

Chapter 5

Scaffolding the development of effective collaboration and learning

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Abstract

Research in Mexican and British schools provides an empirical basis for arguing that, by the use of certain kinds of interactional strategies, teachers can enable children to become more able in managing individual and joint reasoning and learning activities in the classroom.

The research described is based on a sociocultural conception and analysis of education, which focuses on the ways that children can be inducted into the communicative and intellectual activities of the classroom as a ‘community of enquiry’. The research has provided (a) an account of strategies teachers use, and for relating teacher’s scaffolding to the interactive process of knowledge construction; (b) an analysis of ways that children talk when working together on joint activities; and (c) a practical method for promoting children’s effective collaboration, communication, reasoning and learning, successfully tested with British and Mexican primary school children. The results of the research are discussed in relation to a Vygotskian conception of the relationship between ‘intermental’ (social) and ‘intramental’ (psychological) development.

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1. Introduction

For the last 7 years, academics from the Open University in Britain (led by Neil Mercer) and from the National Autonomous University of Mexico (led by Sylvia Rojas-Drummond) have been involved in research aimed at understanding and improving the quality of teacher-led dialogue and of peer group activity in primary

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classrooms of both countries. Funded by a British Council grant for academic exchange and inspired by a sociocultural perspective, this collaboration has generated results with implications for both educational theory and practice. In this paper, we provide an overview of this research and its findings. Before describing the research itself, we will explain how it has been shaped by sociocultural theory and shared educational concerns.

1.1. The sociocultural perspective

There is not one, coherent and unified sociocultural approach to research on language and education. It is rather that many researchers, building on the work of Vygotsky (e.g. Vygotsky, 1978), have begun to adopt a similar view of how language and social interaction are involved in the process of human development and learning. Those researchers treat education and cognitive development as cultural processes, whereby knowledge is not only possessed individually but also shared amongst members of communities; and people construct understandings jointly, through their involvement in events which are shaped by cultural and historical factors. Language acquisition and use are seen as having a profound effect on the development of thinking. This does not mean that sociocultural researchers boldly assert that social experience rather than heredity shapes children's development. They may take different positions on that issue. But they share the view that we cannot understand the nature of thinking, learning and development without taking account of the intrinsically social and communicative nature of human life. Education is seen as taking place through dialogue, with the interactions between students and teachers reflecting the historical development, cultural values and social practices of the societies and communities in which educational institutions exist. The educational process which takes place within those institutions might thus be better described as 'teaching-and-learning', rather than there being separate processes of 'teaching' and 'learning'. This implies that educational success, and failure, may be explained by the quality of educational dialogue rather than being just the result of the intrinsic capability of individual students or the didactic presentational skills of individual teachers.

Vygotsky (1978) described language as both a cultural tool (for the development and sharing of knowledge amongst members of a community or society) and as a psychological tool (for structuring the processes and content of individual thought). He proposed that there is a close relationship between these two kinds of use, which can be summed up in the claim that 'intermental' (social, interactional) activity forges some of the most important 'intramental' (individual) cognitive capabilities, with children's involvement in joint activities generating new understandings and ways of thinking. But although this claim has been treated with great interest by development psychologists and educationalists, surprisingly little evidence has been offered to support or refute it. We have tested this claim through a series of studies in British and Mexican primary schools.

1.2. *The educational functions of dialogue in classrooms*

As well as being inspired by Vygotsky's ideas, our research was also motivated by practical educational concerns. Basically, we wished to explore two functional aspects of interaction in classrooms. The first is teachers' use of spoken interaction with children as a means for 'scaffolding' the development of their knowledge and understanding. The second is the potential value of peer group discussion as another means of promoting such development. We will briefly describe the background to each of these interests.

