
Article:
Hardman, Jan orcid.org/0000-0001-6404-8837 (2019) Developing and supporting implementation of a dialogic pedagogy in primary schools in England. Teaching and Teacher Education. 102908. ISSN 0742-051X

https://doi.org/10.1016/j.tate.2019.102908

Developing and supporting implementation of a dialogic pedagogy in primary schools in England

Jan Hardman, University of York, UK

This paper presents the findings of a process evaluation of a dialogic teaching intervention designed to help primary school teachers improve the quality of classroom talk and boost learning outcomes in the core subjects of English, mathematics and science. It found teachers in the intervention schools made significantly greater use of discussion and dialogue compared to teachers in the control schools and student contributions were more extended and expansive in content and reasoning. The paper concludes with a discussion of the implications of the findings for policy and practice with regard to the provision of school-based professional development.

Keywords: dialogic pedagogy, primary schools, classroom talk, school-based professional development, randomised controlled trial, process evaluation

1. Introduction

Research stretching back to the 1970s has provided rich theoretical perspectives on the role of talk in the teaching and learning process. Since the start of the 21st century it has increasingly focused on identifying the optimal patterns of a dialogic pedagogy for opening up more space in the classroom talk to promote greater student participation, engagement and learning (Howe, Hennessy, Mercer, Vrikki, & Wheatley, 2019). There has also been a greater emphasis on researching the impact of a dialogic pedagogy on student learning outcomes. Studies have found that students who experienced a dialogic pedagogy in the classroom, whether in group-based or whole-class talk, demonstrate higher learning outcomes

and more positive attitudes to schooling (Resnick, Asterhan, & Clarke, 2015). Most of the reported gains in student learning following the implementation of a dialogic pedagogy have, however, come from studies focusing on group-based rather than whole-class interaction (Hattie, 2009; Howe & Abedin, 2013; Webb et al., 2014; Wilkinson; Murphy, & Binici, 2015).

In order to address current gaps in knowledge about the most optimal patterns of a dialogic pedagogy in whole-class teaching, the current paper presents the findings of a process evaluation of a 20-week professional development intervention adopting a 'dialogic teaching' approach. The data were collected as part of a larger evaluation of the dialogic teaching designed to develop dialogic pedagogical practices in Year 5 classes (nine and 10 years of age) in primary schools serving socio-economically deprived areas of England. The process evaluation therefore formed part of a larger randomised controlled trial (RCT) designed to investigate the impact of the intervention on student learning funded by the UK's Education Endowment Foundation (EEF)[1].

2. Theoretical background

With the growing interest in researching a dialogic pedagogy since the start of the 21st century, has come a plethora of terms for describing the pedagogical approaches (Haneda, 2017; Khong, Saito & Gillies, 2017). Some studies have focused on student-student interactions using paired and group-based arrangement and often making use of questioning prompts such as 'reciprocal teaching' (Rosenshine & Meister, 1994), 'exploratory talk' (Mercer & Littleton, 2007), 'philosophy for children (Topping & Tricky, 2015), and 'dialogic interactions' (Gillies, 2016). Others have focused more on teacher-student interaction in

[1] The EEF is a charity which promotes the use of independent impact evaluations of educational innovations using RCTs. In addition to an impact evaluation to estimate the effect of an intervention on student attainment, a linked process evaluation is also carried out to study whether the intervention was implemented as intended (i.e., the fidelity of the implementation) and to study changes, if any, in pedagogical practices.

whole-class, paired and group-based activities using terms such as 'instructional conversation' (Tharp & Gallimore, 1988), 'dialogic inquiry' (Wells, 1999), 'accountable talk' (Michaels & O'Connor, 2015) and 'dialogic teaching' (Alexander, 2006).

Despite differences in focus and terminology, all draw upon common features of classroom talk including greater student involvement, open exchanges of ideas, joint inquiry and construction of knowledge and respectful classroom relations. They have also led to the identification of some talk moves that are thought to be academically productive by encouraging greater student participation, elaboration, and reasoning in both group-based and whole-class talk (Vrikki, Wheatley, Howe, Hennessey, & Mercer, 2018). Such moves are underpinned by a socio-cultural theory of learning which posits that knowledge and meaning are co-constructed and language plays a central mediating role in the activity (Littleton & Mercer, 2013). According to this theory of learning, one of the most important ways of working on developing student understanding is through talk, particularly where they are given the opportunity to assume greater control over their learning in teacher-student and student-to-student interactions by initiating ideas and being asked to elaborate on their thinking and that of other students.

While, as discussed earlier, most of the studies examining the impact of dialogue and discussion on student learning have focused on student-to-student interaction, some studies showing the impact of whole-class talk on student learning outcomes have started to emerge. For example, Nystrand, Wu, Gamoran, Zeiser, and Long (2003) reported a correlation between the use of 'dialogic episodes' in whole class teaching and student learning outcomes in 200 eighth and ninth-grade English and social studies lessons in a variety of schools in the Midwest of America. Similarly, in a study of two middle school sixth grade mathematics classes (N = 52) in Chelsea, Massachusetts to compare a 'discourse-intensive approach' with 'direct instruction' using a counterbalanced controlled comparison design, O'Connor,

Michaels and Chapin (2015) found that on standardised test students experiencing the productive talk conditions made significant gains in learning. Using what O'Connor et al. (2015) term as academically productive talk moves, the middle school teachers were trained to prompt and probe students to make their contributions, to listen to other students, to keep the focus on providing reasons for their answers and to work respectfully and productively with the ideas of others. In England, a large-scale study of the impact of teacher-student dialogue on learning outcomes of students aged 10-11 in 72 primary schools also found a positive association between greater student participation, reasoning and elaboration and higher academic attainment in mathematics and literacy (Howe et al., 2019).

Such talk moves for use in whole-class talk build on ground-breaking research dating back to the 1970s into the linguistic patterning of classroom talk in primary English lessons in England which first revealed the dominance of the three-part teaching exchange in whole-class talk. This three-part structure, which became abbreviated as the IRF, was found to consist of an *initiation*, usually in the form of a teacher question, a *response* in which a student attempts to answer the question, and a *follow-up* move It was found that the follow-up (henceforth F-move) was usually in the form of an evaluation of the 'correctness' of the student answer in light of the teacher's frame of reference (Sinclair & Coulthard, 1975). A few years later a similar study was conducted in the United States which used *evaluate* to designate the third move (abbreviated as IRE) to reflect the fact that the F-move was often an evaluation of a student's answer (Mehan, 1979).

Building on this early research into the linguistic patterning of classroom talk, researchers continued to find that most of the questions asked by teachers were closed requiring only one answer and followed by cues as to how to arrive at the answer. In what became known as the 'recitation script', it was found that student answers were often brief

and simply evaluated on their appropriateness by the teacher (Author, 2003; Tharp & Gallimore, 1988; Nystrand, Gamoran, Kachur, & Prendergast, 1997).

In response to the perceived limitations of the IRF exchange, research into classroom talk increasingly focused on improving teacher questioning approaches by including, for example, more open-ended (i.e., allowing for a range of answers) and authentic questions. Research also focused on getting teachers to open up the F-move by, for example, probing student answers to get them to elaborate on their thinking or to clarify and justify their opinions with evidence, asking other students to comment on the answer and by building student answers into subsequent questions. The research suggested that opening up the F-move encouraged more reciprocity and extended contributions from the students, which included explaining, arguing and justifying their thinking and building on the ideas of other students thereby creating a more dialogic form of interaction in whole-class talk.

For example, in a study of 12 whole-class activities in three Italian primary schools made up of 587 minutes of video recordings and 828 IRF exchanges, it was found that open questions were often followed by complex answers and the re-initiation of the same question to different students (Molinari, Mameli, & Gnisci, 2013). Teacher follow-up to student contributions was therefore a key factor in extending the teaching exchanges. Where teachers accepted or rejected an answer the sequence was often short, but in cases where the teacher followed-up an answer to help the student elaborate or reformulate the response the exchanges became more extended and dialogic. In such exchanges, the teachers were also observed asking students for clarification or asking another student to comment and build on the contribution in order to extend and improve the quality of the answer. Similarly, in a study of literacy lessons taught by seven teachers based in a large primary school in east London, it was found, following the sequential analysis of over 7000 discourse moves, that when teachers used a higher proportion of open, probing and uptake questions it generally

promoted higher levels of argumentation, elaboration and reasoning from the students (Lefstein, Snell, & Isreali, 2015).

In his influential conceptualisation of a dialogic pedagogy, Alexander (2006) places great emphasis on teachers developing their repertoire of talk moves in whole class, group-based and one-to-one interactions with students by including dialogue, discussion and argumentation alongside rote, recitation, explanation and instruction. The model consists of five principles whereby the classroom talk is collective, reciprocal, supportive, cumulative and purposeful. Such principles are reflected in the way teachers interact with students: for example, by asking of questions which go beyond the simple recall of information, probing student answers to ensure they are followed up and built upon and inviting other students to comment and ask questions on the matter under discussion, leading to more varied and extended student contributions.

