

How far do children who receive the Maths Recovery Intervention in Year Two ‘catch up’ and ‘keep up’ with their peers in Key Stage Two?

A study into the longitudinal effects of Maths Recovery as an intervention for children to catch up and keep up with age related expectations.

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Abstract

This study explores the longitudinal effects of the Maths Recovery intervention as it has been implemented in a northern Metropolitan Borough in the United Kingdom. Specialist teaching assistants delivered the intervention to Year Two students across a range of primary schools in the local authority. Three years of data associated with the Maths Recovery Intervention has been gathered. The children who took part in the intervention were then tracked through to their Key Stage Two SATs. Their results were compared with whole school results and results for children on each of the schools' Special Educational Needs registers. The report concludes that a higher proportion of the children who received the Maths Recovery intervention in year two reached age related expectations than the overall average for children with Special Educational Needs and their results were on a par with whole school averages within the sample in terms of making 2 National Curriculum levels of progress across the key stage over three years.

Introduction and rationale

The project took place in the context of a Special Educational Needs Service for a northern Metropolitan Borough. The borough consists of 115 primary schools, 22 secondary schools and 6 Special schools. It is comparatively, a deprived borough, with 54% of its population classified as living in the 2 most deprived quintiles nationally; that is the lower 40% (compared to 40% nationally). 9 LSOAs (Lower Layer Super Outlet Areas) fall into the poorest

3% of England. 7% of its teenagers are classed as NEET (Not in Education Employment or Training). Within the borough, 4% of its residents are of Black or Minority Ethnicity, 5% of its school population (The Metropolitan Borough's Joint Strategic Needs Assessment 2011).

The Metropolitan Borough supports its schools to provide for their children who have special educational needs (SEN) through a centralised service. Within the service there are specialist teachers and support staff for literacy, maths and behaviour for primary, secondary and special schools since 2005. Across the borough, maths results have been good and generally in line or above the average results for the North West and England:

Children who attained level 4 in maths	2005	2012
Metropolitan Borough	77%	88%
North West	76%	86%
England	75%	84%

Children who made 2 levels of progress from Key Stage 1 to Key Stage 2	2005	2012
Metropolitan Borough	74%	88%
North West	75%	89%
England	74%	87%

During the 1990s the Metropolitan Borough did not have such comparatively strong maths results. In order to support school development, the Metropolitan Borough's Maths service sought advice from Jim Martland at the University of Liverpool in order to establish what would be a successful early intervention for mathematics. Maths Recovery was recommended. Since 1996, the SEN team has championed the Maths Recovery intervention. In 2005 one of the SEN service's Maths specialists became one of the first elected members of the Maths Recovery Council for UK and Ireland. While the SEN service continues to develop and promote the use of other maths strategies such as the intervention Talking Maths and the use of Numecon, the relationship between the Metropolitan Borough and the Maths Recovery Council for UK and Ireland remains strong with the current SEN team Maths Co-ordinator also sitting on the Maths Recovery Council for UK and Ireland.

Maths Recovery was originally developed in New South Wales, Australia between 1992-1995 and was funded by the Australian Research Council (Wright et al 2006a). It was born out of research into the early acquisition of number and mathematical knowledge and studies into the longitudinal effects of starting school as a low attainer in maths conducted by Wright (1991, 1994) Aubrey (1993) and Young-Loveridge (1989, 1991) (cited Wright et al 2006a). It has its roots in research into the effects of the constructivist approach to teaching mathematics; the explorative way that children discover mathematical skills in the early years, and, perhaps more importantly, what happens when misconceptions develop (Wright et al 2006b).

As an intervention, Maths Recovery sits well within the ideological principles of the SEN team of the Metropolitan Borough as it advocates one to one teaching (either with a teacher or teaching assistant), specific training, flexibility and autonomy on the part of the facilitator and personalised learning. This method of one to one support is reflected in the other intensive interventions advocated by the SEN team, for example *Sounds-Write* and *Fisher Family Trust Wave Three*; both one to one Literacy interventions which, like Maths Recovery, are not 'off the shelf' interventions but require the deliverer to know where the child's needs are and where they will need to go with the help of the intervention. The interventions are data driven and the progress is measurable.

The Maths Recovery Programme assesses children using the Learning Framework in number (LFIN) (Wright et al 2006c), a framework that contains 11 interlocking aspects of early number learning. These 11 aspects are then divided into 4 parts containing up to 6 different aspects (A: Early Arithmetical strategies and base ten arithmetical strategies. B: Forward number word sequences and number word after, Backward number word sequences and number word before, numerals C: Other aspects of Early Arithmetical Learning D: Early Multiplication and Division. They are seen as largely chronological and the Stages of Early Arithmetical Learning (SEAL) in part A is seen as the primary, most important aspect of the LFIN.

Since recent records began in 2006, 562 children have received the short term Maths Recovery intervention from The Metropolitan Borough's SEN

team. Progress for children who receive the short term Maths Recovery intervention from specialist staff in the Metropolitan Borough is measured each year and a report of the SEN team's progress is generated. Year on year, the children make progress within the assessment measures of the Maths Recovery framework.

When assessing the children's ability before beginning the programme, the Metropolitan Borough team recorded the data, paying particular attention to the children's SEAL stages both before and after the short term intervention. Over the 7 years from 2006 – 2013, the children involved in the short term intervention made, on average 2 SEAL stages of progress. Such progress in SEAL is interpreted as "advancements in which children reorganise their numerical thinking and construct novel strategies that, in a mathematical sense, are more sophisticated than their previous strategies." (Wright et al 2006b p52). In other words, children develop their own, transferable skills that they can apply to mathematical situations that they find in their mainstream classroom.

Maths recovery is designed to be an early intervention programme for children displaying difficulty in early number skills. It is made up of six assessments, the scored data from which forms the basis for a detailed one to one teaching programme undertaken three or four times per week for 30 minute sessions. The intervention usually lasts for up to two terms. The intervention is data driven and the assessments undertaken at the start of the intervention are repeated at the end so that progress across the six strands can be measured.

This study sought to explore the longitudinal effects of the Maths Recovery intervention as it is being delivered in The Metropolitan Borough. In particular, it sought to ask how Maths Recovery, as an intervention, sits in the modern climate in which schools are required to publicise a 'school offer' for Special Educational Needs alongside their local authority 'Local Offer' which sets out to provide value for money and accountability in terms of public spending. Also in the context by which schools' achievement is judged by Ofsted: age related expectations at the end of Key Stage Two. In short; does Maths Recovery support schools in getting the results Ofsted grade their performance by and, therefore, does it offer value for money in terms of public spending?

Research studies have shown that children do make progress within the Maths Recovery assessment framework during the intervention (for example Willey et al. 2007). The data that the maths team leader gathers for The Metropolitan Borough corroborates this research– the children that the maths team have delivered Maths Recovery for *do* make progress against the Maths Recovery benchmarks (an average of 2 SEAL stages).

However, it has been noted that there has been little longitudinal research into whether or not children who have Maths Recovery not only close the gap between themselves and their peers, but maintain that closed gap as they return to class, receiving differentiated quality first teaching (Australian Council for Educational Research 2013 and Smith et al., 2013). In fact Smith

et al.'s research showed that one year after the Maths Recovery intervention 'no significant effects were found on any measure' (2013, p398).

During the coalition government's tenure, since 2010, the drive to make schools more autonomous has seen an increase in devolved funding. Schools are now responsible for their SEN budgets – spending up to £6000 before applying for additional funding by way of an Education Health Care Plan. Pupil Premium funding provides an extra £1300 per child in the Primary System who has ever been eligible for Free School Meals in the past six years (known as 'ever six'). Ofsted's review of the Pupil Premium spending in 2013 comments that best practice is seen in the form of schools 'maximising the impact of spending' (p9), analysing data, developing systematic approaches and evidence based decision making. The coalition policy appears to be in pursuit of a 'self-improving system' (Jopling, 2015) where the onus has been put on schools, not local authorities to justify decisions in spending.

In The Metropolitan Borough, there are 143 schools, just over 10% of which are academies, retaining control of their spending in order to commission services of their choice. The remaining 90% have seen changes to their funding streams for children with SEN bringing them more control over the spending of their Higher Needs Block and Level 2 funding for SEN. Along with this control comes higher accountability and schools must now publicise the spending of their SEN level 2 funding and Pupil Premium funding through costed provision maps for parents, the Local Authority, Ofsted and Social Services where appropriate. There is a drive to see that all teachers are

teachers of Special Educational Needs (Draft special educational needs and disability code of practice 0 to 25 years, April 2014, 6.33) and research suggests that teaching assistants should develop a more pedagogical role (Russel et al. 2013 p43). In this climate of control and accountability, schools need longitudinal data to measure the impact of the interventions they are investing in over time.

