An evaluation into the efficacy of the FunKey Mathematics Peer Mentoring Programme

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Summary

The **key findings** from this impact evaluation are as follows:

- FunKey provides a very low-cost and highly effective peer-teaching intervention for KS1 children who are not meeting age-related expectations in mathematics.
- In addition to the mathematical gains in number work for the KS1 children, there is some evidence to suggest that participation in the intervention also lead to gains in mathematical reasoning and mathematical communication skills for both mentees and mentors.
- In addition to mathematical gains, there are considerable benefits to the mentors and mentees in terms of building self-esteem, self-confidence around maths, and social skills.
- In addition, mentors develop organisational and leadership skills.
- The quality of the initial training and materials and the commitment of the project lead in each school underpin the ability of the mentors to work successfully with their mentees.
- There is evidence that participation in the programme leads to an increased understanding of ways of learning mathematics and an appreciation of the possibility that mathematics is learnable. This seemed to make many of Dweck's (2006) ideas about 'mindsets' visible.
- The highly structured content of the mathematical programme ensures that mentors are not required to teach, but rather to facilitate carefully graded practice steps which build skills, thereby minimising the possibility of misconceptions being introduced by the mentors.
- The intervention has huge potential and merits further investment.

Next Steps

- The next stage of the development of the project should seek information, which will give an insight into the durability of the learning gains and the transferability of the knowledge and skills gained.
- Consideration might be given to the possibility of running the intervention with mentees whose first language is not English and/or whose language skills are under-developed.

FunKey Evaluation Report

1. Introduction

Vygotsky's theory of social constructionism suggests strongly that children learn best in the company of a 'more knowledgeable other', which, in school situations at least, is almost always an adult. Despite this, there is considerable evidence of the efficacy of peer learning where peers are either of the same age, or slightly older than the learners (see Rohrbeck, Ginsberg-Block, Fantuzzo and Miller, 2003 for a meta-analysis). FunKey is a mathematics intervention, which draws on the benefits of peer learning by pairing children in Year 2 (typically 6-7 years old) with children from Year 5 (typically 9-10 years old) to do some mathematics together. The following report documents the impact of a trial of the FunKey initiative in ten schools, eight schools in and around Hereford and two schools in Bristol.

2. Background

The FunKey intervention pairs children in Year 2 (from here known as mentees) whose mathematical understanding is well below age-related expectation (ARE) with children in Year 5 (from here referred to as mentors). The children meet together under the supervision of, but not directly taught by, an adult. In the schools participating in the pilot, these were either the mentees' class teacher, a Learning Support Assistant (LSA) attached to the class, the mentors' class teacher, or the school's mathematics subject leader.

Each mentor then meets with his/her assigned mentee for at least three 15 minute sessions a week over the course of the programme with highly targeted learning outcomes and goals. The timing of the programme is kept flexible, so as to be responsive to the different needs of each mentee. For the purposes of this evaluation report, the unit focused on counting backwards. This is the third of three units on counting. This is one of several units that are included in the FunKey scheme, which is designed to address key areas of mathematics that are fundamental to the further development of mathematical skills beyond Year 2.

The mentors are given comprehensive training, which covers two fundamental areas: the mathematics involved and the wider skills needed to be an effective mentor. This training explores issues such as how to motivate and encourage young children, how memory works, how to build in variation, strategies to deal with mistakes or misunderstanding and communication and leadership skills. This training reflects the recognition within the FunKey programme that there is both a practical, knowledge related element to learning mathematics and an affective/emotional element. For children who have struggled with learning mathematics, addressing the possible negative emotions associated with it is seen as being significant. This is explored more below.

Aims and Objectives

The aims of this evaluation study were to explore the efficacy of the FunKey maths intervention and any effects it may have on the mathematical knowledge and understanding of the mentees and to look at any possible effects that participation may have on the mentors.

The evaluation considered the impact of one of the FunKey Units, Counting Backwards 100 – 0, as it was carried out in ten primary schools, eight in Herefordshire and two in Bristol. The intervention on which this evaluation study is based ran from September 2017 to Jan 2018.

Methodology

A range of data was gathered to support the evaluation. Quantitative data was collected in the form of the mentees' pre- and post-intervention scores on a range mathematical tasks. These skills were measured for fluency and for accuracy.

