

Protocol for Evaluation of the University of Oxford Improving Numeracy and Literacy Programme

Intervention

This project will test the impact on student outcomes of two different initiatives: 'Mathematics and Reasoning' and 'Literacy and Morphemes'. The former is a numeracy intervention that develops children's understanding of the logical principles underlying mathematics. The latter is a literacy intervention that sees children being taught about morphemic spelling rules; this aids children's spelling and also their reading comprehension. Each of the two programmes require teachers to be trained for one day in the approaches prior to the intervention starting, and last for 12 weeks, with children receiving one hour of instruction per week. The lessons are all delivered through electronic resources, including PowerPoints (which the teachers use for whole class teaching) and online games that the children can access at school and at home.

Both programmes have been tested in intervention studies: a 2007 study by Nunes showed that logical reasoning training had an effect of 1.2 standard deviations on mathematics achievement¹. Morphological training has been tested in a study with both an active and no treatment control groups, children given morphological training showed improvements over and above both groups in terms of spelling². The intervention has been shown to have an effect size of between 0.3–0.6 standard deviations, depending on how it is delivered.

Research Plan

Research Questions

The two primary research questions are:

- what is the impact of 'Mathematics and Reasoning' on student development of numeracy ability?
- what is the impact of 'Literacy and Morphemes' on student development of reading ability?

Design

Sixty primary schools in Oxfordshire and surrounding counties will be recruited for participation in the study. Oxford University are responsible for recruiting all the schools. Year 2 pupils, subject to each student's passive parental consent, will be the potential recipients of the interventions.

Baseline testing in literacy and numeracy will be administered to all pupils by Oxford University, prior to randomisation. Randomisation of schools into each of the two intervention groups and one wait-list group by NFER will then occur. Post-intervention testing of literacy

¹ Nunes, T., Bryant, P., Evans, D., Bell, D., Gardner, S., Gardner, A. and Carraher, J. (2007), The contribution of logical reasoning to the learning of mathematics in primary school. *British Journal of Developmental Psychology*, 25: 147–166. doi: 10.1348/026151006X153127

² Nunes, T., Bryant, P., and Olsen, J. (2003), Learning Morphological and Phonological Spelling Rules: An Intervention Study. *Scientific Studies of Reading*, 7(3): 289–307. doi: 10.1207/S1532799XSSR0703_6

and numeracy in schools, to measure outcomes, will be administered by NFER. All schools will be tested for both literacy and numeracy.

The trial will be designed, conducted and reported to CONSORT standards³.

Inclusion Criteria

All Year 2 pupils within participating schools will be included in the trial, subject to each student's parental consent to participate.

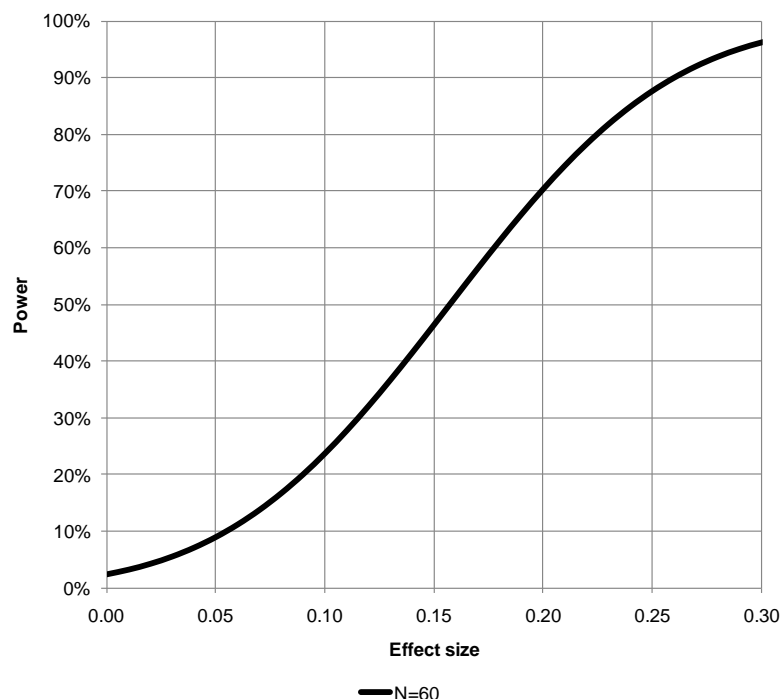
Randomisation methods

Randomisation will allocate schools to intervention and wait-list groups and will be carried out by a statistician at NFER.