In supporting the implementation of a dialogic pedagogy in the classroom, Alexander (2018) argues that school-based professional development based on his dialogic principles offers the best way of addressing the theory-practice gap by giving teachers a considerable degree of control over their professional development. It is a view supported by teacher development research which suggests teachers need ample opportunities to think through new ideas and to try out innovative practices, preferably in a context where they get feedback from peers and a more expert practitioner to refine their practice in collaboration with colleagues (Davies, Kiemer, & Meissel, 2017; Sedova, Sedlacek, & Svaricek, 2016; Wilkinson et al., 2017). Observation, coaching and talk-analysis feedback aided by video-stimulated reflective recall have been found to be useful tools for professional development (Saito & Khong, 2017). Such reflective cycles of professional learning have also had a sizeable impact on student outcomes (Coe, Aloisi, Higgins, & Major, 2014).

This paper reports on a school-based professional development intervention designed to develop the teacher and student talk repertoire, thereby promoting greater student participation, which includes students arguing, explaining and justifying their thinking and asking questions directed both to the teacher and other students. Situated within a larger RCT study designed to draw causal inferences into how a dialogic approach can enhance student learning, it highlights the types of learning talk engaged in by students and how teachers who had received the intervention played a key role in enabling such high-quality talk to occur in the classroom. It concludes with a discussion of the implications of the findings for school-based professional development in helping teachers to understand the importance of a broad repertoire of talk moves during whole-class teaching.

3 The study

3.1 Design and participants

The aim of the study was to evaluate the effectiveness of a school-based professional development intervention based on Alexander's (2006) dialogic teaching approach using both an impact and process evaluation. It addressed two main research questions:

1. Does the dialogic teaching intervention have an impact on student attainment in primary English, mathematics and science?
2. Does the intervention improve pedagogical practices and the quality of classroom talk in primary English, mathematics and science?

The impact evaluation carried out independently by Sheffield Hallam University was designed to answer the first research question and used an RCT to test the efficacy of the intervention before subjecting it to a larger effectiveness trial. The process evaluation was designed to answer the second question and was conducted by the programme development team based at the University of York and is the central focus of this paper.

3.2 Professional development intervention

The school-based professional development intervention based on Alexander's concept of dialogic teacher was designed to develop the teacher and student talk repertoire by building on traditional forms of teaching talk made up of exposition, closed questions and directions to include more dialogue and discussion (Alexander, 2018). The school-based professional development intervention was run intensively over two school terms (20 weeks). It consisted of 11 cycles of training including induction, training and plenary workshops, directed reading activities, mentoring and video-based stimulated recall of lesson episodes, and follow-up to schools by the project team to monitor implementation and provide support to the mentors and teachers (Author et al., 2017).

Each school appointed an experienced teacher as peer mentor to support at least two Year 5 teachers in the cycles of professional learning. The mentors were given additional training on how to implement the training cycles and how to support their colleagues during the mentoring sessions. The mentoring relationship with the teachers was, therefore, intended to be one of peer support and reflection to encourage open and non-judgemental discussion. Mentors were required to organise in consultation with the teachers the timeline for each of the eleven planning and review cycles (each lasting two weeks, except for the first and the last cycle) and to meet at least once in each cycle. Mentors could work with their mentees either singly or jointly; however, most chose to work jointly.

A vital component of the programme was the guided planning, target setting and review using video and audio footage of a lesson recorded on equipment supplied by the programme development team. During the weekly mentoring meetings, a key focus of the discussion was on the dialogic teaching principles and talk repertoires by reviewing what happened in the lesson and setting targets for the teaching of the follow-up lesson. A proforma was also provided to provide the mentor and teachers to guide planning, target-

setting and review during each of the 11 cycles. Details of the intervention programme are provided in the EEF-commissioned report by Jay et al. (2017).

3.3 Impact evaluation

Following a pilot of the professional development programme in 10 London primary school in 2014 – 15, the programme was subjected to a full RCT in 2015- 2016 to test the efficacy of the intervention run independently by a team from Sheffield Hallam University (Jay et al., 2017). Seventy-six schools serving socio-economically deprived areas in the cities of Birmingham, Bradford and Leeds were initially recruited for the trial. To be eligible to participate in the study, schools needed to have at least two parallel Year 5 classes and at least 25 per cent of their students eligible for free school midday meals (which is used as a proxy to measure socio-economic deprivation in the UK). The actual percentage of students in the recruited schools receiving free school meals was over 35 per cent and 50 per cent spoke English as an additional language.

The 78 schools recruited for the study were randomly assigned to an intervention (n=39) or control (n=39). However, following randomisation, five control schools and one intervention school dropped out of the study before implementation of the workshop training. Therefore, 72 schools made up of approximately 5,000 Year 5 students eventually completed the trial assessments with an average class size of 30. Also taking part in the trial phase were 80 teachers, 38 mentors and 37 head teachers from the intervention schools. During the 20 weeks of the intervention, in the control schools, it was 'business as usual', and they were expected to follow their normal curriculum activities. Using a 'waiting list' approach, they were offered the dialogic teaching professional development programme following the trial in the summer term of 2016.

Overall, the independent post-intervention impact evaluation using the EEF's methodology of converting effect sizes into months of progress found that students in the

intervention schools whose teachers had received the dialogic teaching programme made, on average, two additional months' progress in English and science, and one additional month's progress in mathematics, compared to students in the control schools. Students eligible for free school meals made two additional months' progress in English, science and mathematics compared to similar children in the control schools (Jay et al., 2017).

3.4 Process evaluation

As discussed in section 3.1 the process evaluation was conducted by the programme development team during phases 1 and 2 of the dialogic teaching programme. It consisted of two strands: firstly, a comparative analysis of video-recorded lessons in a sub-sample of intervention and control schools to measure the impact of the intervention on pedagogical practices and student talk; secondly, semi-structured interviews with teachers, mentors and head teachers to elicit their views on the challenges of implementing the school-based programme and the perceived benefits for student engagement and learning.

For the video analysis teachers from the intervention and control schools were asked to volunteer to participate in the video-recording while attending the July 2015 induction meeting. Fifteen teachers in the intervention schools and 11 teachers from the control schools agreed to participate in this aspect of the study. The schools were matched using national assessment data, number of children receiving free school midday meals and speaking English as an additional language. Two video recordings of each teacher teaching across English, mathematics and science[2] were made in weeks 2 and 3 of phase 1 (autumn 2015) to provide a baseline and again towards the end of phase 2 in weeks 18 and 19 (spring 2016) to follow-up the impact of the dialogic teaching programme on classroom practices. Over the two phases, the development team collected a total of 134 lessons (i.e., 50 English, 50 mathematics and 34 science) for the computerised systematic analysis (67 in each phase).

[2] In some schools, science was not taught on a weekly basis resulting in fewer lessons available for recording

Two sets of semi-structured interviews were also conducted with teachers, mentors and head teachers in the intervention schools: the first taking place towards the end of phase 1 and the second towards the end of phase 2. The focus of the interviews was on how closely the teachers and mentors had followed the 11 cycles of training and the challenges they faced during its implementation. The interviewees were also asked, using an agreed schedule of questions, about their perceptions of the programme's impact on teaching practices, student engagement and learning. Documentary analysis of mentor records was also conducted capturing the cycles of planning and review and triangulated with the content analysis of the interviews. Details of the process evaluation are provided in the report by Author et al., (2017).

3.5 Video data analysis and coding system

In order to systematically analyse the large database of lesson recordings, a computerised observation software package known as The Observer XT 12.5 was used to quantify the coded talk moves. This software has been successfully used in previous studies of classroom interaction (Author et al., 2003; Author et al., 2004; Snell, 2011). A granular and relatively low inference coding system for coding the talk moves was developed drawing on the dialogic pedagogy literature. It was piloted during the development phase of the study (2014-15) in the 10 London schools.

The coding scheme for the quantitative analysis of the video data as set out in Table 1 was primarily based on the three-part IRF exchange structure. It investigated teacher questions, student responses and the types of follow-up given in the F-move. Within each talk move, a range of *modifiers* was available to capture, for example, the type of question and F-move to a student answer made by the teacher. The coding scheme was uploaded to the Observer XT 12.5, and four coders were trained to use the software to analyse the data set of 134 lessons and to check inter-rater reliability to maximise coding consistency.

Four coders were recruited from a cohort of PhD students studying educational linguistics and trained intensively over two weeks using the selected sample of 6 lessons (2 English, 2 mathematics and 2 science) which had initially been coded by one of the lead researchers. This amounted to approximately 360 audio-minutes of data. They were also involved in the iterative process of testing and refining the coding scheme. The coding inter-reliability between the pairs of coders was calculated using Cohen's Kappa. After four training sessions and three checks on the inter-rater reliability of the coders in the Observer software, the level of agreement between the pairs reached nearly 80 per cent (Kappa = 0.73 and Kappa = 0.75). Ambiguities and differences in codings were discussed and resolved (sometimes with the help of the senior researcher). For example, to determine if the teacher move 'agree/diasgree' was intended to be open was through the analysis of the student response.

