Research for Teachers

Raising achievement through group work

published: Wed Nov 01 10:35:44 GMT 2006

What can teachers do to improve pupils' communication skills? How can we make sure that group work encourages, includes and values contributions from everyone?

To shed some light on these important issues, the TLA research team looked at evaluations of a classroom approach called 'Thinking Together' which helped pupils learn to work collaboratively and improve their capacity to think.

Our last summary explored how teachers planned and used talk for learning in their classrooms. This summary explores what teachers can do to help pupils work collaboratively using dialogue both to communicate with each other and to reason together.

The researchers developed their Thinking Together approach to promote primary pupils' use of exploratory talk. Exploratory talk is a type of talk believed to be effective for thinking and learning. Pupils who engage in exploratory talk pool ideas, opinions and information. They think aloud together to create shared knowledge and understanding. Central to the Thinking Together approach is the researchers' belief that collaborative thinking skills can and should be explicitly taught. The Thinking Together approach is underpinned by Lev Vygotsky's educational theory (which we have reported in an earlier summary), that an important way in which children learn to think individually is through learning to reason with others through dialogue.

The researchers have carried out a number of experimental implementations and evaluations of their Thinking Together approach over the last ten years or so. They considered ICT, particularly stand-alone computers, to be a useful tool for collaborative discussion, and they investigated its application in school classrooms in a number of their research projects. Their studies repeatedly showed that when children were taught how to reason together through exploratory talk, they were able to transfer their reasoning skills to other educational experiences. These

benefits were particularly significant for children for whom English is an additional language.

This TLA research summarises and synthesises three of the researchers' studies:

Wegerif, R., N. Mercer and L. Dawes (1999). 'From social interaction to individual reasoning: an empirical investigation of a possible socio-cultural model of cognitive development'. *Learning and Instruction* 9 (5) pp.493-516.

Wegerif, R., K. Littleton, L. Dawes, N. Mercer and D. Rowe (2004). 'Widening access to educational opportunities through teaching children how to reason together'. *Westminster Studies in Education* 27 (2) pp. 143-156.

Wegerif, R. (2004). 'The role of ICT as catalyst and support for dialogue'. *NALDIC Quarterly* 1 (4) pp. 4-12.

In this summary we explore:

- the rationale underpinning the Thinking Together approach
- how primary aged pupils benefited from the Thinking Together approach
- how they were taught to interact and reason with each other, and
- ways computers were used to support pupil dialogue.

We also give a range of examples of successful pupil interactions drawn from the studies, together with some that were less effective, to illustrate the impact the Thinking Together approach had on primary pupils' discussions with each other. Several of the case studies we have selected illustrate ways of encouraging exploratory talk during collaborative group work at secondary level.

We think that practitioners at both primary and secondary level, who would like to promote collaborative working, improve their pupils' thinking skills and make effective use of computers will find the material helpful.

Back to top

Overview

Why is the issue important?

Getting children to work together in small groups does not of itself help their learning. For example, confident children may dominate discussions whilst quiet children are uninvolved. Children may argue unproductively with each other or they may happily go along with what others say without any reflection or debate. They may even chat off-task. It's important that teachers give pupils support to enable them to learn effectively from each other during small group discussion.

What did the research show?

Children who were taught how to work collaboratively with each other in small groups (sometimes with computers) using the 'Thinking Together' approach, were engaged in 'exploratory talk' (the type of talk considered to be effective for thinking and learning) more often after the programme of lessons than they were before it. The children:

- involved each other
- asked each other questions
- listened carefully to what each other said
- responded constructively
- gave reasons for their opinions.

These improvements were particularly noteworthy for children for whom English is an additional language. Pupils also made significant gains in their reasoning and teachers reported how the approach had a positive impact on inclusion in the classroom.

How was this achieved?
Over nine lessons, teachers taught the children how to use social ground rules through explicit modelling and coaching in group discussions. For example, they modelled asking 'Why?' questions, using 'because' to give reasons for statements, asking other children what they thought and reaching an agreement before coming to a decision. A key lesson in the programme involved eliciting the ground rules in the children's own words. The rules were displayed on the classroom wall for the children to refer to. For example, one class composed these ground rules for talk:

- Discuss things together. That means: ask everyone for their opinion, ask for reasons why and listen to people.
- Be prepared to change your mind.
- Think before you speak.
- Respect other people's ideas - don't just use your own.
- Share all the ideas and information you have.
- Make sure the group agrees after talking.

How was the research designed to be trustworthy?
The researchers conducted a number of separate, complementary studies. The three studies reported in the RoM involved samples of pupils aged 6-10 years who worked together on reasoning tasks and at computers. The researchers gathered and analysed a range of data including:

- the children's scores on two non-verbal reasoning tests (before and after the programme)
- video recordings and observations of how children worked with each other
- interviews with school staff.

