talked about shoe sizes, weights of bowling balls, numbers on the score screen, how many pins had been knocked down and how many were left standing each time. The trip took place using public transport and children were encouraged to count the stops and look out for numbers and shapes along the way.
- A series of story-based bags used on home visits and then made available to families to borrow, including 'Ten in the Bed' supported by finger puppets, number cards and a small coverlet. This was followed up by a shape workshop within the early years setting.
- A 'Goldilocks and the Three Bears' themed maths workshop including making porridge and sorting bears into small, medium and large categories. The workshop was attended by 59 nursery children and their parents and all 90 families in the nursery received a resource pack following the event.

Data collection methods

An observational data collection form was designed in order to gather data on the following areas:

- Children's learning and development in mathematics
- Learning practices within the home
- Parents' knowledge and confidence in supporting their child in early mathematics
- Learning and development in relation to the three strands of mathematics.

The first part of the child data collection form consisted of a set of progressive scales, describing aspects of children's learning and development in mathematics. Practitioners were asked to indicate the description on each scale which, in their professional opinion, best reflected their observations of the child within the early years setting. Parents were asked how often their child exhibited aspects of mathematical learning and development at home.

The data collection sheet was completed and returned to NCB as a pre-project baseline and a post-project measure. The post-project data collection form also included additional open-ended questions to gather practitioners' and parents' views on any changes in children's learning and development, any changes to learning practices within the home and any other feedback about the project.

A separate feedback form was provided to practitioners in order to gather data on the impact on early years settings.

Commentary on child data collection methods

The potential strengths of this evaluation approach were:

- The process was straightforward and low-cost to administer
- Parents were actively involved in giving feedback on their child's learning and development
- Findings reflected the child's learning and development both within the setting and at home
- Findings were based on practitioners' observations of children's embedded learning and development within the early years setting
- The observational approach was familiar to practitioners and based on established early years practice.

The potential limitations of this evaluation approach were:

- Reliance on accurate interpretation and administration by individual practitioners
- Potential for 'observer bias' in findings reporting increases in children's mathematical learning and development. For example, parents who were more aware of mathematical language and behaviours following the project work might be more likely to report such behaviours in their children.

Cohort of children

34 focus children were selected for the Making Maths REAL project work. The selection of focus children was left to the individual discretion of practitioners, with a request to involve two-year-old children where possible.

The gender, age and ethnicity data for children at the start of the project was as follows:

Age group		Gender		Ethnicity	
Children aged 5:	3	Male	16	White:	21
Children aged 4:	9	Female:	18	Mixed:	3
Children aged 3:	14			Black:	5
Children aged 2:	8			Asian:	5
				Other:	0
Total	34		34		34

Ethnicity categories according to the 2011 Census.

The cohort completing the project was 33 children. Two-year-old children included those receiving funding for free early education places.

The project events and activities were also opened up to other parents and children at the discretion of each early years setting, but data was only gathered on the project focus children.

Findings: Number and counting

Observation by practitioners	Shows no/very little interest in numbers and counting	Plays at counting-using some number names (not accurately)	Can count a small group of 2 or 3 objects accurately.	Can count a larger group of objects accurately.	Can work out how many objects there will be if one object is added on or taken away.
Pre-project (34 responses)	8 24%	14 41%	8 24%	3 9%	1 3%
Post-project (27 responses*)	0 0%	2 7%	9 33%	11 41%	5 19%

*One practitioner did not complete this part of the post-project data form. Percentage values have been rounded.

Key finding:

Pre-project: practitioners observed that 8 out of 34 children (24%) showed no or very little interest in numbers and counting

Post project: practitioners observed that all children now used numbers, either in their play or to count smaller or larger groups of objects accurately.

Key finding:

Pre-project: practitioners observed that only 3 out of 34 children (9%) counted a group of more than three objects accurately

Post project: practitioners observed that 11 out of 27 children (41%) counted a group of more than three objects accurately

The findings from observational data were supported by **practitioners' responses** when asked if children had been observed to do anything new that they did not do before:

'E can recognise numbers 1 – 10. She can also count objects independently.'

