



Catch Up[®] Numeracy

Evaluation Report and Executive Summary

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The Education Endowment Foundation (EEF)

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We aim to raise the attainment of children facing disadvantage by:

- Identifying promising educational innovations that address the needs of disadvantaged children in primary and secondary schools in England;
- Evaluating these innovations to extend and secure the evidence on what works and can be made to work at scale;
- Encouraging schools, government, charities, and others to apply evidence and adopt innovations found to be effective.

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Executive Summary

The project

Catch Up^{® 1} Numeracy is a one to one intervention for learners who are struggling with numeracy. It consists of two 15-minute sessions per week, delivered by teaching assistants (TAs). The approach is based on research indicating that numeracy is not a single skill, but a composite of several component skills that are relatively discrete. The intervention breaks numeracy down into ten elements, including counting verbally, counting objects, word problems and estimation. Pupils are assessed on each component and instruction is targeted on those areas requiring development.

In this evaluation, the intervention was run for 30 weeks and delivered to Year 2-6 pupils who were struggling with numeracy, as identified by TAs. The Catch Up Numeracy intervention was compared to a 'business as usual' control group and a 'time equivalent' intervention group, who received the same amount of one to one teaching by TAs, but did not use Catch Up Numeracy. Those TAs delivering Catch Up Numeracy were supplied with detailed session plans and received three half-day training sessions, led by Catch Up and Dr Ann Dowker of the University of Oxford. The project ran from September 2012 to July 2013.

What impact did it have?

The overall effect size of Catch Up Numeracy in comparison to the 'business as usual' control group was +0.21, meaning the programme led to a noticeable improvement in numeracy outcomes. This effect size suggests that, on average, pupils receiving the interventions would make approximately three additional months of progress over the course of the year compared to pupils that did not.

However, the 'time equivalent' group also showed similar significant gains (+0.27), suggesting the effect is likely to be a result of regular and sustained one to one teaching, rather than an intrinsic benefit of Catch Up Numeracy.

The study demonstrates that one to one teaching with TAs is an effective strategy to increase numeracy skills in Year 2-6 pupils. Sub-group analysis did not identify any differential effects for pupil gender or eligibility for free school meals.

The process evaluation indicated that most TAs valued Catch Up Numeracy and believed it had a positive impact on pupils' confidence, engagement with learning and willingness to attempt numeracy problems.

Group	Number of pupils	Effect size	Estimated months' progress	95% confidence interval (CI)	Evidence strength*
Catch Up Numeracy vs. control	108	+0.21	+3	0.01-0.42	★ ★ ★ ☆ ☆
Equivalent time one to one support vs. control	102	+0.27	+4	0.06-0.49	★ ★ ☆ ☆ ☆

*Evidence ratings are a new measure under development based on a number of factors including study type, size and drop-out. Ratings are provisional and are not given for sub-group analyses, which will always be less secure than overall findings. For more information about ratings visit: www.educationendowmentfoundation.org.uk/evaluation.

¹ Catch Up[®] is a not-for-profit UK registered charity (1072425). Catch Up[®] is a registered trademark

How secure is this finding?

The evaluation was set up as an effectiveness trial to test the impact of Catch Up Numeracy in comparison to a 'business as usual' control group and an 'equivalent time' intervention group, with the developer leading the training and overseeing the provision of the intervention. Effectiveness trials aim to test whether an intervention can work at scale, in a large number of schools.

The findings are based on a three-arm randomised controlled trial using an intent to treat analysis (i.e. pupils were compared in the groups to which they were originally randomly assigned). Six pupils from each of 54 primary schools (two with two sites within the same school) were randomly assigned to one of three groups: a control group that received normal teaching, a Catch Up Numeracy intervention group that received the intervention as described above, and an 'equivalent time' group that received two 15 minute sessions a week without Catch Up Numeracy, to replicate the one to one nature of the intervention. The primary outcome measure was numeracy ability, as measured by the Basic Number Screening test. Blind marking of test papers was undertaken. There was relatively low drop out, relatively evenly spread across the control and intervention groups.

The main threat to the internal validity of this trial is the possibility that TAs delivering Catch Up Numeracy passed on knowledge of the intervention to those TAs in the 'time equivalent' group within the same school – called cross-contamination. There is some evidence that the time equivalent group of TAs had some knowledge of Catch Up Numeracy and amended their approach in light of this knowledge, although it is unclear as to whether this had an impact on the results of the trial. Overall, the evaluators consider that the effect of one-to-one teaching is robust. However, the differences between the time equivalent group and the Catch Up group are harder to identify. The study findings are consistent with the wider evidence base on one to one tuition, and a smaller number of studies evaluating the use of TAs for one to one support.

The process evaluation revealed that there was some variance in the way in which the intervention was delivered, including a failure to deliver two 15-minute sessions each week for the full 30 weeks, as the trial intended. It is suggested successful implementation would benefit from TAs having sufficient time to plan and prepare for the sessions, with time scheduled specifically within the existing timetable.

How much does it cost?

The cost of the approach is estimated at £130 per pupil. This estimate includes resources (estimated at £2.00 per pupil), direct salary costs of TA (£95 per pupil), initial training (£17.50 per pupil) and on-going monitoring and support (£8.75 per pupil). Estimates are based on a school delivering the intervention to 40 pupils and training two TAs and one teacher as the Catch Up Coordinator who supports the TAs but does not work directly with pupils.

Key Conclusions

1. Within this trial, one-to-one support by TAs led to a significant gain in numeracy skills.
2. Catch Up makes similar significant gains, but there is little evidence that Catch Up Numeracy provided any additional gains in numeracy outcomes over and above those from one to one teaching itself.
3. Schools can find it challenging to run two 15 minutes sessions per week, due to timetabling and other issues.
4. Structured interventions, such as Catch Up Numeracy, should be planned into the timetable from the start of the new school year to ensure they are given priority and status.

Introduction

Intervention

Catch Up Numeracy is a one-to-one intervention for primary school children who are struggling with numeracy. It consists of two 15-minute sessions per week, usually delivered by TAs. To prepare them for the intervention, classroom assistants are supplied with detailed lesson plans and receive three half-day training sessions. The intervention breaks numeracy down into ten components, tests children's ability on each component and targets subsequent instruction so that the tutor always addresses the exact area requiring development. Components include counting verbally, counting objects, reading and writing, hundreds, tens and units, ordinal numbers, word problems, estimation, remembered facts and derived facts and translation.

The approach is based on research indicating that numeracy is not a single 'big' skill, but a compound of several 'little' skills that seem to be quite discrete. Children (and adults) may be very strong in some skills but very weak in others. Further, brain-imaging studies suggest that the different skills are handled by different parts of the brain. By recognising and building on this finding, the Catch Up Numeracy intervention enables tutors to diagnose and treat problems precisely and effectively.