1.2.1. *The educational value of teacher-led discussion*

There has been a common tendency amongst educational researchers to deplore the frequent use by teachers of questions and similar strategies during classroom interaction. For example, Dillon (1988) and Wood (1992) have claimed that because most teachers' questions are designed to elicit just one brief 'right answer' (which often amounts to a reiteration of information provided earlier by the teacher) this unduly limits and suppresses students' contributions to the dialogic process of teaching-and-learning. The functions of teacher questions are thus seen as simply maintaining control of classroom talk and evaluating children against the teacher's expert knowledge and pedagogic agenda. By this reasoning, teachers' frequent use of questions, especially if they constitute the first act of an initiation-response-feedback (IRF) exchange, should be discouraged. Classroom research in many parts of the world certainly indicates that this particular use of questions by teachers—asking 'closed' questions to which they already know the answer—is common. However, as we (Rojas-Drummond, 2000; Mercer, 1995) and others (Alexander, 2001; Gibbons, 2001) have argued, it is not valid to use this fact to evaluate all teachers' questions, as such an evaluation is based on an impoverished understanding of the nature of classroom education and the multifunctional nature of talk within it. Alexander's (2001) examples from schools in several different cultures illustrate well that we should not associate the use of one structural feature of talk (an IRF exchange) with just one pragmatic, pedagogic function (eliciting answers to closed questions in order to test pupils' knowledge). While teacher questioning certainly can indeed generate little more than an uninspiring quiz called 'guess what's in the teacher's mind', that is merely one possible function. Teacher's questions can also:

- (a) encourage children to make explicit their thoughts, reasons and knowledge and share them with the class;
- (b) 'model' useful ways of using language that children can appropriate for use themselves, in peer group discussions and other settings (asking for relevant information possessed only by others, or asking 'why' questions to elicit reasons which are relevant to both functions (a) and (b)).
- (c) provide opportunities for children to make longer contributions in which they express their current state of understanding, or to articulate difficulties.

Evidence of this functional variety is illustrated by Alexander's (2001) account of the common practice by Russian teachers of encouraging children to share their

misunderstandings of mathematics problems with the rest of the class, and how this can make a useful contribution to the development of their own and others' understanding. And using data from Australian classrooms, Gibbons has shown the value of questions for enabling children to generate 'stretches of discourse in contexts where there is a 'press' on their linguistic resources, and where for the benefit of the listener they must focus not only on what they wish to say but on how they are saying it' (Gibbons, 2001, p. 260). Our own earlier research had also shown that a teacher asking children why they had gone about an activity in the way they had was often very useful for revealing their perspective on the task and stimulating their own reasoning (Mercer, 1995). This led us to the view that if there was a problem with teachers' questions, it might not be that they were used too frequently but rather that they were not always used for the most productive educational purposes.

1.2.2. The educational value of peer group discussion

As with evaluations of teacher-led discourse, researchers have differed in their assessments of the educational value of putting children into pairs and groups to work and talk together. On the one hand, experimental and observational studies have demonstrated the value of collaborative talk in problem solving (Teasley, 1995; Lyle, 1993; see also Littleton & Light, 1999). On the other hand, observers of collaborative activity in classrooms have reported that most of the talk observed was off-task, uncooperative and of little educational value (Galton, Simon, & Croll, 1980; Bennett & Cass, 1989). But this is not quite the paradox that it seems. Closer consideration of relevant evidence suggests that some ways of talking in group activity are indeed of special educational value, but that such ways are relatively uncommon in classrooms. Our explanation for the relatively low educational value of much group talk in classroom has been that children are not commonly taught about ways of talking effectively together, or helped to develop specific dialogic strategies for thinking collectively (Mercer, 1995).

The quality of children's discussion when engaged productively in collaborative activities in the classroom can be related to the idea of 'Exploratory Talk', a way of using language for reasoning which was first identified by the pioneering British educational researcher Douglas Barnes (Barnes & Todd, 1995). Our own definition of this way of communicating is as follows:

Exploratory Talk is that in which partners engage critically but constructively with each other's ideas. Relevant information is offered for joint consideration. Proposals may be challenged and counter-challenged, but if so reasons are given and alternatives are offered. Agreement is sought as a basis for joint progress. Knowledge is made publicly accountable and reasoning is visible in the talk (Mercer, 2000, p. 98).

There are good reasons for wanting children to use this kind of talk in group activities, because it embodies a valuable kind of 'co-reasoning', with speakers following ground rules which help them share knowledge, evaluate evidence and consider options in a reasonable and equitable way. Exploratory Talk represents an effective way of using language to think collectively which is

embodied in some powerful genres, such as those used in science, law and business, and it is reasonable to expect that education should help every child to become aware of its value and become able to use it effectively. As mentioned above, however, the development of such ways of talking is rarely given attention or priority in classrooms.

