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Protocol: An efficacy randomized controlled trial of Reciprocal Reading in high schools

Abstract

This paper presents the research protocol for an efficacy randomized controlled trial of the Reciprocal Reading program in high schools. The program is a workforce development program that supports Teachers and Teaching Assistants develop and deliver targeted reading comprehension instruction to high school students aged 11-13. The protocol outlines a Level 2 exploratory randomized controlled trial research design to assess whether the program delivered over approximately 6 months improves reading outcomes, in a sample of 311 children from 14 schools in four English districts with high socio-economic disadvantage. The primary outcome measure for analysis is reading comprehension with secondary outcomes of overall literacy and reading accuracy. A process evaluation will measure fidelity to implementation and potential for scale-up.

Key Words

Reading; Comprehension; High School; Teacher Training; Literacy; RCT

1. Background

Reading is recognized as a key skill for success yet statistics from 2014 show that one in five children in England cannot read well by age 11 (Department for Education, 2015). By age 15, about 20% of students in OECD countries, on average, do not attain the baseline level of proficiency in reading, considered the level of proficiency at which students begin to demonstrate the reading skills that will enable them to participate effectively and productively in life. In the United Kingdom, as a whole, 18% of students perform below Level 2 in reading. There is therefore both national and international interest in improving reading comprehension levels (Organisation for Economic Co-operation and Development, 2017; The United Nations Educational, Scientific and Cultural Organization, 2009).

There is extensive research in respect of interventions to improve reading skills, specifically at word level, although the quality of the studies in this body of work varies (Snowling & Hulme, 2012). Comprehension instruction in classrooms is a further strategy for improvement in reading and existing interventions include Inference Training (Kispal, 2008) and reciprocal reading (Palincsar, 1982). Reciprocal reading has been implemented mostly in the US and New Zealand, with a range of studies reporting positive outcomes from reciprocal reading training programs (Palincsar, 1982; Palincsar & Brown, 1984; Rosenshine & Meister, 1994; Sporer, Brunstein & Kieschke, 2009; Crawford & Skipp, 2014). Rosenshine and Meister (1994) found an effect size of +0.32 when standardized tests were used across sixteen studies with varying designs, and a more recent randomized controlled study in 41 schools in the UK showed a more modest positive effect of +0.09 (Crawford & Skipp, 2014). The Education

Endowment Foundation in 2017-18 funded a large RCT of 100 primary schools in England to test the impact of Reciprocal Reading delivered by Fischer Family Trust Literacy, based in the North East of England (O'Hare, Stark, McConnellogue, Lloyd, Cockerill & Biggart, 2018).

The following protocol describes a Medical Research Council Level 2 efficacy/exploratory randomized controlled trial (Medical Research Council, 2000) study aimed at evaluating the impact of the Reciprocal Reading program on students' attainment in reading comprehension on a targeted basis, when used at the secondary stage in education. This study has been funded by the Strategic School Improvement Fund from the Department for Education in England.

2. The Intervention

The Fischer Family Trust Literacy (FFTL) Reciprocal Reading program for secondary age pupils aged 11-13 was developed in 2018, adapted from the previously existing program for 8-11 year olds in primary schools (O'Hare et al, 2018). The intervention is delivered by practicing teachers and teaching assistants in mainstream UK settings for pupils aged 11 to 13 years during the first two years of secondary education, and workforce development is an essential part of the program. All teachers and teaching assistants involved in delivering the program receive two days off-site training from FFTL, who also provide on-site advisory support during delivery of the program (half day in schools). The training covers the knowledge, skills and understanding that practitioners need to deliver the FFTL Reciprocal Reading program in a targeted format. The training covers an understanding of the nature of reading comprehension and an evidence-based package of strategies as well as instructional components, such as how to conduct reciprocal reading sessions and associated issues such as choices of texts and the use of planning and recording sheets.

Reading comprehension instruction to the identified small group of students is teacher-facilitated using collaborative reading of texts. The task is the use of evidence-based strategies - predicting, clarifying questioning and summarising - modelled by the teacher and used collaboratively between teacher and students and students and students, to derive meaning from the text. The participants are students in mixed-ability Year 7 classes who continue to receive the program when in Year 8 (aged 11 to 13 years).

Teachers and Teaching Assistants involved in this targeted reading comprehension program deliver weekly sessions of 20-30 minutes in length to small groups of students aged 11 to 13 years (Year 7 and Year 8 in secondary schools in England) who have been identified as having reading comprehension skills which are relatively weaker than their reading accuracy ('good readers but poor comprehenders'). The program is delivered over approximately 6 months (July18-January19).