Outcome Measures

Progress in English (PiE) and Progress in Maths (PiM; GL Assessment) will be used to measure reading and numeracy ability respectively. The baseline literacy test will be PiE6 and the post-intervention test will be PiE7. The baseline numeracy test will be PiM6 and the post-intervention test will be PiM7.

Sample size calculations



Randomisation will be conducted at school level, allocating the 60 schools to intervention and control groups: 20 will be allocated to receive the literacy intervention, 20 to receive the numeracy intervention and 20 will be allocated to the wait-list group.

The design provides adequate statistical power for the expected effect size of intervention: power to detect an effect size of 0.3 is 96.3%, power to detect an effect size of 0.2 is 70.4%.⁴

³ <http://www.consort-statement.org/consort-statement/>

Analysis

The main analysis will be to estimate the impact of the literacy and numeracy interventions on the intervention groups. This will be done by comparing follow-up test data in those groups with the data from the control group. The main outcome measures will be total test scores from the PiE (for the literacy intervention) and PiM (for the numeracy intervention) tests. The definitive analysis will be 'intention to treat', reflecting the reality of how interventions are delivered in practice and avoiding attrition bias. We will use multi-level models to enable us to combine results across schools whilst accounting for clustering, and will include baseline data as a covariate in each of our models.

We will undertake basic descriptive analysis of baseline test data to provide a check that the randomisation process has been carried out successfully. Whilst we would not expect treatment and control groups to exhibit identical characteristics, we will carry out statistical tests to verify that any small differences that do arise are consistent with what one might expect assuming an unbiased randomisation.

In addition to the main analysis we will:

- test hypotheses relating the impact of the interventions on pupils of differing abilities through the inclusion of interaction terms in the modelling
- analyse the differential impact of the interventions on FSM and non-FSM pupils, and EAL and non-EAL pupils
- analyse the impact of the interventions on end of Key Stage 1 reading, writing and maths
- analyse the impact on specific domains of the tests where the interventions are thought to have a particular effect: specifically, 'Grammar' and 'Reading non-narrative' in PiE and 'Solving routine problems' in PiM
- analyse any transfer effects, testing the impact of the numeracy intervention on literacy test scores, and of the literacy intervention on numeracy test scores.

Process evaluation

The focus of the process evaluation will be the efficacy of implementation of the interventions. Researchers from NFER will undertake observations of both the literacy and numeracy training days. Two to three session observations of each of the numeracy and literacy interventions will also be carried out – one lesson observation per selected school, followed by short teacher and pupil interviews. We will look to gain a deeper understanding of the perceptions of the intervention's impact and any barriers that may exist for its wider rollout. Views would also be sought into the effectiveness of the training and guidance materials as preparation for delivery of the intervention and whether any improvements to these processes and documents would make a wider rollout more likely to succeed. The evidence from these observations and interviews will directly contribute to the scalability evaluation.

We will conduct a survey of all teachers involved in the two interventions (ie approximately 80 teachers). This will take place in the summer term of 2014. Survey development will involve a range of stakeholders to inform and review the questionnaire development (this may involve online focus groups or telephone interviews and expert reviews).

⁴ Assumptions: size of two-tailed test=95%, expected number of pupils per school=30, intra-school correlation=0.15, correlation between pre- and post-test scores=0.8, number of intervention and wait-list schools=20.

