Evaluation of Edge Hill University's 'Learner Response System' – Protocol
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Team Members

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EVALUATION SUMMARY

Evaluation Summary	
Age range	Primary (years 5 & 6)
Number of pupils	9600
Number of schools	100
Design	Randomized controlled trial, with randomization at school level
Primary Outcome	Key stage 2 English and Maths attainment on SATs

Background

This study provides an opportunity to test the effectiveness, acceptability and fidelity of a classroom based programme which utilize electronic hand held devices. The LRS approach is based on the premise that timely and focused feedback is a powerful tool to facilitate learning. The overall objective is to improve the pace and quality of feedback and associated intervention by teachers. Feedback is conceived to be two-way; learners can respond to questions and instantly be told if they have made a mistake, and receive suggestions as to how they might rectify that mistake. In addition, teachers receive feedback on how each learner is progressing - for example, how long they are taking with each question, how many attempts they need, where they are going wrong. This is meant to provide information to the teacher on which elements of a topic pupils understand or find challenging, so that they can adjust their approach and feedback accordingly within the lesson and target support at struggling pupils.

Intervention

The Learner Response System (LRS) intervention, devised by Edge Hill University, will provide year 5 and 6 primary school pupils in intervention schools with hand-held electronic clicker devices (ActivExpression, by Promethean) to provide immediate feedback to the pupils and their teachers.

The project will supply handsets for each year 5 and year 6 pupil. All year 5 and 6 teachers from programme schools will be provided with a 2-day baseline training, then with one training day per half term for one school year (6 training sessions). The training sessions will cover both technical issues as well as ways in which the handsets can be used (e.g. lesson plans).The Edge Hill project team will provide a staff member to be on-call to deal with problems being faced by schools.

It is expected that the LRS will be used in classrooms in a variety of ways. It can be used as part of a group activity, for instance as a tool to assess prior knowledge or as a plenary to plan for next steps. Alternatively, learners can follow self-paced tasks and their responses can be monitored by the teacher to assess progress of each individual and target intervention as necessary. Questions can be set at different levels and the system can be configured to automatically move learners onto a higher level if they are answering lower level questions correctly, thus allowing the teacher to differentiate learning. Results of self-paced tasks are automatically saved by the system, so could potentially save teacher time on marking. The intervention will require teachers to use the handsets in a minimum core set of maths and literacy lessons each half term, but will encourage the use of the handsets in other, more advanced and/or creative ways.

Research Design
The study will be carried out using a randomised controlled trial design in 100 primary schools in the North West and West Yorkshire regions of England. This impact study will be combined with an integrated process evaluation that has the scope to provide valuable insight into why the intervention has, or has not, had the intended impact on attainment, as well as explaining the variation in use of the LRS by different teachers.

Research questions
The primary research question we will set out to answer is: What is the effect of *LRS* on children's achievement in mathematics and literacy? The evaluation will also investigate:

(i)   whether treatment effects differ across certain demographic groups (e.g. boys versus girls, those with/without free-school meal eligibility);
(ii)   whether there are heterogeneous treatment effects across the academic achievement distribution.

Design
This will be a stratified, clustered randomised control trial – with random allocation occurring at the school level.

The Institute of Education (IOE) along with the Edge Hill and Education Endowment Foundation (EEF) teams have defined the population of interest as students in primary years 5 and 6. These years were selected as most appropriate given that: pilot work with the LRS

was positively reviewed for these year groups as having potential for impact on attainment; and ,pragmatically, because it allowed for the timely use of standardized attainment data (end of year 6 SATs) as the primary outcome measure.

Selecting the sample frame

In the first instance, specific geographical areas in England (certain local authorities (LAs)) will be selected by the Edge Hill team where they have capacity to deliver the intervention. These LAs fall within the North West and West Yorkshire regions. The Institute of Education will then produce a list of all primary schools within these geographic regions. Independent schools, schools where LRS already operates, and schools taking part in another Edge Hill EEF funded evaluation (The Lesson Study project) will be excluded. For logistical reasons, it has been agreed that only one- and two-form entry schools will be included in the evaluation. The population of interest will be further restricted to schools with a high intake of disadvantaged pupils, based upon the percentage of children receiving Free School Meals (FSM) (this has been set initially to at least 70 percent of Key Stage 2 pupils who had been eligible for FSM in the last six years or are 'Looked After' by the local authority continuously for 6 months, as specified in the 2011 DfE's schools performance tables[1]) as this group is of particular interest to EEF. Thus the population of interest is defined as all year 5 and 6 state school pupils within the selected geographic regions, who attend a one- or two-form entry primary school, with a high proportion of disadvantaged pupils and whose school does not currently run the Edge Hill University team's LRS or Lesson Study programmes.