This targeted FFTL Reciprocal Reading program also comprises:

a) A set of strategies – used to strategically process text;

b) An instructional dialogue;
c) Materials – texts;
d) Book journal activities;

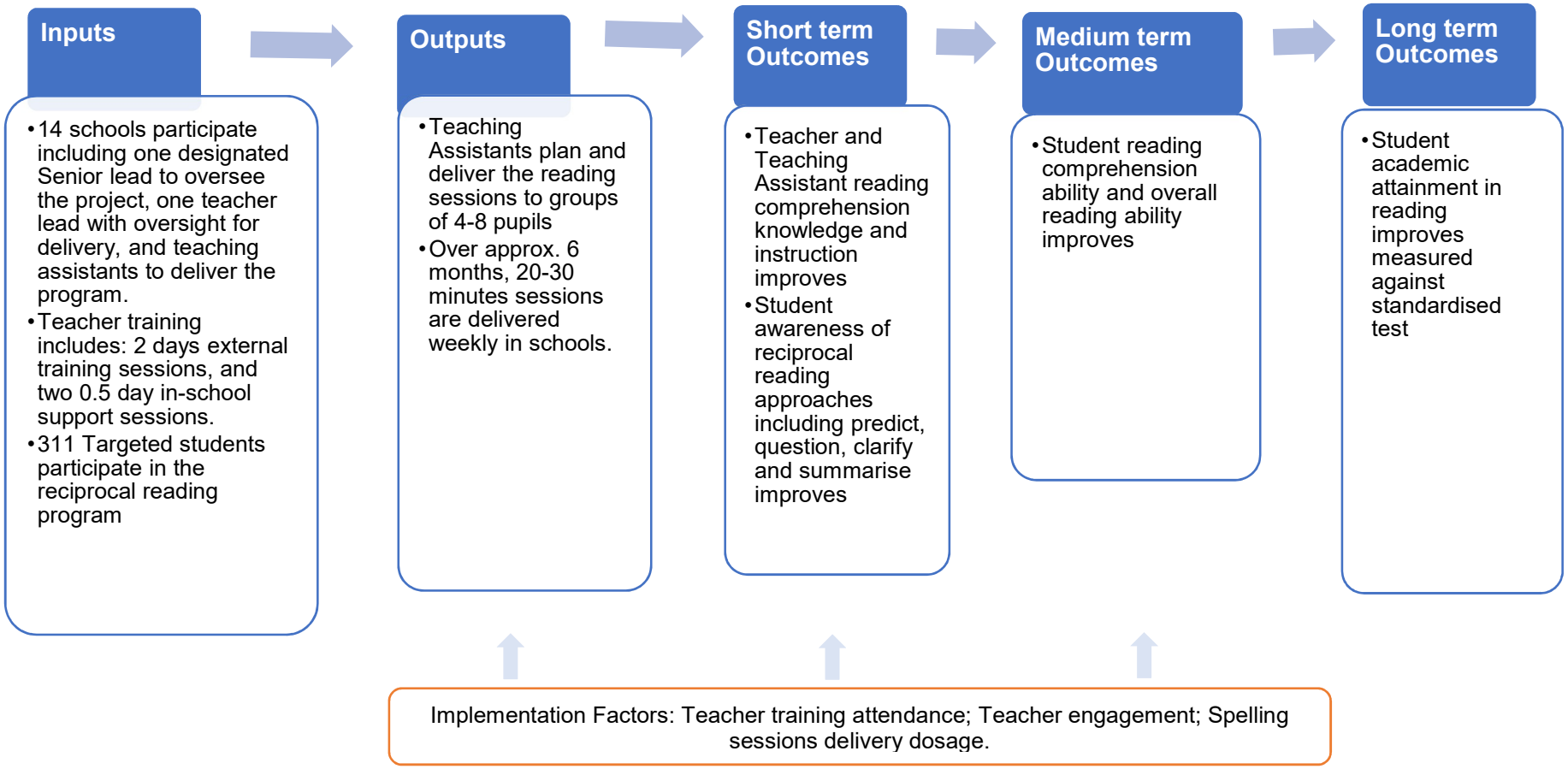
The Reciprocal Reading program is summarised in Table 1. The treatment group students (n=upto15 per school) receive the intervention, which the control group pupils (n=upto15 per school) in each of the 14 schools continue with business as usual, comprising of their normal literacy and specific comprehension instruction practices for students aged 11 to 13 years.