We will also conduct a series of post intervention telephone interviews with school heads, or members of SMT in 4-5 schools per intervention to discuss their perceptions of implementing the interventions, their impact and any roll out issues they envisage.

Our report on the findings of the process evaluation will draw on these findings and make recommendations to ensure the sustainability and replicability of successful interventions when they are scaled up.

Personnel

The project will be led by Terezinha Nunes and Peter Bryant (University of Oxford) and be managed by Deborah Evans. The impact evaluation will be led by Jack Worth at NFER. The process evaluation will be led by Juliet Sizmur at NFER. Camilla Neville will have overview of the evaluation at EEF and Emily Yeomans will oversee the grant.

Roles and responsibilities

Each person will carry out their duties with the assistance of teams at their respective institutions:

- Oxford University: recruitment and retention of schools, training and delivery of intervention, supply of list of eligible schools for randomisation, administration of pre-test
- NFER: trial design, purchasing and marking tests, randomisation, administration of post-test and analysis. Process evaluation observation visits, surveys and interviews.

Data protection statement

NFER's data protection policy is available at:

<http://www.nfer.ac.uk/nfer/about-nfer/code-of-practice/nfercop.pdf>

Timeline

Apr–Sep 2013	Recruitment of schools
Jul 2013	Write and agree protocol, and register protocol at www.controlled-trials.com/
Nov 2013	Pre-testing. Once pre-testing is completed, randomisation of schools by NFER into intervention and control groups
Nov–Dec 2013	Training of teachers. Training observations
Dec 2013–Mar 2014	Implementation of intervention programmes. School visits
May–Jun 2014	Post-intervention testing and survey. Headteacher/ SMT telephone interviews
Jul 2014	Analysis of test data
Sep 2014	Training of teachers in control group for following cohort (pupils in control cohort not treated)
Oct 2014	Longitudinal follow-up of KS1 results
Jan 2015	Final report to EEF

Risks

Risk	Assessment	Countermeasures and contingencies
School, teacher or pupil attrition	<p>Likelihood: moderate</p> <p>Impact: moderate</p>	<p>Clear information / initial meeting with schools explaining the principles of the trial and expectations. 'Intention to treat' analysis will be used.</p> <p>Attrition will be monitored and reported according to CONSORT guidelines.</p>
Interventions are not implemented well	<p>Likelihood: low</p> <p>Impact: moderate</p>	<p>Clear information / initial meeting with schools explaining the principles of the trial and expectations. 'Intention to treat' analysis will be used.</p> <p>Process evaluation will monitor this.</p>
Control pupils exposed to elements of the interventions	<p>Likelihood: moderate</p> <p>Impact: moderate</p>	<p>Clear information / initial meeting with schools explaining the principles of the trial and expectations. 'Intention to treat' analysis will be used.</p>
Delays in training of teachers and commencing interventions	<p>Likelihood: moderate</p> <p>Impact: low</p>	<p>Agree a clear timetable with project teams up front.</p> <p>Revise timetable for pre and post testing periods.</p>
Failure in recruiting pupils/schools	<p>Likelihood: low</p> <p>Impact: high</p>	<p>Project teams could make use of NFER's Research Operations Department to recruit more schools (at additional cost).</p> <p>Timescale could be revised.</p>
Poor completion of surveys by teachers	<p>Likelihood: low</p> <p>Impact: moderate</p>	<p>Set clear expectations at the start of the study what is required from participating teachers/ schools.</p> <p>Our data support services provide excellent systematic procedures for reaching targets and staff are trained in the use of persuasive techniques.</p>
Researchers lost to project due to sickness or absence	<p>Likelihood: moderate</p> <p>Impact:</p>	<p>NFER has a large research department with numerous researchers experienced in evaluation who could be redeployed.</p> <p>Senior staff can stand in if necessary</p>

	low	
Project teams do not follow correct trial protocols	Likelihood: moderate Impact: high	Meetings with project teams at start of project. Provision of clear guidance describing protocols for distribution to all schools.