A list of schools meeting this criteria will be produced by the IOE and provided to the Edge Hill University team, who will send all of these schools a letter inviting expressions of interest. They will follow non-responders with phone calls. Interested schools will then be sent a further information sheet, a memorandum of understanding, and an Excel sheet for recording of prospective year 5 and year 6 pupil information. The recruitment period will run from January to early May 2014. The Edge Hill team will aim to recruit 100 schools. If the Edge Hill team cannot recruit this number from the initial list of provided schools, IOE will produce a list of additional schools which meet, as closely as possible, the same inclusion criteria, but with a slight relaxation of the FSM percentage, to 55-60%.

The IOE statistician (Jerrim) will stratify and randomly assign recruited schools to treatment and control groups in May 2014. This will be done approximately one week after receiving the full list of schools that have been recruited into the study. Schools will firstly be stratified into different groups by Key Stage 2 maths and English scores at the school level in 2013. Using a random number generator in STATA, schools will then be randomly selected from within these strata into either treatment or control groups. A 50/50 allocation fraction shall be used. All children in year 5 and 6 classes in treatment schools will be required to use the programme to avoid selection problems.

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[1] See http://www.education.gov.uk/schools/performance/metadata.html

We regard 100 schools (50 treatment and 50 control) as the minimum necessary to achieve statistical significance of an effect of approximately 0.20 of a standard deviation of children's test scores at a 95% level confidence level. Effects of this size are often considered to be 'educationally significant' (see Bloom 2005).

This is assuming:

(i) An inter-class correlation (ICC) of $\rho = 0.15$ at the school level
(ii) Year 5 and 6 pupils only
(iii) 1 year dose and 2 year dose treated as separate interventions
(iv) Approximately 60 two-form and 40 one-form entry schools (with average of 30 pupils per form) are recruited
(v) Key stage 1 scores used as the baseline test (which we assume will explain 40% of the variance in the outcome)
(vi) Key Stage 2 scores as the follow-up test
(vii) 'Status quo' control group
(viii) 80% power for a 95% confidence interval

The schools chosen to form the control group will not receive *any* of the LRS intervention from Edge Hill for the following two years (i.e. until the academic year starting September 2016). (The process evaluation will monitor what 'business as usual' is

Children will start the intervention in September 2014. This will last one academic year (ending July 2015) for the year 6 pupils and two academic years for the year 5 pupils. All year 6 children in treatment and control schools will then take Key Stage 2 maths and English exams in June 2015 (one year after treatment) and all year 5 pupils will take these exams in June 2016. The primary outcomes of interest will be children's overall scores on the Key Stage 2 maths and English tests. Secondary outcomes will include performance on sub-domains of the Key Stage 2 tests (see page 24 of http://www.bris.ac.uk/cmpo/plug/support-docs/ks2userguide2011.pdf and differences between sub-groups (e.g. gender, FSM). The year 6 children's Key Stage 2 test scores should become available around October / November 2015 and the year 5 children a year later.

Analysis – Impact evaluation

Our analysis strategy will use intention to treat. All children in the participating year groups within the schools that are randomised will be included in the analysis. Even if a school withdraws from the intervention all the data on the children participating in the study will be included in the analyses (if possible). Similarly, as test scores will be drawn from the National Pupil Database (NPD) we should be able to track children even if they move schools part way through the school year. These children's scores will be included in the intention to treat analysis.

The mean Key Stage 2 score will be compared between treatment and control groups, controlling for children's performance on their Key Stage 1 tests (and any other important observable characteristics), with robust standard errors that take into account clustering at the school level. This will be done using OLS regression. We will adjust standard errors for clustering using Huber-White. A 95% confidence interval for the differences in test scores between the intervention and control group will be reported. The IOE will also undertake sub-group analysis focusing upon: (i) gender differences (ii) free school meals as a measure of deprivation / low income. We will also use quantile regression to investigate whether there are heterogeneous treatment effects across the achievement distribution.

Our focus shall be on children's Maths and English test scores as dual primary outcomes. Secondary outcomes are: (i) the breakdown of children's math and English test scores into performance on the separate Keys Stage 2 domains within them (ii) differences between sub-groups (e.g. gender, FSM, those who received the intervention for one/two years).

The Process Evaluation

Our process evaluation will work alongside the impact evaluation to help understand the presence or absence of treatment effects. It will also measure fidelity and acceptability of the intervention, and highlight issues relevant for future sustainability and wider implementation.

Process evaluation instrument development and analysis will be informed by relevant current evidence and the theories of change underlying the intervention, as developed by the IOE and the Edge Hill University teams. The process evaluation will address a variety of questions listed below.