In addition to the quantitative data, a range of participants in the intervention were interviewed. These included mentors from a range of schools, teachers and teaching assistants who were administering the intervention and mathematics leaders in participating schools. This mixture of both quantitative and qualitative data was gathered in an attempt to evaluate more than simply any possible gains in mathematical attainment shown by the mentees; an attempt was made to capture some of the nuances of a peer-mentoring intervention.

3. Design of the training and the mathematical tasks

Training

The training of the mentors is considered to be a crucial element of the FunKey programme.

Project leads from each school were trained by the FunKey Programme Lead, Maggie Steel. The half day training for the project lead equips them to return to their schools, identify suitable mentors and mentees, run the pre-intervention testing, and train their mentors.

The mentor training is robust and comprehensive. It takes place during a half-day session and is divided into two parts, as follows:

- Generic training in how to work successfully with young children who are struggling with particular areas of mathematics.
- Maths-specific training on the activities that the mentors will conduct with their mentees.

In terms of time, there is a weighting towards the generic training and mentors do not move onto the maths-specific training until they have completed the generic training. No mentor is allowed to work with a mentee until both elements of the training have been completed satisfactorily. This prioritisation of the generic training over the mathematics training is important. It signals to the mentors and to the adults overseeing the FunKey programme that the way the mentors interact with their mentees will have a significant impact on the progress that they are likely to make.

This generic training identifies the essential characteristics of good mentors, and explores issues such as communication, the impact of emotions on learning, feedback, memory and leadership. It equips mentors to make good pedagogical decisions about the learning process.

For example, mentors are taught that there is an emotional element to learning mathematics in addition to a practical, knowledge-related element. The mentors are given training in how to address the emotional element by being encouraging, and communicating in a supportive and motivating way. Mentors are explicitly asked to consider how they communicate with their mentee, in terms of the words used, as well as the tone of voice, their body language and eye contact.

Mentors also consider the role of memory in learning mathematics and the importance of repeating activities regularly over time to ensure that understanding is deeply embedded. They also consider the best way to give feedback to their mentees and the difference that their choice of words can make when framing questions and feedback. For example, they consider the difference between asking 'What's the answer?' and 'Shall we try this one together?' Each mentor is given a small booklet with the key elements of the generic training summarised for easy access during the FunKey sessions themselves.

Mentors are also trained on how to deliver the mathematical activities and games that are involved in the programme. Project leads have access to activity videos to demonstrate the activities and to model mentor talk and interactions with a mentee.

Mentors are explicitly taught about the possible misconceptions that their mentees may bring to particular areas of mathematics and how to help them to overcome the misconceptions. The structure and design of the mathematics activities are exclusively the remit of the adults running/administering the programme. The mentors do, however, have autonomy over the specific interactions with each mentee and have some freedom to make their own pedagogical decisions. The impact of this training is visible in some of the findings discussed in the sections below.

Mathematical Activities

The mathematical activities have been developed over a number of years and are carefully constructed so as to ensure that the key learning is broken down into small, manageable parts. This lends itself to the frequent, targeted intervention that is a feature of the FunKey Programme.

Each Unit has a small booklet called the 'Licence', which sets out ten activities associated with that particular unit. For example, the 'Counting Backwards 100-0' unit that was the subject of this impact evaluation had ten separate activities to get children counting backwards fluently in 1s, able to say one less than any number, and count back from any number. The first three of these activities were designed to ensure that the children are able to count backwards in tens and have a clear conceptual understanding of what they are doing (i.e. they are not simply learning a string of words to be repeated in the correct order). The activities were also designed to support the children in developing a strong visual number line. For example, in Activity one, the children learn to count backwards in tens verbally. In Activity 2, they order multiples of ten and in Activity 3, they learn to say what is ten more and ten less than any given multiple of ten.

4. Quantitative Data Review

All the participating schools completed a pre- and post-intervention assessment for the Counting Backwards 100-0 Unit. The data is displayed in the Tables below. The pre-intervention tests were carried out prior to the beginning of the programme and the post-intervention measures carried out one to two weeks after the completion of the programme The assessment gathered data on the children's counting in terms of both fluency and accuracy. Both scores are reported in the statistical analysis below. There were 65 children for whom complete data sets were obtained. Paired samples t-tests were carried out to see if the differences in the mean scores pre- and post-intervention were significantly different.