Background evidence

The Catch Up Numeracy approach is informed by a number of key research findings on how children learn mathematics. The first is that arithmetical cognition is made up of multiple components, and that there can be large discrepancies in ability on each (Dowker, 1998; 2005). The second is that different arithmetical procedures are carried out in different parts of the brain (e.g. Castelli *et al.*, 2006). The third is that the different components of arithmetical cognition cannot be arranged into a strict hierarchy: a child may be strong on a component that most struggle with, and weak on a component that most find easy (Denvir and Brown, 1986).

The Catch Up Numeracy intervention was designed with these findings in mind. The initial diagnostic tests identify exactly which components or processes a child struggles with; tutors then direct their attention to these areas, rather than always starting with what seems the most basic process in the sequence.

A trial of Catch Up Numeracy was carried out in 2010 with the participation of 246 pupils across eleven local authorities (Dowker and Sigley, 2010). Schools were asked to nominate four to six children for the trial, assigning each pupil to either a treatment group (who received Catch Up Numeracy), a matched-time control group (who received the same amount of one-to-one maths instruction, but not using the Catch Up methods), or a pure control group (who received classroom teaching as normal). Assignment to experimental group by the school rather than through randomisation may have introduced some bias into the trial, but it is impossible to say what direction this might be in.

Children in the trial were tested before and after using the Basic Number Screening Test. There were small differences between groups on pre-test scores, but these were not statistically significant. Post-test results suggest the intervention had medium to large effects: 0.3 standard deviations versus matched-time controls, and 0.4 standard deviations versus pure controls. These results were found to be highly statistically significant.

Overall, the research behind Catch Up Numeracy is quite strong. The intervention is rooted in an evidence-based understanding of how children learn arithmetic, and the only trial so far has shown promising results. The logical next step is a full randomised trial that includes enough pupils and TAs to detect educationally relevant effects with reasonable confidence.

Evaluation objectives

The primary research question was to identify the impact of the Catch Up Numeracy intervention on individual pupils over a 30-week intervention period. Pupils' numeracy skills were measured by performance on the Basic Number Screening Test.

The process evaluation explored the implementation and scalability of the intervention.

Project team

The internal evaluation team was led by Dr Ann Dowker of Oxford University and Dr Graham Sigley from Catch Up. These evaluators were responsible for the recruitment of schools and TAs, the training of TAs to use the Catch Up intervention, the administration of the numeracy tests and undertaking follow-up sessions with TAs at the end of the intervention.

The external evaluation team at the NFER was led by Simon Rutt, Head of Statistics. While the overall project and the impact evaluation were led by Simon Rutt the process evaluation was led by Claire Easton, a Senior Research Manager within the Research Department. The NFER team were responsible within the impact evaluation for the randomisation of TAs and pupils, the analysis of test data and the writing of a final evaluation report. The NFER was responsible for the whole of the process evaluation and its contribution to the final report.

Ethical review

The NFER has a well-developed Code of Practice that contains detailed ethical protocols. These protocols govern all research undertaken by NFER and the trial lies within them. Parents gave active written consent for all eligible pupils put forward for the intervention and testing, and the Catch Up team confirmed that consent had been received before continuation of the trial.

Methodology

Trial design

This was a multi-centre, three-arm, parallel-group pupil-randomised trial within schools in England. The trial involved 54 schools (two with two test sites within the same school) with two TAs and six eligible pupils within each school. Teaching assistants were randomised to one of two intervention groups: one delivering a time equivalent intervention and the other delivering the Catch Up intervention. The six pupils within each school were randomly allocated to one of three groups: Catch Up, time equivalent and control. This design was developed from earlier evaluations that noted a Catch Up effect but could not differentiate this effect from the quality of the TA, or the potential bias in pupil allocation. The randomisation of TAs and pupils eliminated these potential sources of bias, while the time equivalent group of pupils will allow analysis to identify any Catch Up effects over and above the effects of one-to-one teaching.

Eligibility

Schools were selected and approached by Catch Up prior to the involvement of the external evaluator. These were originally planned to be around three main areas: Oxford, Southend and Thurrock. NFER therefore had no input into the early phases of the trial set up. Each school paid £275 to take part in the trial; this is a little less than the normal cost of Catch Up Numeracy materials and training of £350 per person. The costs associated with the trial may result in a specific type of school that is predisposed to the use of interventions, and one that is prepared to invest in such activities, agreeing to take part. However, this recruitment strategy has the advantage of being similar to reality since schools were charged a cost.

The normal intervention process is for eligible pupils to be chosen by the nominated individual after they had received training from Catch Up. For the purposes of the trial pupils were selected prior to any training. It was agreed that TAs would be able to identify those pupils who were struggling with numeracy and would benefit the most from the Catch Up intervention. This occurred before any randomisation so is free from bias that could impact on trial findings.

Intervention

Catch Up Numeracy is a one-to-one intervention for pupils who are struggling with numeracy. It consists of two 15-minute sessions per week which are usually delivered by a trained TA outside of the usual teaching class. To prepare them for delivering the intervention, TAs are supplied with detailed session plans and receive three half-day training sessions. The intervention breaks numeracy down into ten components, assesses children's ability on each, and targets subsequent instruction so that the tutor always addresses the exact area of weakness.

The intervention is made up of four key stages: assessments for learning, identifying an appropriate focus, individual sessions and ongoing monitoring. These are outlined below.

Stage one: assessments for learning

- a bank of easy-to-administer assessments to determine what the learner can do and where their needs lie
- setting the learner's level and identifying the appropriate starting point for the intervention.

Stage two: identifying an appropriate focus

- using the results of the assessments for learning to complete the Catch Up Numeracy learner profile
- using the learner profile to set the target level and identify an appropriate focus for numeracy intervention.

Stage three: individual sessions

The trial instructed TAs to deliver two 15 minute sessions each week for a 30 week period. These 15 minute sessions break down into three sub parts;

Stage four: ongoing monitoring

The learner profile is revisited and the Catch Up Numeracy target level is reviewed.

The review and introduction:

- reminds the learner of what was achieved in the previous session and outlines the focus of the current session
- confirms to the learner the number range being used
- introduces and reviews key vocabulary
- links the focus of the current session to the learner's mainstream class teaching, where appropriate.

The numeracy activity:

- gives an opportunity for the learner to work on the focus of the session in a range of learning styles; e.g. Visual; Aural; Verbal; Physical
- familiarises the learner with vocabulary appropriate to the focus of the session.

The link recording:

- reinforces the skills learned during part two of the individual session, using writing/recording as an additional approach to learning
- provides focused teaching based on observed miscues (i.e. mistakes).

Below is a description of one of the Catch Up Numeracy activities.

Cool fans!

Tell the learner that the number fan is very good at making numbers but needs help to keep the numbers in order.

Use the fan to make a 1, 2, or 3 digit number as appropriate for the number range. Write the number on the whiteboard. Repeat for two further numbers

Ask the learner to point to the numbers in order of size, smallest first.

Repeat the activity for other sets of 3 numbers

Repeat the activity, asking the learners to point to the numbers in order of size, starting with the largest number.