The coding system included closed and open questions referring to teacher initiation questions. They could serve a dual function: that is to elicit recall of information from the students and, in the case of open questions, to generate a range of answers from the students. The feedback/evaluative teacher talk moves indicated if a student response was accepted (or rejected) and often provided low-level evaluation and/or comment on the response. On the other hand, as discussed earlier, teacher F-moves can be used to extend, sustain and deepen a teaching exchange by asking for student elaboration, argumentation and reasoning. As with open questions, the research suggests these talk moves open up the IRF structure, and the coders used them as key indicators of dialogic episodes of active whole-class discussion or dialogic spells. Examples of teacher talk moves in dialogic spells can be seen in the analysis of Transcripts 2 and 3 in Section 4.2.

Table 1: Coding system of teacher and student talk moves

TEACHER TALK MOVES	DESCRIPTIONS
Initiation questions	
Teacher closed question	Teacher asks a closed/recall question - allows one possible response
Teacher open question	Teacher asks an open/authentic question - allows various responses
Feedback/evaluation talk moves	
Teacher acknowledgment/rejection	Teacher simply accepts or rejects a student's contribution
Teacher praise	Teacher praises a student's contribution
Teacher comment	Teacher remarks, summarises, reformulates, builds on and/or transforms a student's contribution
Follow up talk moves	
Teacher add-on question	Teacher asks student to add on to another student's contribution
Teacher agree/disagree question	Teacher asks if a student or students agree or disagree with another student's contribution
Teacher expand question	Teacher stays with the same student and asks to expand
Teacher rephrase question	Teacher asks a student to repeat or reformulate his/her own or another student's contribution
Teacher revoice question	Teacher verifies his/her understanding of a student's contribution, which requires a student response
Teacher why question	Teacher stays with the same student and asks for evidence/reasoning
Teacher challenge question	Teacher provides a challenge or counter example

STUDENT TALK MOVES	DESCRIPTIONS
Student contributions	
Brief student contribution	Student provides pre-specified, brief information without any development – expressed in a word, phrase or simple clause.
Extended student contribution	Student provides non-specified information and thinking. The contribution is developed to some extent through, for example, explanation, expansion, evaluation, justification, argumentation and speculation.

The coding system also included student talk moves in response to teacher questions, coded as being either 'brief 'or 'extended'. A brief student contribution, providing pre-specified, brief information was often in response to a closed question requiring one 'right'

answer from the class and usually expressed in a word, phrase or clause as in the following example taken from a mathematics lesson:

Transcript 1: whole class interaction in mathematics
(Key: T = teacher, S1 = student 1, S2 = student 2, Ss = chorus response etc.)

Turn		
1	T	I know and I am aware of the fact that there are known words on this board. Well, about 80% of these words you know, but there are some words you might not know. Zara?
2	S1	Congruent.
3	T	Congruent, has anybody heard that word before?
4	Ss	No.
5	T	What do you think, Phoebe?
6	S2	Is it a (inaudible)?
7	T	No, that's a nonagon
8	S3	Is it a (inaudible)?
9	T	No, congruent just means the same. So, there could be two shapes that are identical – congruent - I … congruent means identical. Say it after me, congruent means identical.
19	Ss	Congruent means identical.

Here the teacher is using the F-move to briefly evaluate the correctness of the student's response in light of the required answer 'congruent means identical' which is typical of teacher-led recitation.

In contrast, an extended student contribution, providing non-specified information and thinking and developed to some extent through, for example, explanation, expansion, evaluation, justification, argumentation, and speculation, was often a more elaborated response (i.e. moving beyond a word, phrase or clause) to an open question or an elaborated contribution prompted by a teacher follow-up question. It was also regarded as a key indicator of dialogic episodes as it often incorporated some form of reasoning, elaboration and clarification. Examples of extended student contributions can be seen in the analysis of Transcripts 2 and 3 in Section 4.2.

3.6 Statistical procedure

Following the coding of the frequency of both the teacher and student talk moves, the data were analysed to compare within-group subject differences in the teaching of English, mathematics and science, and for differences in the talk moves between the intervention and control teachers across both phases of the study. In order to analyze the differences in talk moves between control and intervention groups in the teaching of English, mathematics and science, means and distributions of the talk move variables were compared. Independent sample t-tests were applied (with a two-tailed confidence level of 95%), and where sample distributions were found to be skewed and not normally distributed, Mann-Whitney tests were used instead. Tests for unequal variances were also applied and the appropriate test statistic reported. Effect sizes were estimated using Cohen's d values for standard t-tests, and correlation r values for non-parametric tests. Statistical data are presented in Appendix 1.

For the analysis of the differences in talk moves used by teachers in the intervention and control groups across both phases of the study, means and distributions of the talk move variables were compared for each group. Only lessons that formed corresponding pairs in both phases, by subject and teacher, were included. Paired sample t-tests were performed (with a two-tailed confidence level of 95%), and where sample distributions were found to be skewed and not normally distributed, Wilcoxon tests were used instead. Effect sizes were estimated using Cohen's d values for standard t-tests, and correlation r values for non-parametric tests.

3.7 Analysis of lesson transcripts

Following on from the computerised systematic observation of the videoed lessons and quantification of teacher and student talk moves, transcripts of lesson episodes (averaged 13 audio-minutes in length) from a sub-sample of 54 lessons (from weeks 18 and 19 towards the end of phase 2 of the study) were qualitatively analysed. The transcript analysis was

carried out in two ways: at a meso level of episodes to identify patterns of teacher-student talk exchanges and at a micro level of utterances to closely examine the kinds and nature of talk engaged in by student when making extended contributions. The sustained chains of teacher-student exchanges and expansive and reasoned student contributions were therefore regarded as key indicators of dialogue and discussion.

A separate coding scheme was designed for the fine-grained micro-analysis of extended student contributions as shown in Table 2. The scheme consisted of 12 sub-categories at the lower level of talk *act*s, the smallest units of discourse (Sinclair & Coulthard, 1975). The categories largely correspond with Michaels & O'Connor's (2015) teacher talk moves which prompt students to share and expand upon their ideas, to provide evidence for their claims, and to build on, elaborate and improve the thinking of the group. They also reflect Alexander's (2018) repertoire of learning talk consisting of narrating, explaining, instructing, questioning, building on answers, speculating/imagining, exploring and evaluating ideas, discussing, arguing, reasoning and justifying, and negotiating.

Table 2: Coding scheme for extended student contributions

Extended student contribution	Student provides non-specified information and thinking. The contribution is developed to some extent through explanation, expansion, evaluation, justification, argumentation, speculation and so on
Sub-types of extended student contributions	**Descriptions**
Student expand/add	Student says more by building on, adding to or extending own or another student's contribution
Student connect	Student makes an intertextual reference to something else, e.g. a previous discussion, another text, event, experience or resource
Student explain/analyse	Student explains something in some detail or examines own or another student's contribution. (not to convince/persuade)
Student rephrase	Student repeats, reformulates or summarises own or another student's contribution
Student recount	Student gives an account of an event or experience
Student evaluate	Student makes a judgement
Student argue	Student states a position/opinion/argument (to convince/persuade)
Student justify	Student provides reasoning/evidence
Student speculate	Student predicts/hypothesizes an idea or situation

Student imagine	Student creates an analogy, mental image or scenario
Student challenge	Student provides a challenge or counter-example
Student shift position	Student indicates a change of mind or perspective

The qualitiative analysis of lesson transcripts was carried out by two senior members of the development team with expertise in classroom discourse analysis. The data coding of a randomly-selected sample of 9 transcripts (3 English, 3 mathematics and 3 science) was checked for reliability and the coders agreed on the categories assigned to over 80% of the talk acts. Ambiguities and differences in codings were discussed and consesus reached by taking into account, for example, discourse markers (e.g. 'because', 'but' and 'and then'), signalling words (e.g. 'reason', 'I think', `why', 'maybe' and 'good'), a change of talk focus or purpose, a change of discourse type (e.g. from narration to evaluation) and a juxtaposition of discourse acts.