Data for the Accuracy Scores

	Mean	N (number of participants)
Pre-Programme Accuracy	7.431	65
Post-Programme Accuracy	14.569	65

	Mean	t	Significance
Post Acc – Pre Acc	7.1384	14.224	<0.0001

For the accuracy measures, the data above show that the differences between the mean scores pre- and post-intervention were highly statistically significant ($p<0.0001$).

Data for the Fluency Scores

	Mean	N (number of participants)
Pre-Programme Fluency	6.723	65
Post-Programme Fluency	13.954	65

	Mean	t	Significance
Post Fluency – Pre Fluency	7.231	15.103	<0.0001

A similar picture emerged for the fluency scores, with the differences between the pre- and post-intervention being highly statistically significant ($p < 0.0001$).

The significance scores suggest that the intervention was highly successful in developing the mathematical understanding of the mentees. Their average scores increased considerably. The significance score suggests that there is a very high level of confidence that this big increase in the scores was caused by participation in the intervention and not by any other factors.

Unsurprisingly, the data showed that, on average, the children who took part in the FunKey programme made statistically significant gains in their understanding of counting backwards. This was true for the data on fluency and for that on accuracy.

There was quite wide variation in the gains made by the children in the different schools. This was caused partly by the different pre-intervention scores (the children in some schools scored almost nothing in the pre-intervention assessment) and partly by variation in the progress made. In section 5 (below), there will be some discussion about the possible reasons for the variation in the impact that the intervention had in the different schools. Analysis and consideration of the reasons for variations in the efficacy of the intervention and of the circumstances surrounding particular

children whose performance did not mirror that of the majority of children will enable further refinements to the programme and increase its efficacy in future.

There have been some concerns raised about the possible dangers within a peer mentoring programme of mentors passing on or reinforcing misconceptions. The programme was designed with this risk in mind. To mitigate the risk, the training of the mentors included identifying possible misconceptions and working hard on specific language to use in particular activities. This language is explicitly practised in the training session where the training model is Watch, Do, Observe. In other words, mentors watch the activity video which models appropriate mentor talk, they practise the activity in pairs to practise the mentor talk themselves and then one pair models the activity to the group and receives feedback.

The training for the game Slap Bingo is a good example. In the activity video, the actor playing the role of mentor explicitly says, "Keep using the phrase: *What's one less than?"* During the training mentors will also discuss why other phrases such as "What comes before 17?" are imprecise or potentially ambiguous and must be avoided.

The high scores in the post-intervention assessments are reassuring, suggesting that mentors are unlikely to have passed on or reinforced misconceptions. Furthermore, teaching staff in the school are encouraged during their own training to observe mentor talk closely particularly in the early stages of the programme. And finally, when a child is not making the anticipated progress within the programme, the project lead is encouraged to investigate at an early stage the possible reasons, so that if there is a problem with the mentor it is picked up early. In this pilot, there were no cases found where a mentor had been unwittingly passing on misconceptions.

5. Further Development of the Intervention.

Despite the overall impact of the intervention, there was variation in the amount of progress made by individual children within the sample. While it is not possible to comment on the reasons for this variation among all the children, there were one or two children whose progress was considerably less than would have been expected, given the gains made by the children overall.

One of these was Ned from Ashley Down Primary School in Bristol. He made very little progress during the intervention, scoring less well for Accuracy and only three marks higher for Fluency on the post-intervention paper than he had done on the pre-intervention. Ned's school attendance during the period of the FunKey intervention was very erratic and he missed more than half the FunKey sessions. Non-attendance at some of the sessions would explain some of the poor performance. However, the fact that he did attend some of the sessions, but still made almost no progress suggests that the FunKey intervention is highly cumulative and therefore demands commitment from the mentors, from adults involved in running the intervention and from the parents of the mentees. Ned's case might indicate that the learning gains made in a particular session are quickly lost, if not reinforced within a day or two. Long gaps between sessions may mean that the lack of consolidation of learning gains results in the learning being lost.

The staff at Ashley Down have since been able to discuss Ned's lack of progress in the intervention with his parents (who are recent arrivals to the UK and may not have fully appreciated the need for his attendance in school). Ned has also taken part in Phase 2 of the intervention and has made significant progress.