'H now points out to us the numbers he knows. It's created an interest in the setting and at home.'

'A counts objects independently. She notices how many balls in the basket and says 'there's three balls'.'

Parents' responses to this question also described children's development in number knowledge and counting:

'H is definitely more interested in numbers, counting, addition and generally using numbers every day.'

'S is adding and subtracting simple numbers much more than she used to.'

'Counting dinosaurs....can count up to ten now.'

Mathematical stories, songs and rhymes

Observation by practitioners	Shows no/very little interest in number songs and rhymes	Listens to number songs and rhymes and watches as others take part	Knows some words and actively joins in with number songs and rhymes	Can say or sing some number songs and rhymes independently	Can use number knowledge to predict the next part of the song or rhyme
Pre-project (34 responses)	6 18%	12 35%	15 44%	0 0%	1 3%
Post-project (27 responses*)	0 0%	0 0%	11 41%	9 33%	7 26%

*One practitioner did not complete this part of the post-project data form. Percentage values have been rounded.

Key finding:

Pre-project: practitioners observed that 6 out of 34 children (18%) showed no or very little interest in number songs and rhymes. A further 12 children (35%) only took part through watching and listening to others.

Post project: practitioners observed that all children participated actively in number songs and rhymes, some doing so independently. Seven out of 27 children (26%) were observed to use their number knowledge to predict the next part of the song or rhyme.

Parents were asked how often their child talked about **numbers, shapes or groups of objects in children's story books*** and were given examples of what this might look like.

Observation by parents	Never	Rarely (once a month or less)	Sometimes (about once a week)	Often (Most days)
Pre-project (34 responses)	5 15%	14 41%	9 26%	6 18%
Post-project (32 responses*)	0 0%	0 0%	15 47%	17 53%

*One parent did not record data for this question. Percentage values have been rounded.

Key finding:

Pre-project: parents said that 5 out of 34 children (15%) 'never' talked about the mathematical aspects of story books

Post project: parents said that all children are doing this at least once a week and 17 out of the 32 (53%) children are doing so 'most days'.

While parents might be more aware of their child's mathematical language and behaviour following the project work, this finding also fits with the increased lending and circulating of books and story packs featuring a strong mathematical content over the course of the project.

Using mathematical language in everyday life

Observation by practitioners	Rarely or never uses mathematical language:	Will join in with other children or adults using mathematical language:	Can use mathematical language independently in everyday situations:	Uses mathematical language confidently in everyday situations, including solving problems:
Pre-project (34 responses)	10 29%	19 56%	4 12%	1 3%
Post-project (27 responses*)	1 4%	7 26%	17 63%	2 7%

*One practitioner did not complete their part of the post-project data form. Percentage values have been rounded.

Key finding:

Pre-project: practitioners observed that 10 out of 34 children (29%) rarely or never used mathematical language in their play or everyday activities.

Post project: practitioners observed that 17 out of 27 children (63%) used mathematical language independently in everyday situations.

Parents were also asked to provide feedback on how often their child used mathematical language in everyday situations at home and were given examples of what this might look like.

How often does the child use mathematical language to describe everyday situations at home?

Observation by parents	Never	Rarely (once a month or less)	Sometimes (about once a week)	Often (Most days)
Pre-project (34 responses)	9 26%	8 24%	6 18%	11 32%
Post-project (32 responses*)	0 0%	0 0%	11 34%	21 66%

*one parent did not record data for this question. Percentage values have been rounded.

Key finding:

Pre-project: parents said that 9 out of 34 children (26%) 'never' used mathematical language at home

Post project: parents said all children are doing so at least once a week and 21 out of 32 children (66%) are now reported to be using mathematical language 'most days'.

Using mathematical language in everyday life continued:-

The findings from observational data were supported by **practitioners' responses** when asked if children had been observed to do anything new that they did not do before:

'He notices differences between sets of objects e.g. who has more or less and can order objects according to size using correct vocabulary to describe and compare them.'

'More confident generally. More language used. More engagement in maths activities.'

While the parental findings might be interpreted in the light of parents being more aware of their child's mathematical language and behaviour following the project work, **parents' responses** also supported the findings:

'Yes, counting things at home. He tells his little sister shapes, colours and numbers.'

'He is using different mathematical vocabulary, especially 'more/less'; positional vocabulary and opposites 'big/small', 'under/over' etc.'

'S is looking for numbers all the time. She told her Grandad: 'the wheels on your car are circles.'

Mathematics in the environment

How often does the child talk about numbers, shapes or groups of objects that they can see in the environment?

Observation by parents	Never	Rarely (once a month or less)	Sometimes (about once a week)	Often (Most days)
Pre-project (34 responses)	11 32%	8 24%	5 15%	10 29%
Post-project (32 responses*)	0 0%	0 0%	9 28%	23 72%

*One parent did not record data for this section. Percentage values have been rounded.

Key finding:

Pre-project: parents said that 11 out of 34 children (32%) ‘never’ talked about numbers, shapes or groups of objects that they can see in the environment.

Post project: parents said that all children are doing so at least once a week and 23 out of 27 children (72%) are now reported to be using mathematical language ‘most days’.

However, this must also be interpreted in the light of parents being more aware of their child’s mathematical language and behaviour following the project work.

This finding of children was also supported by the qualitative responses to the post-project observation form. Parents and practitioners were asked to **describe anything new that the child does following the project that they did not do before**. Comments relating to children’s awareness of mathematics in the environment around them included:

‘She will count the cars on her way home and she counts when she is eating.’

‘Notices numbers and shapes outside’

‘Every day – all the time!’

Although practitioners were not asked to assess children on this aspect of mathematics, **practitioners’ qualitative responses** included a number of references to children’s awareness of mathematics in the world around them:

‘H now points out to us the numbers he knows. It’s created an interest in the setting and at home.’

‘Looking for shapes and numbers in the environment and when playing outside.’

‘J is much more confident and pro-active in terms of noticing numbers and shapes.’

Parents' knowledge and confidence in supporting young children's early mathematical development

Parents' knowledge and confidence in supporting their child's early mathematical development was gauged through two aspects of the evaluation:

- Practitioners' pre-project and post-project observations of parents' confidence in talking about their child's mathematical development.
- Parents' own qualitative feedback via the post-project observation form.

'Based on your interactions with parents, how confident are parents to talk about their child's mathematical development?'

Observation by practitioners	Not at all confident	Somewhat confident	Quite confident	Very confident
Pre-project (34 responses)	11 32%	14 41%	5 15%	4 12%
Post-project (27 responses*)	0 0%	5 19%	16 59%	6 22%

*One practitioner did not complete their part of the post-project data form. Percentage values have been rounded.

Key finding:

Pre-project: practitioners described 11 out of 34 parents (32%) as 'not at all confident' to talk about their child's mathematical development

Post project: practitioners did not describe any parents as 'not at all confident' to talk about their child's mathematical development and 22 out of 27 parents (81%) were described as either 'quite confident' or 'very confident' to talk about their child's mathematical development.

This finding suggests that the project work was very helpful to those parents most lacking in confidence in discussing their child's mathematical development.

This finding was supported by the qualitative data from the 'other comments' section of the post-project observation form. Relevant comments related to **parents' increased knowledge and awareness of the mathematical potential of everyday activities:**

'The teachers really helped me, they explained number learning to me.'

'It has been good to be made aware of more everyday things which can be maths based, I didn't necessarily realise it before e.g. sorting the washing, noticing shapes in the kitchen.'

'The project has been really useful as it has pointed me in the right direction so that I know what to do with my child.'

Impact on family learning practices within the home

Key finding:

Post project: parents reported a number of new learning practices within the home environment, including making use of mathematical opportunities presented by everyday activities such as cooking, dressing or meals.

Key finding:

Post project: parents reported that the mathematical content of their own interactions with their children had increased.

The impact of the project work on family learning practices within the home was gauged through parents' own qualitative feedback via the post-project observation form. Parents gave 21 responses to the question: 'do you do any new things at home now to help your child learn?'

All of the responding parents reported one or more new practices within the family or home environment, many of which were closely related to the strands of mathematics: pointing out numbers or shapes in the environment (six comments), making use of mathematical opportunities presented by everyday activities such as cooking, dressing or meals (twelve comments) and making use of stories, songs and rhymes (two comments).

Parents also reported that they were **aware of changes in their own behaviour and interaction with their child**, in the form of increased mathematical content in their interactions (five comments). This was reported as either something that they found themselves doing unconsciously or an intentional decision to increase the mathematical content of their dialogue:

'I am talking about numbers a bit more. I am getting A to lay the table and count out objects. I am making use of everyday opportunities for counting, rather than using a 'counting numbers book'.'

'I make more of an effort to bring maths into what we do at home. When we're cutting up stuff for dinner, A helps and we talk about shapes.'

'I try to be much more conscious about talking about time, numbers, measuring and including her in conversations about what I am doing which involves numbers...the maths project probably encouraged me to think about this more.'

Finally, parents also reported seeking out **additional mathematical activities, using both traditional resources and mobile technology**:

'I have deliberately found more mathematical games to play like Ludo and snakes and ladders so that J can recognize numbers and count'

'We use a calendar every day, with sticky fabric dates, days etc and she works out the date.'

'I put lots of number games on the ipad.'

'[using a] wipe book at home'

Other aspects of the qualitative responses

Key finding:

Post project: practitioners observed an increase in children's engagement with and enthusiasm for mathematical activities within the setting, including that children were more likely to access maths related activities during their independent play and learning.

Practitioners:

- When describing what children were now observed to do that they did not do prior to the project work, seven out of the fourteen comments from practitioners feedback included comments on the level and nature of children's **engagement with and level of enthusiasm** for mathematical activities within the setting, including 'more engagement in maths activities', 'more enthusiasm for number related activities' and 'more engaged in maths related activities'. Five of these comments also noted that children were **more likely to access maths-related activities** of their own volition during their independent play and learning.
- Practitioners also appeared to suggest a related increase in **children's general confidence** within the early years setting: the phrases 'confidence', 'more confident', 'keen' or 'pro-active' occurred six times in the comments.

Parents:

- Parents also described some ways in which children **were applying their mathematical knowledge and making new creative connections in their learning following the project work**. One parent described how their child '...makes connections between things e.g. she knew something was an octopus because it had eight legs'. Another parent described how her child, having experienced the school maths games provided as part of the project, was now inventing games of his own: 'he invents hop scotch patterns on the kitchen floor to jump onto...[he] loves being timed as to how fast he can run to the front of the house and back, and checking whether he is faster than the last run (or his sister)'.
- Although the project did not formally monitor impact on siblings, parents reported (five comments) that **younger and older siblings became involved in the project work**, for example that 'he tells his little sister shapes, colours and numbers' and that 'big sister got involved and added on and counted on.'
- The benefit to the **wider family, including grandparents** was also reported by parents: '[she] has really enjoyed completing the activities that have been sent home and it has been very beneficial to share these with grandparents too.'
- Finally, parents made **generally positive comments about their experience of the project work** (14 comments), describing it as 'useful', 'enjoy[able]' and 'a good initiative'. Some parents reported that they missed the activities now that the project had been completed and that they would like to do more in the future. One parent said: 'It was so much fun. We all enjoyed it and miss the surprise of new 'homework' twice a week'.

Impact on practitioners and early years settings

Feedback from practitioners and early years settings was obtained through use of an end-of-project questionnaire. Three questionnaires were returned from the six settings, in addition to informal and face-to-face feedback via email and from practitioners attending the February Making it REAL celebration event. As the cohort was very small, it was not possible for practitioners to give feedback anonymously or to draw together general themes, but a selection of the comments is below:

'How helpful did you find the ORIM framework and strands of mathematics when working with families to support children's early mathematical development?'

'It was useful to know the background research that the project was based on. The principles of the framework are what we base a lot of our work with parents around anyway, so it wasn't new to our setting.'

'We focused on the Everyday Maths strand which really helped parents to appreciate that they do not need to buy games/puzzles/education toys to do maths...but they can use normal, routine, daily activities to encourage mathematical development and thinking.'

'The strands were useful to ensure coverage.'

'The ORIM framework...also demonstrated to the parents how important their own role is in supporting and encouraging their children's early mathematical developments.'

'What impact has the Making Maths REAL project work had on your setting?'

'Without engaging on the REAL study and the ORIM framework this concept would never have gone this far. I still feel we have only just scratched the surface of what is possible to get practitioners, parents and families more engaged, empowered and building on what they already do.'

'The project work has also helped parents to understand that maths learning is not simply counting by rote, recognizing numbers and shapes, but it is about practical activities and talking to their children about maths concepts.'

Other comments:

'I think that the project work has helped parents to change some of their attitudes about maths and they are more aware of how maths can be incorporated into routine activities and experiences.'

'I enjoyed taking part and would be interested in future research.'

'It was very interesting to see whether there was a difference between the pre-project and post-project observations and to note the parents' views before and afterwards.'

Evaluation summary

Following analysis of the project data, the impact of the project work includes:

Children

- Practitioners observed that **a greater number of children showed higher levels of mathematical learning and development following the project work, compared to observational data gathered before the project.** This applied to children's learning and development in number and counting, their engagement with number stories, songs and rhymes and the extent to which they were able to use mathematical language in everyday situations.
- Parents reported that **a greater number of children 'often' demonstrated their mathematical learning and development at home following the project work,** compared to what they reported before the project. This applied to the frequency with which children talked about numbers, shapes or groups of objects that they could see in the environment or in children's story books and their use of mathematical language in everyday situations.
- Practitioners observed an **increase in children's engagement with and enthusiasm for mathematical activities within the early years setting,** including that children were more likely to access maths-related activities during their independent play and learning.

Parents:

- Across the cohort of project children and their parents, practitioners reported an **increase in the number of parents whom they would describe as either 'quite confident' or 'very confident' to talk about their child's mathematical development.**
- Parents described the positive impact of the project work in terms of **increased knowledge and awareness of the mathematical potential of everyday activities,** new learning practices within the home environment and increased mathematical content in their interactions with their children.

Practitioners and early years settings:

- Positive feedback was received on the use of the ORIM framework and strands of mathematics when working with families, especially in enabling parents to value the potential of everyday activities to support their child's mathematical learning and development.

Further work

Other related work in Year 2 included:

- Presentation of workshops 'Exploring early mathematics and the ORIM framework' at the London 'Making it REAL' dissemination event in September 2014 and at the 'Making it REAL' Celebration event in Sheffield, February 2015.
- Project participants attended the Making it REAL' Celebration event in Sheffield, February 2015 and shared their project work with participants during the above workshops.
- Filming professional video footage of a maths workshop, for use in future training and dissemination activities
- Development of a one-day training course for future delivery, including practice examples for practitioners.

Future developments:

Potential future developments for the 'Making Maths REAL' work include:

- Continuing to host 'Making Maths REAL' material and resources for practitioners on the Early Childhood Unit website.
- Pilot and delivery of a one day training course in 2015.
- Potential for linking with other organisations interested in supporting mathematics in the early years.
- Applying for funding for further project work and evaluation.

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The Early Childhood Unit (ECU) at NCB works to sustain and improve services for young children through direct work with children's services and settings, and through its national networks.

ECU's mission is to promote young children's well-being, learning and development, and to remove barriers to these by providing support for the planning and provision of services for young children and their families.

Early Childhood Unit
National Children's Bureau
8 Wakley Street
London
EC1V 7QE

Tel: 0207 843 6444

Email: ecadmin@ncb.org.uk

Web: www.ncb.org.uk/areas-of-activity/early-childhood

Registered Charity Number 258825