Measuring the impact of the Maths Recovery intervention in a longitudinal way was particularly challenging. The information that is available in terms of pupil progress is very subjective and perhaps that is why there is little research into this area as yet. It is relatively straightforward to evaluate the impact of an intervention over the period of time that the intervention takes place (Willey et al 2007). However, looking at pupil progress over time, it can become more tenuous to attribute a pupil's 'success' or 'failure' over four years to a short term intervention.

In order to continue the use of SEN funding for specialised one to one interventions, schools and local authorities need to justify the spend and ensure that schools are 'maximising the impact of spending' (Ofsted 2013 p9). It is clear from the evidence gathered by the Metropolitan Borough, mentioned above, that children are making progress in their acquisition of skills in the Maths Recovery intervention's short term programme, and that there are significant gains over the period of the intervention. However, this research seeks to explore whether or not this impact is sustained over the remainder of

the child's primary school career and whether or not the gains are transferred into gains when measured against national benchmarks.

Using the current literature for longitudinal research into the effects of both Literacy and Numeracy interventions, the research is modelled on a mixed methods approach, drawing on methods and lessons learned from a range of studies. The results of the data analysis, combined with the responses to questionnaires, informed the conclusions that schools express that Maths Recovery is a worth while intervention to support children achieving below age related expectations in maths.

Review of the literature:

There is a wealth of research into the effectiveness of interventions in the primary school. However, research into their longitudinal effects is limited. With the long-term effectiveness of a short term intervention in mind, this review covers a range of literature from constructing a study of mathematical interventions, to longitudinal studies into the effectiveness of literacy interventions to see what can be learned from the methodology of these studies. As Maths Recovery is an intervention rooted in constructivist pedagogy, explorations of the constructivist approach are also reviewed. However, before discussing the merits and challenges faced by those researching the effects of an intervention programme, it is necessary to

explore the nature of interventions themselves and the intentions of those who use them.

“Having no intervention does not enable pupils...to catch up” (DfE 2012 p4)

In 2012 the DfE published *Literacy and Numeracy Catch-Up Strategies* in which they pooled together research from 2004 and 2009 (Dowker) to sum up what works best for children who are not achieving age related expectations in school. The following were noted as successful attributes:

- Early intervention
- Constant monitoring of a child's progress
- Tailored teaching
- Cognitive approaches based on mental processes
- Working 1:1 with a trained professional

(DfE 2012)

The overriding theme of the document is that children who need support to 'catch up' benefit from early, tailored one to one support, which is regularly assessed. This is corroborated by Ofsted's report into effective use of the pupil premium funding (2013) where one to one support from well-trained staff was praised.

Dowker does concede that there is limited evidence of the longitudinal effects of interventions and that there did not appear to be any programme which could be seen as the most effective. She concluded that different programmes

may be beneficial for different children at different stages of their education but that individualised work appears to be the most effective method of intervention (2009).

Research into the mathematics interventions for children with SEN is not as prolific as research into the delivery of literacy interventions. However, the research appears to fall into two distinct camps: either research which is conducted *into* a mathematical difficulty itself (for example; Ellmore-Collins and Wright 2007, Samuelsson and Erikson-Gustavasson, 2013, Guarino et al. 2014) or short term action research projects have been conducted and reported on as case studies into the effects of one or two waves of the intervention in one particular geographic location (for example Willey et al. 2007).

Both of these forms of research have provided information, which has fed into pedagogy. The exploration into what children know and what kinds of mathematical knowledge they have when they begin Kindergarten in New South Wales Australia fed into the origins of the Maths Recovery Intervention (Wright et al 2006a p1). Without this research into how children acquire number skills (or why they don't), there would be no Maths Recovery. The follow up action research projects (for example Willey et al 2007) serve as useful tools by which to measure the impact of an intervention over a short period of time and serve as an accurate way of measuring impact of a single intervention.

There appears to be few studies into the effects of Maths interventions over time. Where there are studies, they tend to explore the authenticity of the research (for example Smith et al. 2013, and Munter et al 2010). Examples were significantly limited in terms of longitudinal studies into the mathematical progress of the pupils who had received Maths Recovery as an intervention. While one can legitimately say that in the instances monitored, Maths Recovery as an intervention made a difference for the children who received it, there is no evidence to suggest that the differences it made for the children had long lasting effects.

In fact, the Australian Council for Educational Research (ACER), when conducting its report to the Ministerial Advisory Group on Literacy and Numeracy in 2013, taking into account, not just Australian research but research conducted globally, including in the UK and the USA, stated:

“There is little rigorous research evidence on the effectiveness of the Mathematics Recovery program. Available data on Mathematics Recovery are primarily descriptive, limited to small samples and provide little information on the research design or the fidelity of the implementation” (p69)

While there is little evidence of the long-term effectiveness of the intervention, ACER attributes Maths Recovery's roots to Radical Constructivism (Wright 1994) and claims that an essential element of the Maths Recovery programme is the relationship between the learner and the teacher. The

programme seeks to 'develop models which will predict students' mathematical learning and development' (2013 p69).

Constructivism as a teaching methodology attributes the acquisition of knowledge to the continuing 'constructing' of "facts, concepts, experiences, emotions, values and their relationship with each other" (Baviskar, Hartle and Whitney 2009 p543). Baviskar et al cite the works of Piaget (1978) and Vygotsky (1978) in order to break constructivism into two distinct parts:

- Cognitive constructivism (Piaget) in which the mind constructs and reconstructs knowledge as it is challenged
- Social constructivism (Vygotsky) in which the act of discovering new facts, concepts and experiences *socially* challenges the status quo.

Baviskar et al argue that both cognitive and social constructivism lead to the acquisition of new knowledge or skills, that it is enough for a person's construct to be challenged by what is in front of him, and that he bring his prior knowledge to a situation whether he be in a social situation or alone.

Given the nature of early intervention for young children who may have already developed low self esteem for a subject, the challenging of constructs must be done delicately and in order for constructivism to be successful, the learner must feel motivated to re-evaluate their existing constructs. This is where the one to one aspect of an intervention, so highly commended by Dowker (2009) comes in to play; the facilitator can motivate, encourage, guide and model the learner through the process of challenging their constructs.

According to Ayarnal and Gautam constructivism is described as constructing a reality from ones ideas Radical constructivism is described as assuming all ideas have merit and that learning is a series of episodes of cognitive reorganisation (2011). They stress the importance of experiencing the physical phenomenon and artefacts of a subject before learning the theory behind them. They explain that it is the practical application, which drives the construction of a theoretical explanation. They attribute the following skills to constructivist learning:

- Reasoning
- Critical thinking
- Problem solving
- Retrieval, understanding and use of an idea
- Cognitive flexibility
- Reflection
- Distributed expertise.

Again, the one to one nature of the successful intervention (Dowker 2009) allows for these skills to be developed in the learner. Perhaps the mathematical learning is secondary in the first instance to the development of the skills needed in order to reorganise one's constructs.

The individualised nature of constructivism; whereby the teacher must 'attempt to understand the individual student's approach to a problem in order to meet them at their stage of development' (Von Glaserfelt, 1991, pxvii) and

gently challenge their constructs, may have resulted in a reluctance to engage in a longitudinal study of the effects of Maths Recovery as an intervention.

The approach appears to go against the positivist nature of longitudinal, data driven studies, as Steffe says (1991):

“In a teaching experiment [using the constructivist approach], the role of the researcher changes from an observer who intends to establish objective scientific facts to an actor who intends to construct models that are relative to his or her own actions” (p177).

Using the constructivist approach, it would appear that Maths Recovery, as an intervention is a different intervention for every child who receives it. And it is exactly this method that Maths Recovery teachers would claim was the key to its success. Its rootedness in the constructivist approach and working within a child’s zone of proximal development (Willey et al 2007) means that children receive a tailor made programme which meets them where their inconsistencies and misconceptions lie. This individualised teaching programme is very difficult to compare school to school, year to year, even child to child.

For this reason, and in order to develop a clearer sense of conducting a longitudinal study, this literature review has been broadened to encompass literature associated with generic longitudinal studies and longitudinal studies in Literacy.