In analysing the impact of the FunKey intervention, it is worth considering whether there are children for whom FunKey will not be effective in raising their attainment. Ned's case suggests that the intervention's 'little and often' approach makes it effective, but potentially vulnerable to gaps in attendance, or if there were gaps in delivering the intervention to the children. While this is not an inherent weakness in the programme, it is something to be considered as guidance is compiled for schools seeking to adopt the programme.

6. Discussion of the reasons for the gains

Repeated Practice: The reasons for the gains are self-explanatory. The intervention addresses directly those skills that are assessed in the pre- and post-intervention assessment. Repeated practice of those skills will almost inevitably lead to gains in performance. That said, the gains explored above are considerable and highly statistically significant.

Distributed Practice: There is a considerable literature on 'distributed practice' i.e. practising a skill 'little and often' over a period of time to maximise retention (see Baddeley and Longman, 1977). The short, but frequent nature of the intervention coupled with the fact that, within each session, there are a number of games, each reinforcing a particular concept, or piece of understanding, suggests that the intervention has been designed to maximise retention and understanding.

Verbal mathematical reasoning: When discussing the learning gains with the teachers of the mentees, it became clear that, for some of them, one of the key reasons for their children's improved performance was the increase in their ability to reason mathematically and to express their reasoning verbally. While the FunKey programme does not seek to 'teach' reasoning explicitly, many the activities in the Counting Backwards unit of the intervention deliver opportunities for mentors to engage in discussion with mentees about their choices and answers.

7. Limits of the data

Durability

An exploration into the durability of the learning gains created by the FunKey programme is beyond the scope of this particular pilot study and impact evaluation. The data from Phase 1 does not allow any claims to be made about the durability of the children's understanding. In order to establish whether the children's understanding was durable, a post-intervention test, several weeks after the end of Phase 1 would be needed.

This would enable us to know more clearly how durable the gains are and how important it is to structure the programme so that concepts from a particular unit are re-visited during subsequent units in order to consolidate understanding. See report recommendations in Section 12.

No Control Group

There could be an argument that the gains made by the children were caused by their participation in mathematics lessons outside the FunKey programme. Initially some consideration was given to running the intervention on a 'matched-pairs' basis i.e. with each mentee being matched as closely

as possible with another child from the same class, who wouldn't take part in the intervention. This would have allowed a different statistical analysis in which any gains made by the child in the FunKey programme could have been compared with those made by the matched child not involved in the programme.

This approach was rejected on two grounds:

Logistically, given that matched pairs would have to be taken from the same class in the same school (to isolate the effects of participation in maths lessons), there were simply not enough children for whom participation in FunKey would have been beneficial.
Ethically, it was felt to be inappropriate to exclude some children from participation in FunKey who might have benefited from inclusion, as would have been necessary to pursue the matched-pairs design.

Application

The nature of the pre-intervention assessment for Phase 1 is such that the assessed tasks are those that the children have practised during the intervention. As a result, the current analysis does not allow for any comments to be made about the children's ability to apply their understanding of the concepts covered in Phase 1 to novel, or unfamiliar situations or problems. This in no way compromises the intervention itself, but places a limit on the claims of applicability that can be made at this stage.

A recommendation is that, where possible, the post-intervention test be expanded for future iterations of the intervention so that teachers are able to see the extent to which the children are able to apply their skills.

The post-intervention assessment for Unit 2 (Place Value) does contain items that are different from those that have been directly practised by the children during their work with their mentors. At the time of writing, not all the participating schools have been able to provide post-intervention data for Phase 2. The data that has been provided is discussed below.

In conclusion, the data from Phase 1 of the intervention show without any doubt that the intervention is highly effective in producing very significant immediate gains in the children's understanding of number and counting. These gains can be attributed directly to the intervention and are delivered at very very low cost, both financially and in terms of the time the children spend out of the classroom and therefore not participating in other learning. At the time of writing, the data do not allow for any comment about the durability of these gains, or the children's ability to apply their understanding to new situations.

8. Qualitative Data

Discussions with the teachers about the mentees

While the quantitative evidence presented above about the impact of the FunKey intervention on the mentees' mathematical performance is compelling, it is not especially surprising. What makes

FunKey different from a lot of teacher-led mathematics interventions is its use of peers (the mentors) to teach the mentees. This impact evaluation sought to explore whether there were benefits to the mentees that might be gained that are not reflected in the quantitative data about their mathematical performance.