Pupils were assigned to one of three groups as part of the trial: a pure control group that received normal teaching; an 'equivalent time' intervention group that received two 15-minute sessions a week to replicate the one-to-one nature of the intervention; and a Catch Up intervention group that received the intervention as described above. The 'equivalent time' group could receive any form of numeracy support as long as it was not Catch Up and the TAs were asked to keep a log that recorded the actual focus of their sessions. It became evident during the process evaluation interviews and from manipulation check questionnaires that some of the 'equivalent time' TAs deviated from the original delivery protocol. The interpretation section in the conclusion discusses this issue in more detail.

Outcomes

The primary outcome measure focused on numeracy ability, as measured by the Basic Number Screening Test². Secondary outcome data was collected by Catch Up and the University of Oxford on reading ability, using the Salford Sentence Reading Test³, and on general ability, using the Non-Reading Intelligence Tests 1-3⁴.

Dr Dowker and the Catch Up office recruited research assistants from among students at the University of Oxford to administer the tests. Dr Dowker trained the research assistants in test administration; they were also provided with the necessary test manuals.

The Catch Up office contacted each school and agreed a suitable date and time for a research assistant to visit the school and administer the tests. The visits were organised on a geographical basis in order to minimise costs and the test schedule took place in as short a time period as possible. Pre-tests were administered between September and November 2012 with post-tests administered between June and July 2013. The research assistants then visited the schools and administered the tests. For the pre-intervention tests, the research assistant did not know which of the three groups the pupils had been assigned to and did not know who they were testing until they arrived at the school. Where a pupil was absent, arrangements were made for a research assistant to re-visit the school, where possible. In a small number of cases, a Catch Up approved trainer who had no connection with this trial administered tests to absentees. These trainers also administered the tests with no knowledge of group membership. A similar process was followed for the post-intervention re-testing.

All test papers were sent to Dr Dowker who marked all the papers and generated the raw scores, subsequent maths ages and standardised scores. Dr Dowker did not know the membership of each group until she had finished marking the post-test data. All data was sent to NFER via a secure data transfer portal.

The process of test administration and test marking was not evaluated by the external EEF evaluator but there is no evidence to suggest that this has not been conducted by following appropriate protocols.

² <http://www.hoddertests.co.uk/tfsearch/numeracy-maths/bnst.htm>

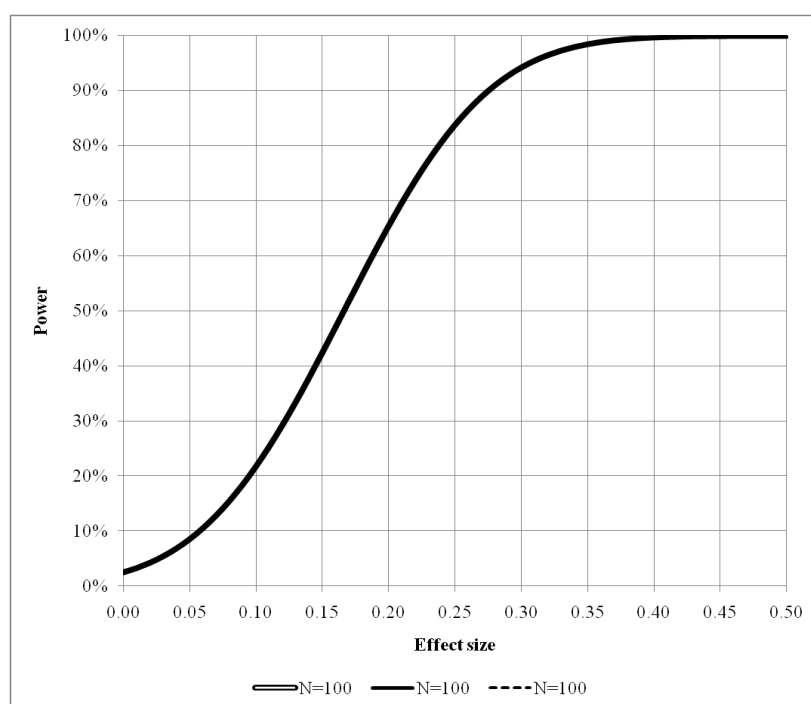
³ <http://www.hoddertests.co.uk/tfsearch/reading/nssrt.htm>

⁴ <http://www.hoddertests.co.uk/tfsearch/reasoning/nrit1-3.htm>

Sample size

The sample size was determined by the intervention provider prior to the external evaluators (NFER) being appointed.

NFER carried out power calculations on the basis of the planned sample size before the trial commenced. In calculating the power of the design, intra-class correlation (ρ) was assumed to be 0.05. As pupils were being randomised within schools this was assumed to be negligible but still present. Given the sample sizes and assumptions on ρ and looking for a power of >0.80 this design should be able to detect an effect of at least 0.25. Evidence from earlier studies suggests that this design is well powered.



Randomisation

NFER was responsible for the randomisation of TAs to the Catch Up delivery and equivalent time groups as well as the randomisation of pupils to one of the three trial groups. Schools were sent an Excel spreadsheet to populate details of TAs and the six eligible pupils. Schools first sent the list of two TAs and these were randomly allocated to either deliver the time equivalent sessions or the Catch Up Numeracy sessions. These randomisations were returned to the schools and the selected TA received the required training.

Schools selected six eligible pupils and this list was sent to NFER for randomisation. Two pupils were randomly allocated to each of the three groups: control, time equivalent and Catch Up. The randomisation process was run for each school separately. The schools Unique Reference Number (URN) was used as the seed for the random number generator used to randomly allocate pupils and TAs. Randomised lists were returned to schools.

Analysis

Analysis was undertaken on an intention to treat (ITT) basis. This was a pupil-randomised trial but the randomisation was stratified by school. Since school has therefore to be taken into account, analysis

was undertaken using a multi-level model. Data was prepared in SPSS, using each school's URN as the cluster identifier; analysis was undertaken in the R statistical package using a two-level model (pupil and school). Pre-intervention test scores were used as a covariate to the post-intervention test score. Two dummy variables were included in the analysis to identify pupil membership of either the control group or Catch Up intervention group. This allowed analysis to identify differences between the equivalent time group and the control group and between the Catch Up intervention group and the equivalent time group.

Sub-group analysis introduced variables for eligibility for free school meals (FSM) and gender. This helped determine if effects were the same for all pupil characteristics or if there was a differential effect. Further terms were introduced looking at the interaction between FSM and group membership and with gender and group membership. Interaction terms that incorporated pre-intervention test scores were additionally introduced into the models. This sub-group analysis was pre-specified in the trial protocol.

The analysis described above was replicated on the secondary outcomes using pre-intervention and post-intervention test score data obtained from the Salford Sentence Reading Test and the Non-Reading Intelligence Tests 1-3.

An analysis specification was developed by the lead external evaluator and passed to a statistician within NFER who undertook analysis without knowing the group membership conferred by the dummy variables.

Process evaluation methodology

The process evaluation comprised three phases. In addition to these three phases manipulation check questionnaires were also sent to TAs. While these are primarily part of the impact evaluation they will be reported in the process valuation section as the outcomes are similar.