4 Findings

4.1 Computerised systematic analysis

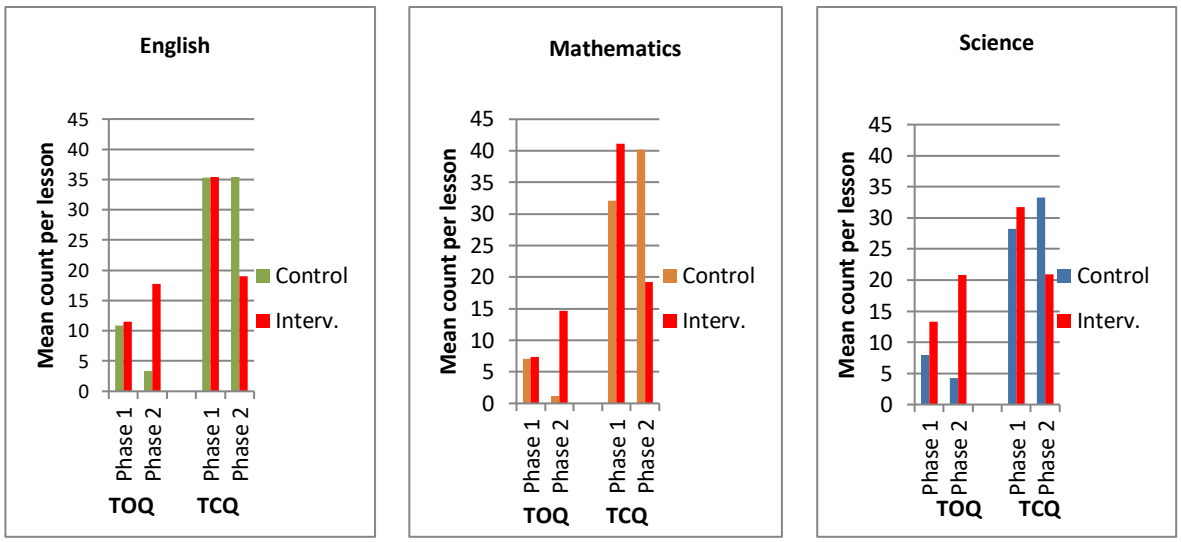
Overall, the preliminary findings from the computerised systematic analysis of the video-recorded lessons showed that the intervention had impacted positively on teacher questioning and F-moves, thereby extending the length of student contributions in English, mathematics and science in the intervention teacher classes (Author et al., 2017).

4.1.1 Teacher initiation questions

Figure 1 below shows the ratios of open and closed teacher questions over time (phases 1 and 2 of the intervention) and the intervention/control comparisons in English, mathematics and science. A teacher question plays a pivotal role in classroom talk as it not only initiates a teaching exchange but the structure it takes can either close or open space in the classroom talk for students. Open/authentic teacher questions (TOQ) encourage contributions that are not always anticipated by the teacher and require students to think, share and reason. In contrast, closed teacher questions (TCQ) often refer to test questions

which have a closed structure and are intended to check student recall rather than invite student thinking, reasoning and genuine exploration, resulting in answers which are often brief which teachers tend simply evaluate as right or wrong and not to build upon.

Figure 1: Control/intervention group comparison of open and closed teacher initiation questions in the three subjects in phases 1 and 2



As can be seen in the graphs above, the ratios of closed and open questions were largely balanced at the start of the intervention (in phase 1) across all three subjects. By the end of phase 2, however, the intervention teachers were making significantly greater use of open questions with a large effect size found between the means: (r = -0.76) in English, (r = -0.80) in mathematics, and (r = -0.82) in science. Conversely, there was a significant reduction in the use of closed teacher questions by the intervention teachers in phase 2 with a mean of 19.21 compared to a mean of 36.04 in the control group, resulting in large effect size between the means (d=1.67). Similarly, by the end of phase 2, no subject differences were found in the use of open teacher questions by the intervention teachers across subjects. The findings suggest that questioning skills of teachers in the intervention group had improved over the course of the 20 weeks by ensuring a better balance of open and closed questions.

4.1.2 Teacher follow-up moves

As discussed earlier, teachers in the intervention group were trained to deploy a variety of F-moves that probed, extended and followed-up student contributions on the basis that these talk moves would both increase student engagement and enhance their learning. As shown in Figures 2.1 (English), 2.2 (mathematics) and 2.3 (science), the analysis of the teacher F-moves showed that teachers in the intervention schools were making significantly greater use of the moves compared to teachers in the control schools which went beyond simple a low-level evaluation of the student answer to include a broader repertoire of F-moves. It also resulted in a greater number of students participating in the classroom talk in the intervention schools compared to the control group. Differences between the two groups were most marked in mathematics and science.

Figure 2.1: Control/intervention group comparison of teacher use of follow-up moves in phases 1 and 2 - English

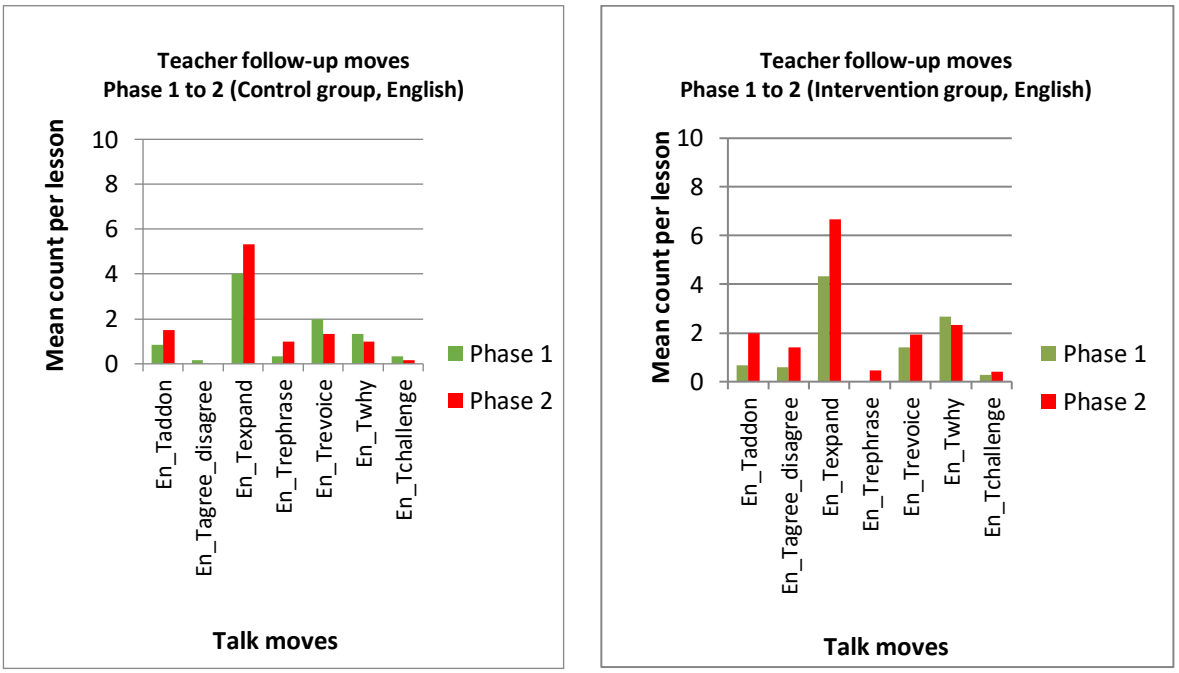


Figure 2.2: Control/intervention group comparison of teacher use of follow-up (dialogic) talk moves in phases 1 and 2 of the intervention programme – mathematics