The following discussion is based on data gathered from a number of interviews with staff at participating schools. The staff included maths subject leaders, who were overseeing the programme, class teachers and teaching assistants who were involved in the FunKey sessions. They all discussed the impact that they had seen on the mentees in areas other than mathematical attainment.

Mentors as role models

There was a sense in which the mentees looked up to and even idolised the mentors. This meant that the mentees' perceptions of mathematics may have been altered somewhat. Children whom they looked up to and aspired to be like, were explicitly involved in doing mathematics with the mentees. The mentees' ideas of what mathematics is and how it is viewed by people they aspire to be like may well have been changed. This kind of effect can only be brought about by a peer mentoring intervention, as teachers, however well-intentioned and skilful, cannot ever be a mentee's peer. They are not 'like' the children they teach. The FunKey mentors however, are only three years older than their mentees and therefore a much more immediate role model. It should be noted here that this thought was not explicitly articulated by the mentees themselves, but was an observation made by staff in the participating schools.

In terms of developing the programme further, it may be worth considering which children are chosen to mentor specific mentees. For example, if one of the reasons for a specific mentee's lack of attainment in mathematics is a perception that mathematics is not for someone like him/her, pairing that specific mentee with one of the more popular, or 'cool' children in the school, may help to give the specific mentee a different view of mathematics. Being good at mathematics might then become something that the mentee aspires to.

Confidence to talk about mathematics (verbal reasoning)

The FunKey intervention appears to have had an impact on the confidence with which some mentees are able to discuss mathematics and to explain their reasoning. The second unit in this pilot study on Place Value requires that the mentees engage in a lot of discussion with their respective mentors and that they are asked to explain their thinking and the reasons for their answers and mathematical choices. The staff in the participating schools were clear that the FunKey mentees were better able to explain their reasoning as a result of FunKey. In some schools, the children's reasoning scores on classroom tests had improved, even if their attainment in other aspects of mathematics, not covered by the FunKey programme, had not significantly changed. For many FunKey mentees, the confidence afforded by having the opportunity to talk about mathematics and express mathematical reasons, led to an increase in participation in mathematics lessons beyond FunKey.

Some of the staff who were interviewed were aware that the mentees' progress in mathematics was not always reflected in the classroom assessments that they carried out. Several reported hearing children engage in mathematical conversations with their mentors and solve problems verbally, only

to find it difficult to record their thinking in written classroom assessments. In terms of future planning for the intervention, it is recommended that some units involve the children in recording their mathematical thinking in written symbols, as this is the form in which they will often be required to demonstrate their mathematical understanding.

9. Discussions with the teachers about the mentors

The fact that FunKey is a peer-mentoring intervention means that there are two sets of children involved. In evaluating the impact of FunKey, consideration should be given to the impact that participation may have on the older children (mentors). The following discussion is based on interviews with one of the class teachers of a group of mentors as well as with other staff members (maths subject leaders) who were overseeing the programme.

Organisational skills

Participation in FunKey had a significant impact on the personal organisation of some of the mentors. Mentors have to take responsibility for getting resources and games ready for their mentees; this requires an ability to plan ahead and to be organised. In some schools, the subject leader responsible for the administration of the FunKey intervention deliberately chose mentors whose organisational skills needed to be developed. One class teacher explained that mentors' personal organisation skills were helped by the fact that FunKey happens several times a week, over a period of several weeks. This enables the children to get into a routine with their organisation and to learn from instances where a lack of organisation may have caused problems.

One of the mentors was experiencing some mental health problems prior to the beginning of FunKey and was quite anxious about coming into school. Her participation in the programme and the fact that she was not only able to, but required to think about someone else on the mornings when the FunKey intervention was running, helped her to overcome some of this anxiety and be more willing to come to school.

Reinforcing the mentors' own mathematical understanding

There were clear developments in the mathematical skills of some of the mentors. The different schools had different criteria for their selection of children to be mentors, but they certainly didn't all select their strongest mathematicians for the role. Some of the weaker mathematicians had benefited from engaging in simple mathematics and reinforcing their understanding. However, a more powerful effect was in the mentors' understanding of their own mathematical understanding. Asking their respective mentees to articulate their mathematical understanding and reasoning seemed to have had an impact on the mentors' ability to do the same in the context of their own mathematical learning. The class teacher who was interviewed also noted his mentors' enhanced ability to process and follow instructions. He speculated that the experience of having to give instructions and seeing their mentees not always willing, or able to follow them, had given the mentors a clearer grasp of what it was to receive and act on instructions.

