

Evaluation Summary	
Age range	Year 5 (9-10)
Number of pupils	Average 60 pupils per school
Number of schools	12 treatment and 12 control schools
Design	Randomised Controlled Trial with Delayed Treatment
Primary Outcome	KS2 Mathematics Score

BACKGROUND

Significance

The Institute for Effective Education at the University of York is conducting an impact and process evaluation of the Flipped Learning approach to be implemented by Shireland Collegiate Academy in Smethwick. The approach will involve innovative teaching and learning strategies, making use of new technology applications in mathematics for Year 5 in primary schools in Birmingham and the Black Country.

“Flipped Learning” (often referred to as the “Flipped Classroom”) is an approach in which pupils are given assignments to do at home on computers or tablets. These may include video lessons made by the teacher. This enables the teacher to use classroom time for activities such as co-operative learning, problem solving, projects, and attending to individual difficulties.

Flipped Learning is currently being widely discussed, but rigorous research on it is lacking. Recent reviews cite good rationales for why Flipped Learning might enhance learning, but they do not present actual comparisons of Flipped Learning and traditional teaching. For this reason, a randomised evaluation of a Flipped Learning model could be very important as a first rigorous test of this attractive idea. The evaluation is likely to be of benefit to a number of audiences, including practitioners, education advisers, and the ‘new technologies’ research community.

Intervention

The intervention involves Shireland Collegiate Academy working with primary schools in the local area of Birmingham and the Black Country. The approach will involve innovative teaching and learning strategies in mathematics for Year 5 (‘Maths Flip’). Flipped Learning involves teacher and pupil access to a virtual learning environment (VLE) and the use of laptops to carry out work both at home and at school.

RESEARCH PLAN

Research questions

The aim of the evaluation is to assess the extent to which training and support in Flipped Learning can improve pupils’ mathematics performance in Year 5. Addressing this aim will be achieved through the use of a randomised school group approach (to assess impact), an on-line teacher survey, school visits and interviews with key academy staff and participating primary school teachers (predominantly to assess “process” factors). The use of Key Stage data (and specially-commissioned mathematics tests at the pre-intervention stage) for pre- and post-intervention outcomes will produce reliable, robust statistical evidence on whether the approach improves performance outcomes in mathematics; and the process evaluation will help to explain the “how” and the “why” of the Flipped Learning approach (see Methodology below).

Design

For the Impact Evaluation we will use a randomised trial with two groups of schools. We believe that the school, rather than the class group, should be the unit of treatment and of random assignment as this reduces possibilities for ‘contamination’ (exchange of information among teachers and pupils in different treatments) and increases possibilities for collaboration among teachers within each school.

We will therefore use a simple two-group approach, with a full treatment group of twelve schools and a control group of twelve schools. The treatment group (Phase 1 schools) will receive the on-line learning environment, the necessary devices, and Shireland’s training and resources, and the control group will receive none of these, but will carry on learning mathematics in “the usual way”. The control group (Phase 2 schools) will be provided with the Flipped Learning approach one year on, making this a “delayed treatment” group and helping their motivation to take part in the trial.

In accordance with the implementation timescale, 24 primary schools will be recruited to the project by January 2014. Key Stage 1 data for the relevant pupils in the schools will be collected before randomisation occurs. In addition, in March 2014, all 24 schools will be asked to ensure that their Year 5 pupils complete the GL Assessment Progress in Mathematics (PiM) test – this will provide an additional set of baseline data.

We will assist with recruitment to ensure that this is done in line with RCT-evaluation requirements. We will then match schools on one or two key indicators, such as prior attainment and free school meals (FSM), and then randomly assign them to an immediate treatment experimental group or the delayed treatment control group. Randomisation will be completed by February 2014.

The project timeline assumes some teacher involvement in the programme in the spring term 2014, with the main implementation programme and evaluation both commencing at Easter 2014. The numbers of Year 5 classes and pupils to be tested has yet to be confirmed, and will also depend upon the sizes of the primary schools recruited to the evaluation. We have assumed, for the purposes of this proposal (but can vary our assumptions as required), that the Flipped Learning approach will be implemented with an average of 60 pupils (or two class groups) in each of 12 schools for the RCT.

The Year 5 pupils in both treatment and control schools will be assessed on reliable and valid measures of mathematics knowledge and applications. In the early stages of the evaluation Key Stage 1 data from the National Pupil Database will be used, to help with minimising the burden on schools. Data will be collected on KS1 mathematics, English (for additional information) and overall scores. GL Assessment PiMs data will provide an additional set of baseline/pre-intervention data.

The approach will be implemented with about 60 Year 5 pupils in each of 12 schools (a total of 720 pupils), and a similar number of pupils in a control group of 12 schools (also 720 pupils, for a total of 1440 pupils in all). Key Stage 2 Mathematics SATs tests would be taken around mid-June 2015, so we propose that these should be used as ‘post-test’ data.

Using routinely collected data (KS2 scores), which can be obtained either from the NPD, as post-test data minimises costs and the burden on schools and pupils. These standardised measures are high in contextual validity and, since they constitute the main indicators of school and pupil academic performance, control school teachers as well as Flipped Learning teachers will be focused on ensuring that pupils succeed in them. The reliability and validity of these measures have been well established.