Firstly the team attended and observed the 'Delivering Catch Up Numeracy' and 'Managing Catch Up Numeracy' training sessions prior to the intervention commencing. The team attended training sessions in four locations during September and October 2012. Phase two involved observing the follow-up (post-intervention) 'Review and Next steps' sessions in the same locations during June and July 2013. The team was keen to observe training delivered across locations and carried out by different trainers to assess the extent to which the training followed the same pattern.

For the third and final phase, the team undertook telephone interviews with 25 TAs and 24 Catch Up Numeracy coordinators across 27 participating schools (N=49 participants). Each school has a Catch Up Numeracy coordinator who oversees the intervention within the school and offers support to the TAs. Researchers chose this data collection method in order to gain in-depth qualitative data from a wide range of interviewees during a short timescale while ensuring disruption to the participating schools, TAs and coordinators was kept to a minimum. This was particularly important given the timing of the interviews: the end of the academic year.

Originally the team randomly sampled one TA or one coordinator from each participating school and invited them to participate in the research. However, due to a low response rate to the original invitation, the team revised the strategy and invited all TAs and coordinators to participate in an interview with the aim to achieve up to 50 participants in total. The timing of the interviews meant that recruiting TAs and coordinators was challenging: furthermore their availability was limited due to end of school- year activities.

Two experienced NFER researchers carried out all interviews via telephone. Interviews took between 15 to 40 minutes, with most taking around 25 minutes. As per NFER's Code of Practice, at the start of every interview the researchers explained the purpose of the interview, and the data protection and confidentiality protocols. Interviews were recorded only where interviewee permission was granted.

Impact evaluation

Timeline

The intervention commenced at slightly different times in each school due to issues of school recruitment and the training of TAs. The first pre-test was carried out on 26 September 2012 with the last on 23 November 2012. Pupils were tested before the commencement of intervention delivery and at the end of the 30 week delivery period. Schools were contacted by the Catch Up office to arrange convenient times for research assistants to visit and conduct the tests. For post-testing this occurred as close as possible to when the intervention was completed within the schools.

Participants

Schools were recruited to the trial in one of three ways.

- Any school that contacted Catch Up between April and September 2012 enquiring about Catch Up Numeracy was offered the opportunity to be part of the project if they could get other geographically neighbouring schools involved (in order to create a viable training group).
- Catch Up local authority contacts were asked if they had schools that were in challenging contexts and that could benefit from intervention support.
- Catch Up directly approached some schools.

Approximately 130 schools were approached by Catch Up with 54⁵ agreeing to take part in the trial.

All interested, and potentially interested, schools were invited to briefings⁶ and provided with a project briefing paper. Schools that could not get to a briefing were followed up by email and telephone. Participating schools were asked to complete an evaluation agreement and schools were recruited up to October 2012 half term.

Eligible pupils were identified by the schools **prior** to the training using the school's own assessment of need. This approach sought to avoid any contamination which could arise from the trained TAs working with all six pupils in each school. This process is a variation from the normal selection of eligible pupils for the Catch Up intervention.

The tables below identify the characteristics of the schools taking part in the trial. Table 1 identifies that schools were predominantly drawn from Wales and the southern half of England. Table 2 highlights the quintiles of pupils with eligibility for free school meals within these schools. It shows that approximately 44% of schools had higher levels of free school meal eligibility while only 26% of schools came from the lower levels of eligibility. Table 3 identifies the extent of special educational needs (SEN) within trial schools. Approximately 76% of trial schools had more than 16% of their school cohort assessed as having SEN, which compares to approximately 65% in the overall population of primary schools.

⁵ Two schools had two sites and were treated separately. They provided six pupils and two TAs from each school/site thus resulting in the total sample of 336 pupils.

⁶ These were not observed by NFER as they occurred before the external evaluator was appointed.

Table 1: Geographical location

	Frequency	Percent	Cumulative Percent
Midlands	25	46.3	46.3
South	18	33.3	79.6
Wales	11	20.4	100.0
Total	54	100.0	

Table 2: Eligibility for free school meals (quintiles)

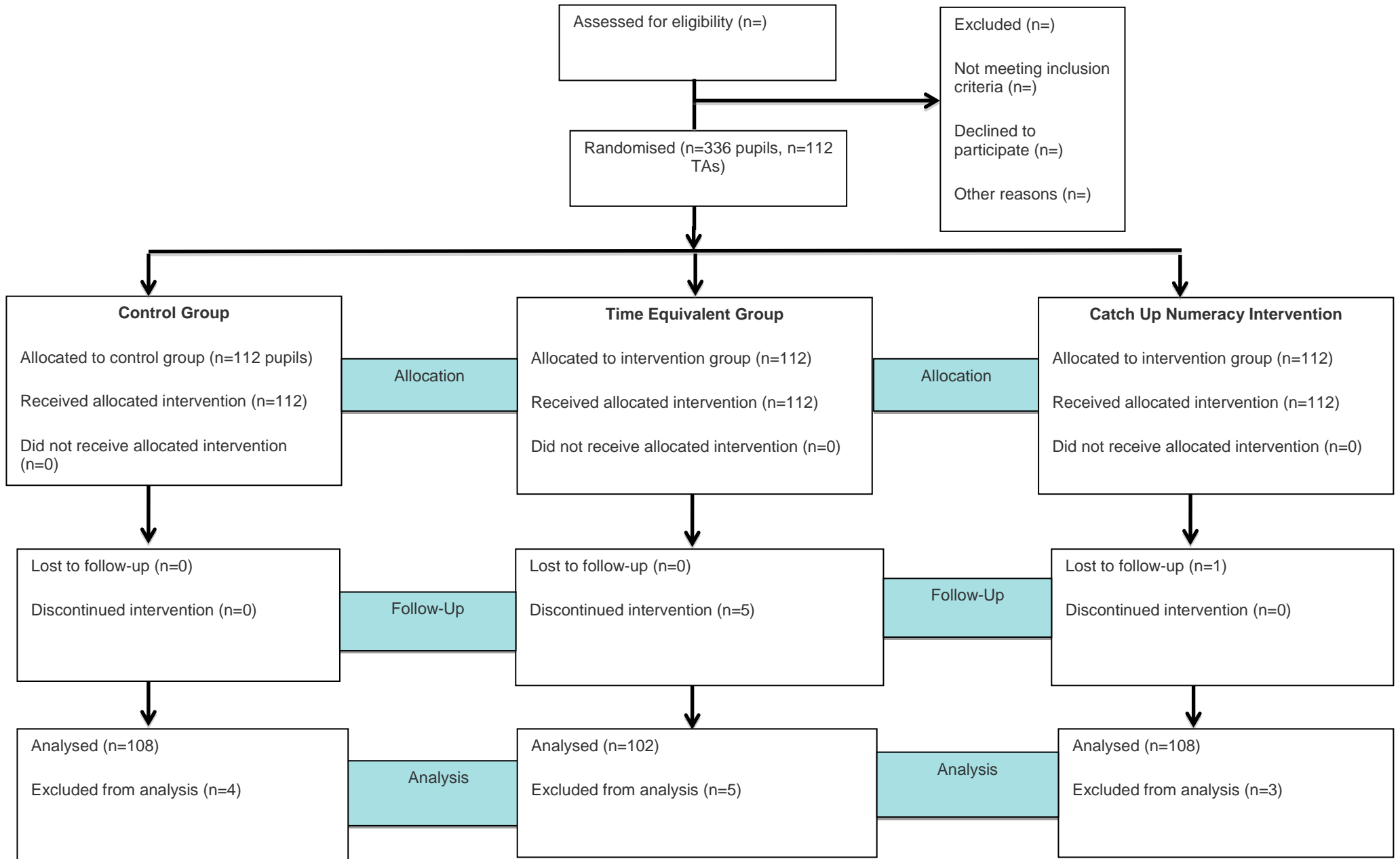
	Frequency	Percent	Valid Percent	Cumulative Percent
Lowest 20%	3	5.6	5.8	5.8
2nd lowest 20%	11	20.4	21.2	26.9
Middle 20%	14	25.9	26.9	53.8
2nd highest 20%	12	22.2	23.1	76.9
Highest 20%	12	22.2	23.1	100.0
Total	52	96.3	100.0	
N/A	2	3.7		
Total	54	100.0		