Responsibility and confidence

It was clear from everyone involved that the mentors greatly enjoyed the responsibility and kudos that came with being selected to be a mentor. Staff in the schools were clear that the mentors had a great sense of pride in what they were doing and that they enjoyed being able to 'give something back' to the school. In some of the schools, children who were in receipt of Pupil Premium funding had been explicitly selected, so as to boost their confidence. Several of the subject leaders talked about the development of the mentors' confidence, both within the FunKey teaching sessions and more widely in school. A good example of this was the fact that the mentors, on the whole and as a group, became better and better at solving their own problems as the programme went on. For example, if a mentor was absent, the other mentors would organise to pair up two mentees for a session, so that the mentee did not miss the session. The mentors, with approval from school staff, also arranged swaps of mentees if particular relationships were not working well, or they sensed that a different pairing would work more effectively.

Impressively, the mentors also became very adept at adjusting and altering their teaching to fit the changing situations with their mentees. All the school staff commented on the way that the mentors took increasing pedagogical responsibility, adjusting their questions, changing the order of the activities, doing some activities more frequently to consolidate their respective mentee's understanding. It was clear that the mentors were doing a lot more than simply 'administering' a prescribed programme. There was a great deal of reflection about the mentees' learning and application of impressive pedagogical skills. This was corroborated in discussion with the mentors themselves (see below).

There was a suggestion from the discussions that the mentors had benefited in different ways from school to school depending to an extent on the conversations which the adults in school had had with them. For example, one group of mentors had had a lot of discussion with the adult overseeing the intervention about the specifics of the mathematics involved and had therefore possibly benefited mathematically more than those children who had not had those conversations. Conversely, many of the adults had had conversations with their mentors about the skills needed to be a good mentor (patience, careful questioning, sensitivity to the mentee etc) and had possibly taken these lessons into their own teaching more explicitly.

10. Discussions with the mentors

In seeking to explore the impact of the intervention on the mentors, a large number of them were interviewed about their experiences. The impact of their involvement is discussed below.

Insight into learning process and pride at their mentees' achievements

The most striking thing about the discussions with the mentors was the fact that, when asked specifically about what they had enjoyed about their involvement, they talked much more about learning than they did about the specifics of the work they had been doing with their mentees. Without exception they expressed satisfaction and often pride in the progress that had been made by their mentee. They were fully invested in the project and had come to feel pride in what they were doing. A number openly expressed satisfaction in the fact that they were able to give something back to the school community and had a clear sense that they had benefited from being in school and wanted their mentees to benefit from what they were doing. It could be that one of

the unseen, but nevertheless important benefits of FunKey is in fostering a greater sense of school cohesion. It is possible that, having been put into the role of 'teacher' themselves, the mentors are more aware of the difficulties faced by their own teachers.

The level of pedagogical sophistication was striking. A large number of the mentors were able to give specific examples of strategies that they had used to further their mentee's learning. For example, they often talked about how they had changed, or adapted their questioning so as to lead their mentee to a particular understanding. Many talked about strategies to engage reluctant learners, such as asking easy questions to begin with, so that their mentee had some initial success, and then asking progressively more challenging questions. Some of the mentors had also been able to take autonomous pedagogical decisions; some had made the decision to put pairs together having assessed the situation and decided that the two mentees would benefit from working together.

Many mentors also talked about offering hints to their mentees when they were unable to answer a question, but being able to judge how much help to give, so that they were not simply telling the mentee the answer, but were able to offer to lead their mentee to a correct response through careful questioning. From the discussion with the mentors, it was hard to escape the conclusion that their participation in FunKey must have given them an insight into the process of learning, which they had been able to incorporate into their own mathematical learning.

Confidence

When asked specifically about whether their participation in FunKey had had an impact on their own learning, many acknowledged that there had been some gaps in their own mathematical knowledge and understanding and that engagement with mathematics had helped them to feel more confident in some of these areas. Some of the mentors were also able to see underlying ideas about mathematical learning more generally and were able to apply those insights to their own learning. For example, one of the mentors, having spoken about how he had worked with his mentee to break down a difficult problem into a series of easier steps, was reminded to do that for himself when confronted with a difficult problem in his own mathematics lesson later that day.