2. Integrating teacher-led dialogue and peer group discussion: the Mexican and British strands of research

As explained in our introduction, for several years we have been involved in research, based in schools both in England and in Mexico, aimed at improving the quality of both teacher-led dialogue and of peer group activity in classrooms. However, although a sociocultural perspective has informed all this research, in the earlier stages of this collaboration the research in each of the two countries had a different focus. We will explain the nature and development of these two strands of research below and then explain how they came to be more closely integrated.

2.1. The British strand of research

The British line of research emerged from an interest in both teacher–pupil interaction (Edwards and Mercer, 1987) and peer group activity (Mercer, 1994; Wegerif, 1994). It focused on a proposal to increase children use of Exploratory Talk in classroom activities and to evaluate the effects of doing so on the quality of their talk, reasoning and learning. We acted upon this by designing a programme of planned intervention which integrated teacher-led whole class dialogue and group activity, so that children could be expected to begin their activity and discussion with a shared conception of relevant knowledge and of how they should talk and think together effectively. The programme consisted of a set of 12 ‘Talk Lessons’ created by researchers working with local teachers. This programme was then implemented with children aged 8–11 in primary schools in Milton Keynes.

At the start of the intervention, each participating teacher received a basic training in the approach and was provided with the Talk Lessons. The first five ‘core’ lessons provided teachers with activities for establishing with their classes a set of ‘ground rules’ which embody the essential qualities of Exploratory Talk. That is, these lessons were mainly aimed to develop children’s understanding and use of Exploratory Talk. The complete programme included lessons which related to specific curriculum subjects and consists of both teacher-led sessions and group activities (some of which use specially designed computer-based tasks based on curriculum topics).

In order to evaluate changes in the quality of children’s talk, we video-recorded groups of children carrying out activities. We did this in both ‘target’ classes

(i.e. those involved in the programme) and in ‘control’ classes (i.e. with matched classes of children in local schools which were not involved in the programme).

As mentioned above, we also wished to investigate any effects that the intervention might have on children’s individual reasoning skills. That is, we wished to test Vygotsky’s claims about the influence of ‘intermental’ activity on ‘intramental’ development. To do so, we used *Raven’s Progressive Matrices*, a test which has been commonly used as a general measure of non-verbal reasoning (Raven, Court, & Raven, 1995). Both target and control sets of children were given this test before the target classes began the experimental programme, and then again after the series of lessons had been completed. Using two sets of the Raven’s test items, we were able to assess the children’s thinking both collectively (as they did the test in groups) and individually (when they did the other version of the test alone).

The results of our evaluations produced three interesting results (described in more detail in Mercer, Wegerif, & Dawes, 1999; Wegerif, Mercer, & Dawes, 1999). First, our analysis of the children’s talk showed that children in target classes came to use much more Exploratory Talk than those in control classes. Secondly, by examining the recorded talk of the groups, we found that groups who used more Exploratory Talk tended to solve the Raven’s puzzles more successfully. Thus when we compared groups in target classes who had failed on specific problems in the pre-lessons test with their successes in the post-lessons test, we could see how the ‘visible reasoning’ of Exploratory Talk in the transcripts had enabled them to do so. We will discuss the third finding shortly. But first, to illustrate our first two findings, are two sequences from the talk of children (aged 10 and 11) in the same target group. They are doing one of the Raven’s puzzles (D9). Sequence 6 was recorded before they did the series of lessons, while Sequence 7 was recorded after they had done so. (*For copyright reasons, we are not allowed to reproduce the test item here.*)

Sequence 1: Graham, Suzie and Tess doing Raven’s test item D9 before the Talk Lessons

- Tess: It’s that
 Graham: It’s that, 2
 Tess: 2 is there
 Graham: It’s 2
 Tess: 2 is there Graham
 Graham: It’s 2
 Tess: 2 is there
 Graham: What number do you want then?
 Tess: It’s that because there ain’t two of them
 Graham: It’s number 2, look one, two
 Tess: I can count, are we all in agree on it?
 (*Suzie rings number 2 - an incorrect choice - on the answer sheet*)
 Suzie: No
 Graham: Oh, after she’s circled it!

Sequence 2: Graham, Suzie and Tess doing Raven's test item D9 after the Talk Lessons

- Suzie: D9 now, that's a bit complicated it's got to be
 Graham: A line like that, a line like that and it ain't got a line with that
 Tess: It's got to be that one
 Graham: It's going to be that don't you think? Because look all the rest have got a line like that and like that, I think it's going to be that because
 ...
 Tess: I think it's number 6
 Suzie: No I think it's number 1
 Graham: Wait no, we've got number 6, wait stop, do you agree that it's number 1? Because look that one there is blank, that one there has got them, that one there has to be number 1, because that is the one like that. Yes. Do you agree?
 (*Tess nods in agreement*)
 Suzie: D9 number 1
 (*Suzie writes '1', which is the correct answer*)

In Sequence 1, the talk is not 'exploratory' but more aptly described as 'disputational' (Mercer, 1995). Cycles of assertion and counter assertion, forming sequences of short utterances which rarely include explicit reasoning, are typical of disputational talk. We can see that Tess does offer a reason—a good reason—for her view, but Graham ignores it and she seems to give up in the face of his stubbornness. Suzie has taken the role of writer and she says little. At the end, having ringed the answer Graham wanted, she disagrees with it. It is not the right answer; but they all move on to the next problem anyway.

Sequence 2 illustrates some ways that the talk of the same children changed after doing the programme of Talk Lessons and how this helped them to solve the problem. The children's language clearly shows characteristics of Exploratory Talk. Graham responds to opposition from Tess by giving an elaborated explanation of why he thinks 'number 1' is the correct choice. This clear articulation of reasons leads the group to agree on the right answer. Such explanations involve a series of linked clauses and so lead to longer utterances. All three children are now more equally involved in the discussion. They make more effective rhetorical use of language for expressing their opinions and persuading others of their value. Compared with their earlier attempt, language is being used more effectively by the group as a tool for thinking together about the task they are engaged in.

We now come to our third main finding. The 'before-and-after' comparisons of Raven's test performances therefore confirmed that the Talk Lessons were changing the quality of children's joint reasoning. But, as we hoped, the results also provided some evidence related to Vygotsky's hypothesis about the link between social activity and individual development. We found that target class children who did the Talk Lessons became significantly better at doing the Raven's items individually, compared with the control children who had not. That is, the target children appeared not only to have learned more effective discourse strategies for thinking collectively (and so become better at working together) but also as a result of taking

part in the group experience of explicit, rational, collaborative problem-solving to have improved their *individual* reasoning capabilities. (It should be noted that the target children had no more or less experience or training in doing the Raven's test, together or alone, than the control children.)

Of course, we cannot be sure exactly what the target children learned from their experience that made the difference. It may be that some gained from having new, successful problem-solving strategies explained to them by their partners, while others may have benefited from having to justify and make explicit their own reasons. But a more radical and intriguing possibility is that children may have improved their reasoning skills by internalising or appropriating the ground rules of Exploratory Talk, so that they become able to carry on a kind of silent rational dialogue with themselves. That is, the Talk Lessons may have helped them become more able to generate the kind of rational thinking which depends on the explicit, dispassionate consideration of evidence and competing options. That interpretation is consistent with Vygotsky's claims about the link between the social and the individual; collective thinking is a shaping influence on individual cognition. These findings were disseminated to teachers in the form of a set of practical classroom materials (Dawes, Mercer, & Wegerif, 2000).

2.2. *The initial Mexican strand of research*

The Mexican strand of this research began with a comparison between two sets of teachers in state schools in Mexico City; those whose pupils had been found to develop particularly well in reading comprehension and mathematical problem solving; and teachers in similar schools whose pupils had not made any such significant achievements. Using video recordings of classroom interactions, we attempted to discover if the better teachers differed from those who were less successful in the ways that they interacted with their pupils. Essentially, we were trying to see if the better teachers were providing a more effective 'scaffolding' for their pupils' learning. We were also interested in what kinds of learning teachers appeared to be encouraging.

Our analysis covered several features of classroom interaction, including teachers' uses of questions. We looked at the content of tasks, activities and discussions, at the extent to which teachers encouraged pupils to talk together, and the kinds of explanations and instructions teachers provided to pupils for the tasks they set them. The results of these time-consuming and complex analyses are described in more detail in Rojas-Drummond (2000), Rojas-Drummond, Mercer, and Dabrowski (2001) and Wegerif, Rojas-Drummond, and Mercer (1999). Briefly, we found that the more effective teachers could be distinguished by the following characteristics:

- (1) They used question-and-answer sequences not just to test knowledge, but also to guide the development of understanding. These teachers often used questions to discover the initial levels of pupils' understanding and adjust their teaching accordingly, and used 'why' questions to get pupils to reason and reflect about what they were doing.

- (2) They taught not just ‘subject content’, but also procedures for solving problems and making sense of experience. This included teachers demonstrating the use of problem solving strategies for children, explaining to children the meaning and purpose of classroom activities, and using their interactions with children as opportunities for encouraging children to make explicit their own thought processes.
- (3) They treated learning as a social, communicative process. As mentioned, earlier research has shown that most teachers make regular use of questions. The more effective teachers still did so, but compared with the less effective teachers they used them more for encouraging pupils to give reasons for their views, organising interchanges of ideas and mutual support amongst pupils and generally encouraging pupils to take a more active, vocal role in classroom events.

These findings of our research encouraged us to believe that it is useful for teachers to become aware of the techniques they use in dialogue and what they are trying to achieve through using them. Teachers have found this approach useful for examining their own practice, and less effective teachers can use it to adapt their interactional strategies. Even very good teachers, who probably do these things without being aware that they do so, seem nevertheless to appreciate gaining this meta-awareness.

3. Integrating the Mexican and British strands of the research

We will next describe how the continued exchange between British and Mexican researchers has enabled the further development and integration of the two lines of research.

3.1. The recent British research: the thinking together project

The most recently completed phase of the British research has involved the implementation of a revised, larger scale intervention programme of ‘Talk Lessons’ in the Thinking Together project (funded by the Nuffield Foundation). Seven target classes of children in Year 5 (aged 9–10) in primary schools in Milton Keynes participated actively by following the Thinking Together intervention programme over a period of approximately 8 months. 109 of the original 196 children completed the programme. A set of 210 children in control classes in matched MK schools were also identified, with 121 of those still being in the control classes by the time the last data collection was made. Control classes did not participate in the Thinking Together programme, but followed the same prescribed science National Curriculum. Pre- and post-intervention observations of talk in group activity were made for one ‘target group’ of children in each of the target classes and control classes. Video-recorded observations of those and other groups of children carrying out activities in both target and control classes were also made throughout the project. The methods and findings of the Mexican research regarding effective ways that teachers can use dialogue for promoting the learning, problem solving and other ‘thinking skills’ of pupils were incorporated into the training for teachers of target classes.

The Thinking Together project aimed to do more than replicate the earlier findings of the British research on changes in children's talk habits and the apparent effects on their reasoning; it also aimed to discover if the discursive training had any measurable effects on their learning in science and mathematics. Accordingly, both target and control classes were given pre- and post-intervention tests in those subjects, based on official Standard Attainment Task assessments for Key Stage 2 produced by the government and made available to schools. As this project has only just ended at the time of writing, its results have not yet been published in detail. But in summary, they are as follows. The pre/post-intervention comparisons of the scores of individual children in the target and control classes in the test of scientific knowledge and understanding were made using an analysis of covariance with pre-test results as covariate, post-test results as dependent variable and condition as fixed. For the maths assessment, the target classes made significantly greater improvements than the control classes ($F(1, 253) = 24.44$; two-tailed $p < 0.001$). An analysis of the scores of the test of scientific knowledge and understanding also showed a significantly greater improvement by target children ($F(1, 253) = 7.93$; two-tailed $p = 0.005$). The findings of the earlier research regarding changes in the quality of children's talk in joint activities were also replicated.

3.2. The recent Mexican research: Exploratory Talk as a dialogic tool to promote reasoning among primary school Mexican children

Although in 1992 there was a wide modernization of the Mexican National Curriculum, prioritising the development of children's reasoning and communication skills, in general these efforts have not been reflected in everyday classroom practice. Thus, in our Mexican study (Rojas-Drummond, Pérez, Vélez, Gómez, & Mendoza, 2003) we wanted to find out, in accordance with the British results reported earlier, whether we could train primary school Mexican children to use more Exploratory Talk, and whether this training resulted in better group and individual problem solving abilities.

Participants were 84 children between 10 and 12 years old. They came from two parallel state primary schools equivalent in socio-economic level. They were assigned in equal numbers to two groups: an experimental and a control group. As in the earlier British study, we used a modified version of the Raven's Test, creating two parallel forms as individual and group versions and administering these versions as pre- and post-tests. Six teachers implemented the intervention, using a translated and culturally adapted version of the original British programme of Talk Lessons (Dawes et al., 2000). The 10 lessons were taught over a period of 5 months.