(i) Research Questions

- Following LRS training, how feasible and acceptable is it for primary school classroom teachers to use the LRS in numeracy and/or literacy teaching? How does implementation of the LRS vary between teachers and schools? How much does it vary between subjects? What level of usage is achieved?
- How feasible and acceptable is it for primary school pupils to use the LRS and how do they respond to the ensuing teacher feedback response in these classes? How do the children describe the benefits to learning of using the LRS?
- How does feedback vary with use of the LRS devises? What are staff perceptions of the impact of the intervention after 1 and 2 years on the quality of feedback pupils receive and subsequent impact on outcomes in literacy and numeracy? How do staff perceive it affects different sub groups (e.g. low, medium and high attainment pupils)? What are their perceptions of facilitators and barriers to impact?

- What are pupils' perceptions of the impact of the intervention after 1 and 2 years on the quality and immediacy of feedback they receive and subsequent impact on outcomes in literacy and numeracy? How do different sub groups experience it differently (e.g. low, medium and high attainment pupils)? What are their perceptions of facilitators and barriers to impact?

(ii) Process Evaluation Design

Our process evaluation design has three main strands: an online survey with the whole sample of teachers (control and intervention); fidelity monitoring form completed by all intervention teachers; and mixed methods data collection with teachers and pupils in a number of case study intervention sites. This will provide data of both breadth and depth, while reducing fieldwork costs and demands on teacher time.

Our design contains the following elements.

1. Development of a logic model for the intervention using a Delphi-technique with the Edge Hill University team. This will involve three stages to determine a consensus amongst programme developers regarding the inputs of the intervention, the short term outputs and how these relate to the intended attainment outcomes. Questionnaires will be sent to key individuals at Edge Hill; answers will be compiled and a follow up questionnaire developed from the initial responses, asking for confirmation and ranking of the original responses. A logic model will be developed from responses and this will be circulated for further comment and refinement.
2. Observation by a researcher of: one initial 2-day teacher LRS training session (June 2014); four half termly training sessions near the start of the first year of the intervention (i.e. approximately October 2014); and four late training sessions in the first half term of the summer term in approximately May 2015). This will enable inclusion of the year 5 teachers who will cease to be part of the intervention in the 2nd year of the study.
3. Online survey of all class teachers at end of the one year intervention period. All teachers (control and intervention) will be asked to provide relevant background information on themselves and their class and any previous experience of using LRS or other feedback mechanisms. They will also be asked for their views of taking part in the study. Teachers in the intervention arm will, in addition, be asked questions on their experience of the training and the delivery of the intervention. The questions regarding the intervention will be informed by case study interviews (described below) and will set out to determine the range of ways that the LRS has been implemented. For non-responders we will send an email reminder and if non-response persists we will offer an alternative of a postal questionnaire or completion over the telephone.
4. Fidelity monitoring proforma. At each of the half termly training events that all intervention teachers will be attending, they will be asked to complete a form to show to what extent they have been delivering the LRS tasks taught at the previous training session. This will be primarily a quick quantitative exercise though we will include free text boxes to allow for comments. The completed forms will be placed together in a large SAE and posted to the research team to ensure confidentiality.

5. In-depth assessment within six case study sites. We will purposively select six case study sites from within the intervention schools. Selection will try to ensure a range of geographic locations, school average attainment levels, FSM eligibility and levels of enthusiasm for the intervention (as determined by fidelity monitoring exercise at teacher training session, October 2014). In each case study site we will carry out a total of two site visits – once in the first year of intervention and once in the second. The following components will be included for each case study:

   - **Observation of classes using LRS.** One researcher will carry out non-participant observation in order to describe the different methods of delivery of the intervention. This will also provide some data on how the intervention is received and utilised by the children.

   - **Interviews with year 5 and 6 teachers** (either face to face during site visits; or subsequently over the telephone). These will provide detailed information about the different ways in which the LRS is being used in the classroom, teachers' perceptions of its usefulness and for subsequent lesson planning, feedback and work with individual students. These will explore teacher perceptions of impact on students with different levels of attainment. In the 2nd year of the intervention the year 6 teachers will be re-interviewed, to assess how their use, and also perceptions, of LRS has modified with additional use.

   - **Focus groups with year 5 and 6 children.** We would suggest running a focus group to gain their views on the acceptability and usefulness of the LRS. Other options include using the LRS to ask children across the year 5 and 6 classrooms in the case study schools a series of short questions about their views of the intervention.

   - **Interviews with head teacher (or another SLT member) and LRS trainer.** The head teacher will be interviewed (either face to face during site visits; or subsequently over the telephone) to determine how keen the school has been about the LRS intervention, wider possibilities for use and sustainability issues. The LRS trainer will be interviewed to explore the perceived level of enthusiasm and competence of case study teachers to use the LRS.

Interviews and focus groups will be digitally recorded. Notes will be taken during the interviews and typed up afterwards. This will be supplemented with selective transcription to ensure accuracy of quotes. These data collection decisions are informed by our previous experience and based on an awareness of the high cost of transcribing interviews.

(iii) Analysis – process evaluation

We will use Framework Analysis for the analysis of the qualitative data. This involves the construction of frameworks based on key themes that answer the main research questions. This method affords the possibility of exploring the data by both theme and respondent-

type, so we might better describe and explain the data through the identification of patterns and associations across and between themes and types of respondents.

We will carry out descriptive statistical analysis of the teacher surveys and the fidelity monitoring data using SPSS.

A range of strategies will be used to integrate the analysis of the different types of process and impact data to answer the evaluation research questions.

Ethical considerations

The study has gained Ethics approval from the Institute of Education's Faculty Research Ethics Committee.

All parents in intervention and control schools will be sent an information letter in which the study will be described, including the use of NPD data at baseline and follow up, and the archiving of this data in the EEF and UK data archives. Parents will be asked to give back a tear off slip to a named contact at the school if they wish to have their child opted-out of the study.

The Project Team

The project will be lead by **Meg Wiggins**, Senior Research Officer in the Social Science Research Unit at the Institute of Education. Meg will oversee the impact and process evaluations, conduct process evaluation analyses and lead on the study report.

 Dr John Jerrim, a Lecturer in Economics and Social Statistics at the IoE, will be involved in the design of the impact study, the randomization of the schools, and will carry out the analysis of the NPD data.

Mary Sawtell, an experienced Research Officer who has recently worked on the EEF Chess in Schools evaluation will lead the process evaluation and manage a junior research officer.

Dr Eleanore Hargreaves will contribute her extensive research expertise into teachers' classroom feedback and pupils' experiences of classroom learning to the research conceptualization and analysis of the data collected. Her many years of experience in interviewing primary aged children will also be an important asset and she will conduct some of the case study visits.

Risks to the Evaluation

The following table summarises the main risks to the evaluation and how they might be addressed.

Risk	Means of minimising risk
Difficulties in recruiting and retaining sufficient numbers of schools	The evaluation team will work with the Edge Hill project team to develop recruitment materials that are clear about both the

	intervention and the evaluation responsibilities. The evaluation has been designed to limit disruption to schools to minimise drop out.
Contamination of random allocation	Through the process evaluation we will monitor the degree to which programme schools use the handsets and deliver the intervention. Additionally we will determine from control schools what 'business as usual' is in relation to the use of electronic handsets in classrooms.
Unexpected absence of research team members	Research team members will cover for short term absence. IOE has a large staff team from which to fill any longer term absences of evaluation staff.

The IOE has developed systems to ensure that we comply with the data protection act in terms of data security and research ethics. This involves the use of password protected computers, limited access drives, the use of ID codes instead of names on data, encryption and password protection of sensitive documents, lockable filing cabinets for storing paper files and secure entry to our office building (which does not have any public access).

Timeline

Dec 2013- May 2014	Schools recruited into trial including agreement of data access for NPD; treatment and control schools assigned
May – July 2014	Intervention head teacher event; Treatment teacher's baseline 2 day training. Observation of one of these training sessions.
September 2014	Parental information and opt-out consent sheet distributed Trial intervention begins in years 5 and 6 Development of logic model using Delphi technique.
September 2014 – July 2015	1 day training per each half term for all treatment teachers; researcher observation of four in October 2014 and four in May 2015; teachers complete fidelity monitoring sheet at training days.
February – April 2015	Case study site visits for class observation, teacher interviews & child focus groups. Interview with LRS trainer
May - June 2015	On-line survey of teacher (years 5 & 6; intervention and control)

May 2015	Year 6 children (1 year of intervention) sit Key Stage 2 SATS exams (numeracy/literacy)
September 2015	Trial intervention continues for second year for previously year 5 pupils, now in year 6.
December 2015	IOE receive NPD data on 1st (1-year) cohort –
February 2016 - March 2016	Case study site visits for class observation, teacher and head teacher interviews & child focus groups. Interview with LR trainer
May 2016	Year 6 children (2 years of intervention) sit Key Stage 2 SATS exams (numeracy/literacy)
December 2016	IOE team receives NPD data from 2nd (2-year) cohort.
December 2016 – April 2017	IOE analyses data and writes final EEF report
April 2017	EEF report submitted

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