Several mentors noted the fact that they had seen their mentee make progress and that repeated practice of a mathematical process, and determination to improve had led to learning. They were clear about how this had affected their attitudes towards their own mathematical progress. Others were aware of the fact that learning often occurred as a result of encouragement. While this, in itself, was a sophisticated insight, a few made the link between this understanding and their own learning.

> *'You are telling people to do stuff which can help them learn, but because you are saying that to try and encourage them, you're saying it a lot and that is making you think "Oh, maybe I should be doing that a bit more." (Y5 FunKey Mentor)*

From the discussions with the mentors and staff in school, it is clear to me that the benefits of FunKey extend well beyond the obvious mathematical gains made by the Year 2 children. The mentors seem to gain at least as much from their involvement as the mentees. To explore some of these gains in more detail, this report will conclude with two brief case-studies of children involved, one a mentee and one a mentor.

11. Case Studies

Evie (Mentor)

Evie is a child in Year 5, who was selected as a mentor. She was chosen specifically because, while very willing and diligent, she was rather disorganised and had a very deep dislike for mathematics. She was also quiet and lacking in confidence, so it was something of a risk on the part of the school to ask her and on her part to agree to be a FunKey mentor. As part of the data collection for the evaluation report, I was able to speak to Evie herself, to her class teacher and to the school's maths subject leader who had been overseeing the FunKey programme.

The first change that FunKey had brought to Evie was in her general confidence. She participated in a group interview along with two of her fellow mentors with me. She was confident and seemed self-assured during the interview. It was only afterwards that the school subject leader noted that, prior to her involvement in FunKey, Evie would not have been able to face such an interview due to a lack of confidence. Having a role in school where she felt secure and in control, seemed to have given her a much greater confidence in all aspects of school life. When asked why she would recommend being a FunKey mentor to a friend, her first response was to talk about the increase in confidence that it gave. By coincidence, Evie's mother spent a lot of time in the school as she was training to be a teacher there. She expressed a certain amount of incredulity on seeing Evie working with her FunKey mentee, noting that she was almost unrecognisable from the child that her mother knew from home.

Evie had started to make progress in terms of her own personal organisation. This was corroborated in conversation with the school's maths subject leader, who knew Evie well and had taught her. Evie talked about the need to plan ahead and anticipate organisational situations. She was also clear about the fact that she had not always been particularly organised, but it seemed that the fact of having to be organised for someone else (her mentee) had given her some strategies into how to be better organised, which she was then beginning to apply to herself.

Possibly the biggest impact on Evie had been in terms of her own attitude towards and success in mathematics. Prior to her involvement in FunKey, she had had a strong dislike of mathematics and was really struggling with the subject. Evie's class teacher said that, for the first time, Evie was beginning to enjoy elements of mathematics. While nobody in the school expressed it in these terms, it may be that Evie's perception of mathematics as a subject that is not to be enjoyed may have been challenged by seeing other children engaging in mathematics, and by being directly involved in teaching mathematics in a way that is enjoyable for both teacher (mentor) and learner (mentee).

Alongside her growing enjoyment of mathematics was a feeling that her attainment in the subject was also improving. She was benefiting directly from consolidating some of her own mathematical understanding through repeated practice of simple mathematics with her mentee. For children who are struggling with mathematics and who may have gaps in their understanding of ideas that they had encountered previously, FunKey may give them a legitimate and therefore non-embarrassing way to practise skills and consolidate understanding.

Of all the mentors interviewed, Evie was the most eloquent and sure about having learned lessons from FunKey about learning mathematics in general. She talked readily about seeing her mentee make progress in mathematics because of hard work and repeated practice. This seems to have had

a significant impact on her own attitude towards mathematics and her own approach to learning. Her class teacher had noted an increased determination in her approach to mathematical learning. Evie was clear that practising mathematics could lead to greater understanding.