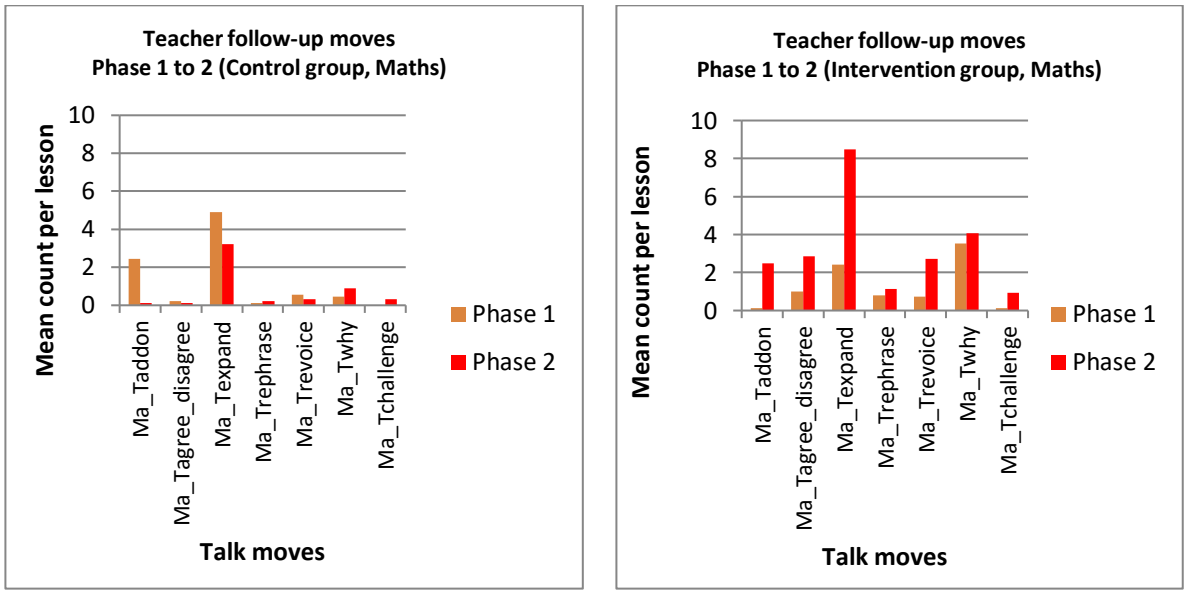
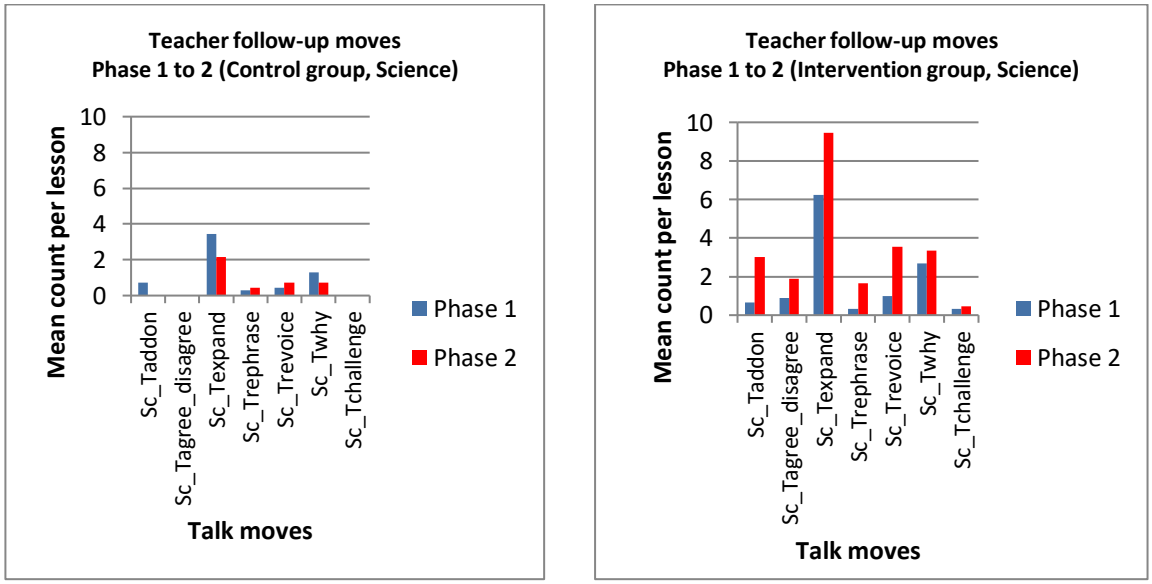


Figure 2.3. Control/intervention group comparison of teacher use of follow-up moves in phases 1 and 2 science



Subject differences were found in the use of F-moves by teachers. In phase 1 in science, the intervention teachers were already deploying a greater proportion of F-moves compared to the control group (d= -1.18). However, there was no difference between the

intervention and control groups in English and mathematics. By phase 2, there was a moderate difference in terms of the frequency of the F-moves between the intervention and control groups in English and a marked increase in the use of teacher F-moves in science (d= -1.90), with the greatest increase being seen in mathematics (d = -1.41).

In English, while the overall increase in F-moves appeared moderate, upon closer analysis, it was found that the intervention teachers were making greater use of a broader range of such moves compared to the control group. In particular, the talk move 'agree/disagree', which was absent in the control group, was now present in the intervention group. Research suggests this talk move is responsible for encouraging students to listen attentively, think with others and build on each other's contributions.

In mathematics, there was a very marked difference regarding the deployment of F-moves by teachers in the intervention and control groups in phase 2. The intervention teachers not only deployed a wider range of F-moves, but also a significantly greater proportion of discourse moves, such as 'add on', 'agree/disagree', 'expand', 'rephrase', 'revoice', 'why' and 'challenge', than their control counterparts with a very large effect size (d = -1.41). In contrast, the discourse moves in the control group were largely limited to 'expand' (i.e., seeking student explanations).

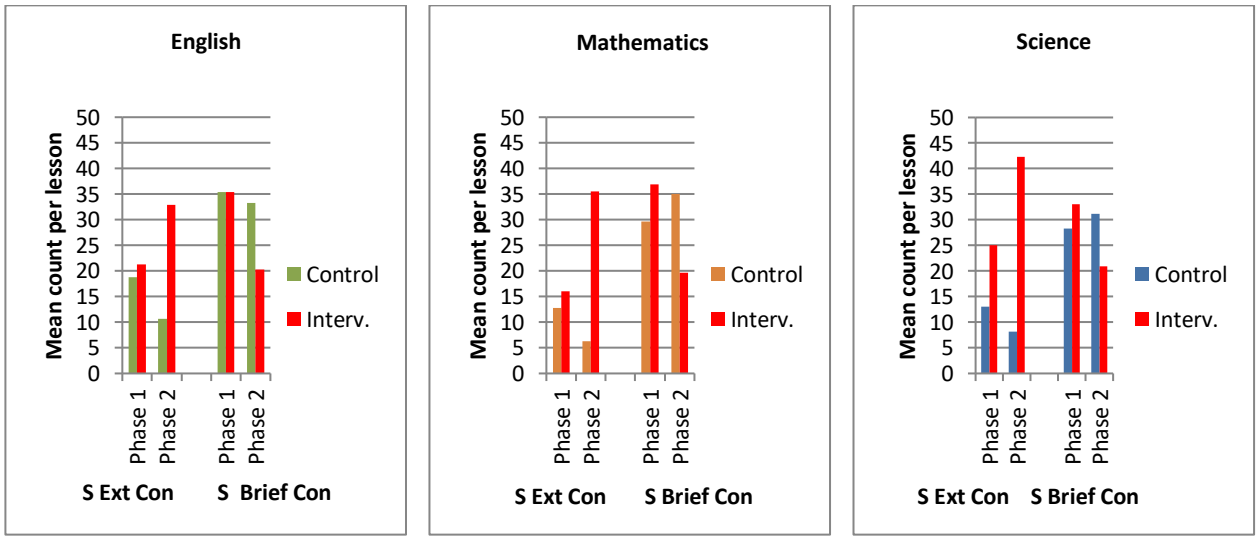
In science, the intervention teachers already deployed in phase 1 a wider variety and a greater proportion of F-moves compared to their control counterparts. This may have been due to the fact that the intervention teachers had already been introduced to the dialogic teaching moves when they attended the project induction meeting in July 2015, 6-8 weeks before the baseline data collection in September 2015. However, the same teachers were not using them to the same extent in mathematics and English. By phase 2 the difference between intervention and control teachers was even more marked with a very large effect size (d = -1.90).

Overall, the findings suggest that following the dialogic teaching professional development programme, teachers in the intervention schools were using a wider repertoire of F-moves compared to the control schools, with most impact being seen in mathematics and science. This meant that the talk exchanges between teachers and students were more extended and sustained with teacher ratifying the importance of student responses and allowing them to influence the course of the discussion in some way, thereby building extended student contributions into the classroom talk.

4.1.3 Brief and extended student contributions

The analysis of the student talk moves showed significant differences between the intervention and control groups with large effect sizes in terms of an increase in student participation and extended contributions as shown in Figure 3.

Figure 3: Control/intervention group comparison of brief and extended student contributions in phases 1 and 2 - English, mathematics and science



In phase 1 there were no significant differences in the use of brief and extended student contributions between the intervention and control schools in English and mathematics, but they were significant in science (d = -1.77). However, by phase 2, the intervention group had significantly more extended student contributions in English (d = -2.09), mathematics (d =2.29) and science (d = -2.57) compared with the control group, and

there was a decrease in brief student contributions. The extended student contributions indicated greater student participation in the whole-class talk, and they correlated strongly with teacher use of open initiation questions and F-moves in English, mathematics and science. Overall, the findings suggest that it was through teacher talk in whole-class interaction that student contributions were either constrained or extended.

4.2 Analysis of lesson transcripts

The meso-level analysis of lesson episodes showed patterns of teacher-student talk exchanges in the intervention group of classes tended to be lengthened and sustained to support dialogue and discussion, and this is illustrated in the analysis of Transcript 2. The fine-grained micro-analysis of extended student contributions as presented in Table 3 showed that the intervention students tended to express high levels of evaluation, justification and argumentation in response to teacher open initiation and follow-up questions. By contrast, teacher-student talk patterns in the control group of classes were largely closed, short and tightly-structured IRF/E and student responses were brief often expressed as a word, phrase or clause.