[Insert Table 1 here]

3. Program Theory of Change (ToC)

The logic model (Figure 1) describes the program components (Inputs, outputs, outcomes), including the theory of change, and how implementation factors relate to program outcomes.

Figure 1: Reciprocal Reading program Logic Model



3.1 Underpinning Theory of Intervention

The underpinning Theory of Intervention is as follows. As shown in logic model (Figure 1), the overall aim of the Reciprocal Reading program is to increase the reading comprehension ability of young people, resulting in improved overall reading ability. In order to achieve these outcomes teacher training is necessary to improve teacher knowledge, change professional practice of reading instruction, learn to scaffold student learning, and promote student collaboration during Reciprocal Reading. Students need to be exposed to using the Reciprocal Reading strategies (predict, question, clarify, summarise), to interrogate text working collaboratively, to develop their metacognitive ability to read with greater understanding. Training and materials for this program are based on the following underpinning theories and evidence:

Reciprocal Reading, or in prior iterations developed as Reciprocal Teaching (Palincsar & Brown, 1984) is a metacognitive, instructional approach aimed to improve reading comprehension for poor comprehenders. The Reciprocal Reading program involves a multi-strategy approach composed of four strategies to engage particular processes: predicting (making and exploring inferences), clarifying (critical evaluation), questioning (focusing on main ideas) and summarising (allocate attention and monitor understanding). This multi-strategy approach is underpinned by theories about metacognitive development which in reading comprehension is suggested could result in a higher standard of coherence (Perfetti, Landi & Oakhill, 2005).

Metacognitive skills develop when children are aged five to six and increase rapidly from the age of eight (Veenman, 2016). Skills are demonstrated through young children's emerging awareness of their memory (metamemory) and self-monitoring of understanding. Development of these skills is crucial in fostering independent learning and enables children to become active learners. A review of the impact of metacognitive strategies by the Education Endowment Foundation (EEF) suggests it has positive effects (ES+0.7) and that metacognitive development is most effective when instruction involves adult scaffolding and collaborative group work (Higgins, Katsipataki, Kokotsaki, Coleman, Major, & Coe, 2014).

The reciprocal element in Reciprocal Reading refers to the interactions that take place between members of the group that enable collaborative construction of meaning whilst reading a text (Palincsar & Brown 1986). Collaborative learning can be defined as a learning situation in which two or more students learn together to achieve a common goal or solve the task at hand, commonly through peer directed interactions where learners actively participate in group activities, while teachers usually serve as facilitators. Research shows that collaborative learning can work well for all ages if activities are suitably structured for learners' capabilities, and positive evidence has been found across the curriculum. Theories underpinning social interaction during collaborative learning have been substantively developed and described by Social Interdependence Theory (Johnson, Johnson & Roseth, 2010; Johnson & Johnson 2012). A meta-analysis undertaken some years ago by Johnson, Johnson & Stanne (2000) finds positive effects (ES +0.19 - +0.91) and more

recently the Education Endowment Foundation toolkit recommends collaborative learning as a very low-cost approach with moderate impact (ES +0.5) based on extensive evidence.

The four key strategies in Reciprocal Reading should be modelled explicitly and applied flexibly in a scaffolded manner to promote student autonomy as it is expected that students eventually lead sessions, with minimal adult involvement. The approach promotes a slow pace of reading for deeper understanding and thinking about the text (Palincsar, David, & Brown, 1989). The need for scaffolding during the modelling process in the Reciprocal Reading program is underpinned by Vygotsky's theory (1978) of learning within the 'zone of proximal development' which requires mediation and carefully directed modelling/support in small groups of learners working together to make this scaffolded learning possible. This approach is in line with research which suggests scaffolding is effective (Van de Pol, Volman & Beishuizen, 2010).