To illustrate our results, we next present two dialogues of a group in which a girl (Georgina) and two boys (Luis and Mauro) of 6th grade (12 years old) were working together to solve a Raven's test item. The first transcript is of their performance in the pre-intervention testing and the second of their post-test. The problems in both situations were selected to be similar in degree of difficulty and were isomorphic, both representing a problem in which a geometric feature has to be eliminated to reach the correct answer. (*For copyright reasons, we are not allowed to reproduce the test item here.*)

Sequence 3: Georgina, Luis and Mauro doing Raven's test item E4 before the Talk Lessons

- Luis: Now you think, Georgina
 Georgina: You stupid...
 Luis: (*Laughs*)
 Georgina: Let's see, number three (*points to the booklet*)
 Luis: Number three
 Georgina: Three?
 Mauro: Two
 Luis: It's three
 Georgina: Number three? Number three
 Luis: Three...yes, three. Yes, we are thinking correctly
 Mauro: Number three
 (*Georgina writes down option number 3 on the answer sheet, which is incorrect*)

Sequence 4: Georgina, Luis and Mauro doing Raven's test item E5 after the Talk Lessons

- Georgina: Here they remove the dots and this, this cross (*points at a drawing*)
 Mauro: No but wait, it does not fit
 Luis: No, wait
 Mauro: No
 Georgina: Let's look at the sequence. Here it has like this, they remove the cross and the dots. Here they are not there any more, here (*points*)
 Luis: And here they remove only the dots

 Georgina: Yes, the dots. And this part, only the star
 Mauro: It would be this one, look at it (*points*)
 Luis: Which they have removed
 Mauro: It would be this one, because, look, it goes like this (*points*)
 Georgina: But how, if it doesn't have dots?

 Luis: It doesn't have dots. It would remain just the cross
 Georgina: Yea, for what they have removed!
 (*Georgina writes down option number 1 on the answer sheet, which is correct*)

It can be seen that in the pre-test the dialogue mainly has the characteristic features of 'cumulative talk'; that is, the children simply agree with each other without debate and without giving reasons for their answers (Mercer, 1995). Their final choice is wrong. In contrast, in the post-test the same children answer correctly a parallel problem using a very different type of talk—much more 'exploratory'. They negotiate more, make many more arguments, offer various perspectives for consideration and make their reasoning visible in their talk. This illustrates how the lessons helped the children develop dialogic skills for reasoning together to solve problems, as shown in the British studies. But it is valid to ask: how representative is this example?

Our data showed that in the pre-test the preferred style of talk of all the groups was cumulative. In contrast, while in the post-test the control groups still used mainly cumulative talk, the groups who had studied the Talk Lessons used significantly more Exploratory Talk. This was accompanied by a highly significant increase in both group and individual scores on the Raven's test (Fernández, Wegerif, Mercer, & Rojas-Drummond, 2002).

We have shown that it is possible to increase Mexican children's use of Exploratory Talk and that improvement in Exploratory Talk resulted in better group and even individual problem solving capacities. Our results thus confirmed the original British studies. We obtained similar results in a very different cultural, educational and linguistic context, which suggests the findings are robust.

4. Conclusions

The British and Mexican studies reviewed in this paper have provided results which link sociocultural theory and educational practice. On the theoretical side, the research has provided new evidence in support of Vygotsky's claims about the influence of 'intermental' activity on 'intramental' development. Results from both countries indicate that, when language is shaped into a suitable cultural tool for the intellectual task in hand, discursive interaction not only enables collective thinking to become more effective but also promotes development of individual reasoning and the advancement of learning and understanding in curriculum subjects. The research has also provided insights into the functions of teacher–pupil interaction, in ways that have direct relevance for the training and professional development of teachers. And, crucially, findings support the view that children will especially benefit from a classroom experience in which there is a careful integration of teacher-led discourse and peer group interaction. The results of this research have in fact now been incorporated into educational policy in the UK, for example in the teacher guidance and training materials for the National Literacy Strategy and the National Strategy for Teaching and Learning in the Foundations Subjects (QCA, 2001; DfES, 2002). In addition, the international team of researchers has developed new ways of combining qualitative and quantitative methodologies for studying the effects of an educational intervention. The outcomes encourage the continuation of our collaborative efforts.

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