Table 3: Sub-types of extended student contributions in English, mathematics and science

Sub-types of extended student contributions	English		Mathematics		Science	
	Intervention	Control	Intervention	Control	Intervention	Control
Student expand/add	6.87%	7.01%	3.96%	-	5.30%	5.66%
Student connect	3.05%	-	0.79%	-	2.27%	-
Student explain/analyse	33.58%	42.10%	22.22%	85%	39.39%	66.03%
Student rephrase	1.52%	7.01%	3.96%	5%	0.75%	3.77%
Student recount	1.52%	1.75%	-	-	0.75%	3.77%
Student evaluate	3.81%	1.75%	-	-	0.75%	-
Student argue	25.95%	7.01%	30.95%	10%	14.39%	7.54%
Student justify	15.26%	7.01%	27.77%	-	31.06%	7.54%

Student speculate	4.58%	5.26%		-	-	3.77%
Student imagine	1.52%	21.05%	1.58%			1.88%
Student challenge	2.29%	-	6.34%	-	4.54%	-
Student shift position	-	-	2.38%	-	0.75%	-
Total	131	57	126	20	132	53
Mean frequency	13.1	7.12	12.6	2.5	13.2	6.62

Table 3 also shows there were some subject differences in the types of extended student contributions. In English students in the control schools mainly provided 'explanation/analysis' (whereby they explained something in some detail or examined their own or another student's contribution) and 'imagination' (whereby they created an analogy, mental image or imaginary scenario), accounting for 42 and 21 percent of their contributions respectively. Other types of learning talk such as 'expansion/addition' (i.e., building on, adding to or extending own contribution and that of another student), 'argument' (stating a position or opinion), 'justification' (providing evidence or reasoning) and 'challenge' (providing a challenge or a counter-example) were also used but to a limited extent. In science, the control group of students predominantly provided 'explanation/analysis', accounting for 66 per cent of their contributions. In mathematics, the control group of students almost exclusively provided 'explanation/analysis', accounting for 85 per cent of their contributions. This suggests that students in the control schools in mathematics were using a much narrower range of learning talk.

By contrast, the analysis of extended student contributions in intervention schools in phase 2 of the study showed students were participating in greater numbers and using a wider repertoire of extended contributions that included explanation, analysis, argumentation, reasoning and challenge supported by evidence in English, mathematics and science. Many of the contributions by students in the control group often lacked evidence and therefore read

as assertions compared to the intervention group who were often being held accountable for their contributions by the teachers.

Overall, students in the intervention group were making more extended contributions to the classroom talk and using higher levels of explanation, analysis, argumentation, challenge and justification, suggesting their talk was more dialogic than that of the control group. Differences between the two groups were most marked in mathematics, whereby extended student contributions in the intervention group was six times (mean frequency =12.6) higher than that of the control group (2.5). This is illustrated in Transcript 2 presenting an episode taken from a mathematics lesson from phase 2 of the study in which the teacher from an intervention school is leading a whole-class discussion on place value.

Transcript 2: whole class interaction in mathematics
(Key: T = teacher, S1 = student 1, S2 = student 2, etc.)

Turn		
1	T	What do I need to do next to write this number correctly? Barney.
2	S1	1 in the 10,000
3	T	But how do I know that there's a 1 there in the 10,000 column? Florence.
4	S2	You need to write a number down (inaudible 00:00:23).
5	T	But I don't know how to write my number down. And I get confused between my 1000s column and my 10,000s column and my 100,000s column. And I get confused with all the place values.
6	S2	Put the last number in the units and then you put the rest of them going… So you do it backwards so instead of doing one zero zero one zero every zero one every zero zero one.
7	T	Oscar, do you agree?
8	S3	I get what Florence is saying because you have to put each number each column, you can't have two numbers in a column. But maybe an easier way to explain it would be maybe put the biggest, I don't know actually, biggest part of the number in the furthest place where you have your column to the left.
9	T	Yeah, in the largest place value column. Why do you think that might be easier? Why would you do it like that?
10	S3	Because then you can work down and if you're working up you might get a bit confused and muddled up, possibly.
11	T	Okay. Do you have anything to add, Rowan?
12	S4	I prefer Florence's idea probably because -
13	T	You agree with Florence's idea?
14	S4	Yeah, I agree with Florence's idea, probably because if Oscar's… Say if there was 100,000 there and you just left it blank. If we did Oscar's one

		you'd have like a 101,000 der, der, der, because he said put it in the highest column, what if you had more columns than that?
15	T	But I've already established what columns I have because I heard the number that was said to me, which is 10,010, so I know the highest is 10,000, so I've set up those columns according to the number that I already have. Does that change your opinion?
16	S4	Hmm, I think it probably would be easier to work down from the left, but it would… Yeah it probably would be easier to work down instead of working up because you wouldn't have to write the number backwards.
17	T	Because you wouldn't have to write the number backwards. That kind of makes sense. Anything to add, Phoebe?
18	S5	Well, I was thinking, because it's 10, put 10 in in the top corner, in the 10,000s, and 10 just like -
19	T	Perfect, thank you. The number is 10,000.

This episode presents a discussion exchange that is extended and coherently sustained through the deployment of a wide variety of teacher F-moves, inviting the collective engagement of several students, thereby scaffolding their conceptual understanding in solving of a mathematical problem. The interaction starts with a closed teacher question: '*What do I need to do next to write this number correctly?* (in Turn 1), eliciting a brief (and correct) response from student 1 (S1) '*1 in the 10,000*' (in line 2). However, rather than merely evaluating the student response as being correct, thereby closing down the interaction, the teacher keeps it open and elicits further contributions from other students.

In doing so the teacher makes good use of open questions and a broader repertoire of F-moves beyond low-level teacher evaluations. For example, in Turn 3 the teacher asks an open question: *"But how do I know that there's a 1 in the 10,000 columns?".* In Turn 7 she deploys the 'agree/disagree' talk move "*Do you agree?*" and in Turn 11 she uses the 'add-on' talk move "*Do you have anything to add?*" both of which encourage students to listen attentively and to build on their own and others' contributions. The teacher also uses the F-moves that help to deepen student reasoning such as the 'why' move: *"Why do you think that might be easier? Why would you do it like that?"* (in Turn 9) and the 'challenge' move: "*Does that change your opinion*?" (in Turn 15). In response to the open teacher questions

and F-moves, the students provide more expansive contributions as in line 14 where S4 says: "*Yeah, I agree with Florence's idea, probably because … Say if there was 100,000 there and you just left it blank. If we did Oscar's one you'd have like a 101,000 der, der, der, because he said put it in the highest column, what if you had more columns than that?*". The teacher finally rounds up the episode with the feedback/evaluation move of 'praise': "*Perfect, thank you"* and talk move of 'comment' by confirming the correct answer: *"The number is 10,000*" (in Turn 19).

Another typical example is taken from an English lesson from phase 2 of the intervention group (Transcript 2). This is a whole class discussion, immediately following small group discussions on features of a newspaper report based on North American folklore entitled 'Bigfoot':

Transcript 3: whole class interaction in English

Turn		
1	T	Right, I said everyone looking this way. I've worked my way round and people have got some great ideas. So, newspaper, I'm going to ask for features. You're going to show me active listening, …I'm going to ask for features, you're gonna listen, you're gonna add to it, you're gonna tell me… If they don't say why, you're going to add to it, tell me why you need that feature. Okay, you might want to change it so active listening. … Right, Sam let's start. Don't wave your hand about because you're not listening, are you, if you wave your hand about. You're listening.
2	S1	You need evidence so you can prove that it's true because if you don't have they'll be asking why, why, why, and you don't have any backup. Diane, would you like to say something?
3	S2	Yeah, it needs to be realistic.
4	T	Sometimes newspaper reports aren't realistic? Let's work on this evidence a minute. How are we going to get evidence in our newspaper report? Penny.
5	S3	We need some footage from a camera like footprints. But then footprints can be made by anything like… You can (inaudible 00:02:07) footprints, you could, like, just draw them in the snow, anywhere. So also you could have footage of something moving, something walking, which would give them an idea of that, "is this rumour true?" Maybe I'm lying because we've already known about this. Maybe this isn't just a made-up fairy tale. Sam.

6	S4	You could also have quotes with people that have seen it, like, the mountaineer and the local ranger.
		5 turns later
12	T	Does anyone agree in our newspaper, or disagree in our newspaper report, there should be footage? You have to agree or disagree with a reason (inaudible 00:03:32).
13	S7	I would disagree to use footage in a newspaper report because it's a newspaper and you can't put a video in a newspaper -
14	T	Unless you're from Harry Potter world, but… Okay. Yeah, so you've the idea that you need the footage, so what can you do with that footage? You've got it. Amina?
15	S8	You could put it on the actual television and everybody can see that that's proof.

The extract shows how the teacher encourages active listening and student-to-student talk. In Turn 1 the teacher explicitly instructs the students to listen actively to one another so that they can add on to other's contributions or ask for reasoning: "*You're going to show me active listening … If they don't say why, you're going to add to it, tell me why you need that feature. Okay, you might want to change it so active listening …".* The students respond to this instruction by engaging in the student-to-student talk. For example, in Turn 2, S2 offers an extended contribution in which he argues and reasons: "*You need evidence so you can prove that it's true because if…*". He then nominates a peer to build on his contribution: *"Diane, would you like to say something?*". The same thing happens in Turn 5 where S3 makes an extensive contribution, offering an idea and analysing and evaluating it. He finishes his turn by inviting his peer Sam to add on to his idea.