The Reciprocal Reading program aims to improve students' reading ability including with understanding through instruction in small groups using the Reciprocal Reading strategies. Social-cognitive theory, indicates that the development of higher order thinking skills inherent in reading comprehension, require a social dimension (Vygotsky, 1978; Collins, Brown & Newman, 1988). The teaching approach of Reciprocal Reading, underpinned by this theory requires students to acquire complex skills through social modelling and scaffolding which require explicit teaching (Palincsar, Ranson, & Derber, 1989). Through scaffolded dialogue teachers transfer of responsibility for active strategy-use to students (Van de Pol et al., 2010). The strategies, particularly summarizing and questioning, encourage students' own ability to monitor their understanding whilst reading text (Higgins, Katsipataki and Colemen, 2014: 13). Shared dialogues between teachers and students and subsequently between students themselves, include language to talk about the process of reading and the success or otherwise of the strategies practiced. This enables students to acquire the ability to monitor their understanding of the text, identify when they do not understand and know which of the strategies to use to repair this (Pressley, 2000). This process helps students control their approach to the reading tasks as they acquire both knowledge about the task and how to carry it out (Kucan & Palincsar, 2011). This process during Reciprocal Reading is hypothesised to result in improved reading comprehension increased scores in standardised assessments of academic attainments (Crawford & Skipp, 2014).

In order to deliver this approach in the classroom, the Reciprocal Reading intervention must include high quality professional development based on evidence-informed theory, as recommended by research (Coe et al., 2014). Reading comprehension involves constructively responsive reading where the reader works to identify the overall meaning of the text by actively searching, reflecting on and responding to the text in pursuit of its main ideas (Pressley and Afflerback, 1995). Research supports the need for a firm understanding of the component skills of reading comprehension for effective instruction (Oakhill, Cain & Elbro, 2015) and warns of difficulties in teaching reading without explicit comprehension instruction (Pressley, 2000). The training for the Reciprocal Reading program therefore includes external training days where groups of

teachers come together from different schools to learn together about the approach and its underpinning theory and evidence. Teachers are trained to deliver the program, and to identify students who may have reading comprehension difficulties. Reciprocal Reading training explains the simple view of reading (Gough & Tunmer, 1986) to teachers and how to identify the students who may fit within the 'good decoders/poor comprehenders' quadrant (Nation & Snowling, 1997). In addition, external training is combined with in-school support visits by program trainers to work alongside teachers during instruction delivery.

The impact of the multi-strategy approach of the reciprocal reading program on reading comprehension and overall reading ability will be investigated using an online reading comprehension test measure.

3.2 Theory of Change (ToC)

Figure 1 also illustrates the ToC. It is proposed that by providing a structured reading comprehension program and appropriate training to teachers and teaching assistants, that the processes underpinning the teaching of reading comprehension can be changed. This assumes that the training will impact on the professional action of teachers and teaching assistants, resulting in use of alternative pedagogies. As a result, it is projected that students' use of reading comprehension strategies such as predicting, questioning, clarifying and summarising will improve their comprehension skills and lead to improved reading attainment.

Teacher surveys and attendance at training, in addition to Reciprocal Reading teacher instruction dosage will be analysed as implementation factors/mediators for outcome change.

3.3 Criteria for recommendation that Reciprocal Reading is ready for a Stage 3 Definitive RCT

The following criteria were developed to determine whether Reciprocal Reading is ready for a Stage 3 Definitive RCT:

- That professional development in use of Reciprocal Reading is able to be delivered in line with specification to high school teachers
- That Reciprocal Reading is able to be delivered in line with specification to students in high school (note that it has only previously been delivered to students in elementary/primary school)
- That high school teachers evaluate their use of Reciprocal Reading positively enough to conclude that it could be scaled up
- That use of Reciprocal Reading, when compared to a control group not using the technique, can result in a positive *effect size* for students using the technique.

4. Research Plan

Research questions
The reciprocal reading program study will be a Level 2 efficacy/exploratory trial (randomized at the individual pupil level, using block randomization to ensure even numbers of intervention and control pupils in each arm of the trial within each of the 14 schools) complemented by a process evaluation. The study will primarily look at the effect of the FFT Reciprocal Reading program on the reading comprehension and reading ability of students in secondary schools. Pre and post-test measures of the children in 14 schools will assess the efficacy of the reading comprehension program in optimal conditions on a small scale.

The study will address the following research questions:

a) Can the program be delivered in secondary schools?

b) What is the impact of the Reciprocal Reading program at post-test on:

- Young people's reading comprehension ability?
- Young people's decoding ability?
- Young people's overall reading ability?

c) Does the impact of the program differ significantly according to variations in implementation fidelity? (Process evaluation)

d) Is the adapted version of the Reciprocal Reading program for secondary age students scalable?

Answers to the above questions, and the success criteria previously stated, will inform decisions as to whether the program is ready to be scaled to an effectiveness/definitive randomized controlled trial.

5. Design summary of the randomized controlled trial (RCT) and process evaluation

5.1 Logic Model: A logic model has been developed for the Reciprocal Reading program intervention (Fig. 1). The logic model will help guide the process evaluation and enable us to interpret the findings of the RCT. The SPIRIT guidelines have been consulted to help structure the protocol for this trial (SPIRIT, 2015).

