Evaluation of *Chess in Schools* – Protocol (26/07/13)

Significance

The intervention will investigate whether teaching primary school pupils to play chess for one hour a week over 30 weeks (during normal school time) boosts academic achievement. The intervention will target year 5 pupils in purposefully selected areas of England. The Institute of Education will conduct an independent evaluation using a clustered randomised control trial (RCT). The evaluation focus is on establishing an unbiased estimate of impact of the intervention on academic achievement tests (maths, English and science) one year after the intervention has finished. This is combined with an integrated process evaluation that has the scope to provide valuable insight should the intervention prove successful (or, should it not appear successful, why this might be).

Research plan: Impact evaluation

Research questions

The primary research question is: What is the impact of *Chess in Schools* on children's achievement in mathematics? The evaluation will also investigate:

(i) whether there are spill-over effects to other subjects (e.g. English)
(ii) whether treatment effects differ across certain demographic groups (e.g. boys versus girls, Free School Meal status)
(iii) whether there are heterogeneous treatment effects across the academic achievement distribution

Design

The Institute of Education along with the Chess in Schools team will define the population of interest. Specific geographical areas in England (certain LA's) will firstly be selected by Chess in Schools and Communities (CSC) where they have capacity to deliver the intervention. These areas are:

- The City of Bristol
- Hackney
- Hammersmith and Fulham
- Leeds
- Liverpool
- Middlesbrough
- Newham
- Sefton
- Sheffield
- Southwark
- Tameside

The Institute of Education will then produce a list of all primary schools within these geographic regions. Private schools and schools where CSC already operate will be excluded. For logistical reasons, it has been agreed that any primary school with four-form entry shall not be included in the evaluation. We have therefore also excluded schools with more than 90 pupils currently aged 11 from the sampling frame (working on the assumption that there are approximately 30 pupils per class within primary schools and that year group size within schools does not significantly change within a short space of time). Any school that CSC approaches with four form entry shall we excluded from the study. 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. (This has been set to at least 37 percent of Key Stage 2 pupils who have been eligible for FSM in the last six years or who have been looked after by the local authority continuously for 6 months)[1]. Thus the population of interest is defined as all year 5 state school pupils within the selected geographic regions, who attend a one, two or three form entry primary school, with a high proportion of disadvantaged pupils and whose school does not currently run the CSC programme.

This final list of schools produced by the IoE will contain approximately 450 schools and shall act as the sampling frame. CSC will then attempt to recruit 100 out of these 450 schools by the 3rd week June 2013. CSC will send all interested schools an information pack – those that decide to take part will complete a consent form to participate in the study and allow access NPD form and an Excel sheet of prospective year 5 pupil information prior to randomisation.

Under the assumption that 100 schools are recruited, the IoE will decide in June 2013 which schools will be in the treatment group and which will be controls. They will do this approximately one week after receiving the list of 100 schools that have been recruited into the study. This will be a stratified, clustered randomised control trial – with random allocation occurring at the school level. Schools will firstly be separated (stratified) into different groups by important observable characteristics (e.g. historical key stage 2 math scores at the school level, percentage receiving free school meals). Schools will then be randomly selected from within these strata into either treatment or control groups. A 50/50 sampling fraction shall be used. All children in Year 5 treatment schools will be required to use the programme to avoid selection problems.

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 in maths test scores at a 95% level confidence level. Effects of this size are often considered to be 'educationally significant' (see Bloom 2005).

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

This is assuming:

(i) An inter-class correlation (ICC) of $\rho = 0.15$ at the school level
(ii) Year 5 pupils only
(iii) An average of two forms of 30 children per class = 60 children per school
(iv) Key stage 1 scores used as the baseline test (which explain 40% of the variance in the outcome)
(v) Key Stage 2 as the follow-up test
(vi) 'Status quo' control group
(vii) 80% power for a 95% confidence interval

A condition of the trial is that all schools chosen to form the control group will not receive *any* CSC treatment for the following two years (i.e. until the academic year starting September 2015). Control schools will, however, be allowed to receive the treatment after this point.

Children will start the intervention in September 2013. This will last one academic year (ending July 2014). All year 5 children within all treatment schools will be treated. All children in treatment and control schools will then take Key Stage 2 maths and English exams in June 2015 (one year after treatment). The primary outcome of interest will be children's overall scores on the Key Stage 2 maths test. Secondary outcomes will include (i) performance on Key Stage 2 English tests (ii) performance on Key Stage 2 Science tests (where available) and (iii) performance on sub-domains of the Key Stage 2 Maths test (see page 24 of http://www.bris.ac.uk/cmpo/plug/support-docs/ks2userguide2011.pdf). Children's Key Stage 2 test scores should become available around October / November 2015. The Institute of Education will produce the final report by the end of April 2016.

Analysis

Our analysis strategy will use intention to treat. All children in the participating year group 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.

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 pre-treatment characteristics), with robust standard errors that take into account clustering at the school level. This will be done using OLS regression. 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) a measure of deprivation / low income (e.g. Free School Meals). 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 test scores as the primary outcome. Secondary outcomes are: (i) the breakdown of children's math test scores into performance on the two separate Key Stage 2 maths papers (ii) children's English test scores (iii) children's science test scores (where available).

Process evaluation

Our process evaluation will have three purposes. First, we will assess the fidelity of delivery of the intervention, which is a prerequisite for any anticipated effect to be realised successfully. Second, we will address research questions related to the feasibility of the intervention proposed by Chess in Schools. Third, we will work alongside the impact evaluation to help understand why the treatment effects were observed (or not).