These turns demonstrate instances of student-to-student co-construction. It is also noticeable that the students emulate the turn-taking strategies employed by the teacher by nominating their peers. These behaviours suggest that the students feel safe and confident in engaging in a classroom dialogue and challenging others' contributions as demonstrated in Turn 13 by P7 who states: "*I would disagree to use footage in a newspaper report because it's a newspaper and you can't put a video in a newspaper".* This is made possible by the teacher steering the interaction in the direction of dialogue: *"Does anyone agree in our*

newspaper, or disagree in our newspaper report, there should be footage? You have to agree or disagree with a reason ..." (in Turn 12).

4.3 Interviews

The interviews with teachers, mentors and head teachers conducted towards the end of phase 2 to ask about their perceptions of the programme's impact on pedagogical practices, student engagement and learning, and to monitor implementation of the school-based professional development programme, supported the findings of the video analysis. Overall, they spoke of positive gains regarding professional learning and student engagement. They particularly valued the use of audio and video recordings in mentoring sessions for capturing the talk moves and for stimulating critical reflection.

Many teachers, mentors and head teachers expressed the view, however, that the 20-week programme was too short for it to fully embed dialogic teaching in the classroom and to show positive gains on students' learning. Documentary analysis of the mentor planning/review forms also supported the views expressed in the interviews that the programme was implemented with a reasonable degree of consistency with regards to the 11 cycles of training and that it was both useful and feasible in developing the quality of teacher-student interaction and talk. By the end of phase 2, all of the schools had completed the 11 cycles and 57 per cent reported they had kept to the timeline as recommended in the handbook.

The main challenges faced by teachers and mentors included creating insufficient time for the planning/review cycles (33 per cent of schools in both phases 1 and 2), particularly in light of the national curriculum and assessment changes they were undergoing at the time of the study, staff and student turnover, and staff illness, especially in phase 2. However, most of the challenges were intrinsic to the day-to-day running of the schools

rather than difficulties arising from the implementation of the professional development programme.

5 Discussion

The study set out to evaluate the effectiveness of a school-based professional development intervention designed to change teachers' pedagogical practices to improve the quality of whole-class talk, thereby producing higher learning outcomes. It was found by the independent impact evaluation that following the 20-week dialogic teaching programme that students were on average two months ahead of their control peers in English, mathematics and science. The process evaluation also showed positive results in the intervention schools in terms of improved pedagogical practices and quality of classroom talk.

The process evaluation findings showed teachers in the intervention schools made significantly greater use of open questions, thus achieving a better balance of closed and open questions, and that they used a wider repertoire of follow-up talk moves to promote extended student contributions than those found in the control schools. Such contributions involved the students in sharing, explaining, arguing and justifying their thinking and building on the ideas of other students. In contrast, teachers in the control schools largely operated within a recitation script made up of closed questions, brief student answers and low-level evaluation as to the appropriateness of the answer. When extended student contributions did occur in the control schools, they were often, limited to explanations/analysis and they tended to lack evidence. Overall, the whole-class teacher-student interaction identified in the intervention schools showed a high degree of reciprocity leading to higher levels of student engagement and learning outcomes compared to the control schools. Such high levels of reciprocity have mainly been found in studies of group-based interaction (Howe & Abedin, 2013; Howe et al., 2019).

Such analysis as captured by the theoretically-grounded discourse analytical frameworks for teacher talk and for student talk developed for the current study therefore advances our understanding of student learning talk in the whole-class teaching of primary English, mathematics and science, particularly where teacher are helped to broaden their repertoire of questioning and follow-up approaches to student responses. It therefore makes a significant and original contribution to the whole-class talk literature which has largely focused on teacher talk, with student talk often being taken for granted or somewhat peripheral to the analysis. In future interventions the frameworks could be used to make the learning visible for both teachers and students (Hattie, 2012). In addition to providing teachers and mentors with tools for analysing classroom interaction and talk, they could also be used with students to help develop their metadiscoursal and metacognitive awareness of how participating in classroom talk can enhance learning outcomes.

The intervention also shows that schools need to be central to the professional development process by providing them on-going continuing professional development to support improvements in pedagogical practices to help address the theory-practice divide. This was a view point largely supported by head teachers, teachers and mentors in the intervention school interviews. Observation/feedback routines structured explicitly as part of whole-school professional development have been found to be particularly effective in enabling teachers to work on implementing pedagogical changes to improve student learning outcomes (Coe et al., 2014; Hennessy, Dragovic, & Warwick, 2018). Feedback loops using video footage, as in the current study, have also been found to be a powerful tools for teacher professional development (Davies et al., 2017; Saito & Khong, 2017; Wilkinson et al., 2017)

According to the interviews, this element of school-based professional development was found to be most useful by the intervention teachers and mentors in changing their pedagogical practices and provided them with opportunities for monitoring and self-

evaluation of their talk practices. Such forms of professional development have also been found to foster teacher well-being and higher job satisfaction, and to support professional learning by strengthening teacher collaboration and improving the professional knowledge base within the school (Darling-Hammond, 2017).

Teachers identified as using a more dialogic teaching approach can also play a central role in school-based professional development by observing, coaching and proving feedback to colleagues. As Vrikki et al (2018) argue, aggregating data and reporting on the means can mask individual variation in the use of a dialogic pedagogy. The standard deviations found in the current study (see Appendix 1) suggest there was a great deal of individual variation. In the baseline analysis, for example, it was found that teachers in the intervention schools were already making greater use of discussion/dialogue than the control group and that this lead was sustained into phase 2 and increased significantly as the intervention progressed. It is therefore important to identify teachers with a more dialogic teaching approach at the school level so they can act as coaches and mentors. Such individual variation does not, however, detract from the general finding that in order to help teachers achieve a greater consistency in their implementation of a dialogic pedagogy they need to be supported by a well-designed school-based teacher development programme.

The limitation of running a 20-week as revealed in the interviews with teachers, mentors and head teachers for implementing and embedding a dialogic pedagogy also points to the need for teachers to be given sustained periods of time to try out new approaches and to reflect and receive feedback on their efforts. This is supported by a meta-analysis of experimental and quasi-experimental studies to evaluate the impact of sustained professional development (ranging from 30 to 100 hours spread over 6 to 12 months) on student achievement. It was found that an average of 49 hours in a year boosted student achievement by approximately 21 percentile points (Yoon, Duncan, Lee, Scarloss, & Shapley, 2007).

Such findings support the view that teacher professional development needs to be sustained over time, focused on teaching subject content and embedded in the classroom.

Providing teachers with substantial blocks of time in order to implement a dialogic pedagogy in the classroom raises the issue of the scalability and sustainability of school-based professional development programmes. In the current study, teachers and mentors were spending on average 90 minutes per fortnight on the school-based collaborative programme. Howe and Mercer (2017) argue that a 'lesson study' approach, first developed in Japan, where teachers are expected to collaborate within and across clusters of schools at a year or grade level on an action research project, could be adapted to help schools in England overcome the challenges of implementing and scaling up a dialogic pedagogy.

6. Conclusions

The aim of this paper was to present the findings of a process evaluation of a professional development intervention designed to support teachers in the implementation of a dialogic pedagogy in the teaching of English, mathematics and science in primary schools serving socio-economically deprived areas of England. The findings make a significant contribution to the existing literature on whole-class interaction as the large sample of student talk allows some important conclusions to be drawn with regard to implementing a dialogic pedagogy in the classroom. While any system of talk analysis will inevitably simplify the complexity of classroom interaction and discourse, the analytical frameworks used in the current study point to some fundamental changes occurring in the underlying pedagogy of teachers in the intervention schools compared to the control schools. The same changes in the pedagogy were also observed across all three subjects suggesting the dialogic teaching was generic and that such an approach may help improve student thinking and interactive skills in addition to their subject knowledge.

Overall, the impact and process evaluations revealed that in addition to significant gains in student learning attainment there were changes in pedagogical practices and higher levels of student participation in the classroom talk in the intervention schools following the dialogic pedagogy training. Teachers in the intervention schools were using a broader repertoire of questioning and F-moves within the IRF structure to prompt students to participate, share, expand and provide evidence for their reasoning, and to listen to and build on other contributions. Teachers, mentors and head teacher were also very positive about the professional development programme in terms of it improving student participation, engagement and learning. The findings also point to the fact that the repertoire of student talk is central to the learning process and that it is the teacher who enables such talk to occur.

Finally, there is the need to build a more rigorous evidence base for both policymakers and practitioners about the types of dialogic practices which are the most academically productive in whole-class teaching and the kinds of professional development approaches that will help build teacher capacity and bring about sustainable transformations in pedagogical practices and student learning. Longitudinal and large-scale studies tracking the scale-up of national school-based professional development programmes designed to implement a dialogic pedagogy in schools using both impact and process evaluations will help build such a rigorous evidence base.