5.2 RCT Evaluation: The main outcomes will be evaluated using ANCOVA analysis. The RCT will test for changes in both students reading comprehension, decoding, and overall reading abilities. Any changes in the intervention group receiving the reading comprehension program will be measured against the control group who do not receive the treatment during this time. It is calculated that a sample in excess of 300 students is large enough to detect a significant *Effect Size* of 0.28 (roughly in-line with previous reported *Effect Sizes* for the intervention), with $p>0.05$, and 80% power (Soper, 2019). It is proposed that ANCOVA is an appropriate analysis for this intervention as randomization is at the individual level, and so any clustering effects should influence intervention and control groups evenly (Connolly *et al.,* 2018). Results will also be presented as *Effect Sizes* and Cohen's *d* will be calculated

for each of the main outcome measures.

5.3 Process evaluation: A process evaluation will supplement the RCT to measure the fidelity to implementation for the program. Guided by the MRC Framework (Moore, Audrey, Barker, Bond, Bonell, Hardeman, Moore, O'Cathcain, Tinati, Wight & Bair, 2015) the process evaluation will seek to assess whether the reciprocal reading training was attended, teacher engagement, and dosage of implementation. To help assess this, the trainer will provide naturally occurring training attendance data, and teacher leads, teaching assistants will complete student attendance records during session delivery, and a post-program teacher survey.

6. Assessment procedures

All students in both intervention and control groups will be tested before and after the intervention. Schools will be provided by the trainers with guidance to select up to 30 students from year 7 who are good writers and poor spellers.

6.1 Pre-test measures

The selected students, up to 30 from year 7, will be tested prior to teacher training and program intervention.

- New Group Reading Test (NGRT) pre-test: All the students in the study (n=311) will complete a standardized NGRT test, in digital version, from GL-Assessment. This is an adaptive test which has high reliability (GL-Assessment, 2018). All students will be tested in exam conditions by schools prior to teacher training and program intervention. These will assess students reading comprehension and overall reading ability.

6.2 Post-test measures

These will be repeated with all treatment and control students after the completion of the Reciprocal Reading program delivery. This will include the following test:

- Reading post-test: The selected students from each school will complete an online standardized reading test, the New Group Reading Test (digital version) from GL-Assessment. This is an adaptive test which has high reliability (GL-Assessment, 2018). All students will be tested in exam conditions by schools prior to teacher training and program intervention. These will assess students' reading ability, including sentence completion and reading comprehension.

6.3 Dosage record:

A teacher implementation session delivery plan will be used by teachers to record weekly delivery data and will be collected at post-test to help measure the program's implementation fidelity.

6.4 Teacher questionnaire at post-test

The teachers and teaching assistants will be asked to fill in a questionnaire at post-test for their feedback regarding the Reciprocal Reading program and the implementation process. All questionnaires will be completed online using Lime Survey. The teacher questionnaire will consist of 19 questions to include 11 questions measured on a 4-point scale ranging from 'strongly agree' to 'strongly disagree'. In addition, the questionnaire will include 5 open questions and three closed questions with menu of options about session delivery.

6.5 Training delivery naturally occurring data: training attendance.
Training attendance records will be collected by FFT Literacy program trainers.

Instruments and measures are summarized in Table 2.

[Insert Table 2 here]

7. Sample

Up to 311 pupils in Years 7 (pupils aged 11 to 13 years), from 14 schools in the North East of England will be recruited to the trial. The trial will include up to 30 students from each school selected by the school as eligible to take part in this trial. Schools will select students using the guidance provided to them by the trainers to identify pupils who are good readers but poor comprehenders.

8. Randomization

Pupils will be individually randomized to condition. This will be undertaken by listing the students according to the time when they completed the NGRT pre-test, grouped by school. A random number generator (Random Number Generator for iPhone version 5.0 by Nicolas Dean) will be used to generate a whole number between 0 (control) and 1 (Reciprocal Reading intervention). Once the first student from a class is assigned to condition the other students are randomized sequentially to condition. This will ensure even numbers of intervention and control pupils in each arm of the trial.