Participants

In accordance with the implementation timescale, 24 primary schools will be recruited to the project by January 2014, 12 in the treatment and 12 in the control group. The participating pupils will be in Year 5 in the spring term 2014. Excellent progress has already been made in the development of the necessary Flipped Learning training and resources, and in identifying schools to take part, and the evaluation team will work closely with Shireland Collegiate Academy on recruitment.

Outcome Measures

The first collection and analysis of NPD KS1 data will take place before randomisation occurs. The GL Assessment Progress PiMs tests will be administered in March 2014, before any of the teachers participate in any training for Flipped Learning. For the second phase, we will analyse mathematics

KS1 and KS2 scores in the summer and autumn of 2015, comparing schools randomly assigned to the Flipped Learning treatment to those in the randomly assigned control group, controlling for pre-intervention scores. The KS2 mathematics score will be the primary outcome measure but we will also examine English and overall KS2 scores, and attendance, as secondary outcomes.

Sample size calculations

With 12 schools in each condition, we will use analyses of covariance (ANCOVA) with pre-intervention scores as covariates. Assumptions based on prior experience are as follows:

Number of schools: 24

Students per school per year group: 60

Pre-post correlation (squared): +0.60

Intraclass correlation: 0.15

Criterion for statistical significance: $p < .05$

Based on these assumptions a minimum detectable effect size (MDES) of 0.20 could be detected with a probability in excess of 0.80, so this sample size is appropriate.

Analysis plan

These analyses will address not only the overall assessment of the effectiveness of the Flipped Learning approach, but also the question of whether the approach works with particular pupil groups, and will in this way help to inform future decisions about a potential expansion or roll-out of the approach.

After the main analyses including all pupils, subgroup analyses will be carried out for boys and girls, for high, average and low achievers, and for pupils eligible for Free School Meals (FSM). As noted above, the KS2 mathematics score will be the primary outcome measure but English and overall KS2 scores, and attendance, will also be used as secondary outcomes. Where the pupils have a different teacher in Year 6 we will continue to use these pupils' data, since Flipped Learning is a generic approach in mathematics and its impact should continue into Year 6. We understand that data on pupils' engagement with the Flipped Learning VLE will be available and we will include this in our statistical analyses, looking at their degree of engagement to see if this has any impact on outcomes.

Process evaluation methods

The process evaluation will aim to develop an understanding of the context of the Flipped Learning approach and of the day-to-day delivery of the project. This aspect of the evaluation will help to assess the fidelity of the intervention. By means of 'triangulation', the data collected will also help to inform and explain some of the impact evaluation findings.

The process evaluation will have four linked elements: (1) face-to-face interviews with key members of staff at Shireland Collegiate Academy; (2) an on-line staff survey, for all participating schools (in both treatment and control groups); (3) ten individual telephone interviews with a sub-sample of participating staff; (4) four full-day school visits to include, where possible; (a) lesson observations; (b) focus group interviews with a sub-sample of participating staff; and (c) focus group discussions with a sub-sample of participating pupils.

(1) Face-to-face **interviews with implementation staff** will also be conducted, at an early stage in the evaluation, at Shireland Collegiate Academy, in order for the research team to develop a detailed understanding of the aims, nature, and development process of the Flipped Learning approach. These are likely to be with the Principal and the Head of ICT and any trainers or other key staff at the academy.

(2) The first **on-line staff survey** will be administered around Easter 2014, to provide "baseline" views. The second survey will be administered towards the end of the Flipped Learning evaluation, around Easter 2015. Assuming two classes per school, across 24 schools, we anticipate that the sample will consist of up to 48 school staff. The survey will be administered to both treatment and control schools with a common core of questions to facilitate comparisons. The survey questions will

be drafted in consultation with Shireland Collegiate Academy staff. Topics to be covered by the survey will include:

- details of the school context and context for mathematics teaching;
- age, experience, roles and qualifications of school staff;
- patterns of achievement in the school generally and in mathematics as a subject;
- any previous experience of other mathematics approaches or interventions;
- current approaches to teaching mathematics;
- views about methods for teaching and learning mathematics, e.g. whiteboards, textbooks, e-learning, blended learning;
- (for treatment schools) views about the programme; challenges and successes in the Flipped Learning approach; whether the approach appears to be more or less suitable for any pupil groups (e.g. high-ability pupils); and
- (for control schools) the extent to which new technologies are used in mathematics teaching and learning; how they are used; what works in mathematics teaching.

The survey findings will be analysed cross-sectionally (comparing control and treatment schools at one point in time) and longitudinally (comparing views over one year). The use of an analytical framework will guide these processes, and will also enable the qualitative and quantitative data for the same schools to be matched.

(3) In order to collect more detail than a short survey would permit, we also propose to conduct ten individual **telephone interviews** with primary school staff who are participating in the Flipped Learning intervention. The individual telephone interviews will be with the key member of staff at each of ten participating treatment schools. We propose that these should take place about half way through the intervention (around September to October 2014) so that some formative evaluation findings could be produced.