In order to fully evaluate the benefits of an intervention, Cartledge et al (2011) states that pupil assessment needs to occur 'over extended periods to ensure that the early intervention produces desired effects (p143). This suggests that, in order to realistically evaluate an intervention, one would need to evaluate the progress the children make over a longer period of time to ensure that the desired affects were long lasting. The question should always remain 'do children keep up?' If not, the next questions should naturally be 'why not?' 'What shall we do next?' And 'Is it worth repeating this intervention with another cohort?'

Looking at the wider picture of education systems promoting, advocating and subsidising interventions, Schwartz et al (2009) goes even further and suggests that to examine the 'retention of gains' as a result of an intervention is of paramount consideration when an education system is considering advocating the use of such an intervention. While it is not as simple as saying a child has either been 'fixed' or 'not fixed' as a result of an intervention, Schwartz et al are suggesting that there should be a longer term impact as a result of the intervention.

Longitudinal and follow-up studies of literacy interventions do appear to paint a positive picture. It does appear that early intervention for children who are struggling with reading or an "initial shot" as Cartledge et al. calls it (2011), supports later literacy gains. This can be found using a range of interventions; phonics based (Cartledge et al. 2011, Vadasy et al. 2012), language based (St Clair et.al. 2012), comprehension based (Haenn 2002, Hollimann et al.

2013) or a comprehensive literacy intervention (Ferguson et al. 2011) and across a range of time spans from two to eight years. Success, in these studies, is measured in gains as opposed to reaching national benchmarks.

What remains unclear in each of these research projects is what is happening in the times between the waves of research. Are these children receiving any further intervention as their school career progresses; what effect, if any, do these interventions, other life events and circumstances in the school have on the progress of the child? One cannot conduct follow-up research such as this without considering the whole child and their experiences. The literature around the positive long term effects of an intervention in primary education appears to be largely positivist in nature (in that it is data driven and judgements are made on the intervention as the only causal effect on the child's progress) for example; Vadasy et al (2012), Cartledge et al (2011) Ferguson et al 2011) and St Clair et al. (2012). Limitations remain, however, with these kinds of follow-up and retrospective longitudinal studies. Taking an interpretivist view of the data, one would need to examine what has happened for each child, each year of the study; has a child moved school? Has the class changed their teacher? Has a child suffered bereavement; developed an illness and so on? An impossible task for anything more than a case study or a piece of action research within a school. For this reason, follow-up studies appear to have a large number of children across a range of schools so that averages can be generated and generalisations made.

Due to the limited longitudinal research into the effects of Maths Recovery, this project was a retrospective follow-up study based on the model and structure of Vadasy et al (2012), Cartledge et al (2011) Ferguson et al 2011) and St Clair et al. (2012) studies. The circumstances are similar; the children had already received their intervention and follow up sought to assess whether or not they have maintained the gains they made during the intervention. Each study had original data from which a starting point can be formed. They each monitored a comparison group, which ran parallel to the study. Their cohorts were each measured in waves through the study.

Each of the above projects used screening tools for assessing the children throughout the study. Haenn (2002) on the other hand used national assessment data to measure the progress of the children in his study. In this way, Haenn was able to compare the children with national averages and see how children who had accessed Reading Recovery fared alongside their peers who had no special educational need and those who received no interventions during their schooling. Perhaps this gives a truer indication into whether or not an intervention really does allow a child to re-integrate and 'keep up'. For this project, as with Haenn's study, the children were tracked using national assessment data for the end of each Primary Key Stage. In this way, as Haenn has done, this project monitored the children's progress against national expectations. However, unlike Haenn, who realised the limitations of measuring his cohort alongside national data – noting that the children were, at the end of the study, still behind the national average as the children, by nature of their SEN were behind the national expectations and the

majority of their peers before the intervention began (2002 p1), this project drew from the above research and use the comparison model – monitoring the progress of the intervention children and a comparison group (children on the SEN register) against national expectations using nationally standardised assessments (for example end of Key Stage SATs). In combining the two methods, this project was more robust in its comparisons while remaining relevant for the national context and the assessment profile these children experienced.

It is clear that researchers advocate the use of interventions (Dowker 2009, Schwartz et al and Cartledge 2011) and that, in doing so, one to one interventions appear to offer the most gains (Dowker 2009). However, the research into mathematics interventions and particularly the one to one intervention Maths Recovery is limited and generally only short-term studies (Meirs et al 2013). Perhaps this is due to the constructivist nature of the intervention (Wright 1994) a fluid form of pedagogy which relies on the individual and their personal constructs which require challenging in order for learning to take place (Baviskar et al 2009).

In order to devise a methodology for this longitudinal study into whether or not pupils who receive Maths Recovery as a short term, one to one intervention maintain their gains over time, a mixed methods approach will be implemented, drawing on the studies carried out by Vadasy et al (2012), Cartledge et al (2011) Ferguson et al (2011) and St Clair et al (2012), but

drawing also on the influence of Haenn (2002) who sought to measure the pupil's gains against national expectations.

Methodology

This study used a mixed methods approach, relying on quantitative and qualitative data. Mixed methods research helps the researcher focus on multiple and multi-layered research questions (Trainor 2011). It helps to illustrate and explain quantitative findings and allows the researcher to explore the reasons behind unexpected effects as well as describing both process and product during research (Kilnger and Boardman 2011).

The first part of this study used a positivist approach to gathering and analysing quantitative data. Rooting the methodology in the ideas of philosopher Auguste Comte and "limiting enquiry and belief into what can firmly be established" (Cohen et al 2011 p7), the data analysis in this study will seek to interpret the data and generate generalisations based on the subject matter only; the anonymised academic results of the schools in the study.

The second part of this study was developed in response to anti-positivist ideology, which rejects the belief that human behaviour is governed by general, universal laws and seeks not to be a detached observer but share the frame of reference of the studied (Cohen et al 2011). The questionnaires will look at the overall impact of the short term intervention from the view point

of the staff in the schools, unpicking their perception of the intervention. The questionnaires will give voice to the frame of reference of the schools in the study.

Critics of the anti-positivist ideology comment that there is less control and greater inaccuracy when being subjective with a study and that sharing a frame of reference with those involved in the study can invalidate results. However, seeing the pros and cons of both methods, Cohen et al (2011) comments:

“Just as positivistic theories can be criticised for their macro-sociological persuasion, so interpretive and qualitative models can be criticised for their narrowly micro-sociological perspective” (p21)

Citing Onwuegbuzie and Leech (2005a: 337 and 382) Cohen et al continues that using either quantitative or qualitative data alone can lead to puritanism, he reflects that puritanism should give way to pragmatism when conducting research (2011: 21) that is; what do you want from this piece of research? What are you hoping to find information about? In this way, the mixed methods approach is more dynamic and creates an opportunity where a discussion is opened up (Cohen et al 2011) between the methods and the research drives the process rather than the methodology.

The study took a quantitative methodological approach in asking 'what' has happened through data analysis and a qualitative methodological approach as a consequence of the data analysis attempting to answer 'how' or 'why' by highlighting trends of best practice (Cohen et al. 2011).

This could best be described as an interpretive approach. With concern for the individual and anti-positivist in its methodology, the questions asked will seek to understand the data from within its context. This is in contrast to the naturalist approach; making use of the methods of natural science research and assuming that human behaviour is rule governed (Cohen et al 2011). It is also explanatory in it's design (Klinger et al citing Creswell & Plano-Clark 2011); seeking to use the qualitative data to explain the analysis of the quantitative data.

The data the study analysed was historic and was studied in the context of a follow-up study; the respondents whose data was analysed remained the same for each wave. As the end point had already been defined (the end of Key Stage Two) the study was retrospective in its nature.

The sample size was relatively small (96 children) and confined to one northern Local Authority. It was, by this token, a study of a case in it's own context.

Given the nature of a historical study, it transpired that schools were reluctant to comment in hard terms about the 'how' and 'why' of children's progress

from 2007 to 2013. In attempts to obtain meaningful retrospective qualitative data, only 2 of the 18 schools responded. When asked to comment, school staff explained that staff had moved on over the passed 7 years or had changed roles. Responses from the two schools were poor and lacking in validity. The same reason: changes in staffing, was cited as a result. Staff agreed that the information provided was not reliable. Taris (2000), who cites Bernard et al (1984), estimated that 'about half' of the responses given on retrospective questionnaires are probably incorrect. This, he comments, is due both to response errors; how one remembers the events to be and reporting errors; how one wishes the outside world to see the events. On discussion with staff about their responses, they agreed that Taris' summary was probably correct; that it was hard to remember, with accuracy, what happened over the past seven years. In order to get 'real time' thoughts from the staff, 20 historic evaluations from 2010-12 were used and cross-referenced with the two questionnaires in order to look for patterns, which may help to explain the quantitative approach.

The quantitative data gathered was retrospective, taking existing, historic data for three cohorts of children in The Metropolitan Borough who received the Maths Recovery intervention from specialist teaching assistants employed by the Local Authority. By monitoring the children who had access to the specialist teaching assistants, a level of consistency was created across the borough. The specialist teaching assistants received the same level of on going training and support from the specialist Maths Recovery Consultant and the Maths Recovery Council for UK and Ireland. They attend regular team

meetings; have performance management and supervision with the same line manager and the reports that they write in order to feedback to schools are reviewed by the same line manager. In this way, the maths team seeks to ensure that there is a balanced provision for schools regardless of which teaching assistant is supporting their children.

Originally, one cohort was selected (pupils in primary school from 2005 to 2011). However, enlarging the data-base to encompass three year groups (Key Stage Two leavers from 2012- 2013) allowed for anomalies in the data when collating averages and cross referencing with whole school data and made the data more robust.

Children who were selected for the Year Two intervention were selected on the basis of their scores on their Early Years Foundation Stage (EYFS) profile. These children were not causing significant concern for schools although they were performing at below the expected stage for their age. These children, it was anticipated, would be put on the school's special needs register but would not be expected to receive a significant amount of external intervention during their school career.

The option of identifying a comparison group was investigated from the historic data; children with the same EYFS profile in each of the schools where the intervention took place. However sizable comparison groups could not be made up from the historic data as children in their early years of schooling are more mobile and some cohorts too small for a comparison

group to be of significance. At this stage, it was decided to use the historic data available in the form of tracking the progress of children with special educational needs within each school and tracking the progress of the whole cohort in each school.

As the data sample had increased substantially as it was now encompassing three years, the averages would be more robust than when using only one sample year group.

The retrospective longitudinal / follow-up research looked at two nationally reported benchmarks for the three cohorts of children:

- I. Key stage two SATs results for a school*
- II. Key stage two SATs results for children who received the Maths Recovery intervention in year two*
- III. Key stage two SATs results for children who are on the school SEN register for School action, school action plus or a statement of Special Educational Needs*
- IV. Pupil progress (2 levels) across Key Stage Two for a school*
- V. Pupil progress (2 levels) across Key Stage Two for children who received the Maths Recovery intervention in year two.*

The data analysis was a direct comparison; how did the Maths Recovery cohort fare when measured against national benchmarks as compared to the whole cohort and the cohort on the SEN register?

As the data that was used in this study was historic and in the public domain, there was little concern raised in terms of compliance with the BERA guidelines. There was no consent needed as school's data was already published on their websites and was available from the Metropolitan Borough's education support service. There were no concerns around the right to withdraw for the same reason. All schools data was anonymised for the purpose of the study so it was not possible to determine who individual children or vulnerable groups were. The data published was in cohorts by academic year across The Metropolitan Borough. There was a moderate risk to the anonymity of individuals in schools where the cohort was small and might have been identified. In order to protect against this risk, the data has been reported in cohorts.

Limitations with the historic data:

As this study was retrospective in its accumulation of data, there were limitations to the data that was available to analyse. School mobility, changes to the way that the results were collated and a boycott by schools of the statutory assessments in 2008 meant that the project's data sources were limited.

Examples of limitations due to the historic nature of the data and the changes made to the study as a consequence:

- An attempt was made to compile a comparison group from the historic data; children with the same EYFS profile in each of the schools where the intervention took place. However, sizable comparison groups could not be made up from the historic data as children in their early years of schooling are more mobile and some cohorts too small for a comparison group to be made.
- An attempt was made to track children's Key Stage One as well as Key Stage Two scores, however the boycott of the 2008 SATs assessments by some schools meant that some of the scores recorded were teacher assessments and others were derived from the SATs assessments, making a comparison unreliable.
- Some children who did not reach level 3 in the Key Stage Two SATs were reported to the local authority as scoring N (no level) while other children's scores were reported as their teacher assessed level of either 1 or 2. These children were omitted from the study as it was not possible to determine the levels of progress made by children who scored N at the end of Key Stage Two. Children who did not achieve a level that enabled them to access the end of Key Stage Two SATs received a range of other interventions from the Special Needs Service across key stage two – the difficulties they faced with mathematics

could be the contributing factor to their lack of progress against national benchmarks as opposed to the efficiency of the Maths Recovery intervention.

- Changes to the way that schools publish data and the way that schools record children with special educational needs over the last six years meant that it was not possible to identify the severity of a child's special educational need and whether children with special needs had made two levels of progress in key stage two.

For these reasons, the value of the data collected is limited. However, for a complete picture of the longitudinal benefits of Maths Recovery a long term, real time, project would ensure that consistent data is gathered over time for the study even if it is no longer required in the public domain.

While the results of the historic study are, somewhat limited, there is now an infrastructure within the specialist SEN service of the Metropolitan Borough for the study to continue in real time, using the data collection systems set up by this project and the relationships which exist with the schools currently receiving Maths Recovery as an intervention. It was valid, therefore, as a starting point, to continue with this project beyond the data gathering stage, despite the limitations, as the limitations exercise has served as a tool to begin the design of risk limitation strategies for a real time study.

Findings, Analysis and Discussion

The data was divided into three cohorts based on the academic year group. Cohort one receiving the intervention in 2007-2008, cohort two receiving the intervention in 2008-2009 and cohort three receiving the intervention in 2009-2010. The three-year window was permissible because from 2007 onwards the maths team decided to limit their intervention delivery to year two students. Also, in order to receive children's data for Key Stage Two SATs, 2009-10 was the last cohort of children whose Key Stage Two data would be available in 2014.

All the children received the Maths Recovery intervention in Year 2 and were chosen as a result of their EYFS profile scores, which were perceived as being below average but not significantly below. Schools were chosen from across the local authority from a range of demographics; the only criteria being the EYFS profile scores. There were 18 schools in total in the study, with Free School Meals (FSM) eligibility ranging from 1.99%-47.4% (Average: 25.8%) and index of multiple deprivation (IMD) scores ranging from 1374-22402 (Average: 9037.3).

This table shows the 3 waves of intervention from 2007-2010.

	Number of schools	Number of pupils receiving the intervention	Year of Maths Recovery Intervention.	Year of Key Stage Two SATs
Cohort one	13	45	2007-08	2011-12
Cohort two	4	12	2009-09	2012-13
Cohort three	11	39	2009-2010	2013-14

The Data was analysed in two sections:

1. Percentage of children who achieved at least the expected level at the end of Key Stage Two (Level 4 or above)

	Whole school	Maths Recovery Children	SEN children
Cohort one	84	72	45
Cohort two	84	65	51
Cohort three	76	70	54
Average	81	69	50

2. Children who made at least the expected progress across Key Stage Two (2 levels or more):

	Whole school	Maths Recovery children
Cohort one	89	89
Cohort two	93	89
Cohort three	88	91
Average	90	90

Over the three years, children who had Maths Recovery as an intervention in Year Two were more successful at achieving age related expectations at the end of Key Stage Two (level 4 or above) than the cohort of children classed as special educational needs. This would imply that the children who accessed Maths Recovery in Year Two caught up with their mainstream peers and kept up with them until they reached Year 6

Children who received Maths Recovery as an intervention in Year Two were also as likely to make 2 levels of progress as the rest of the children in the class. This would imply that the Maths Recovery intervention enabled these children to make progress in the maths curriculum, which they accessed with their mainstream peers outside of the intervention.

This shows that the children who have received Maths Recovery have, in effect, caught up with their peers and are improving at the same rate of progress as their peers including those who have not been identified as having a special educational need.

While Maths Recovery is largely constructivist in it's approach, teaching to the needs of the individual and teaching at the pace of the individual in a programme where the adult continually monitors the child's progress and adjusts their teaching accordingly, it appears that, in this Metropolitan borough, it enables children to access a curriculum which is currently increasingly traditionalist, with its emphasis on rote learning of facts as

opposed to understanding concepts and ideas (Garner 2013, Warrell 2013). This constructivist approach appears to enable the children to transfer their basic number skills into the whole class environment and is enabling them to keep up with their peers.

According to the data gathered from 2007-2014, children in Year Two who received the short term Maths Recovery intervention from the specialist maths recovery team in the Metropolitan Borough fared better than other children on the Special Educational Needs register in their end of key stage assessments. They also matched their mainstream peers in terms of making expected progress across key stage two (two levels of progress from their Key Stage One SATS in year two to their Key Stage Two SATs in year 6).

In order to understand the quantitative data and in order to understand what effect the short term intervention had on the schools involved in the project, 2 questionnaires were returned. While this is limited in number, the 2 questionnaires have been cross-referenced with the evaluations that schools completed on the point of exit at the end of the short term intervention. Twenty exit evaluations were examined from 2010-2013 (These evaluations were completed by SENCOs about a whole cohort rather than individual children which explains why the numbers are significantly less than the number of children who took part in the intervention).

There were three major areas where the 2 questionnaires were in agreement:

1. That the Maths Recovery intervention made a difference in their school.
2. That the Maths Recovery intervention identified gaps in children's learning.
3. That the Maths Recovery intervention raised the profile of supporting the SEN group in Maths in their school.

All 20 evaluations stated that

- The intervention was of a high quality
- The children made good progress
- The impact on children's ability to access the mainstream classroom had been good.

Positive responses to the intervention recorded in the evaluation forms that schools were asked to fill in at the end of each intervention can be structured into categories under these three headings, giving us a clearer idea of the overall impression of the impact of Maths Recovery in individual schools:

The intervention made a difference	The intervention identified gaps	The intervention raised the profile of Maths
<ul style="list-style-type: none">• The children made good progress• The children	<ul style="list-style-type: none">• The children developed a range of strategies to help	<ul style="list-style-type: none">• The children used the strategies they learned in class

<p>have grown in confidence</p> <ul style="list-style-type: none"> • The children are more able to cope in lessons • The children benefitted from the one to one support • Much more confident and accurate with number • Happy to volunteer to answer questions without fear of being wrong. • The child is more able to explain reasoning • They would apply their new skills in the lesson. • The children are 	<p>them where they were struggling</p> <ul style="list-style-type: none"> • The intervention sorted out misconceptions • Gaps in the children's learning have been seen and addressed • Some have actually gone up one sublevel • It has enabled him to acquire generic skills • It was unlikely that pupils would have met their targets in numeracy in summer without this support. • 	<ul style="list-style-type: none"> • The children were keen to explain things to the rest of the class. • The children are more willing to participate in class • Keen to share with the rest of the class • More secure 'I can' attitude • Really enjoyed the sessions • The school continues to work on the aspects that he found difficult • Strategies have now started to be adopted by teaching
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<p>now applying the skills they've learned in their daily maths lessons.</p> <ul style="list-style-type: none">• It has shown that this kind of intervention really makes a big difference.		<p>assistants.</p> <ul style="list-style-type: none">• Big difference in the classroom
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The responses given by schools mirror Dowker's findings cited in the 2012 DfE publications which became generic recommendations made by the DfE for successful interventions:

- Early intervention
- Monitoring progress
- Tailoring teaching
- Cognitive approaches based on mental processes
- One to one support

Using Creswell and Plano-Clark's model, cited by Klinger and Boardman (2011) the Explanatory Designed mixed methods study enables us to analyse the data first (which shows that pupils who receive the Maths Recovery

intervention in Year 2 maintain their gains during Key Stage Two), then look at the qualitative data in order to help explain the quantitative data.

Taking Cohen et al's argument (2011) one should seek to answer 'What do you want to find out from this piece of research?' Ultimately we need to ask the question *what was it that enabled the children to maintain the gains they made during the intervention?* The questionnaires and evaluations completed by schools appear to attribute to the three areas:

- Maths Recovery made a difference for the children at the point of the intervention,
- It helped to identify the gaps in the children's knowledge
- It raised the profile of maths amongst the SEN groups.

These three factors appear to be what has enabled the children who took part in the short term intervention to maintain the gains they made during that time.

It is worth noting that there are a number of caveats to this data analysis exercise. While other longitudinal studies such as Haenn's (2002) took place at the instruction of the study's designer, this study was historic and depended on the data that was available to analyse. This means that the events have already happened and the information has already been gathered. There are several questions that arose while researching:

- *While the children who were chosen were classed as Special Educational Needs when they were approved for the Maths Recovery*

intervention, they may not have been classed as Special Educational Needs in Year Six.

- *The severity of a child's Special Educational Need is not classified in the data so in comparing children on the SEN register with children who received the Maths Recovery Intervention could mean that a child with significant needs is compared with a child who is performing at just below age related expectations.*
- *Children who were on the SEN list in year six may not have been on the list when the Maths intervention children were selected*
- *Mobility; some children may have moved schools*
- *Staffing; some children may have been exposed to a range of differing standards of quality first teaching for mathematics*
- *Some schools may have take on board some of the Maths Recovery techniques and employed them with other children, thus enabling the other children to improve their mathematics under the banner of a different intervention.*

In order for this study to be completed in a more thorough and rigorous manner, a longitudinal project would be beneficial. Ideally a long term project would track the individual children from the start of their intervention. In this way a range of corroborating data could be gathered in order to further verify the results. For example:

- *Identifying comparison children within each school who's progress could be tracked even when they moved to an alternative school / local authority.*
- *Identifying mitigating factors and noting their affect on the data (for example the children who have been removed from the analysis above as it became clear that their needs were greater than the sample of children.*
- *Identifying disruptions to the education landscape and gathering data independently if required (for example conducting assessments if schools boycott the national assessments).*
- *Identifying changes to the education landscape (for example schools are no longer required to keep an 'SEN' register and are assessing without National Curriculum Levels – making it harder to compare children's progress over a larger cohort, as well as a stronger emphasis on evaluating levels of progress made as opposed to benchmarks reached).*
- *Asking staff to evaluate as they are delivering their teaching would mean that the case study aspect of the project would be current rather than historic and subject to an individual's recalling of information.*
- *Asking school staff to reflect on their progress and the effects that Maths recovery is having on their day-to-day number work would mean that the Explorative Design of the interpretive approach (Klinger et al 2011) to the study would be more valid and enable school to reflect on the bigger picture of the effects of Maths Recovery.*

- *Engaging school in the process of professional reflection on a regular basis over a longer-term research project would negate the reluctance from staff to 'remember' how things were historically. Given that the information would be current, it would be more likely to be accurate (Taris 2000)*

Having developed this study, the systems are now in place in The Metropolitan Borough for a longer, real time study to take place. It is clear which data would need to be collated and risk limitations could be built into a real time study, taking into account changes to government policy or funding arrangements, which may not be apparent at the start of the study. Real time interviews with schools could take place to capture relevant information to feed into the interpretive approach of the research and schools could take much more ownership of the review process, which would eliminate the problems surrounding retrospective questionnaires.

As it stands, this historic longitudinal study shows that, in this northern local authority, using the specialist teaching assistant model, children who receive the Maths Recovery Intervention do make the same progress as their peers. However, by conducting the longitudinal study over a longer period, adjusting the research and information gathering in real time would be the next step to verify these findings.

Summary and conclusions:

As a historic longitudinal study, this study is a valuable start to the process of verifying Maths Recovery's long-term effect for the children in primary school, showing that repeatedly, children catch up with their peers and keep up with them after receiving Maths Recovery.

Similar limitations occurred during this study as had occurred in other historical longitudinal studies (for example Haenn 2002). However, unlike the Haenn study, the fact that this study used data for mainstream children *and* children with special educational needs so that it was possible for meant that it gave a clearer picture of the children's progress in comparison to their mainstream peers and their peers who had difficulties accessing the curriculum.

While there is little longitudinal research for interventions in mathematics, the short-term evidence – for Maths Recovery as a short term intervention is that it does enable children to make progress in basic number skills. It shows that the children make significant gains, both in the Maths Recovery stages and when measured against the UK curriculum bench marks. As with other measured interventions, it is easy to conduct a study to explore whether or not this is the case. Maths Recovery is, by its very nature, diagnostic. It offers an assessment at the start and an assessment at the end of its short term intervention to show very clearly what a child can and can't do before the intervention starts and how much more they can do by the end of the intervention. Due to its flexibility and its rootedness in constructivist theory (Wright et al 2006b), the intervention is designed to match the individual

needs of each child – working on the areas that they, specifically find challenging and, perhaps crucially, not moving on until they are secure in their knowledge of an area. It is the nature of this intensive, bespoke package, which enables children to develop the skills they need to access the mainstream curriculum alongside their peers.

This historic study shows that, over time, the children who made significant gains over the short term intervention caught up with their peers and were able to reintegrate into the mainstream classroom. They were able to transfer the skills they had learned in a constructivist intervention and apply the skills when being assessed using a traditionalist model. The early intervention, monitoring of progress, tailored teaching, cognitive approach, and the one to one support (DfE 2012) shows the flexibility of the constructivist approach to interventions; that the skills can be transferred.

Retention of the gains made during an intervention being an important part of the intervention itself (Schwartz et al 2009), the data showed that the children who accessed the short term intervention were able to keep up with their peers in terms of the rate of progress they made and were also able to make more gains than their peers on the SEN register. These results appear to say that the best outcomes for children with difficulty in maths is to have a constructivist, child led, short term, 1:1 intervention. They appear to confirm that, these children are able to maintain their gains and continue to make progress at the same rate as their peers; retention of gains being a major purpose

For further conclusions, it would be useful to conduct a longitudinal study drawing on real time data over a longer period of time. This study would provide more robust commentary on whether or not the children who receive Maths Recovery in Year Two made progress when they accessed mainstream learning alongside their peers. It would take into account other environmental factors that may take place as the child progresses through the school, such as other interventions, changes of staff, changes to personal circumstances and would also take into account changes to the educational landscape, which may affect the demands placed on children in the mainstream environment, such as new curriculum expectations. Using the waves model of Longitudinal research (for example Cartledge et al 2011), whereby the schools are visited on a yearly basis and data gathered to support the study, a clearer, more in-depth picture would develop. Here the case study element to the study would become very effective as schools could be asked poignant real time questions about what they feel has happened over the last year of maths teaching in the school.

However, the existing study, which shows that three cohorts of children who received Maths Recovery as a short term intervention in Year Two did catch up and keep up with their mainstream peers, serves as a useful introduction into longitudinal research for Maths Recovery and the challenges and the limitations which may occur when conducting a study of this kind. The limitations that were identified above serve as a useful starting point to eliminate risks from a real time study.

While there is certainly more work to be done, in particular a real time study over a period of time; it is clear that this constructivist approach to teaching mathematics, and particular, early number, supports children, not just in their acquisition of basic number skills but in accessing their mainstream, traditionalist curriculum. The constructivist approach is well suited to Maths as O'Shea and Leavy (2013) discuss "Maths is about sense making" (p298) and about learning as a series of cognitive realisations. This is what Maths Recovery seeks to do in its one to one environment so that "children reorganise their numerical thinking" (Wright et al 2006b p52). Interventions such as Maths Recovery empower children on two levels; *both* with a knowledge of the number system which will help them access the world around them and skills which they can transfer into the mainstream education system.

**MA Education: Module PBM4029
Research Project Proposal Form and
Application Form for Ethical Approval of the Research Project**

Part 1: Complete these details

Your name:	Joanna Gibbs
Your student ID number:	22720243
Your Research Tutor's Name	Tim Rutter
Date:	May 2014

Part 2: Read this

- **Project Proposal and Ethical Approval**
Please note that you may not carry out any fieldwork research (interviews, focus groups, questionnaires etc) until you have had ethical approval for your research project from the MA Programme Ethics Panel.

You must discuss this form and your completion of it with your assigned PBM 4029 Tutor.

You decide on the focus/topic of your practice-based research project and discuss it with your tutor. You then use your focus to develop a project proposal and apply for ethical approval of your project using this form.

Experience has shown that time put into a thoughtfully considered and carefully designed project proposal pays dividends later on because participants develop a structured, feasible and focused project in the early stages of the module. This means that, following successful proposal, participants can go on to execute and report on a successful project without going down 'blind alleys' and having to re-write and re-think major aspects of their work.

Following your discussion and completion of the form, your tutor will forward it to the Chair of the MA Programme Ethics Panel. The Programme Ethics Panel will discuss your project proposal and application for ethical approval. There are four possible **outcomes from the Programme Ethics Panel:**

Outcome	Comment and guidance	What next?
Proceed (no changes required)	Your project design has been approved and given ethical approval.	You may carry out your research
Proceed (minor amendments to be accepted by tutor)	Your project design has been approved and given ethical approval. Minor aspects of your application require you to consult with your tutor.	You may carry out your research Consult with your tutor about the minor amendments.
Re-submit (minor	Your project design has	You may not carry out

amendments)	not been approved or given ethical approval. Minor aspects of your application require you to consult with your tutor and the resubmit your form to the Programme Ethics Panel	your research. Consult with your tutor about the minor amendments to the proposal and application for ethical approval.
Re-submit (major amendments)	Your project design has not been approved or given ethical approval. Major aspects of your application require you to consult with your tutor and the resubmit your form to the Programme Ethics Panel	You may not carry out your research. Consult with your tutor about the major amendments to the proposal and application for ethical approval.

All the sections of this form are designed to:

- Enhance your development as an enquiring, informed and reflective professional
- Support you in developing a structure for your research project
- Initiate the process of thinking about your project
- Highlight the importance and relevance of locating your research project in wider professional, political and academic debates
- Enable you to begin to gain insights into research methodology and methods
- Help you to understand and apply ethical principles to educational research

Part 3: Research Project Proposal – complete this form

Part 3 of this form is designed to set you on the road to preparing, undertaking and reporting on a piece of structured and purposeful practice-based research.

It is designed to take you through the process of:

- Exploring and discussing your professional context
- Identifying the focus or topic of your research
- Establishing what is already known about your focus/topic
- Developing a structure for your research

As you consider the above four points you will move to:

- Set your research questions
- Suggest a title for your project

Finally you will:

- Undertake a preliminary discussion about the ethical implications and considerations of your proposed research project
- Anticipate and suggest how your research project will develop practice and affect the outcomes for children/young people/other learners, as appropriate to your own context.

Please use the guidance document to help you complete this proposal.

1. Introduction and Rationale

I work for the Special Educational Needs Service for a northern Local Authority; within the service there are specialist teachers and support staff for literacy, maths and behaviour for primary, secondary and special schools. The maths team largely deliver Maths Recovery training, teaching and assessments in primary schools. There is a great emphasis on the use of Maths Recovery as an early intervention programme across primary schools in the Local Authority. The team advocate the training of school staff and also offer trained staff from the service to deliver the two term intervention. The team has been offering this service since 2006.

In order to monitor effectiveness, the Team Manager has an interest in the long term results of the interventions we advocate. For this reason, and as I have recently undertaken the Maths Recovery Training and have delivered the Maths Recovery programme within a local school, it seemed poignant that this should form the basis of my research project.

As I work with SENCOs and school leaders to support them in managing provision across their schools, I am particularly interested in how Maths Recovery as an intervention sits in the context of a whole school offer for SEN interventions. This is a popular intervention that schools readily invest in. Research studies have shown that children do make progress within the Maths Recovery assessment frame work over the two terms that is the recommended length of time for the intervention to run (for example Willey et al., 2007). The data that the maths team leader gathers corroborates this research– the children that the maths team have delivered Maths Recovery for do make progress both against the Maths Recovery assessment benchmarks and against standardised assessments.

However, it has been noted that there has been little longitudinal research into whether or not children who have Maths Recovery not only close the gap between them and their peers, but maintain that closed gap as they return to class, receiving differentiated quality first teaching (Australian Council for Educational Research 2013 and Smith et al., 2012). In fact Smith et al.'s research showed that one year after the Maths Recovery intervention 'no significant effects were found on any measure' (2013, p398).

With ever more accountability and autonomy in the modern school landscape, a drive to see that all teachers are teachers of Special Educational Needs (Draft special educational needs and disability code of practice 0 to 25 years, April 2014, 6.33) and research suggesting that teaching assistants should develop a more pedagogical role (Russel et al. 2013 p43), it stands to reason that research into the longer term effectiveness of interventions for children with Special Educational Needs would be beneficial.

Measuring the impact of Maths Recovery (a two term intervention) in a longitudinal way will be a particular challenge. The information that is available in terms of pupil progress is very subjective and perhaps that is why there is little research into this area as yet. While it is relatively straightforward to evaluate the impact of an intervention over the period of time that the intervention takes place (Willey et al 2007). Looking at pupil progress over time, it will be more tenuous to attribute a pupil's 'success' or 'failure' over four years to a two term intervention.

Conducting a longitudinal research project into the progress of children who have or have not received Maths Recovery as an intervention in Year Two will shed insight into the follow-up provision for children who have received this intervention. By examining the school contexts to look for patterns and trends, post intervention, it is intended that best practice may be identified which can then be used to support schools to enable children who receive Maths Recovery interventions continue to make progress when they return to class.

2. Background Reading/Literature Review (What is already known about your topic?)

On exploring the literature connected with Special Educational Needs (SEN) and mathematics, and particularly the effectiveness of Maths Recovery as an intervention to support children with difficulties, I read a wealth of reading material which either conducted research *into* a mathematical difficulty itself (for example; Ellmore-Collins and Wright 2007, Samuelsson and Erikson- Gustavsson, 2013, Guarino et al. 2014) or conducted short term action research projects and case studies into the effects of one or two waves of the intervention in one particular geographic location (for example Willey et al. 2007). There appeared to be few studies into the effects of Maths Recovery over time. Where there were studies, they tend to explore the authenticity of the research (for example Smith et al. 2013, and Munter et al 2010). Examples were significantly more limited in terms of longitudinal studies into the mathematical progress of the pupils who had received Maths Recovery as an intervention.

In fact, the Australian Council for Educational Research (ACER), when conducting its report to the Ministerial Advisory Group on Literacy and Numeracy in 2013, taking into account, not just Australian research but research conducted globally, including in the UK and the USA, stated:

“There is little rigorous research evidence on the effectiveness of the Mathematics Recovery program. Available data on Mathematics Recovery are primarily descriptive, limited to small samples and provide little information on the research design or the fidelity of the implementation” (p69)

While there is little evidence of the long term effectiveness of the intervention, ACER attributes Maths Recovery’s roots to Radical Constructivism and claims that an essential element of the Maths Recovery programme is the relationship between the learner and the teacher. The programme seeks to ‘develop models which will predict students’ mathematical learning and development’ (2013 p69). Perhaps the individualised nature of constructivism whereby the teacher must ‘attempt to understand the individual student’s approach to a problem in order to meet them at their stage of development’ (Ernst, 1991, pxvii) has resulted in a reluctance to engage in a long term study. The approach appears to go against the positivist nature of longitudinal, data driven studies, as Steffe says (1991):

“In a teaching experiment [using the constructivist approach], the role of the researcher changes from an observer who intends to establish objective scientific facts to an actor who intends to construct models that are relative to his or her own actions” (p177).

Using the constructivist approach, it would appear that Maths Recovery, as an intervention is a different intervention for every child who receives it. However, these

children are, for the most part, in mainstream schools, following mainstream curriculums and are expected to achieve against national benchmarks. While the intervention itself may be personalised, individual and a 'teaching experiment' for each individual, the children will still be assessed against national expectations and, in the current climate, schools are to have 'high aspirations and expectations' against these national expectations for children with SEN (DfE 2014 p80). For this reason, schools' interventions should enable children to achieve against national definitions for high aspirations and expectations.

Given the current Government's agenda for education and their advice around achieving those high aspirations and expectations for children with SEN is largely traditionalist in its style; with an over reliance on rote learning as opposed to understanding (Garner 2013, Warrell (2013) it will be interesting to observe how skills transfer when children, who have received a largely constructivist intervention, fare when they return to the traditionalist classroom.

The lack of research into the long term effects of Maths Recovery as an intervention - that is; do children who have received this intervention 'keep up' with their peers when returning to mainstream teaching – highlights the importance of this study. We can see from case studies and action research that children's mathematics improves over the duration of the intervention, but is this sustained improvement over time?

For this reason, and in order to develop a clearer sense of conducting a longitudinal study, this literature review has been broadened to encompass literature associated with generic longitudinal studies and longitudinal studies in Literacy.

Cartledge et al (2014) states that pupil assessment needs to occur 'over extended periods to ensure that the early intervention produces desired effects (p143). This suggests that, in order to realistically evaluate an intervention, one would need to evaluate the progress the children make over a longer period of time to ensure that the desired affects were long lasting. The question should always remain 'do they keep up?' If not, the next questions should naturally be 'why not?' 'What shall we do next?' and 'Is it worth repeating this intervention with another cohort?'

Looking at the wider picture of education systems promoting, advocating and subsidising interventions, Schwartz et al (2009) goes even further and suggests that to examine the 'retention of gains' as a result of an intervention is of paramount consideration when an education system is considering advocating the use of such an intervention. While it is not as simple as saying a child has either been 'fixed' or 'not fixed' as a result of an intervention, Schwartz et al are suggesting that there should be a longer term impact as a result of the intervention.

Longitudinal and follow-up studies of literacy interventions do appear to paint a positive picture. It does appear that early intervention for children who are struggling with reading or an "initial shot" as Cartledge et al. calls it (2014), supports later literacy gains. This can be found using a range of interventions; phonics based (Cartledge et al. 2014, Vadasy et al. 2012), language based (St Clair et.al. 2012), comprehension based ((Haenn 2002, Holliman et al. 2013) or a comprehensive literacy intervention (Ferguson et al. 2011) and across a range of time spans from two to eight years.

What remains unclear in each of these research projects is what is happening in the times between the waves of research. Are these children receiving any further intervention as their school career progresses; what effect, if any, do these interventions, other life events and circumstances in the school have on the progress

of the child? One cannot conduct follow-up research such as this without considering the whole child and their experiences. The literature around the positive long term effects of an intervention in primary education appears to be largely positivist in nature (in that it is data driven and judgements are made on the intervention as the only causal effect on the child's progress). Limitations remain, however, with these kinds of follow-up and retrospective longitudinal studies. Taking an interpretive view of the data, one would need to examine what has happened for each child, each year of the study; has a child moved school? Has the class changed their teacher? Has a child suffered bereavement; developed an illness and so on? An impossible task for anything more than a case study or a piece of action research within a school. For this reason, follow-up studies appear to have a large number of children across a range of schools so that averages can be generated and generalisations made.

Due to the limited longitudinal research into the effects of Maths Recovery, this project will be a retrospective follow-up study similar in structure to Vadasy et al (2012), Cartledge et al (2011) Ferguson et al 2011) and St Clair et al. (2012). The circumstances are also similar; the children have already received their intervention and follow up seeks to assess whether or not they have maintained the gains they made during the intervention. Each study has original data from which a starting point can be formed. They each monitor a comparison group which runs parallel to the study. Their cohorts are each measured in waves through the study.

Each of the above projects used screening tools for assessing the children throughout the study. Haenn (2002) on the other hand used national assessment data to measure the progress of the children in his study. In this way, Haenn was able to compare the children with national averages and see how children who had accessed Reading Recovery fared alongside their peers who had no special educational need and those who received no interventions during their schooling. Perhaps this gives a truer indication into whether or not an intervention really does allow a child to re-integrate and 'keep up'. For this project, as with Haenn's study, the children will be tracked using national assessment data for the end of each Primary Key Stage. In this way, as Haenn has done, this project will monitor the children's progress against national expectations. However, unlike Haenn, who realised the limitations of measuring his cohort alongside national data – noting that the children were, at the end of the study, still behind the national average as the children, by nature of their SEN were behind the national expectations and the majority of their peers before the intervention began (2002 p1), this project will draw from the above research and use the comparison model – monitoring the progress of the intervention children and a comparison group against national expectations using nationally standardised assessments (for example end of Key Stage SATs). In combining the two methods, it is hoped that this project will be more robust in its comparisons while remaining relevant for the national context and the assessment profile these children experience.

3. Research Strategy (Methodology and Methods)

Methodology

This project will use a mixed methods approach. It will seek to take a quantitative methodological approach in asking 'what' has happened through data analysis and a qualitative methodological approach as a consequence of the data analysis as it seeks to answer 'how' or 'why' by highlighting trends of best practice (Cohen et al. 2011)

The data this project will analyse is historic and will be studied in the context of a follow-up study; the respondents whose data will be analysed will remain the same for each wave. As the end point has already been defined (the end of Key Stage Two) the study will be retrospective in its nature.

However, the sample size is small (approximately 100 children including the comparison group) and confined to one northern Local Authority. It will, by this token, be a study of a case in its own context. The case study aspect of the research will seek to 'put flesh on the bones' in order to show how interventions 'influence the way an organisation functions' (Bell 2010 p9).

Methods

The research will be retrospective, taking existing, historic data for a cohort of children who entered Primary School in 2005 and left in 2011. During 2007 (when this cohort were in Year Two) the Local Authority decided to concentrate their Maths Recovery programme on year two pupils. This has resulted in a sizable cohort of Year Two children who received the intervention long enough ago to have passed through two waves of national assessments (Key Stage One and Key Stage Two SATs).

The retrospective longitudinal / follow-up research will look at three nationally reported benchmarks for this cohort of children:

- VI. Early Years Foundation Stage (EYFS) profile (2005)
- VII. Key Stage One SATs (2007)
- VIII. Key Stage Two SATs (2011)

Based on their EYFS profile, a random sample from each school with the same EYFS profile will be selected to monitor as a comparison group for each wave.

The data analysis will be a direct comparison; how do the Maths Recovery cohort fare at two national benchmarks as compared to a similar cohort who did not receive the intervention in 2007?

The Case study element of the research will take place after the data analysis is complete and will seek to explore whether there is any association between access to Maths Recovery in Year Two and maths progress in Key Stage Two. This will be more subjective and include a large number of variables, which means that it may be impossible to attribute the results of this study to the impact of an intervention a child may have had 4 years previously. As Taris states, when looking for causal effects "causal statements are based primarily on substantive hypotheses which the researcher develops about the world, one should consider the temporal order of events (2000 p3-4). As a consequence, while the data will be quantitate, retrospective interviews of staff to explore *what* made good practice in schools where children who receive Maths Recovery made more progress than those who did not, will be heavily influenced by both my hypotheses and the world view of the pupil and staff.

The case study element will use surveys to gather information around schools' interventions, deployment of TAs, staff training and the priority of differentiation in the context of Quality First Teaching in Key Stage Two. In order to ensure against bias, surveys will be put out while the data is being analysed – in this way the surveys will not be delivered in the context of 'good schools' or 'bad schools'.

From this bank of surveys, there will be a number of teacher interviews. This will enable the case study element of the project to scratch beneath the surface of the data. This will be interpretive in its essence, seeing to begin with individual teachers and schools and set out to understand their interpretation of the intervention and its impact on the cohort of children (Cohen et al. 2011)

4. Your research question(s)

How far do children who receive the Maths Recovery Intervention in Year Two 'catch up' and 'keep up' with their peers in Key Stage Two?

5. The title of your project

Does a two term, 1:1, diagnostic intervention such as Maths Recovery have a longitudinal impact on children; that is, once they have caught up, do they keep up?
A follow-up study in a Northern Local Authority.

6. Ethical considerations

The data that I am seeking to analyse is historic and in the public domain so consent from individuals will not be required. Parents and Carers consented to the original intervention taking place.

Names of children and schools will not be used. Many of the schools in the study had similar numbers of children taking part in the intervention and the study will be confined to one year group, so identifying schools or individuals from the list of data will not be possible.

There will be an opportunity for school staff to volunteer to take part in a survey and a retrospective interview as a consequence of the data analysis. At this point, school staff will be briefed as to what will take place prior to the event and permission will be sought from their line manager. School staff will also have the opportunity to withdraw consent after the interview.

7. Impact

As this is an area where there is limited existing research (ACER, 2013), the results of this study will be informative for this Local Authority, in particular in terms of an evidence base for the interventions it advocates.

One would expect that, due to the recorded short-term effects of Maths Recovery, the long-term effects will be evident also. However, there are a number of variables, which will impact upon whether or not a child makes progress across 4 years of schooling. The surveys and retrospective interviews in the second part of the project should highlight trends of good practice. Sharing these trends with other local schools will impact on and improve differentiated quality first teaching and further interventions offered for children with SEN.

Maths Recovery is a labour intensive intervention. It requires a dedicated, fully trained, qualified teacher (or teaching assistant). It requires children to be out of mainstream lessons for 3 30 minute sessions per week for two, sometimes three terms. This is a huge commitment for a school to undertake. It would, therefore, benefit schools if there was research which would seek to identify sustained gains and best practice for post intervention mathematics support for children with SEN.

Part 4: Application for Ethical Approval of your Research Project

You may want to take a look at the exemplar ethical proposal form in the ethics section of 'What do I need to do?' on Blackboard before you begin.

Name:	Joanna Gibbs
Title of project:	
Name of Research Tutor	Tim Rutter
Duration of project	From: Jan 2014 To: May 2015
Type of any educational settings and stakeholders (e.g. Primary School, teacher, pupils, parents) involved in this project	<p>A Northern Metropolitan Borough's Early Intervention Service for Special Educational Needs</p> <p>Data will be used from TESS delivery of the 1:1 Maths Recovery intervention from 2007 – 2009.</p> <p>Data will also be used from:</p> <ul style="list-style-type: none"> • EYFS early learning goals from 2006-08 • Key Stage One SATs assessments from 2007-10 • Key Stage Two SATs assessments from 2012-14.

Compliance with BERA Guidelines

Having studied the BERA guidelines, state briefly how you have addressed each of the following key issues. All boxes must be completed and it is not appropriate simply to insert N/A. (Please refer to the exemplar ethical proposal form in the ethics section of 'What do I need to do?')

<p>Voluntary Informed Consent</p> <p>Think what each of these words means individually.</p> <p>Think about who you're inviting to participate.</p> <p>Think about what you are inviting them to participate in.</p> <p>Think about the activities their participation involves them in.</p>	<p>The data I will be analysing is historic and in the public domain. The schools and families consented to the intervention being delivered and submitted the national data relating to the children's progress to the local authority.</p> <p>The children who took part in the initial intervention will be anonymised, as will the children in the contrast group. The schools will also be anonymised.</p> <p>Where people will be interviewed, they will be provided with an information sheet stating the purpose of the interview; given a briefing regarding the purpose and structure of the interview and consent will be sought from their line manager.</p>
<p>Avoidance of Deception</p>	<p>The data that will be used will be in the public domain.</p> <p>The information sheet and briefing provided will explain the processes of the study and the way in which the data will be used. In this way, deception will be avoided.</p>

Right to withdraw	The data that will be used will be in the public domain. Where staff volunteer to be interviewed, the right to withdraw at any time will be explained to them through the information sheet and briefing.
Use of incentives	The data that will be used will be in the public domain. No incentives will be offered to take part in the retrospective interviews, although the findings of the research will be in the public domain should schools wish to access them.
Possible detriment	As the interventions have already taken place and the interviews will be retrospective, there will be no detriment to the cohort being studied.
Disclosure of illegal behaviour	If any illegal behaviour is disclosed in the process of this project it will be directly and formally referred to the relevant authorities in school, following the school policy.
The particular interests of children or other vulnerable groups (if applicable)	The children and schools will not be directly involved in the project, as the data is historic, unless they choose to be a part of the retrospective interviews. All schools and children will be anonymised.
Minimisation of the burden on schools and educational settings	The data gathering and analysis will be done by myself with support from the local authority, there will be no burden on schools to collate this. The intervention has already taken place so there is no burden on the schools to accommodate an intervention. Schools will be invited to take part in a voluntary survey and interview, should they wish to do so and if they have the time to do so.

Data sensitivity. In light of the above considerations, assess the degree of the sensitivity of the data that you will be collecting – e.g. is personal data that would need to be kept secure and anonymous)			
My data is (please underline or highlight)	(1) Not sensitive	(2) Moderately sensitive	(3) Highly Sensitive
If you have ticked (2) or (3) please briefly describe how you will store and manage your data (e.g. in relation to privacy and anonymity)	<p>Combining the data and questionnaires could be moderately sensitive.</p> <p>However, to ensure anonymity, the data will be reported in cohorts across the Metropolitan Borough as opposed to school by school results. This will ensure that any school by school anomalies which might lead to identification will not occur.</p> <p>The questionnaires will be pooled and anonymised to look for repeating trends across the Metropolitan Borough as opposed to situations in individual schools</p>		

Student declaration

Statement	Tick to confirm
I confirm that I have consulted my tutor in preparing this application and s/he is in agreement that it should now come to the Ethics Panel for consideration for approval and for additional formative feedback where appropriate.	
I confirm that I have studied the BERA Revised Ethical Guidelines for Educational Research during the process of designing this research project.	
I confirm that I will follow BERA principles throughout my project.	
I confirm that I have sought all relevant permissions and consent from all participating institutions and individuals (e.g. Headteacher / Principal).	

Student signature		Date:	
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Educational setting support for the project

(to be completed by an appropriate representative of the educational setting)

Statement	Click to confirm		
I confirm that the MA participant and I have discussed this research proposal and that it satisfies our institutional ethical guidelines and policies (e.g. data protection, child protection, safeguarding, risk assessment, home-school liaison requirements and all other relevant guidelines and policies).	<input type="checkbox"/>		
Signature	Print name	Role:	Date:

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