9. Sample size calculation and analysis

The primary outcome will be reading ability using the New Group reading Test. This will be presented as both *Effect Sizes* of the intervention, compared to the control, and as ANCOVA using pre-test as a co-variate in the model. Secondary to this further analysis will be undertaken looking at the Passage Comprehension and Sentence Completion sub-scales of the New Group Reading Test. As students are individually randomized to condition and this is a Level 2 efficacy/exploratory trial, analysis using multiple regression to look for the main effects of the trial is appropriate. It is not anticipated that gender, English as a Second Language, Special Educational Need or Free School Meal status will be looked at in this analysis. None of these variables were taken into account when randomization took place and there is nothing in the theory of intervention or theory of change to suggest that they will influence outcome.

10. Personnel

- Professor Allen Thurston, Zhengzhou University, China, and Queen's University Belfast will undertake randomisation and analysis blind to condition
- Dr Maria Cockerill, Queen's University Belfast will collect reading test data and teacher survey material
- Andy Taylor, Fischer Family Trust Literacy, who is also the program designer, will deliver professional development and classroom support to teachers using the Reciprocal reading program.

11. Timescales

The planned timescale for the research is from January 2018 until September 2019. Table 3 below outlines a summary of the key milestones.

[Insert Table 3 here]

12. Cost

The cost of implementing the program will include resources and personnel time spent on delivering the program with follow up support. The cost of the Reciprocal Reading program implementation will be estimated per pupil over a one-year period and will include: Teacher training 2 days (external sessions); two teacher in-school support sessions 0.5 days each; teacher manual, reciprocal reading instruction student tools and books for session delivery.

13. Ethics

The trial was approved through two ethics procedures. The intervention of the trial and testing was approved by the Headteachers who took part in the trial. The subsequent matching, combining and analysis of data was approved by the School of Social Sciences, Education and Social Work Ethics Committee from Queen's University Belfast.

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Table 1: FFT Reciprocal Reading Program TIDieR checklist (Hoffman, Glasziou, Boutron, Milne, Perera, Moher, Altman, Barbour, Macdonald, Johnston, Lamb, Dixon-Wodds, McCulloch, Wyatt, Chan, & Michie, 2014).

ITEM No.	Item
Brief Name	
a	Reciprocal Reading program (Targeted intervention)
Why	
b	Training program for teachers aimed at improving reading comprehension ability of students aged 11 to 13 years
What	
c	Materials: A teacher training program delivered by the Fischer Family Trust Literacy, which includes external school training (for teachers and teaching assistants) interspersed with internal follow up support/training. Resources: including teacher manual, student tools and reading books.

d	Procedures: External school training for the program teacher lead, and teaching assistants. Internal follow up training/support sessions have overarching themes of comprehension behaviours and awareness.
Who Provided	
e	Reciprocal Reading trainer provides teacher and teaching assistant internal and external training. Teachers and teaching assistants provide Reciprocal Reading instructional activities to students based on their training
How	
f	Initial training sessions provided to groups of teachers
Where	
g	External training provided out of school setting. Internal training provided in school setting.
When and how much	
h	There are two external training sessions and two internal follow up session over the six month period. Teachers are utilizing their training over the course of the program.
Tailoring	
i	The program logic model was not changed during the research and is included in Figure 1.
Modifications	
j	No program modifications are being made during the trial.
How well	
k	Planned: This will be assessed through the research process evaluation
l	Actual: This will be assessed through the program efficacy Randomized Controlled Trial evaluation.

Table 2: Measurement tools

Outcome	Instrument	Completed by	Alpha values
Reading Comprehension	New Group Reading Test – Passage Comprehension subtest	Pupil	0.9 (GL Assessment, 2018)
Overall reading	New Group Reading Test	Pupil	0.9 (GL Assessment, 2018)
Reading accuracy	New Group Reading Test – Sentence completion subtest	Pupil	0.9 (GL Assessment, 2018)
Implementation factors			
Dosage	Up to 6 months implementation plan	Teacher	n/a
Teacher engagement	Training attendance	Trainer	n/a
Teacher engagement	Teacher survey	Teacher	n/a

Table 3. Gannt Chart of timescales

Activities	Jan-Mar18	Apr-Jun18	Jul-Sep18	Oct-Dec18	Jan-Mar19	Apr-Jun19	Jul-Sep19
Develop logic model							
Recruit schools							
Reading pre-test							
Develop survey measures							
Training day 1 (1.0)							
Program delivery in schools (Treatment group)							
In-school support visits 1 & 2 (0.5)							
Training day 2 (1.0)							
Reading post test							
Teacher survey							
Program delivery (Wait-control group)							
Session delivery data							
Analysis of data							
Write-up (include process evaluation)							
Final report							