(4) The evaluation team will also carry out four full-day visits to schools participating in Flipped Learning. These visits will include, where possible; (a) a lesson observation to see how Flipped Learning is put into practice; (b) a focus group interviews with a sub-sample of between three and six participating staff; and (c) focus group discussions with a sub-sample of between five and eight participating pupils. The observation and discussion schedules will be developed in consultation with Shireland Collegiate Academy staff.

The process evaluation will provide information to Shireland Collegiate Academy and to the EEF about school staffs' and pupils' views of the Flipped Learning project, and what they might see as strengths and weaknesses in this approach.

PERSONNEL

Peter Rudd, PhD. Principal Investigator. Peter is a Reader at the IEE focusing on the theme of overcoming educational disadvantage. Formerly a teacher of mathematics and Principal Research Officer at the National Foundation for Educational Research (NFER), he has expertise in the areas of school improvement, school effectiveness, and strategies for raising attainment, particularly those using new technologies. Peter has a wide range of research skills and experience, from conducting interviews and classroom observations through to carrying out large-scale surveys and randomised-controlled trials. He has previously led research teams carrying out the national survey of schools' uses of ICT (for Becta), and projects on the use of Virtual Learning Environments (VLEs), Computers for Schools, e-safety and e-maturity.

Robert Slavin, PhD. Project Adviser. Professor Robert Slavin is currently Director of the Center for Research and Reform in Education at Johns Hopkins University in Baltimore and Professor at the IEE at the University of York. Professor Slavin has authored or co-authored more than 300 articles and book chapters on such topics as technology-enhanced learning, co-operative learning, school reform, research reviews, and evidence-based reform. He is the author or co-author of 24 books, including Educational Psychology: Theory into Practice. He has received many awards, including the Palmer

O. Johnson award for the best article in an AERA journal in 1988 and 2008 and the AERA Review of Research Award in 2009.

Sarah Blower. Research Associate. Sarah Blower has recently been recruited to the IEE, having previously worked for nine years at the Social Research Unit, Dartington. Sarah has much experience of a variety of research, development and dissemination projects and is in the final stages of completing a PhD. Supervised by the Principal Investigator, she will work on all aspects of the project, assisting with communications with schools, design of the teacher survey and interview schedules, data collection, and the writing of reports.

Alan Cheung, PhD. Data Analyst. Alan Cheung is an Associate Professor in the Department of Educational Administration and Policy, at The Chinese University of Hong Kong. He is also an Honorary Fellow of the IEE and has worked with the IEE for many years, specialising in data analysis and data modelling. He has conducted systematic reviews of the use of ICT to improve learning.

Louise Elliott. Data Manager. Louise Elliott is the Data Manager at the IEE, where she manages all database organisation, data entry, cleaning and descriptive statistical analyses conducted in the research work. Louise is very experienced at implementing, administering and collecting data from school tests.

RISKS

There are two main risks. Firstly, recruiting enough schools to take part in the trial groups (and avoiding attrition) may be difficult. IEE staff experience suggests that fully explaining to schools what the trial involves helps with the recruitment and retention of schools. Also, the promise of delayed treatment should help to keep control schools engaged in the evaluation. The sample size of 24 schools is realistic and should be achievable.

The second risk is to do with the nature of the “usual mathematics teaching and learning” in the control schools. All schools use new technologies to some extent and the control schools may, for example, use tablets, iPads and VLE-based homework or assignments in their mathematics classes. This is something that can be monitored through the use of the on-line teacher survey. In addition, the research team feels that the Flipped Learning approach is so new and so different to other approaches, that it is distinctive enough to be assessed robustly in this treatment-control group design.

Data protection statement: data will be handled in accordance with the Data Protection Act (1998). All outputs will be anonymised so that no schools will be identifiable in the report or dissemination of results. Statistical databases will hold non-identifiable data. Confidentiality will be maintained and no one outside the evaluation team will have access to the database. The trial database will be securely held and maintained on the University’s research data protection server. Ethical approval for this study will be sought through the Ethics Committee of the Department of Education, University of York.

TIMELINE

Initial work with teachers (i.e. Shireland staff working with the primary school teachers to set up the intervention) will commence in the spring term of 2014. The full intervention will commence at the start of the summer term (28 April, 2014) and will be implemented over a 12-month period.

	Autumn Term 2013	Spring Term 2014	Summer Term 2014	Autumn Term 2014	Spring Term 2015	Summer Term 2015	Autumn Term 2015
Work with Shireland Collegiate Academy to recruit schools							
Randomly assign schools to treatment and control groups							

Online school staff surveys							
Collect and analyse pre-intervention data (KS1 scores for pupils)							
Administer and analyse GL Assessment maths test data							
Interviews with key Shireland staff and trainers							
School visits (x4): lesson observations & focus groups with school staff & pupils (x4)							
Individual tel interviews with participating school staff (x10)							
Collect and analyse post-intervention data (KS2 scores for pupils)							
Further analysis phase (all evaluation data)							
Write reports							