References

Alexander, R.J. (2006). *Towards Dialogic teaching: rethinking classroom talk*. York, UK: Dialogos.

Alexander, R. (2018). Developing dialogic teaching: genesis, process, trial. *Research Papers in Education*, *33*(5), 561 - 598.

Alexander, R. J., Hardman, F., & Hardman, J., with Rajab, T., & Longmore, M. (2017). *Changing Talk, Changing Thinking: interim report from the in-house evaluation of the CPRT/UoY Dialogic Teaching Project. York: University of York*. Retrieved on 1 August 2018 from: https://www.robinalexander.org.uk/wp-content/uploads/2017/07/Alexander-et-al-EEF-in-house-interim-report-final-170714.pdf

Borko, H., Jacobs, J., Eiteljorg, E., & Pittman, M. E. (2008). Video as a tool for fostering productive discussions in mathematics professional development. *Teaching and Teacher Education*, *24*, 417 - 436.

Coe, R., Aloisi, C., Higgins, S., & Major, L. E. (2014). *What makes great teaching? Review of the underpinning research*. London, UK: Sutton Trust. Retrieved on 1 August 2018 from: http://www.suttontrust.com/researcharchive/great-teaching/

Darling-Hammond, L. (2017). Teacher education around the world: What can we learn from international practice? *European Journal of Teacher Education*, *40*(3), 291 - 309.

Davies, M., Kiemer, K., & Meissel, K. (2017). Quality talk and dialogic teaching - an examination of a professional development programme on secondary teachers' facilitation of student talk. *British Educational Research Journal, 43*(5), 968 - 987.

Gillies, R. M. (2016). Dialogic interactions in the cooperative classroom. *International Journal of Educational Research*, *76*, 178 - 189.

Haneda, M. (2017). Dialogic learning and teaching across diverse contexts: Promises and challenges. *Language and Education*, *31*(1), 1 - 5.

Hardman, F., Smith, F., & Wall, K. (2003). 'Interactive whole class teaching'in the national literacy strategy. *Cambridge Journal of Education*, *33*(2), 197 - 215.

Hattie, J. (2009). *Visible learning: A synthesis of 800+ meta-analyses on achievement*. Abingdon, UK: Routledge.

Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning.* New York: Routledge/Taylor & Francis Group.

Hennessy, S., Dragovic, T., & Warwick, P. (2018). A research-informed, school-based professional development workshop programme to promote dialogic teaching with interactive technologies. *Professional Development in Education*, *44*(2), 145 - 168.

Howe, C., & Abedin, M. (2013). Classroom dialogue: a systematic review across four decades of research. *Cambridge Journal of Education*, *43*(3), 325 - 356.

Howe, C., & Mercer, N. (2017). Commentary on the papers. *Language and Education*, *31*(1), 83 - 92.

Howe, C., Hennessy, S., Mercer, N., Vrikki, M., & Wheatley, L. (2019). Teacher-student dialogue during classroom teaching: Does it really impact upon student outcomes?. *The Journal of the Learning Sciences,* DOI: 10.1080/10508406.2019.1573730

Jay, T., Willis, B., Thomas, P., Taylor, R., Moore, N., Burnett, C., … Stevens, A. (2017). *Dialogict teaching : Evaluation report and executive summary*. London, UK: Education

Endowment Foundation. Retrievd on 1 August 2018 from: https://educationendowmentfoundation.org.uk/public/files/Projects/Evaluation_Reports/Dialogic_Teaching_Evaluation_Report.pdf.

Khong, T. D. H., Saito, E., & Gillies, R. M. (2019). Key issues in productive classroom talk and interventions. *Educational Review*, *71*(3), 334 - 349.

Lefstein, A., Snell, J., & Israeli, M. (2015). *From moves to sequences: expanding the unit of analysis in the study of classroom discourse. British Educational Research Journal, 41*(5), 866 - 885.

Littleton, K., & Mercer, N. (2013). *Interthinking: Putting talk to work*. Abingdon, UK: Routledge.

Mehan, H. (1979). *The structure of classroom lessons*. *Learning Lessons*. Cambridge, MA: Harvard University Press.

Mercer, N., & Littleton, K. (2007). *Dialogue and the development of children's thinking: A sociocultural approach*. London, UK: Routledge.

Michaels, S., & O'Connor, C. (2015). Conceptualizing talk moves as tools: Professional development approaches for academically productive discussion. In L.B. Resnick, C.S.C. Asterhan, & S.N. Carke (Eds.), *Socializing intelligence through talk and dialogue* (pp. 347 - 362). Washington, DC: American Educational Research Association.

Molinari, L., Mameli, C., & Gnisci, A. (2013). A sequential analysis of classroom discourse in Italian primary schools: the many faces of the IRF pattern. *British Journal of Educational Psychology*, *83*, 414 - 430.

Nystrand, M., Gamoran, A., Kachur, R., & Prendergast, C. (1997). *Opening dialogue: Understanding the dynamics of language and learning in the English classroom.* New York: Teacher College Press.

Nystrand, M., Wu, L. L., Gamoran, A., Zeiser, S., & Long, D. A. (2003). Questions in time: Investigating the structure and dynamics of unfolding classroom discourse. *Discourse Processes, 35*(2), 135 - 198.

O'Connor, C., Michaels, S., & Chapin, S. (2015). "Scaling down" to explore the role of talk in learning: From district intervention to controlled classroom study. In n L. B. Resnick, C. S. C. Asterhan, & S. N. Clarke (Eds.), *Socializing intelligence through talk and dialogue* (pp. 111 - 126). Washington, DC: American Educational Research Association.

Resnick, L. Asterhan, C. & Clarke, S. (eds.) (2015). *Socializing intelligence through academically productive talk and dialogue*. Washington, DC: American Education Research Association.

Rosenshine, B., & Meister, C. (1994). Reciprocal teaching: A review of the research. *Review of Educational Research*, *64*(4), 479 - 530.

Saito, E., & Khong, T. D. H. (2017). Not just for special occasions: supporting the professional learning of teachers through critical reflection with audio-visual information. *Reflective Practice*, *18*(6), 837 - 851.

Sedova, K., Sedlacek, M., & Svaricek, R. (2016) Teacher professional development as a means of transforming student classroom talk. *Teaching and Teacher Education, 57*, 14 - 25.

Sinclair, J. M., & Coulthard, M. (1975). *Towards an analysis of discourse: The English used by teachers and pupils*. London, UK: Oxford University Press.

Smith, F., Hardman, F., Wall, K., & Mroz, M. (2004). Interactive whole class teaching in the national literacy and numercy strategies. *British Educational Research Journal*, *30*(3), 395 - 411.

Snell, J. (2011). Interrogating video data: systematic quantitative analysis versus micro-ethnographic analysis. *International Journal of Social Research Methodology*, *14*(3), 253 - 258.

Tharp, R. G., & Gallimore, R. (1988). *Rousing minds to life: Teaching, learning, and schooling in social context*. New York: Cambridge University Press.

Topping, K. J., & Trickey, S. (2015). The role of dialogue in philosophy for children. In L. B. Resnick, C. S. C. Asterhan, & S. N. Clarke (Eds.), *Socializing Intelligence Through Academic Talk and Dialogue* (pp. 99 - 110). Washington, DC: American Educational Research Association.

Vrikki, M., Wheatley, L., Howe, C., Hennessy, S., & Mercer, N. (2018). Dialogic practices in primary school classrooms. *Language and Education*, DOI: 10.1080/09500782.2018.1509988.

Webb , N.M., Franke, M.L, Ing, M., Wong, J., Fernandez, C.H., Shim, N., & Turrou, A.C. (2014). Engaging with each other's mathemtaical ideas: Interralationships among student participation, teacvhers' instructional practices and learning. *International Journal of Educational Research, 63*(1), 79 - 93.

Wells, G. (1999). *Dialogic Inquiry: Towards a socio-cultural practice and theory of Education*. Cambridge, UK: Cambridge University Press.

Wilkinson, I.A.G., Murphy, P.K., & Binici, S. (2015). Dialogue-intensive pedagogies for promoting reading comprehension: What we know, what we need to know. In L. B. Resnick, C. S. C. Asterhan, & S. N. Clarke (Eds.), *Socializing intelligence through talk and dialogue* (pp. 37 - 50). Washington, DC: American Educational Research Association..

Wilkinson, I. A. G., Reznitskaya, A., Bourdage, K., Oyler, J., Glina, M., Drewry, R., … Nelson, K. (2017). Toward a more dialogic pedagogy: changing teachers' beliefs and practices through professional development in language arts classrooms. *Language and Education*, *31*(1), 65 - 82.

Yoon, K.S., Duncan, T., Lee, S.W.-Y., Scarloss, B., & Shapley, K. (2007). *Reviewing the evidence on how teacher professional development affects student achievement* (Issues & Answers Report, REL 2007-No. 033). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance.