



## Full length article

# Explaining the dialogic processes of teaching and learning: The value and potential of sociocultural theory

Neil Mercer\*, Christine Howe

University of Cambridge, United Kingdom

## ARTICLE INFO

## Article history:

Received 27 February 2012

Accepted 13 March 2012

Available online 10 April 2012

## Keywords:

Dialogue

Classroom talk

Sociocultural theory

Teaching

Learning

## ABSTRACT

Within the broad field of research on learning, culture and social interaction, sociocultural theory is now commonly used as an explanatory conceptual framework. In this article we begin by setting out the essential elements of this theory as it applies to a specific area of enquiry in which we have been involved, which is aimed at understanding the educational functions of classroom talk. In doing so, we will discuss some key concepts generated by the theory. We then review empirical research on talk and learning which has been inspired and informed by a sociocultural perspective, and go on to consider the educational implications of its findings. Finally, we consider how research on the educational functions of classroom talk might be developed, both theoretically and empirically, by using a sociocultural framework to link it with other lines of enquiry into learning and cognitive development.

© 2012 Elsevier Ltd. All rights reserved.

## 1. Introduction

Our aim in this article is to describe and discuss one area of enquiry within the broad field of research into learning, culture and social interaction: the study of the educational functions of talk in the classroom. Our intention in doing so is, in part, to illustrate how the pursuit of applied educational research, concerned with improving the quality of the processes of teaching and learning, can interact with the development of theory. In this way we would hope to illustrate the scope of this new journal, which will welcome both empirical and theoretical contributions. The theory we will focus on – sociocultural theory – provides the main explanatory framework for our own research; but it has in recent times become increasingly influential within developmental psychology and educational research as a whole. Built from the foundations of Vygotsky's work (e.g. Vygotsky, 1978), it is also known as 'cultural-historical activity theory' (van Oers, Elbers, van der Veer, & Wardekker, 2008). As protagonists of this theory, we would never argue against the study of individual processes of thinking and learning, but we believe that the relationship between social activity and individual thinking is a vital, distinctive characteristic of human cognition, and one which underpins cognitive development. As Säljö (2009) has put it, a major interest from a sociocultural perspective is in how human skills are appropriated by individuals. This implies that children's intellectual achievements and failures are not just dependent upon their own efforts or discoveries, but the product of culturally-situated forms of social interaction. Knowledge is not just an individual possession but also the creation and shared property of members of communities, who use 'cultural tools' (including spoken and written language), relationships and institutions (such as schools) for that purpose. From this sociocultural perspective, the nature of thinking, learning and development can only be understood by taking account of the collective, historical nature of human life. Daniels (2001, 2008), Wertsch (1991a,b), Wells and Claxton (2002) and others have provided excellent accounts of the nature and origins of this theory, and how it relates to pedagogical theory and educational enquiry. In this article, our focus is much more specific: on the study of talk and the processes of teaching and learning as an applied field of enquiry, aimed at improving the quality of classroom education.

\* Corresponding author. Tel.: +44 1223 767592.

E-mail address: [nmm31@cam.ac.uk](mailto:nmm31@cam.ac.uk) (N. Mercer).

Vygotsky (1978, p. 88) argued that 'human learning presupposes a specific social nature and a process by which children grow into the intellectual life of those around them'. Although his interest was essentially in adult–child interactions, this claim draws attention not only to the interactions between students and teachers, but also those amongst students. Vygotsky's account of development has often been contrasted with that of Piaget; but as Smith, Dockrell, and Tomlinson (1996), Shayer (2003) and others have argued, there are good reasons to treat them as complementary rather than contradictory. While Piaget placed much less emphasis on the functions of language, he (Piaget, 1932, 1967) did argue that interaction amongst peers could be a powerful influence on conceptual change. If contrasting views were expressed, he suggested, the social dynamics of the situation would create a pressure towards resolution of differences. As he put it, 'Criticism is born of discussion and discussion is only possible amongst equals' (Piaget, 1932, p. 409). This point of view has been elaborated by Piaget's followers, such as Perret-Clermont (1980) and Doise and Mugny (1984), primarily through the concept of *socio-cognitive conflict*, which can be regarded as a bridge between Piagetian cognitivism and Vygotskian socioculturalism in the study of conceptual change. Brought into the framework of sociocultural theory, we suggest this concept has great potential value, especially for the analysis of collaborative learning in the classroom.

## 2. The role of talk in the classroom

Vygotsky (1962, 1978) argued that the acquisition and use of language transforms children's thinking. He 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 also 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—not only for them, but also sometimes for those with whom they are interacting. From a sociocultural perspective, then, language acquisition and its use are seen as having a profound effect on both *collective* thinking and *individual* thinking. Indeed, one of the distinctive strengths of sociocultural theory is that it explains not only how individuals learn from interaction with others, but also how collective understanding is created from interactions amongst individuals. It is not surprising, then, that sociocultural theory has had a strong influence on research into both teacher–student interaction and collaborative learning amongst students. We will discuss each of these in turn.

## 3. Teacher–student talk

Sociocultural pioneers like Barnes (1976) and Cazden (1972) argued years ago that if we want to improve students' engagement and learning outcomes, the role of talk in classrooms needs to be better understood and reappraised. There is now comprehensive research evidence to support their views that talk amongst teachers and students, if of the right quality, can be a powerful motor for the development of reasoning and the improvement of academic performance. Such research has mainly been motivated by concerns about the quality of habitual teacher–student interaction. In whole-class settings, especially in secondary education, teacher–student interaction still tends to be dominated by teacher monologues and exchanges between teachers and students in which teachers use 'closed' questions to seek brief, accurate confirmation that selected students know the 'right answers'. For example, on the basis of their observational research in English primary schools in the early years of the 21st century, Smith, Hardman, Wall and Mroz (2004, p. 14) report that 'In the whole class sections of literacy and numeracy lessons most of the questions asked were of a low cognitive level designed to funnel students' responses towards a required answer.'

From Smith et al.'s point of view, it might seem that teachers' very frequent use of questions should be discouraged, as indeed sociocultural researchers have done in the past (Wood, 1992). But recent research offers a more nuanced understanding of how teachers' questions can and do function. Reviewing an international range of studies on literacy teaching, Wolf, Crosson, and Resnick (2006) conclude that when teachers merely check students' comprehension by seeking yes/no answers, or frame the question in such a way that students only have to complete the teacher's incomplete sentence, this does not help develop students' high-level reading skills. But Wolf, Crosson and Resnick also conclude that when teachers use questions to encourage students to put the main idea in their own words, and press them to elaborate these ideas (for example by asking 'How did you know that?' 'Why?'), this develops students' reading comprehension skills. So while teachers' questions can just require students to guess what answer is in the teacher's mind, they can also serve other very useful functions for guiding students' learning and their own use of language as a tool for reasoning. Sociocultural research has thus helped overcome simplistic conceptions of the relationship between the *forms* and structures of classroom discourse and its educational *functions*.

Research has also shown that when teachers use certain interactional strategies more often, students' participation in class and their educational outcomes are likely to improve (e.g. Brown & Palincsar, 1989; Chinn, Anderson, & Waggoner, 2001; Dawes, 2004; Mercer & Littleton, 2007). In a systematic review of 15 studies of talk in mathematics classrooms, Kyriacou and Issitt (2008) found that good learning outcomes result when teachers use questions not just to seek right answers, but also to elicit reasons and explanations. Rojas-Drummond and Mercer (2004), comparing groups of Mexican teachers whose students achieved good learning outcomes in mathematics and literacy with groups who were less successful, found that the former used question-and-answer sequences not just to test knowledge, but also to guide the development of students' understanding; the less successful teachers relied on more traditional, closed forms of questioning. Alexander (2001) suggests an association between Russian teachers' common use of questions to seek extended contributions from students in mathematics lessons and the high levels of attainment that their students achieve in international comparisons. In a meta-analysis of experimental programmes for teaching science, Murphy (2007) found that the positive effects were greatest when hands-on activity was combined with some form of relevant discussion.

Across different subjects, it has been found that when teachers actively engage students in reflective discussions of what they are studying, this helps them learn, develops their understanding and prepares them well for independent learning.

Informed by sociocultural theory, these research findings make it clear that the educational functions of teacher–student talk in the classroom cannot be understood merely in terms of its use for transmitting information, instructing, checking on understanding or controlling behaviour. It is very important to note that this research does not imply that teachers should avoid checking students understanding, instructing them, giving them the correct knowledge or correcting their erroneous understandings. It is of course vital that they do these things. Rather, the implication is that to get the best results, teachers need to strategically balance what Mortimer and Scott (Mortimer & Scott, 2003; Scott, 2008) call ‘authoritative’ talk (which tends to be the dominant kind of interaction) with ‘dialogue’ (which does not normally happen often).

In order to illustrate what a more ‘dialogic’ episode of teacher–student talk would look like, we have included below an extract from a whole-class discussion one of us recorded when a Year 7 class were studying acids and alkalis in science. As the discussion begins, the teacher has just shown the students a box of indigestion tablets.

Transcript 1  
Indigestion tablets.

---

Teacher:	So what do you think the tablets are going to do?
Alex:	Um like make them feel better
Teacher:	It's going to make them feel better. Now the question is really how's that happening?
Alex:	They're going to neutralise the effect
Teacher:	Ah. You think so? What makes you think that?
Alex:	Because the acid, um, the acid in your body
Teacher:	Mmm
Alex:	And there's only so much of it, could there be some form of acid inside the tablets to actually aid the acid... to help digest the food?
Teacher:	Now – could be, acid add acid – so that won't neutralise it. So what might it need?
Alex:	Alkaline
Teacher:	Ah. Where's the alkali then?
Alex:	It could be in the tablets.

---

The sequence begins with a conventional pattern. The teacher asks a question, and this elicits a brief answer. But unusually, rather than evaluate that answer as right or wrong, the teacher pursues the discussion with Alex to try and elicit a more scientific kind of explanation. And he does provide a suitable response: that the tablets will ‘neutralise the effect’. Moreover, the teacher does not simply move on, or ask another student, but prompts Alex for more information and for a *reason*. Alex's subsequent response, that there might not be enough acid in the body so the tablets have to top it up, is treated with respect by the teacher, but also highlighted as problematic. He has introduced the technical term ‘neutralise’, and the teacher is checking for understanding. Asked to think again, Alex recalls the work ‘alkaline’, or perhaps remembers what the word neutralise means; we cannot tell, but in either case, progress is made towards a more scientific explanation of the tablets' action. The teacher reformulates ‘alkaline’ to ‘alkali’, which prompts Alex to suggest that it is in the tablets. Some learning of science appears to be happening here—and this example shows how a teacher's questions can be used effectively to stimulate and guide a student's thinking in a productive way. It happened not only because the teacher used questions in a rather different way from usual, but also because in that classroom the students had come to believe that their views were valued contributions to such discussions, and would not simply be judged as right or wrong depending on whether or not they guessed what was in the teacher's mind.

It is on the basis of an essentially sociocultural perspective (drawing on the work of Bahktin (1981) as well as that of Vygotsky) that Alexander (2005, 2008) has proposed a practical approach to classroom education that he calls ‘dialogic teaching’. Its basis is that teachers need to be aware of the educational functions of talk and how it can best be used to guide and support children's learning. They need, in fact, a sociocultural perspective on how they use the main tool of their trade, talk. Through the influence of the work of Nystrand (1997), Wells (1999), Scott (2008), Wegerif (2007) and other classroom researchers as well as Alexander, the terms ‘dialogue’ and ‘dialogic’ are now commonly found in the research literature. However, we would suggest it is important that the distinctive meaning of ‘dialogue’ as a form of conversation in which the ideas of the various participants are heard, taken up and jointly considered needs to be upheld if the concept is to retain its value.

#### 4. Learning as a collaborative enterprise

Working and learning with other people is quite common in everyday life outside school; and research evidence showing the value of students working together has been available for some time (Kutnick & Rogers, 1994; Slavin, 2009). Furthermore, an extensive body of more recent research (summarised in Howe & Mercer, 2007; Littleton & Howe, 2010; Mercer & Littleton, 2007) has shown positive effects when students are encouraged to talk and work together on curriculum-related tasks, particularly when they support their views with reasons and differences of opinion (and the reasons behind them) are discussed and resolved. Yet the history of education shows that joint activity amongst students has rarely been incorporated into the mainstream of classroom life.

Moreover, there can be confusion and uncertainty over what precisely joint activity should mean. For instance, in everyday speech, the terms ‘collaboration’ and ‘co-operation’ are both often used loosely to mean that people are working together to get something done. In the research literature, however, there has been considerable debate about how to distinguish between

the two terms (for example, [Dillenbourg, 1999](#)). It is usually agreed that collaboration means something more than students working together in a tolerant and compatible manner. ‘Collaborating’ or being engaged in collaborative learning means that participants are making a coordinated, continuing attempt to solve a problem or in some other way construct common knowledge. It involves co-ordinated joint commitment to a shared goal, reciprocity, mutuality and the continual (re)negotiation of meaning (as described by [Barron, 2000](#)). Participants in collaboration may experience what [Ryder and Campbell \(1989\)](#) call ‘groupsense’ or a feeling of shared endeavour. Such co-ordinated activity depends upon the collaborators establishing and maintaining what [Rogoff \(1990\)](#) and [Wertsch \(1991a,b\)](#) have termed *intersubjectivity*. It will necessarily involve them maintaining a shared conception of the task or problem. Partners will not only be interacting, as they might in cooperative activity, but ‘interthinking’ ([Mercer, 2000](#)).

There has been a great deal of research interest in how children learn together or solve problems collaboratively (as the review of the field by [Howe, 2010](#) illustrates well). Here, we will consider two main types of research: experimental studies, conducted outside the normal activities of the classroom (although often using educationally relevant tasks); and studies in which researchers have observed or intervened in genuine classroom activities.

#### 4.1. *Experimental studies of students' collaborative activity*

Much early collaborative learning research consisted of experimental studies of peer interaction, designed to establish whether solving problems collaboratively was more effective than working alone. Typically, students would be given the same task, but allocated to working either collaboratively or alone, and their performance on the task assessed. These sorts of investigations gave rise to a related strand of research in which independent variables were manipulated and attempts were made to assess their effects. These variables included the size of the group (e.g. [Fuchs & Fuchs, 2000](#)), group composition, with respect to, for example, gender and ability, (e.g. [Barbieri & Light, 1992](#); [Howe, 1997](#); [Webb, 1989](#); see also [Wilkinson & Fung, 2002](#) for a review of work in this field) and the nature of the task (e.g. [Cohen, 1994](#); [Light & Littleton, 1999](#); [Underwood & Underwood, 1999](#)).

However, because the variables under consideration interact with each other in complex ways, it has proved virtually impossible to use this approach to isolate the conditions for effective collaboration. Researchers thus started to focus less on establishing parameters for effective collaboration and more on the ways in which factors such as task design or group composition influence the nature of collaborative interaction ([Dillenbourg, Baker, Blaye, & O'Malley, 1995](#); [Littleton, 1999](#)). This shift to a more process-oriented kind of investigation has brought with it an interest in the talk and joint activity of learners working together on a task, with attempts being made to identify those interactional features which are important for learning and cognitive change.

Some experimental studies of collaborative interaction have focused on how students talk together when they are working on a problem or task. They have handled recorded talk by coding it via pre-defined categories, which in turn lend themselves to treatment by statistical analyses. In particular, correlational techniques have been used to establish whether there is evidence for an association between particular features of the learners' talk and on-task success or subsequent learning gain as indexed by individual performance on a post-test. For example, [Azmitia and Montgomery \(1993\)](#) found that the quality of children's dialogue is a significant predictor of their successful problem-solving. Studying children engaged in joint computer-based problem-solving tasks, [Barbieri and Light \(1992\)](#) found that measures of the amount of talk about planning, negotiation and the co-construction of knowledge by partners correlated significantly with both successful problem solving by pairs, and successful learning outcomes in subsequent related tasks by individuals. Similar analytic techniques used by [Underwood and Underwood \(1999\)](#) demonstrated that for pairs of children working on a computer-based problem-solving activity those who were most observed to express opinions, analyse the situation in words and express agreement and understanding achieved the best outcomes.

One specific example of experimental research into collaborative interactive is the work on conceptual growth in science conducted by [Howe](#) and colleagues (see [Howe, 2010](#), for a summary). Amounting to around 25 discrete studies, the work covered primary-, secondary- and tertiary-level students and encompassed a wide range of topics, for instance floating and sinking, heating and cooling, light and shadows, and force and motion. Each study started with pre-tests to establish students' initial understanding, with the tests sometimes administered via individual interviews and sometimes via individual written responses to whole-class presentations. Thereafter, the students worked in small groups (dyads, triads, or foursomes) on tasks that first required predictions to be agreed, e.g. whether an empty aluminium box would float or sink in water, or whether the water in a thin metal container would cool quickly or slowly. Subsequently, groups were invited to test predictions using apparatus that was provided, and to formulate joint interpretations of outcomes. The studies varied over whether the group tasks were presented via workbooks or computers, but in all cases group interaction was audio- or video-recorded and recorded interaction was coded using pre-defined categories. The studies all concluded with post-tests administered a few weeks after the group task. Post-test format was identical to pre-test. Regardless of student age, science topic, group size or medium of presentation, correlation-style analysis showed that pre- to post-test change was positively associated with what earlier was referred to as ‘reasoned discussion’, i.e. supporting positions with reasons, and addressing differences of opinion.

Overall, then, experimental evidence supports the view that focused, sustained discussion amongst children not only helps them solve problems but also promotes the learning of the individuals involved. This conclusion may seem like common sense: but if it is so obviously true, one is led back to the question of why high quality peer discussion has not been directly promoted and facilitated in formal education.

#### 4.2. *Studies of collaborative activity in school*

Reviews of studies of group-based learning in school have consistently drawn the conclusion that it can be very beneficial to the progress of all students, whether ‘high’ or ‘low’ achievers (e.g. [Slavin, 2009](#)). But perhaps one of the first messages to emerge

from work surveying classroom activity is that truly collaborative activity rarely happens. This was the alarming conclusion of a large-scale research project carried out in Britain in the 1970s called ORACLE (Galton, Simon, & Croll, 1980). The ORACLE team of researchers, observing everyday practice in a large number of British primary schools, found that just because several students were sitting together at a table (as was common), this did not mean that they were collaborating. Typically, students at any single table would simply be working, in parallel, on individual tasks. While they might well have talked as they worked, and while they might possibly have talked to each other about their work, the activities they engaged in did not encourage or require them to talk and work together. This problem of students working *in* groups but rarely *as* groups has also been underscored in a number of more recent studies, some of which have shown that even when children are set joint tasks their interactions are rarely productive (Alexander, 2005; Blatchford & Kutnick, 2003; Galton, Hargreaves, Comber, Wall, & Pell, 1999). This tells us something important about the nature of everyday educational practice and leads to the conclusion that much classroom-based talk amongst students may be of limited educational value.

An important early study of students' talk in groups was carried out in the 1970s by Barnes and Todd (1977) (see also Barnes, 2008; Barnes & Todd, 1995, for reflective accounts of this research). It involved secondary school students, but the insights that the study provided have informed much subsequent research, including work focused on the primary years. In accord with Piaget (1932), Barnes and Todd suggested that students are more likely to engage in open, extended discussion and argument when they are talking with their peers outside the visible control of their teacher; and that this kind of talk enabled them to take more active and independent ownership of knowledge:

'Our point is that to place the responsibility in the learners' hands changes the nature of that learning by requiring them to negotiate their own criteria of relevance and truth. If schooling is to prepare young people for responsible adult life, such learning has an important place in the repertoire of social relationships which teachers have at their disposal.' (p. 127)

Based on their detailed observations, Barnes and Todd suggest that classroom discussion has to meet certain requirements for explicitness which would not normally be required in everyday conversation. One of their key ideas was the concept of Exploratory Talk, in which a speaker articulates half-formed thoughts so that they can be tested out in the telling, and so that others can hear them, and comment (as discussed more recently by Barnes, 2008). This concept has since been elaborated to distinguish a kind of talk in which knowledge is made publicly accountable, relevant information is shared effectively, opinions are clearly explained and explanations examined critically (Mercer, 1995; Mercer & Dawes, 2008). Defined in this way, Exploratory Talk resonates with the productive forms of interaction identified through the experimental studies that were reviewed in the previous section. Indeed, the parallels across the two bodies of work are underlined in research reported in Howe et al. (2007): when the tasks that Howe and colleagues had previously used in experimental contexts (see earlier) were embedded in authentic, teacher-led programmes, they continued not only to boost student understanding but also to do this through identical dialogic processes. This said, Barnes and Todd also argued that the successful pursuit of educational activity depends on learners: (a) sharing the same ideas about what is relevant to the discussion and (b) having a joint conception of what is trying to be achieved by it. These points have been supported by other research based in primary schools (e.g. Bennett & Dunne, 1992; Edwards & Mercer, 1987; Galton & Williamson, 1992; Mercer & Littleton, 2007).

From a sociocultural perspective, Exploratory Talk represents a joint, co-ordinated form of co-reasoning in language, with speakers sharing knowledge, challenging ideas, evaluating evidence and considering options in a reasoned and equitable way. They present their ideas as clearly and as explicitly as necessary for them to become shared and jointly analysed and evaluated. Possible explanations are compared and joint decisions reached. By incorporating both constructive conflict and the open sharing of ideas, Exploratory Talk constitutes the more visible pursuit of rational consensus through conversation. It might be thought of as a communicative tool for revealing 'sociocognitive conflict' (Doise & Mugny, op. cit) and resolving it in a productive way. Its norms or 'ground rules' require that the views of all participants are sought and considered, that proposals are explicitly stated and evaluated, and that explicit agreement precedes decisions and actions, with ultimate agreement being sought. To illustrate what this kind of talk looks like in practice, consider this extract from a discussion amongst three Year 5 students working together in a science lesson. They are predicting how many sheets of tissue paper will completely obscure a light source.

Transcript 2  
Tissue paper.

---

Ross	OK. ( <i>reads</i> ) 'Talk together about a plan to test all the different types of paper.'
Alana	Dijek, how much did you think it would be for tissue paper?
Dijek	At least ten because tissue paper is thin. Tissue paper can wear out and you can see through it... and light can shine through it.
Alana	OK. Thanks. ( <i>to Ross</i> ) Why do you think it?
Ross	Because I tested it before!
Alana	No, Ross, what did you think? How much did you think? Tissue paper. How much tissue paper did you think it would be to block out the light?
Ross	At first I thought it would be five, but second...
Alana	Why did you think that?
Ross	Because when it was in the overhead projector you could see a little bit of it, but not all of it, so I thought it would be like, five to block out the light.
Alana	That's a good reason. I thought, I thought it would be between five and seven because, I thought it would be between five and seven because normally when you're at home if you lay it on top, with one sheet you can see through but if you lay on about five or six pieces on top you can't see through.

---

Other educational researchers have independently come up with very similar characterisations of intellectually stimulating, collaborative and productive classroom talk—though usually with secondary school students. In the USA, Anderson and colleagues (Anderson, Chinn, Waggoner, & Nguyen, 1998; Chinn & Anderson, 1998) have identified the kind of talk they call *collaborative*

reasoning (CR). On the basis of data obtained through their own interventional studies, they say that during CR discussions, the quality of students' reasoning is high and they display higher levels of thinking than in usual classroom discussions. They report positive transfer to the quality of students' written arguments (Reznitskaya et al., 2006). It should be noted, however, that the source of such talk in their studies was *teacher-led* discussion with groups of students. There are also strong links between the concept of Exploratory Talk (as we have defined it) and what some educational researchers have called 'accountable talk' (Michaels & O'Connor, 2002; Resnick, 1999). As Keefer, Zeitz, and Resnick (2000) explain:

'...a productive discussion...should include some progress in the participants' understanding of the original question or issue being debated (e.g., participants ought to show greater interest in the development of ideas and issues than they do in the presentation and defence of their own positions). Furthermore, we believe that participants in discussions having these qualities might be more prepared to change their views—in other words, to seriously listen to (and even construct) arguments that run counter to views that they might initially hold.' (Keefer et al., op. cit, p. 60.)

We can see here some strong similarities between this notion and Exploratory Talk. Keefer et al. also comment on 'the challenge of helping teachers to lead discussions that are appropriate to the content and goals of the dialogue, scaffolding children to reason within the constraints of the dialogue rules and to initiate shifts in context when the content or the course of argumentation might warrant it.' (Keefer et al., op. cit, p. 79).

Taken together, studies of collaborative learning in naturalistic and experimental settings thus lead to the same conclusions: that collective, goal-directed, curriculum-based activity amongst students without a teacher present can offer distinctive and valuable benefits for students' learning and the development of their understanding; but that group-based activity is only likely to be beneficial if certain conditions are met.

## 5. Educational implications

Sociocultural concepts and research findings seem, so far, to have had relatively little impact on educational policy and practice, at least in those countries with which we have had significant contact. Yet the practical implications are quite direct and quite profound, both for understanding what normally goes on in classrooms and for changing the status quo to achieve better educational outcomes. The limited amount of true 'dialogue' found in so many classrooms in so many countries is a product of normal school culture, which expects participants to follow a particular set of conversational 'ground rules'. For whole-class interaction these ground rules include 'Only the teacher can nominate who should speak'; 'only the teacher may ask a question without seeking permission'; 'only the teacher can evaluate a comment made by a participant'; 'students should quickly try to provide answers to teachers' questions which are as relevant and brief as possible'; and 'students should not speak freely when a teacher asks a question, but raise their hands and wait to be nominated'. Students who call out an answer without being asked are breaking a rule, and their contribution may be thus treated as 'invisible' (or disruptive) until they have been formally asked to speak. Other ground rules normally operate in group-based activities, and may include such as 'only offer a view if you are sure you are right' and 'do not share knowledge which might help you achieve better individual grades than your group partners'. As we have explained, research has shown that adherence to these ground rules limits the potential value of talk amongst teachers and students.

What can be done to change this situation? We can see three possible ways forward, though of course there may be more. One is to give the critical examination of classroom dialogue higher priority in teachers' initial training and professional development. Essentially, we would suggest, every teacher needs to become able to see the talk and social interaction in their classroom from a sociocultural perspective. In any occupation, it can be useful to look behind the ordinary, to examine the taken-for-granted, and to question the effectiveness of what is normally done. In the UK, it is apparent to any citizen that over the last decade new ground rules have begun to operate in doctor–patient consultations. The old ground rules used to require patients simply to sit, listen and ask few questions; and for doctors to release minimal information and use highly technical vocabulary. Nowadays, the talk is usually much more evenly distributed and more genuinely communicative. This has not happened naturally, but has required a new focus on communication skills in doctors' initial training and professional development. Encouraging teachers to recognise the dominant patterns of teacher–student talk in their classrooms is a necessary step towards evaluating those patterns and changing them. By noting what is happening in the classroom, teachers can begin to consider what effects this has on students' participation. They may see that, if always dominated by teachers' closed-questions, whole-class talk can amount to little more than rather tortuous question-and-answer routines in which the teacher and some of the class play a game of 'guess what is in the teacher's mind'.

A second way forward would be to use both initial and continuing professional development to help teachers recognise and practise particular *strategies* for interacting with students that will generate an appropriate balance between 'authoritative' and 'dialogic' forms of talk in their classrooms, so that they can put these to work in pursuing their professional goals. Research suggests that by using a wider range of interactional strategies in the classroom, teachers will find that students become more enthusiastically involved and learn well. To be more specific, research suggests that the following strategies are particularly valuable:

- use some 'open' questions to explore students' ideas
- encourage students to put knowledge into their own words (while also offering them new vocabulary to accommodate new ideas)
- press students to elaborate and justify their views, e.g. 'How did you know that?', 'Why?', 'Can you say a bit more?'
- allow students extended turns to express their thoughts and reveal their misunderstandings

- hold back demonstrations or explanations until the ideas of some students have been heard (so that explanations can be linked to what has been said and to issues raised)
- give students enough time to construct thoughtful answers to questions, rather than moving quickly on if they are hesitant
- use whole class discussion to help students see the point and purpose of their study of a topic
- at least sometimes, allow students' comments to shift the direction of a discussion (and even, perhaps, of a lesson!)
- 'model' ways of using language to conduct rational arguments, so that students can learn by example.

Enabling students to play more active roles in classroom dialogue also provides teachers with better opportunities for informally assessing their learning. However, if a teacher decides to try asking more open questions or waiting for extended answers with a class that has had only a very traditional experience of classroom talk, they will probably only hear (at best) a suspicious silence. One of the insights offered by a sociocultural perspective is that the development of shared understanding and norms for behaviour takes time, but it can be achieved (Mercer, 2008; Nystrand, Wu, Gamorgan, Zeiser, & Long, 2003). The generation of different patterns of dialogue depends on a teacher establishing the right classroom climate for talk, together with some new, different 'ground rules'.

The more successful organisation of collaborative learning also will also depend on teachers having a clearer view of what works and what does not, when it comes to the design of activities, preparation of students for group-work and the composition of groups. Research-based, practical guidance on such matters is now quite widely available (see for example [Success for All, 2012](#); [Thinking Together, 2012](#)). While classroom-based researchers of collaborative learning might have slightly different views on some aspects (such as how many children best compose a group—3 or 4?), they are generally agreed on many: such as that mixed ability and mixed gender groups generally achieve best effects, and that activities need to be designed to require, not just permit, collective thinking and the seeking of consensus amongst members.

The third way forward is for students themselves to learn more about the functions and value of talk for learning—which means that they need to be taught about it within the scope of one curriculum subject (probably 'English' in English-speaking countries) and then encouraged to apply the awareness and skills they develop across their study of the curriculum. Students need to develop a metacognitive awareness of the learning functions of talk and an appreciation of its potential value as a cultural and psychological tool, because otherwise they may not treat talk-based activities as an important component of the lessons they are engaged in, and so not appreciate and consolidate what they learn collaboratively. In their out-of-school lives, rational debates, logical deductions, extended narrative accounts and detailed explanations may never be heard. Without guidance, instruction and encouragement from a teacher, many children may not gain access to some very useful ways of using language for reasoning and working collaboratively, because those 'ways with words' (Heath, 1983) are simply not a common feature of the language of their out-of-school communities. It seems that teachers often assume that students will know exactly what to do when a teacher asks them to 'discuss' a topic, or 'talk and work together' to carry out a talk or solve a problem. Students are left to somehow work out what is required and what constitutes good, effective discussion, but they rarely succeed in doing so. This way forward would also require making collaborative learning mainstream, not marginal, in classroom life: and that would take some daring on the part of a teacher, school, or policy maker.

Although we have considered teacher–student interaction and collaborative activity separately here, one of strongest effects of looking at education from a sociocultural perspective is the realisation that these two forms of interaction should not be considered separately in classroom practice. Rather, they should be regarded as different types of opportunities for using talk for learning which, while having their own normative structures, are (a) both taking place within the cultural and institutional constraints of formal schooling and (b) mutually influential. One might note [Webb, Nemer, and Ing's \(2006\)](#) research finding that a strong influence on how students talk together in groups appears to be the way that their teacher talks with them. Practical advice for teachers on improving the quality of classroom interaction must therefore involve them in some reflection and planning about how they *and* their students use talk themselves (as described in [Dawes, 2008, 2010](#)). In our own research, we have begun to study teachers' interventions into students' group-work, and how this relates to both whole-class activity and the dynamics of the group.

## 6. Where should sociocultural research go from here?

We will end by suggesting that there are two fields of enquiry with which could fruitfully develop closer links with the study of classroom talk, with sociocultural theory providing a suitable framework for this integrative development. These areas are the study of conceptual change and the development of self-regulation.

### 6.1. *The study of conceptual change*

The study of conceptual change has its most 'applied' form in research on science education. In her introduction to an influential special issue on conceptual change, [Mason \(2007\)](#) explains how, until quite recently, such research was mainly based on a constructivist, cognitive theory of learning and development. In recent times, however, sociocultural theory has started to exert a strong influence. Mason goes on to review, and compare, those two approaches. In their article in that issue, [Greeno and van Sande \(2007\)](#) begin by stating their aim of building a bridge between these two research traditions, cognitive and sociocultural. In pursuing this aim they make particular use of the cognitive concepts of 'schema' and 'information structures' and the sociocultural concepts of 'distributed cognition' and 'participation structures'. They also introduce a new concept, 'perspectival understanding'. By this they mean the grasping by one person of another's view, so that some common knowledge is provided for the further examination of ideas. On the sociocultural side, they identify conceptual change with discursive change, with

knowledge being a social, shared attribute, based in communities of practice. To 'know' is to operate discursively within such a community. On the other side is the more individualistic notion of schematic understanding. Our own belief is that is good, so far as it goes; but that is not far enough. Such a bridge can indeed be constructed, so long as social interaction, mediated by dialogue, is explicitly recognised as an important motor for conceptual change. Along with the concepts used by Greeno and Sande to build their bridge, two other concepts we have discussed earlier are also useful as construction materials: 'sociocognitive conflict' (Doise & Mugny, 1984) and 'Exploratory Talk'. Generally speaking, disparities between the ways collaborating students, or teachers and learners, make sense of observed phenomena will only emerge if they talk about them. Moreover, such disparities, or conflicting conceptualizations, are only likely to be reconciled through dialogue, and particularly through the kind of discussion we have called Exploratory Talk. Such talk is not merely a means for the expression of different views, or the sharing of relevant information; it is a cultural and cognitive tool for enabling conceptual change. This means that observed, recorded dialogue constitutes one of the most important forms of data for the study of conceptual change, and so should be subjected to an appropriately rigorous analysis (which has not typically been the case even in 'situated' studies of conceptual change). There are links here with the sociocultural research of Scott and colleagues (Mortimer & Scott, 2003; Scott, 2008; Scott & Asoko, 2006) into how the ideas and explanatory frameworks of science teachers and their students can be 'interanimated' and reconciled through dialogue. But both the methodology for the sociocultural study of conceptual change in classroom settings, and for our theoretical account of the processes involved, require further development.

Howe and colleagues' research into collaborative group work in science (introduced earlier) also illustrates productive synthesis between cognitive and sociocultural perspectives. In many of these studies, there was no relation between group task performance and the gains observed several weeks later at post-test: the students who made no progress during the group task or even regressed were as likely to display pre- to post-test growth as the students who advanced during the group task. Indeed, when in a small number of studies 'immediate' post-tests were also administered within hours of the group task, performance at this point was no better than at pre-test (see, e.g., Howe, Tolmie, & Rodgers, 1992). The implication was that there were *delayed* effects of group work, but nevertheless effects that were contingent upon group interaction. Noting that by virtue of being delayed, the effects fulfilled the standard cognitive psychology definition of 'incubation' (e.g. Dorfman, Shames, & Kihlstrom, 1996; Smith & Blankenship, 1991; Yaniv & Meyer, 1987), Howe and colleagues examined the relevance of the main interpretations of why incubation occurs: (a) unhelpful 'mental sets' need time to be broken; (b) post-task reflection can be helpful; (c) stimulating tasks trigger productive use of subsequent events. Three studies were conducted with 8- to 12-year-olds working on floating and sinking. As reported in Howe, McWilliam, and Cross (2005), the results point strongly towards the third explanation, indicating in particular that unresolved contradiction during group interaction 'primed' the students to respond productively to post-group experiences of relevance. Howe (2009) provides further evidence for this account, using a wider range of topics. Empirical studies which explore further the mechanisms through which engagement in dialogue stimulates individual thinking and the development of understanding would be welcome.

## 6.2. Dialogue and the development of self-regulation

Wertsch (1979) used the study of parent-child interaction to make important contributions to our understanding of children's learning and psychological development, in a paper which also contributed significantly to the development of sociocultural research. He provided clarification and support for Vygotsky's conception of egocentric speech as being both a product of a child's experience of social speech and a precursor of the 'inner speech' that arguably informs their individual cognition. Egocentric speech might therefore be both a product of, and a medium for, a shift from 'other-regulation' to 'self-regulation'. Wertsch's detailed examples from parent-child interactions provide the kind of empirical illustrations which were lacking in Vygotsky's original work. Neither Wertsch nor Vygotsky used examples of interactions in school, but the implications for how classroom dialogue might shape the development of self-regulation there are apparent. Such evidence as is available encourages that view. From a recent meta-analysis of intervention studies aimed to develop self-regulation in primary school children (Dignath, Buettner, & Langfeldt, 2008), it is clear that many of those studies involve the strategic use of spoken dialogue, even if that is not explicitly recognised by the researchers involved. Some researchers have claimed that the development of self-regulation underpins effective learning (Swanson, Hoskyn, & Lee, 1999; Wang, Haertel, & Walberg, 1990), and hence the means for encouraging its development should be given explicit educational attention. Reviewing interventional research which has sought to promote self-regulatory skills, Whitebread and Pino Pasternak (2010) and Hattie, Biggs, and Purdie (1996) conclude that such skills can be taught. However, Hendy and Whitebread (2000) comment that although many 'early years' teachers (Nursery to Year 2) wish to help young children develop as independent learners, in their interactions with children they focus almost entirely on 'managerial' issues of behaviour, rather than on learning processes. Our own proposal is that by using sociocultural theory to bring together research on the development of self-regulation with that on developing children's ability to use language to co-regulate group activity (as discussed earlier in this article), a more powerful account of how classroom interaction can help develop reasoning and self-regulating skills could be developed—and that this could underpin the identification and promotion of more effective interactional strategies in early year classrooms.

Sociocultural theory thus provides a suitable frame for the development of a new field of enquiry relating dialogue to the growth of self-regulation in educational settings, and emphasising the roles of (a) language as a social and psychological tool and (b) adults in modelling and scaffolding children's self-regulated activity. But the theoretical framework for understanding the relationship between dialogue, learning and development in educational settings needs attention. Much attention has been given to defining the forms and functions of talk in classrooms, and specifying how ways of interacting relate to the successful pursuit of educational goals in both whole-class and group-work settings. A clearer conceptualization and operational definition



of 'self-regulation' that is applicable to classroom life is needed, and this concept needs also to be distinguished from that of 'metacognition' (as some researchers appear to use these terms interchangeably). One could then begin to study the precise nature of the processes whereby verbal/social interaction influences the development of self-regulatory abilities—and vice versa. Our own reflections on a recent pilot project, and on other current and recent research, encourage us to think that this process is more complex and reflexive than has hitherto been theorised (though still in accord with the basic Vygotskian model of the relationship between social/intermental activity and psychological/intramental development). Essentially, we speculate that it is not only the use of talk for reasoning that helps learning and the development of understanding, but an *awareness* of the potential value of talk for reasoning. Thus interventions which enhance meta-awareness of how talk can be used most effectively for joint reasoning and problem-solving during group work would be expected to achieve stronger effects than those which merely aim to improve the quality of relations and interactions within group work. We have been working with colleagues at Cambridge to develop this line of enquiry, and we encourage others to engage with this theoretical framework and to relate it explicitly to new empirical studies.

## References

- Alexander, R. J. (2001). *Culture and pedagogy: International comparisons in primary education*. Oxford: Blackwell.
- Alexander, R. (2005). *Towards dialogic teaching: Rethinking classroom talk*. Cambridge: Dialogos.
- Alexander (2008). Culture, dialogue and learning: Notes on an emerging pedagogy. In N. Mercer, & S. Hodgkinson (Eds.), *Exploring talk in school*. London: Sage.
- Anderson, R. C., Chinn, C., Waggoner, M., & Nguyen, K. (1998). Intellectually-stimulating story discussions. In J. Osborn, & F. Lehr (Eds.), *Literacy for all: Issues in teaching and learning*. New York: Guildford Press.
- Azmitia, M., & Montgomery, R. (1993). Friendship, transactive dialogues and the development of scientific reasoning. *Social Development*, 2(3), 202–221.
- Bahktin, M. (1981). *The dialogic imagination*. Austin: University of Texas Press.
- Barbieri, M., & Light, P. (1992). Interaction, gender and performance on a computer-based task. *Learning and Instruction*, 2(1), 199–213.
- Barnes, D. (1976). *From communication to curriculum*. Harmondsworth: Penguin Books.
- Barnes, D. (2008). Exploratory talk for learning. In N. Mercer, & S. Hodgkinson (Eds.), *Exploring talk in school*. London: Sage.
- Barnes, D., & Todd, F. (1977). *Communication and learning in small groups*. London: Routledge and Kegan Paul.
- Barnes, D., & Todd, F. (1995). *Communication and learning revisited*. Portsmouth, NH: Heinemann.
- Barron, B. (2000). Achieving co-ordination in collaborative problem-solving groups. *The Journal of the Learning Sciences*, 9(4), 403–436.
- Bennett, N., & Dunne, E. (1992). *Managing classroom groups*. London: Simon and Schuster.
- Blatchford, P., & Kutnick, P. (2003). Developing groupwork in everyday classrooms. *Special issue of the International Journal of Educational Research*, 39, (pp. 1–2).
- Brown, A., & Palincsar, A. S. (1989). Guided, co-operative learning and individual knowledge acquisition. In L. Resnick (Ed.), *Knowing, learning and instruction*. New York: Lawrence Erlbaum.
- Cazden, C. (Ed.). (1972). *The functions of language in the classroom*. New York: Teachers' College Press, Columbia University.
- Chinn, C. F., & Anderson, R. (1998). The structure of discussions that promote reasoning. *Teachers College Record*, 100(2), 315–368.
- Chinn, C., Anderson, R., & Waggoner, M. (2001). Patterns of discourse in two kinds of literature discussion. *Reading Research Quarterly*, 36, 378–411.
- Cohen, E. G. (1994). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research*, 64(1), 1–35.
- Daniels, H. (2001). *Vygotsky and pedagogy*. London: Routledge/Falmer.
- Daniels, H. (2008). *Vygotsky and research*. Abingdon: Routledge.
- Dawes, L. (2004). Talk and learning in classroom science. *International Journal of Science Education*, 26(6), 677–695.
- Dawes, L. (2008). Encouraging students' contribution to dialogue during science. *School Science Review*, 90(331), 101–107.
- Dawes, L. (2010). *Creating a speaking and listening classroom*. London: Routledge.
- Dignath, G., Buettner, G., & Langfeldt, H. -P. (2008). How can primary school students learn self-regulated learning strategies most effectively? A meta-analysis on self-regulation training programmes. *Educational Research Review*, 3, 101–129.
- Dillenbourg, P. (1999). *Collaborative learning: Cognitive and computational approaches*. Oxford: Pergamon.
- Dillenbourg, P., Baker, M., Blaye, A., & O'Malley, C. (1995). The evolution of research on collaborative learning. In H. Spada, & P. Reiman (Eds.), *Learning in humans and machines: Towards an interdisciplinary learning science*. Oxford: Elsevier.
- Doise, W., & Mugny, G. (1984). *The social development of the intellect*. Oxford: Pergamon Press.
- Dorfman, J., Shames, V. A., & Kihlstrom, J. F. (1996). Intuition, incubation, and insight: Implicit cognition in problem solving. In G. Underwood (Ed.), *Implicit cognition* (pp. 257–296). Oxford: Oxford University Press.
- Edwards, D., & Mercer, N. (1987). *Common knowledge: The development of understanding in the classroom*. London: Methuen/Routledge.
- Fuchs, L. S., & Fuchs, D. (2000). Effects of workgroup structure and size on student productivity during collaborative work on complex tasks. *The Elementary School Journal*, 100(3), 183.
- Galton, M., Hargreaves, L., Comber, C., Wall, D., & Pell, A. (1999). *Inside the primary classroom: 20 years on*. London: Routledge.
- Galton, M., Simon, B., & Croll, P. (1980). *Inside the primary classroom (the ORACLE project)*. London: Routledge and Kegan Paul.
- Galton, M., & Williamson, J. (1992). *Group work in the primary classroom*. London: Routledge.
- Greeno, J., & van Sande, C. (2007). Perspectival understanding of conceptions and conceptual growth in interaction. *Educational Psychologist*, 42(1), 9–23.
- Hattie, J. A., Biggs, J., & Purdie, N. (1996). Effects of learning skills interventions on student learning: A meta-analysis. *Review of Educational Research*, 66, 99–136.
- Heath, S. B. (1983). *Ways with Words: Language, life and work in communities and classrooms*. Cambridge: Cambridge University Press.
- Hendy, L., & Whitebread, D. (2000). Interpretations of independent learning in the early years. *International Journal of Early Years Education*, 8(3), 243–252.
- Howe, C. (1997). *Gender and classroom interaction: A research review*. Edinburgh: The Scottish Council for Research in Education.
- Howe, C. (2009). Collaborative group work in middle childhood: Joint construction, unresolved contradiction, and the growth of knowledge. *Human Development*, 52, 215–239.
- Howe, C. (2010). *Peer groups and children's development*. Oxford: Wiley-Blackwell.
- Howe, C., McWilliam, D., & Cross, G. (2005). Chance favours only the prepared mind: Incubation and the delayed effects of peer collaboration. *British Journal of Psychology*, 96, 67–93.
- Howe, C., & Mercer, N. (2007). Children's social development, peer interaction and classroom learning. *The primary review (research survey 2/1b)*. Cambridge: University of Cambridge.
- Howe, C. J., Tolmie, A., & Rodgers, C. (1992). The acquisition of conceptual knowledge in science by primary school children: Group interaction and the understanding of motion down an incline. *The British Journal of Developmental Psychology*, 10, 113–130.
- Howe, C., Tolmie, A., Thurston, A., Topping, K., Christie, D., Livingston, K., et al. (2007). Group work in elementary science: Organizational principles for classroom teaching. *Learning and Instruction*, 17, 549–563.
- Keefer, M., Zeitz, C., & Resnick, L. (2000). Judging the quality of peer-led student dialogues. *Cognition and Instruction*, 18(1), 53–81.
- Kutnick, P., & Rogers, C. (1994). *Groups in schools*. London: Cassell.
- Kyriacou, C., & Issitt, J. (2008). What characterizes effective teacher–pupil dialogue to promote conceptual understanding in mathematics lessons in England in key stages 2 and 3? *EPPI-centre report no. 1604R*. Institute of Education, University of London: Social Science Research Unit.

- Light, P., & Littleton, K. (1999). *Social processes in children's learning*. Cambridge: Cambridge University Press.
- Littleton, K. (1999). Productivity through interaction: An overview. In K. Littleton, & P. Light (Eds.), *Learning with computers: Analyzing productive interaction*. London: Routledge.
- Littleton, K., & Howe, C. (Eds.). (2010). *Educational dialogues: Understanding and promoting productive interaction*. London: Routledge.
- Mason, L. (2007). Introduction: Bridging the cognitive and sociocultural approaches in research on conceptual change: Is it feasible? Special issue on 'bridging the cognitive and sociocultural approaches in research on conceptual change'. *Educational Psychologist*, 42(1), 1–7.
- Mercer, N. (1995). *The guided construction of knowledge: Talk amongst teachers and learners*. Clevedon: Multilingual Matters.
- Mercer, N. (2000). *Words and minds: How we use language to think together*. London: Routledge.
- Mercer, N. (2008). The seeds of time: Why classroom dialogue needs a temporal analysis. *The Journal of the Learning Sciences*, 17(1), 33–59.
- Mercer, N., & Dawes, L. (2008). The value of exploratory talk. (2008). In N. Mercer, & S. Hodgkinson (Eds.), *Exploring talk in school*. London: Sage.
- Mercer, N., & Littleton, K. (2007). *Dialogue and the development of children's thinking*. London: Routledge.
- Michaels, S., & O'Connor, M. C. (2002). *Accountable talk: Classroom conversation that works*, CD-ROM. : University of Pittsburgh.
- Mortimer, E., & Scott, P. (2003). *Meaning making in secondary science classrooms*. Maidenhead: Open University Press.
- Murphy, P. K. (2007). The eye of the beholder: The interplay of social and cognitive components in change. *Educational Psychologist*, 42(1), 41–53.
- Nystrand, M. (1997). *Opening dialogue: Understanding the dynamics of language and learning in the English classroom*. New York: Teachers College Press.
- Nystrand, M., Wu, L., Gamorgan, A., Zeiser, S., & Long, D. (2003). Questions in time: Investigating the structure and dynamics of unfolding classroom discourse. *Discourse Processes*, 35(2), 135–198.
- Perret-Clermont, A. N. (1980). *Social interaction and cognitive development in children*. London: Academic Press.
- Piaget, J. (1932). *The moral judgement of the child*. London: Routledge.
- Piaget, J. (1967). Development and learning. In E. Victor, & M. S. Lerner (Eds.), *Readings in science education for the elementary school*. New York: Macmillan.
- Resnick, L. B. (1999). Making America smarter. *Education Week Century Series*, 18(40), 38–40.
- Reznitskaya, A., Anderson, R., McNurlen, B., Nguyen-Jahiel, K., Archodidou, A., & Kim, S. (2006). Influence of oral discussion on written argument. *Discourse Processes*, 32(2&3), 155–175.
- Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context*. Oxford: Oxford University Press.
- Rojas-Drummond, S., & Mercer, N. (2004). Scaffolding the development of effective collaboration and learning. *International Journal of Educational Research*, 39, 99–111.
- Ryder, J., & Campbell, L. (1989). Groupsense: When groupwork does not add up to 'groupwork'. *Pastoral Care in Education*, 7(1), 22–30.
- Säljö, R. (2009). Learning, theories of learning, and units of analysis in research. *Educational Psychologist*, 44(3), 202–208.
- Scott, P. (2008). Talking a way to understanding in science classrooms. In N. Mercer, & S. Hodgkinson (Eds.), *Exploring talk in school* (pp. 17–36). London: Sage.
- Scott, P. H., & Asoko, H. (2006). Talk in science classrooms. In V. Wood-Robinson (Ed.), *Association of science education guide to secondary science education*. Hatfield, UK: Association for Science Education (ASE).
- Shayer, M. (2003). Not just Piaget; not just Vygotsky, and certainly not Vygotsky as alternative to Piaget. *Learning and Instruction*, 13, 465–485.
- Slavin, R. E. (2009). Cooperative learning. In G. McCulloch, & D. Crook (Eds.), *International encyclopaedia of education*. Abington, UK: Routledge.
- Smith, S. M., & Blankenship, S. E. (1991). Incubation and the persistence of fixation in problem solving. *The American Journal of Psychology*, 104, 61–87.
- Smith, L., Dockrell, J., & Tomlinson, P. (Eds.). (1996). *Piaget, Vygotsky and beyond*. London: Routledge.
- Smith, F., Hardman, F., Wall, K., & Mroz, M. (2004). Interactive whole-class teaching in the national literacy and numeracy strategies. *British Educational Research Journal*, 30(3), 395–411.
- Success for All (2012). <http://www.successforall.org/Early-Childhood/Professional-Development/>
- Swanson, H. L., Hoskyn, M., & Lee, C. (1999). *Interventions for students with learning disabilities: A meta-analysis of treatment outcomes*. New York: Guilford Press.
- Thinking Together (2012). <http://thinkingtogether.educ.cam.ac.uk/>
- Underwood, J., & Underwood, G. (1999). Task effects in co-operative and collaborative learning with computers. In K. Littleton, & P. Light (Eds.), *Learning with computers: Analysing productive interaction*. London: Routledge.
- van Oers, B., Elbers, E., van der Veer, R., & Wardekker, W. (Eds.). (2008). *The Transformation of Learning: advances in cultural-historical activity theory*. Cambridge: Cambridge University Press.
- Vygotsky, L. S. (1962). *Thought and language*. Cambridge, MA: MIT Press.
- Vygotsky, L. S. (1978). *Mind in society*. Cambridge MA: Harvard University Press.
- Wang, M. C., Haertel, G. D., & Walberg, H. J. (1990). What influences learning? A content analysis of review literature. *The Journal of Educational Research*, 84, 30–43.
- Webb, N. M. (1989). Peer interaction and learning in small groups. *International Journal of Educational Research*, 13(1), 21–39.
- Webb, N., Nemer, K., & Ing, M. (2006). Small-group reflections: Parallels between teacher discourse and student behavior in peer-directed groups. *The Journal of the Learning Sciences*, 15(1), 63–119.
- Wegerif (2007). *Dialogic education and technology: Expanding the space of learning*. New York: Springer.
- Wells, G. (1999). *Dialogic enquiry: Toward a sociocultural practice and theory of education*. Cambridge: Cambridge University Press.
- Learning for life in the 21st century. Wells, G., & Claxton, G. (Eds.). (2002). Oxford: Blackwell.
- Wertsch, J. V. (1979). From social interaction to higher psychological processes: a clarification and application of Vygotsky's theory. *Human Development*, 22(1), 1–22.
- Wertsch, J. V. (1991). A sociocultural approach to socially shared cognition. In L. B. Resnick, J. M. Levine, & S. D. Teasley (Eds.), *Perspectives on socially shared cognition*. Washington: American Psychological Association.
- Wertsch, J. V. (1991). *Voices of the mind: A sociocultural approach to mediated action*. London: Harvester Wheatsheaf.
- Whitebread, D., & Pino Pasternak, D. (2010). Metacognition, self-regulation and meta-knowing. In K. Littleton, C. Wood, & J. Kleine Staarman (Eds.), *International handbook of psychology in education*. Leeds, UK: Emerald.
- Wilkinson, I., & Fung, I. (2002). Small group composition and peer effects. *International Journal of Educational Research*, 37, 425–447.
- Wolf, M., Crosson, A., & Resnick, L. (2006). Accountable talk in reading comprehension instruction. *CSE technical report 670*. University of Pittsburgh: Learning and Research Development Center.
- Wood, D. (1992). Teaching talk. In K. Norman (Ed.), *Thinking voices: The work of the National Oracy Project*. London: Hodder and Stoughton.
- Yaniv, I., & Meyer, D. E. (1987). Activation and metacognition of inaccessible stored information: Potential bases for incubation effects in problem solving. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 13, 187–205.