

TEACHER-PUPIL DIALOGUE IN MATHEMATICS LESSONS

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This paper reports the findings of a systematic review of the literature looking at what characterises effective teacher-initiated teacher-pupil dialogue to promote conceptual understanding in mathematics lessons in Key Stages 2 to 4. The review was based on an in-depth analysis of 15 studies. Eight key characteristics were identified: going beyond IRF (Initiation-Response-Feedback); focusing attention on mathematics rather than performativity; working collaboratively with pupils; transformative listening; scaffolding; enhancing pupils' self-knowledge concerning how to make use of teacher-pupil dialogue as a learning experience; encouraging high quality pupil dialogue; and inclusive teaching.

INTRODUCTION

The Mathematics Education Review Group was commissioned in March 2007 by the DfES (as was – now DCSF) to undertake a systematic review into some aspect of effective teaching and learning in mathematics. After a meeting held at the DfES it was agreed that the focus of the review would be on teacher-pupil dialogue. Subsequently, the following review question was developed: “In mathematics lessons in England in Key Stages 2 to 4, what characterises effective teacher-initiated teacher-pupil dialogue to promote conceptual understanding of mathematics?”

This focus arose out of a general concern within the DfES that more use could be made within the teaching of mathematics of strategies which promote pupils' conceptual understanding. Strategies based on the use of teacher-pupil dialogue were seen to be a prime candidate for this, and it was thought that the identification of the characteristics underpinning the effective use of teacher-pupil dialogue in mathematics lessons could make an important contribution to the development of classroom practice.

METHODS USED IN THE REVIEW

Identifying relevant studies involved carrying out an electronic search using keywords with bibliographic data bases, handsearching through key journals and conference proceedings, citations, and publications recommended by contacts. This resulted in 15 studies being identified for the in-depth analysis (Back, 2005; Black, 2004, 2006; Bold, 2002; Coles, 2002; Hadjidemetriou and Williams, 2003; Jones and Tanner, 2002; Mercer and Sams, 2006; Myhill, 2006; Pratt, 2006; Ryan *et al.*, 2003; Smith *et al.*, 2004; Smith and Higgins, 2006; Tanner and Jones, 2000; Wilson *et al.*, 2006)

FINDINGS AND IMPLICATIONS EMERGING FROM THE IN-DEPTH ANALYSIS

The analyses indicated that teacher-initiated teacher-pupil dialogue in mathematics lessons is still dominated by traditional IRF (Initiation-Response-Feedback) sequences and discourse. IRF sequences are typically distributed by the teacher around the classroom so that different pupils are engaged in the interaction, but for each individual pupil the interaction is short, usually requires an answer to a closed question, and is terminated by evaluative feedback (e.g. yes, no, well done), thus limiting the potential of teacher-pupil dialogue in promoting pupils' conceptual learning.

Teachers also engage with pupils on a one-to-one basis during private dialogue when the teacher is typically giving help or support to pupils whilst they are working individually on problems and tasks set by the teacher. Surprisingly little research is reported here on the dialogue during such interactions. This may be a consequence of the way in which the introduction of the NNS has focused research attention on the whole class interactive teaching component of lessons. This is a pity, as we need to know more about the characteristics of high quality dialogue during such private interactions. There are also periods during a lesson in which small groups of pupils may be asked to work collaboratively on a problem and to discuss and share ideas. During such small group work tasks, the teacher may circulate from group to group to observe or listen in on their progress and to initiate dialogue. Again, surprisingly little research is reported here on the dialogue which occurs in such contexts.

There is, however, a clear consensus amongst recent researchers looking at aspects of classroom discourse that there is a need to enhance the quality of teacher-initiated teacher-pupil dialogue in order to promote pupils' conceptual understanding of mathematics. Eight characteristics of effective teacher-initiated teacher-pupil dialogue were identified:

- (i) *Going beyond IRF*: This characteristic deals with the ways in which teachers go beyond the typical use of IRF, by asking open-ended questions and follow-up questions, typically including asking pupils to justify or explain their answer or to comment other pupils' answers.
- (ii) *Focusing attention on mathematics rather than performativity*: This characteristic deals with the ways in which teachers can use dialogue to get pupils involved in mathematical thinking rather than getting correct answers.
- (iii) *Working collaboratively with pupils*: This characteristic deals with the ways in which teachers can use dialogue to establish a learning environment in which pupils and teachers are working collaboratively in exploring mathematical problems.
- (iv) *Transformative listening*: This characteristic deals with the ways in which teachers listen to pupils' contributions in a manner that conveys that there is a

genuine ‘meeting of minds’ and that the teacher is genuinely willing to change their own thinking in the light of what the pupil has said.

(v) *Scaffolding*: This characteristic deals with the ways in which teachers use dialogue to scaffold pupils’ thinking and understanding.

(vi) *Enhancing pupils’ self-knowledge concerning how to make use of teacher-pupil dialogue as a learning experience*: This characteristic deals with the ways in which teachers can enhance pupils’ self-knowledge about the nature of the learning process so that pupils can develop skills that will enable them to make better use of classroom dialogue. Pupils need to appreciate how using talk and listening to teachers and other pupils’ talking is a learning experience.

(vii) *Encouraging high quality pupil dialogue*: This characteristic deals with the ways in which teachers respond in an encouraging manner to pupils’ contributions.

(viii) *Inclusive teaching*: This characteristic deals with the ways in which teachers can convey to *all* pupils regardless of ability that their contribution is equally valued and that all pupils in the class are engaged and have their answers taken seriously.

Few of the studies provided evidence that such characteristics actually led to the promotion of pupils’ conceptual understanding of mathematics. The studies that did offer some evidence of the promotion of pupils’ conceptual understanding of mathematics largely focused on the enhancement of pupils’ self-knowledge concerning how to make use of teacher-pupil dialogue as a learning experience.

The data considered in this systematic review have three clear implications for future research. Firstly, there appears to be a paucity in recent research conducted in England included in this review of high quality evidence concerning the link between each particular characteristic of teacher-initiated teacher-pupil dialogue on the one hand and the promotion of pupils’ conceptual understanding of mathematics on the other hand. This requires attention, lest the general consensus amongst the researchers identified in this review, leads to a taken for granted assumption that these characteristics have a positive impact on pupils’ conceptual understanding, and that bringing about such a positive impact is unproblematic.

The second implication is that we need more research on the development of innovative teaching practices which make use of teacher-initiated teacher-pupil dialogue. In particular, there is a need for research into how to enable pupils to make the best use of teacher-initiated teacher-pupil dialogue. For example, this review indicates that pupils need to understand how such dialogue is part of the learning process.

Finally, research needs to look at other opportunities within the classroom, outside the whole class interactive-teaching phase of the lesson, where teacher-initiated teacher-pupil dialogue can make an effective contribution to the promotion of pupils’ conceptual understanding of mathematics.

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ACKNOWLEDGEMENT

The Mathematics Education Review Group and this review are part of the initiative on evidence-informed policy and practice at the EPPI-Centre, Social Science Research Unit, Institute of Education, University of London, funded by the Department for Children, Schools and Families (DCSF). The review group acknowledges the financial support from the DCSF.

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