Table 3: Percentage of pupils with special educational needs (banded)

	Frequency	Percent	Valid Percent	Cumulative Percent
0 – 5%	0	0	0	0
6 - 10%	2	3.7	3.8	3.8
11 - 15%	10	18.5	19.2	23.1
16 - 24%	21	38.9	40.4	63.5
25% +	19	35.2	36.5	100.0
Total	52	96.3	100.0	
N/A	2	3.7		
Total	54	100.0		

At the time of analysis, the Key Stage 2 results of 2012 were only available for 39 schools (75%) schools within the trial. 27% of these schools were in the top two quintiles of Key Stage performance and 41% were in the bottom two quintiles.

Forty-three of the trial schools had recent OFSTED judgements. 63% (27) of these were considered 'Good', 21% (9) were considered 'Satisfactory', 12% (5) were considered 'Outstanding' and 5% (2) were considered 'Unsatisfactory'.



The sample information reported on the previous page would normally include details of the number of pupils assessed for eligibility. The external evaluator was appointed to this trial after this event had occurred and so had no control over how it was undertaken, although there is no reason to doubt that it was undertaken in an appropriate manner. Unfortunately details of the number of pupils approached have not been maintained. The table identifies how many pupils were excluded from the ITT analysis. In the control group four pupils were excluded, one due to absence from the pre-test and three due to absence from the post-test. In the time equivalent group five pupils left the school and were not contactable for a post-test, three pupils were absent for the pre-test and two were absent from the post-test. In the Catch Up intervention group four pupils were absent for the post-test. The overall attrition was 18 pupils, 5.4%⁷.

Pupil characteristics

Tables 4 and 5 below highlight pupil characteristics by each of the three groups within the trial. Although outcome test scores were age standardised the age profile can also be identified. The overall age mean was 97.7 months, or just above 8 years old.

Table 4: Gender by randomised group

	% Male	% Female	N
Control	54.5%	45.5%	112
Time equivalent	39.1%	60.9%	110
Catch Up	50.0%	50.0%	112
All pupils	47.9%	52.1%	334

Table 5: Eligibility for free school meals by randomised group

	% No	% Yes	N
Control	67.0%	33.0%	112
Time equivalent	68.8%	31.3%	112
Catch Up	64.0%	36.0%	111
Total	66.6%	33.4%	335

⁷ This attrition rate varied between the three groups. For the control group and the Catch Up® intervention group it was 3.2% and for the time equivalent intervention group it was 8.9%.

Outcomes and analysis

The main analysis is an ITT analysis and the results of that analysis are presented in Table 6 below. See the Technical Appendix for a description of how the analysis was undertaken

Table 6: Intention to Treat Analysis Outcomes

	Model coefficient	Standard error	95% CI	p
Intercept	39.29	4.76	29.96 – 48.62	0.00
Maths Pre-test score	0.63	0.06	0.51 – 0.75	0.00
Control group	-3.54	1.40	-6.28 – -0.80	0.01
Catch Up group	-0.79	1.40	-3.54 – 1.96	0.57

The main analysis was to determine if there was a significant difference in amount of progress made by pupils in the Catch Up intervention group when compared to those pupils in the control group. To account for the potential effects of one-to-one teaching a time equivalent group was introduced to the design. This group of pupils acted as the default group of pupils and analysis identifies any differences between this group and the control group, and this group and the Catch Up intervention group. Pupils in the control group, on average, had a post-test score that was 3.54 points below that of the average pupil in the time equivalent group. Pupils in the Catch Up intervention group, on average, had a post-test score that was 0.79 points below that of the average pupil in the time equivalent group. The model controls for the pre-intervention test scores collected before the start of the trial

Table 6 shows that there is a **significant difference** in the post-test maths standardised score, between the pupils in the control group and those in the time equivalent group, but there is **no significant difference** between the time equivalent group and the Catch Up group.

The effect size for the significant effect identified above is **0.27 (CI 0.49 – 0.06)**, based on Cohen's d adjusted for small sample sizes using Hedges' g. While there is no significant difference between the two treatment groups a post-hoc test was carried out to determine any significant difference between the Catch Up group and the control group. This was found to be significant, $p=0.047^8$. Its effect size is **0.21 (CI 0.42 – 0.01)**.

Sub-group analysis was carried out on the ITT dataset introducing gender, eligibility for free school meals and a number of interaction terms. Interaction terms were created for pre-intervention test scores and gender, pre-intervention scores and fsm, pre-intervention scores and control group membership and pre-intervention scores and Catch Up membership. Table 7 reports this analysis.

⁸ Bonferroni adjustment has not been applied

Table 7: Sub-group analysis outcomes

	Model coefficient	Standard error	95% CI	p
Intercept	37.69	9.18	19.70 - 55.68	0.00
Maths pre-test score	.64	.10	0.44 - 0.84	0.00
Control group	-3.30	2.37	-7.95 – 1.35	0.17
Catch Up group	1.42	2.36	-3.21 – 6.05	0.58
Female	1.98	2.17	-2.27 – 6.23	0.36
FSM - Yes	-2.72	2.37	-7.37 – 1.93	0.25
Female in control group	-2.29	2.97	-8.11 – 3.53	0.44
Female in Catch Up group	-5.03	3.04	-10.99 – 0.93	0.10
FSM in Control group	2.74	3.19	-3.51 – 8.99	0.39
FSM in Catch Up group	1.47	3.28	-4.96 – 7.90	0.66
Pre-test Score* control group	.04	.13	-0.21 – 0.29	0.73
Pre-test Score*Catch Up group	.17	.13	-0.08 -0.42	0.18
Pre-test Score* female	-.17	.11	-0.39 – 0.05	0.12
Pre-test Score* FSM	-.09	.13	-0.34 – 0.16	0.49

Table 7 does not alter the initial ITT analysis that shows the intervention groups have significantly higher post-test scores than the control group. The analysis here does not identify any significant interactions.

Further analyses were run to omit pupils where TAs had altered the delivery of the intervention. These were primarily pupils who had received their intervention from a non-randomised TA or where the school dropped out of the intervention. This occurred for pupils in both intervention groups and resulted in seven exclusions due to the school withdrawing from the trial in February 2013, seven exclusions due to a non-randomised TA replacing a randomised TA and four exclusions due to the incorrect TA attending the Catch Up training.

For schools that dropped out of the trial, the control group pupils remained within the analysis as they continued to receive the same treatment. The above exclusions resulted in analysis being carried out on 108 pupils within the control group, 91 from the time equivalent group and 101 from the Catch Up group. The main output from this analysis is in Table 8.

Table 8: Model outcomes for ITT dataset with omissions

	Model coefficient	Standard error	95% CI	p
Intercept	40.34	4.98	30.58 - 50.10	0.00
Maths Pre-test Score	0.62	0.06	0.50 – 0.74	0.00
Control Group	-3.62	1.48	-6.52 - -0.72	0.02
Catch Up Group	-0.90	1.51	-3.86 – 2.06	0.55

Sub-group analysis on this dataset did not significantly alter the original ITT interpretations.

Secondary outcomes analysed included pre and post-test data from the Salford Sentence Reading Test and the Non-Reading Intelligence Tests 1-3. Data was analysed in the same way as that used for the main ITT analysis and while significant increases were found in the post-test scores there was no significant difference between pupils in the control group and either of the two intervention groups.

Cost

The external evaluators did not explicitly ask about or collect data on the costs associated with the intervention. The Catch Up Numeracy intervention costs schools £350 per person trained. As with any intervention, additional resources are required to ensure its successful delivery. For Catch Up Numeracy, these include:

- arranging cover for each staff member to attend the different training sessions (a minimum of two days in total)
- time to plan or prepare for the session with pupils. Some TAs noted that once the resources and materials were set up and TAs became familiar with the intervention, less time would be needed but that some planning time is still required
- time to access the website or download resources.

A very small number of TAs noted that photocopying is required to deliver the intervention, for example the progress booklets and individual session sheets. Making these available on A5 paper or adding more than one session to each sheet was suggested as a way to reduce the amount of paper needed. The costs associated with these different activities have not and cannot be quantified as part of this project but it is worth noting that additional resource input is required.

Independent research reported by New Philanthropy Capital (Paterson *et al*, 2010) estimated that the cost of Catch Up Numeracy is £120 per pupil (increased to £130 on the Catch Up website) which accounted for the required resources and TA time.

Process evaluation

Implementation

Despite Catch Up making the request, five coordinators involved in the interviews did not attend the three half-day N2 training sessions; however all TAs interviewed had attended. In contrast only 11 of the coordinators interviewed attended the N4 training session at the end of the intervention. Most found the training incredibly useful, detailed and delivered to an appropriate pace. A small number of interviewees (four coordinators) commented that it can be expensive for a school to have a senior leader and a TA out of school for three half days, but they recognised the value of the model whereby the theory is given and can be applied in school during the afternoons. It became apparent during the observations that not all TAs returned to school during the afternoon to practise Catch Up Numeracy; however, most TAs had practised with a family member or friend instead.

When asked if they had to spend any additional time familiarising themselves with the Catch Up Numeracy materials after the training and before working with the learners, 18 TAs said yes. This seemed to vary from a quick 'ten-minute' read through the materials to a more thorough revision taking 'several hours'. Seven coordinators said they spent some time doing this but most had not.

The additional support Catch Up provided to the project schools was highly valued by TAs and coordinators alike. They felt that having a trainer visit and support them helped clarify any issues, ensured practice remained focussed, and provided affirmation. For a small number of TAs (three), the Catch Up trainer observations also improved practice (mostly around completing the record sheets).

TAs and Catch Up coordinators identified a number of barriers to delivering Catch Up Numeracy, relating to various issues.

- A lack of time, specifically around TAs having sufficient time to plan and prepare for the sessions and also finding time to fit in two 15-minute sessions each week within the existing school timetable. This was mentioned by ten TAs and 12 coordinators.
- Regular pupil absence made it difficult to do all 60 sessions. This was mentioned by seven TAs and three coordinators.
- The negative attitude of some pupils towards the intervention, mentioned by five TAs and two coordinators. For example, pupils resented being singled out as 'not very good at maths' or being taken out of lessons they enjoy, such as PE, in order to do Catch Up.
- The difficulty in finding suitable resources to run the intervention. This was mentioned by six TAs and five coordinators.
- The difficulty in finding a suitable location within school to run the sessions. This was mentioned by two TAs and three coordinators.
- A lack of senior management support and commitment to the intervention. This was mentioned by four TAs and five coordinators.

Fidelity

No clear patterns emerged when schools ran the Catch Up Numeracy sessions. Sessions were held before school where learners were offered breakfast (in one case); during registration or assembly times (four cases); morning lessons, including during the last 15 minutes before lunchtime (four cases); at lunch time (in one case); during afternoon lessons (because core lessons were held during the morning - this was mentioned seven times) or during maths lessons (in one case). For others, it

varied each week (seven cases). Some schools had ring-fenced time for Catch Up Numeracy to be held but this was not commonplace. Around half of schools had a policy about when interventions should be run - for example, not during mornings when core subjects were taught. It was during this time, that Catch Up sessions were held.

Very few interviewees reported that learners had received two 15-minute sessions each week. TAs tried to adhere to the intervention where possible, but pupils or staff absences prevented this from happening. Furthermore they reported scheduling and school-year activities (such as trips and assessments) resulting in Catch Up sessions not happening.

When asked if the sessions tended to last for 15 minutes each, most TAs (19) and coordinators (17) said they did. However, several noted that, particularly during the early stages, the sessions tended to exceed 15 minutes; for some, this happened throughout the intervention but was usually only extended by a few minutes. TAs noted that learners asking questions and writing their thoughts in the individual record sheets meant that time overran a little. Three TAs noted that they spent 15 minutes with the learners but that Catch Up Numeracy required additional TA time for preparation and planning.

There were several elements of the intervention which TAs and coordinators considered to be adaptable. The most common one was the length of time the intervention was run for. Eight TAs and six coordinators suggested that this could be flexible to the needs of the pupil rather than having to be 30 weeks⁹ (the length of time for this project).

Four TAs and coordinators commented they thought that Catch Up Numeracy did not have to be delivered on a one-to-one basis but could be delivered to small groups instead. Three coordinators commented that the amount of paperwork that was required to be completed, particularly around recording and monitoring pupil progress could be adapted. The other element of the intervention that was perceived as being adaptable was the number of sessions run per week, with two coordinators commenting that this did not necessarily need to be two per week.

Outcomes

Pupil outcomes

Almost all TAs delivering the Catch Up intervention (20) and the school coordinators (23) identified an improvement in pupil confidence towards numeracy. This was evidenced by pupils participating more fully in numeracy lessons and being more willing to put their hand up and answer questions in class. In a number of cases TAs and coordinators commented that these outcomes were not just restricted to numeracy but had been transferred more widely to other lessons also.

Other outcomes that were mentioned by both TAs and coordinators alike included the following.

- Pupils becoming more engaged in numeracy. This was mentioned by three TAs and five coordinators.
- Improvements to pupil attitude and self-esteem and a greater enjoyment and enthusiasm towards numeracy. This was mentioned by eight TAs and seven coordinators.
- Pupils being better behaved, more focussed and less disruptive in class as a result of Catch Up. This was mentioned by three TAs and three coordinators.

⁹ Usually schools would carry out Catch Up with pupils for as long as they felt it was needed. However, for the purposes of this project each pupil received the intervention for 30 weeks.

- Pupils becoming more reflective and more aware of their strengths and weaknesses in numeracy. Mentioned by two TAs and two coordinators.
- In some instances there were changes to how pupil's approached their learning, for example pupils were more willing to take ownership of their work. This was mentioned by nine TAs and seven coordinators.

In terms of the perceptions on the impact of the intervention on pupil attainment in numeracy there was a range of views. Coordinators were more inclined to comment on the attainment outcomes of Catch Up in terms of national curriculum levels and test scores than TAs, with 11 coordinators mentioning this in contrast to only six TAs. Some coordinators and TAs perceived there to be big increases in pupils' understanding in maths and in their attainment. In other cases schools felt that pupils were making the expected two sub-levels of progress while in a small number of cases TAs and coordinators were disappointed with the progress that some pupils were making in relation to attainment.

Ten TAs and nine coordinators identified the one-to-one nature of Catch Up Numeracy and its personalised approach to the individual pupil as the reasons behind any changes to attainment

Impacts on TAs and coordinators

TAs expressed satisfaction in delivering Catch Up Numeracy and many (ten) mentioned the confidence they had gained from being given the responsibility of running the intervention in school. Six TAs also commented that they had gained a greater insight and awareness of pupils' strengths and weaknesses in maths as a result of delivering Catch Up.

Twelve coordinators also commented on the professional development benefits for TAs. Coordinators reported fewer outcomes for themselves; these included increased awareness of how to support pupils with numeracy, fresh ideas about numeracy activities that could be used in school and a greater understanding of gaps in pupil learning (particularly facilitated by the Catch Up Numeracy assessment activities). In four cases coordinators commented that the intervention had very little impact upon them.

A number of other consequences were reported by TAs and coordinators, some positive and some negative. The two most common positive consequences related to improved relationships between staff and project pupils, mentioned by five TAs and one coordinator, and closer working and better communication between different members of school staff (class teachers, TAs, Catch Up coordinators and SENCOs), this was mentioned by three TAs and two coordinators.

TAs and coordinators reported negative effects of Catch Up relating to increased workload, and pressure and stress associated with trying to plan, prepare and deliver Catch Up Numeracy in an already busy timetable. In some instances these negative effects were exacerbated as a result of participation in this project due to its requirement to complete 60 sessions with pupils over the course of 30 weeks.

TAs and coordinators said the best aspects of Catch Up Numeracy were:

- the confidence it gives pupils, in maths but also often across the curriculum
- the assessment, which is diagnostic and means the intervention is tailored to learners' individual needs
- its structure, including the resources such as the progress sheets
- the one-to-one support learners are given.

Formative findings

TAs and coordinators suggested ways in which the intervention could be improved, several of which related to the Catch Up website and included the following.

- There needs to be more resources and linked recording activities available on the website which could be used by TAs. This was mentioned by six TAs and five coordinators.
- The resources on the website need to be updated so that they are more modern. This was mentioned by two TAs and two coordinators.
- The navigation through the website could be made easier. This was mentioned by three TAs and two coordinators.

A number of TAs commented that they felt that the initial assessments could be improved in the following ways.

- By making them more flexible so that the TA does not have to immediately stop the assessment if the pupil makes a mistake. Mentioned by three TAs.
- By simplifying the language used in the assessments so that it is simpler and more child friendly. Mentioned by three TAs.

A number of coordinators felt that Catch Up could be improved by reducing the amount of paperwork involved in delivering and administering the intervention. Furthermore several coordinators suggested that Catch Up could be improved by running it in small groups rather than one-to-one, or by running it for a shorter period of time than 30 weeks.

While most coordinators recognised that Catch Up Numeracy should not necessarily link with normal numeracy teaching, TAs reported that they linked the Catch Up sessions where they could with class teaching. This was not possible in some instances, for example where the number range in class was higher than the focus of Catch Up. Dialogue between the TAs and the class teacher seemed to vary between schools. Some TAs felt dialogue was important, whereas for others it was more difficult as they worked with different year groups for Catch Up than they usually would. A small number of interviewees said that in future they would like the class TA to deliver Catch Up so where linkages can be made this would be possible.

Teaching assistant questionnaires

To help in the understanding of how TAs delivered the two interventions, two questionnaire surveys were carried out on a sample of TAs at the mid-point of the 30 week trial period and at the end. Questions were asked about how the training matched up to reality and how the TAs within each school managed their respective parts of the trial and whether there was any potential for cross contamination in the support provided to the pupils. Catch Up TAs were also asked about how they delivered the Catch Up intervention. Many of the results from the survey follow what was discovered during the process evaluation.

The results of the two questionnaires are discussed below but, to summarise, there would seem to be some discrepancies between how the trial protocol instructed the TAs to deliver their part of the intervention and what happened in practice. In asking teachers to deliver a number of sessions per week, for a set number of weeks, was potentially always going to result in a variation in delivery, primarily due to timetabling issues and TA and pupil absences.

In looking at the number of sessions undertaken there is no significant difference in the reported number of sessions the TAs delivered. Teaching assistants delivering the Catch Up intervention also broadly delivered it as expected and as the training had instructed. To maintain fidelity to the trial the

delivery of the time equivalent sessions required TAs not to deliver Catch Up but to keep a log of the activities they did deliver. Questionnaire responses identified below would seem to indicate that a proportion of TAs delivering the time equivalent sessions had more knowledge of Catch Up Numeracy than could be thought of as ideal. Additionally, some TAs adjusted the delivery of their sessions based on this knowledge.

Time equivalent TAs returned 32 questionnaires at the mid-point of the trial. Twenty-five (78%) of these TAs reported that they held two sessions per week, while four TAs (13%) reported that they held four sessions per week. In the second survey, of the 33 respondents, 28 (85%) said they had followed the protocol of two sessions per week. As for the length of these sessions, 26 TAs reported that sessions lasted between 15 and 20 minutes. In the second questionnaire this had remained consistent for the 27 respondents (84%). Although a desired result would be for all TAs to follow the agreed protocols exactly, the workings of a busy school probably make this difficult (as the process evaluation team found out). Given the responses above it would appear that a high proportion of time equivalent TAs delivered their sessions as planned. A potential cause for concern is that, even though they did not receive the Catch Up training, 15 time equivalent TAs (47%) reported at the first survey that they did know a little about the Catch Up approach to teaching numeracy. Thirteen TAs (41%) at the second survey reported similar knowledge. If this knowledge led to teaching methods being more similar to those adopted by the Catch Up TAs then this makes it harder to maintain a separation of treatments. To further complicate this issue, 12 time equivalent TAs (38%) at the first survey and nine TAs (31%) at the second survey reported that their approach to supporting pupils had changed based on what they knew about Catch Up Numeracy.

For the Catch Up TAs there were 40 respondents to the mid-point survey and 35 to the second survey at the end of the trial. A high proportion again reported that they had held two sessions with their pupils, 35 (86%) at the mid-point survey and 27 (77%) at the second survey. They also reported that their sessions were between 15 and 20 minutes in length, 35 (86%) at the mid-point survey and 33 (97%) at the second time point.

Teaching assistants for the time equivalent and Catch Up groups were required to complete logs recording the sessions they had held with their pupils and an investigation of these shows that for 74 pupils in the time equivalent group, the mean number of sessions received was 35.5. For 76 pupils in the Catch Up group, the mean number of sessions was 34.9. This difference is not statistically significant. While we are unable to determine the length of these sessions it would seem to be a long way off the 60 sessions in the original protocol, although both treatment groups appeared to have received a similar number of sessions.

At the mid-point survey, when asked how well equipped they felt to deliver Catch Up, only 21 (53%) of respondents said to a great extent or entirely. This rose to 27 (77%) respondents at the second survey. This may identify some variable delivery of the Catch Up intervention. Other possible identifiers of variable delivery are from the question that asked if the TAs had adapted the Catch Up Numeracy intervention. At the mid-point survey six (15%) of respondents said they had to 'a great extent' or 'entirely', while a further 15 (38%) said they had adapted the intervention 'to some extent'. In the second survey six respondents said they had adapted the intervention 'to a great extent' and a further 18 (51%) said they had adapted it 'to some extent'. These responses, from 66% of all Catch Up TAs, would suggest that the Catch Up intervention may not have been delivered as intended.

Given the results of the trial described above it is interesting to also note that when asked if pupil enjoyment and confidence in maths had increased, 25 (70%) of TAs said that it had 'to a great extent' or 'entirely'. When asked if it had improved attainment in maths only 14 (41%) of the TAs reported that they felt it had to 'a great extent' or 'entirely'.

Conclusion

Limitations

The main limitation of the study is with the potential cross-contamination between TAs delivering the time equivalent sessions and those delivering the Catch Up sessions, and the degree to which this has impacted on the results. Other more minor threats to the internal validity of the trial come from the level of attrition with a number of pupils dropping out of the analysis, although the overall percentage of attrition is small when compared to other trials. Attrition is also at the same rate for the control group and the Catch Up group. Testing was organised and managed by the delivery organisation with research assistants being trained to administer the tests, and although there was no independent monitoring of this process there is no evidence to suggest that the administration of the tests, or their marking, were not undertaken following accepted protocols. Test administration and marking for both the pre and post-tests were, so the external evaluator was informed, carried out blind to group membership. There is no evidence to suggest that this was not the case.

Interpretation

The main hypothesis that this trial was designed to test was whether the gains in numeracy attributable to those pupils who had been randomly assigned to the Catch Up group were significantly greater than the gains made by pupils who had been assigned to the group that had received sessions that were time equivalent. Both of these groups would have been expected to make gains significantly greater than the control group as the effectiveness of one-to-one tuition is well documented (see Sutton Trust-EEF Teaching and Learning Toolkit).

We conclude that this trial has seen no evidence that Catch Up has produced significant gains in numeracy over and above those that were seen in the time equivalent group. The Catch Up group had a gain that was significantly greater than the control group. But, the conclusion from this trial is that while there is evidence that one-to-one sessions, over a sustained period, do produce a significant improvement in numeracy skills, there is no evidence that Catch Up adds anything over and above this one to one teaching effect.

As described in the process evaluation, and from what can be determined from the questionnaire responses, there would appear to be some variance in how TAs delivered the sessions to their relative groups. It is not clear whether these differences in delivery have actually impacted on how pupils have developed their skills in numeracy. We do know that the training of Catch Up TAs was kept separate and that TAs assigned to the time equivalent group would not have had access to this training. We also know that trainers make it clear that the contents of the numeracy intervention should not be cascaded to colleagues and we have to assume schools adhered to this requirement. While it should be fully accepted that teachers and TAs within the same school will communicate with each other, and there is evidence from the process evaluation and the questionnaires that this did indeed occur, we are unclear as to whether this actually had an impact on the results of this trial.

It is evident from the process evaluation, and the questionnaires, that TAs and Catch Up coordinators valued the intervention and believed it had a positive impact on some pupils. These impacts tended to be around softer outcomes such as confidence, engagement with learning and willingness to attempt numeracy problems. It was also clear from the process evaluation that delivering a structured intervention within a school can be problematic due to pupil absences, TAs' timetables and conflicting demands on their time. An intervention such as Catch Up needs to be planned into the timetable from the outset, and not part way through the year, as was the case with this trial. This may help schools overcome some of these challenges. This would also assist scalability of the intervention and its roll out to more schools.

Future research and publications

There is not enough evidence to be certain that the Catch Up Numeracy does or does not improve numeracy attainment over and above pupils receiving one-to-one support. This would suggest the need for a further trial to ensure there are better controls of how the TAs deliver the intervention with a further trial assisting in any future meta-analysis. Further analysis could be undertaken to look at the session logs provided by the TAs to determine any similarities in session delivery.

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Technical Appendix

Analysis was carried using SPSS and R analytical software. Data was prepared in SPSS by one statistician who was aware of the data structure and group membership of the three randomised groups. Data files created included identifiers for school, a pupil identifier, a standardised score for the pre-test maths score, a standardised score for the post-test maths score, a dummy variable to indicate membership of the control group and a dummy variable to indicate membership of the Catch Up intervention group. The time equivalent group was set as the default group so that differences could be identified between membership of the other groups and this group. This was the primary dataset for the intention to treat analysis. Hierarchical models were analysed using R software with the schools' URN number identifying the higher level and the unique pupil identifier the lower level.

Model coefficients and their standard errors are reported in the main body of the report. Effect sizes were calculated using Cohen's *d* as identified in EEF protocols. The standard deviations used for these calculations were 11.579 for the control group, 14.281 for the time equivalent intervention group and 14.268 for the Catch Up intervention group.

Additional sub-group analyses were undertaken following the same methodology and include the creation of dummy variables to identify gender, eligibility for free school meals and interactions between these variables and pre-test scores and group membership. Model coefficients for this additional analysis are reported in the main body of the report.

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