There is a lot of discussion in schools at the moment of Carol Dweck's ideas about 'growth mindsets' and 'fixed mindsets', with schools trying to convince children that making mistakes in mathematics is a good thing, and that mathematical 'intelligence' is not fixed, but can change as a result of effort. It could be that, for many children, these are just ideas given out by a teacher, along with many other ideas that the children do not always fully believe. The experience of working as a FunKey mentor and seeing another learner make progress as a result of repeated practice may be a far more compelling reason to internalise ideas about a 'growth mindset' (i.e. that mathematical intelligence is malleable and attainment is determined by effort, rather than by some kind of inherent ability in maths), than exhortations from a teacher. Certainly for Evie, something in the experience of being a FunKey mentor had changed her attitude towards mathematics and was beginning to have a highly positive effect on her mathematical attainment.

Joe (Mentee)

Joe was assessed at the end of Foundation Stage as 'Emerging' and not reaching the expected level of development. In a recent maths assessment (February 2018) he was assessed with a standardised score of 98 in maths, with a reasoning score that was higher than many of the other children in the class. There was a noticeable upward trend in Joe's learning (as assessed by his class teacher) during the period of the FunKey intervention

His class teacher cited an example of Joe's recent work in the classroom on a maths topic (fractions) that was not directly related to the work that he had done in FunKey, but he had been able to tackle the learning with a confidence that he had not shown prior to his involvement in the FunKey programme. He was also able to reason in a way that his class teacher would not have expected prior to participation in FunKey. He was organised in his thinking. The greatest impact, from the perspective of Joe's teachers was in his confidence in mathematics, both in terms of participation in maths lessons and in being able to tackle new learning.

Joe's teacher also noted the importance of the relationship that Joe was able to develop with his mentor and that this relationship was central to his progress. Joe 'idolized' his mentor, who was one of the more popular children in Year 6 and towards the top of the social hierarchy. Joe's teachers speculated that one of the reasons for his increased motivation mathematically and his increased participation in mathematical learning in the classroom beyond FunKey was that he possibly saw mathematics in a different light as a result of this relationship.

After participation in one unit of FunKey, the decision was taken that he no longer needed to participate in the second unit, as he had made a great deal of progress and was now meeting age related expectations in mathematics. This suggests that Joe's initial under-performance mathematically was due largely to confidence and participation (i.e. not making the most of the learning opportunities offered by his classroom-based mathematics lessons) rather than a lack of ability to understand mathematical concepts.

12. Conclusions and recommendations

FunKey Maths provides a low-cost peer teaching programme that has clear immediate benefits for the children involved. These benefits include, but are not limited to mathematical gains for the mentees, increases in confidence for both mentees and mentors, insights into the nature of learning for the mentors and developments in personal organisation and responsibility.

As the programme develops further, its organisers are gathering more information (of which this report hopefully forms a part) into the reasons for its success, and therefore the reasons why a very small minority of children do not make the expected gains from the programme. Insight is being gained into ways of managing it more effectively in school, ways of selecting children to act as mentors and how to pair them most effectively with specific mentees.

This impact evaluation is limited in its scope and I would therefore make the following recommendations for the project:

- Continue to evaluate the impact of the FunKey units and include some evaluation of the durability of the gains made by the mentees, possibly by re-assessing the children on a particular unit six weeks after the completion of the unit. This may lead to insights in ways to tweak the timing and structure of the content, so that one or two sessions of revision of previous units can be incorporated into later units.
- In the course of further evaluation, where applicable, include questions in the post-intervention measure that do not look exactly like the questions the mentees have been tacking in the FunKey sessions. This will enable the project organisers to understand more clearly the extent to which the knowledge and skills acquired by the mentees is transferrable.
- Continue to analyse those children who do not make as much progress as others and explore the reasons for this. Ensure that parents are aware of the cumulative nature of the programme, so that children's attendance is likely to be improved.
- Continue to consider the effects of the programme on specific children, or 'types' of children. For example, ways of using mentors who are 'quiet children', ways of supporting quiet mentees. There was a thought put forward by some of the class teachers that children whose first language is not English may benefit greatly from the programme. I think that this is an exciting possibility that is really worth exploring.

In summary, I feel that FunKey is a hugely beneficial programme, which has an immediate and low-cost impact on the children involved. It has undoubtedly not yet reached its full potential, and as more information comes to light about how and why it works so successfully, I think that it will only become stronger and more effective. More information is required to address some of the questions that this impact evaluation has posed, but I am excited to see the potential of the programme and to think about the children for whom it could be a significant event in their mathematics education.

References

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