(i) Research Questions

- How feasible and acceptable is it for chess coaches to implement a 30 week classroom chess intervention in year 5 of primary school? Could teachers who attended training and helped with the intervention continue to teach chess afterwards?
- How feasible and acceptable do teachers and head teachers feel it is for primary school children to play chess in class as part of the curriculum?
- What are the views, on the intervention, of the children who were offered it? How do these vary by different subgroups (e.g. boys vs. girls, ethnic groups)?
- What are staff perceptions of the current and possibly sustained impact of the intervention on children's educational attainment? How do they think it affects different sub groups ? How do they think it impacts on other matters such as class cohesion and school ethos? What are their perceptions of facilitators and barriers to impact? How scalable do they think the intervention is? What are their suggestions for change if the intervention was to be more widely implemented?

(ii) Proposed design

1. Observation of a small number (e.g. 2) of the training sessions for teachers. One researcher will carry out non-participant observation in order to describe the training process and assess feasibility and satisfaction from the perspectives of trainers and trainees.

2. Online survey of all class teachers towards the 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. They will also be asked for their views on taking part in the study. Teachers in the intervention arm will, in addition, be asked questions on their experience of the CSC teacher training and the delivery of the intervention, including their views on fidelity to original intervention plans. 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 phone.

3.Survey of head teachers. All head teachers (control and intervention) will be asked to provide relevant background information about themselves and their school prior to the

intervention (and where possible prior to randomisation) via a brief postal survey. Head teachers in the intervention group will be asked, via an online survey towards the end of the intervention, for their views on the organisation, delivery and impact of the intervention. Non-response will be managed as with teachers.

4. Online survey of all Chess coaches at the end of the intervention period. All coaches will be asked to provide relevant background information about themselves, their chess playing and teaching experience. They will also be asked for their views on the delivery of the intervention in all the different study schools in which they are working. Non-response will be managed as with the teachers.

5. Telephone interviews (up to 15 at half an hour each) with individuals purposively selected by the research team from the following categories: teachers, head teachers, project organisers at Chess in Schools, and chess coaches. These interviews will provide the opportunity to clarify issues of interest arising from other sources of data. Interviews 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.

6. Observations of a chess session in four schools. One researcher will carry out non-participant observation in order to describe the delivery of the intervention and to acquire insights into fidelity. This will also provide some data on how the intervention is received by the children. Purposive selection of the schools by the research team will ensure geographic spread and a range of school characteristics (as determined by initial head teacher survey and prior attainment levels).

7. Questionnaire with year 5 children in intervention schools. All year 5 pupils in intervention schools will be asked to complete a very brief (one side A4) post intervention questionnaire. This will ask about the pupil's previous involvement (prior to the CSC intervention) with/interest in chess playing (in & outside of school); whether they enjoyed the chess lessons; and about frequency of continued chess playing. These questionnaires will be distributed by the class teacher in year 6 – approximately 7 months after the chess lessons finish. As we would like to link these responses to the NPD data on attainment, we will ask the children to put their completed questionnaire in an envelope and seal this, then write their name in pencil on the envelope. We will ask that someone at the school adds the unique pupil number of the child on the sealed envelope, and erases the pupil's name. Participation will be optional for the students, and parents will have been given an opportunity to opt them out of this exercise, should they desire.

(iii) Analysis

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 analyses of the teacher, head teacher, coach and pupil surveys.

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

Personnel

Statistical evaluation - John Jerrim, Lindsey Macmillan, John Micklewright
Process evaluation - Meg Wiggins, Mary Sawtell, Anne Ingold

Evaluation Timeline

April 2013:

- IoE to create a population list / sampling frame of state primary schools within these regions
- IoE to produce a school consent form for NPD linkage
- IoE to produce a template spreadsheet for schools to complete with basic pupil details (UPN, date of birth etc)
- IoE to produce a one page information sheet about the trial for schools
- IoE to submit ethics application to ethics committee

May 2013:

- CSC to start recruiting the 100 schools needed for trial
- Review of number of schools CSC has managed to recruit. Make final decision on whether a "two-round" strategy is more appropriate.

June 2013:

- CSC provides IoE with a list of 100 schools participating in the study by the start of the 3rd week of June
- IoE sends head teachers brief postal survey
- IoE stratifies sample and randomly assign schools into treatment and control groups by start of the 4th week of June
- CSC informs schools of their treatment / control outcome.

August 2013:

- IoE to register the trial
- IoE to submit the protocol

September 2013:

- Schools to update key information spreadsheet if needed
- IoE to approach DfE about providing NPD data
- CSC treatment begins
- Observations of teacher training sessions

March 2014
- Observations of classroom chess sessions

June 2014:
- CSC treatment ends
- On-line survey with teachers and headteachers (intervention)

July 2014
- Telephone interviews (with teachers, coaches, etc)
- Survey with year 5 intervention children

June 2015:
- CSC children sit their Key Stage 2 exams

November 2015:
- Key Stage 2 test results become available

April 2016
- IoE completes report for EEF

Roles of the organisations

Chess in Schools

- Recruit 100 schools and provide this list to the Institute of Education.
- Jointly write with the IoE a consent letter for schools to sign.
- Get permission from schools for the Institute of Education and the EEF to use / link pupils Unique Pupil Number / Key Stage test score information.
- Implement the CSC trial

- CSC coaches to conduct any fieldwork required for questionnaires.

Institute of Education

- Randomly allocate schools
- Conduct statistical analysis.
- Conduct process evaluation
- Write final report for EEF.

EEF

- Project overview
- Assist with permission to use NPD data for purpose of the evaluation.