What are the implications?
The studies show that pupils can learn effectively how to work collaboratively if:

- teachers model productive ways of talking and teach pupils certain key skills, such as asking questions, challenging one another and creating ground rules for group talk
- pupils are prepared beforehand for working together when computers are being used to support learning dialogues
- teachers receive appropriate professional development themselves.

What do the case studies illustrate?
The school case studies show how:

- a teacher decided on the composition of one group of pupils and what the children learned from being in that group
- a piece of computer software supported students' learning conversations in science
- pupils felt they benefited from working in a group
- the impact on teaching and learning of collaborative professional development supported by external specialists aimed at promoting co-operative group work
- a group of teachers conducted research with their classes to find ways of encouraging exploratory talk.

Back to top

Study

What impact did the Thinking Together approach have on pupils?
The research showed that children who had been taught the Thinking Together approach used exploratory talk more often after the programme of lessons than they had before it. (Exploratory talk is the type of talk considered to be effective for thinking and learning). The pupils:

- involved each other
- asked each other questions
- listened carefully to what each other said
- responded constructively, even if their response was a challenge, and

- gave reasons for their opinions.

They also used more exploratory talk than children from matched 'control' schools who had not been taught the Thinking Together approach. The researchers found similar improvements in the quality of talk around computers when the children were prepared for thinking together in small groups beforehand. Teachers of the target classes reported on the positive impact the approach had on inclusion. For example one teacher said:

'Most of the social groups have really knitted well and they have a sense of togetherness, and a sense of helping each other'.

The researchers' detailed analysis of the number of times pupils used words such as 'because', agree', 'I think', 'could', 'why' (which they had identified as key features of exploratory or quality talk) showed precisely how the children's ability to reason together had changed. The target groups' use of the words increased significantly after the programme. No increase in the use of these keywords was apparent in the talk of the control groups.

The researchers also looked at pupils' individual and group scores on tests of non-verbal reasoning. Overall, the scores of the target groups increased more than the scores of the control groups. In two schools where the researchers' observations revealed that the programme had been most carefully and comprehensively carried out, group scores increased by over 10 per cent. The gains made by individual target class children were also significantly greater than those made by children in control classes.

The findings showed that children learned to reason better as individuals when they put into practice the strategies that they first tried in dialogue with others. This fits well with Vygotsky's theory of social interaction as a means of constructing learning. Practitioners can find out details about his theory in our earlier RfT summary about Vygotsky's work.

How can dialogue guide pupils' thinking?

The kind of talk that is most effective for building children's knowledge and understanding together is 'exploratory talk', a term that was first used by Douglas Barnes in 1975 (see further reading). Barnes' work was developed by Neil Mercer in the 1990s. Mercer observed three kinds of talk in British primary schools:

- disputational talk, characterised by assertions, disagreement, short exchanges and individualised decision-making. There are few attempts to pool resources, or to offer constructive criticism of suggestions.
- cumulative talk, in which speakers build positively, but uncritically on what others say. Partners use talk to construct a 'common knowledge' by accumulation. Cumulative talk is characterised by repetitions, confirmations and elaborations.
- exploratory talk (the most educationally effective kind of talk), which occurs when partners engage critically, but constructively with each other's ideas. Statements and suggestions are offered for joint consideration. These may be challenged and counter-challenged, but challenges are justified and alternative hypotheses are offered. With exploratory talk, reasoning is more visible than with the other two types of talk. Progress emerges from the joint agreement that is eventually reached.

Mercer argued that thinking and communicating were inseparable in effective classroom talk. His view was derived from a modern interpretation of Vygotsky's view of learning in which there is not necessarily a 'more expert other' involved in the discussion. Vygotsky suggested that learning occurs when a learner interacts with a more knowledgeable person (such as a child with an adult) who can guide the learners' thinking. While this model of learning is useful, it does not explain the learning that occurs between children. Mercer argued that learning in these situations is based on children having to explain and justify their decisions to each other - the characteristics of exploratory talk.

Why and how did the researchers believe exploratory talk should be promoted?

Video recordings of children's discussions made by the researchers showed how children seldom hold good discussions - they rarely pick up on each other's ideas and consider them critically, resolving any differences through further discussion (exploratory talk). Usually, children tend not to listen to each other, one child dominates the discussion, the children argue unproductively (disputational talk) or the children happily go along with whatever another child says without any reflection or debate (cumulative talk). They suggested the reason this happened was because teachers often assume that pupils know how to talk and work together and

so rarely give them explicit guidance or training in how to make a good discussion happen.

The researchers consulted teachers and the research literature on collaborative learning for ways of promoting good discussion. They arrived at a number of pragmatic social ground rules that they suggested pupils needed to act upon during group discussion:

- all relevant information is shared
- the group seeks to reach agreement
- the group takes responsibility for decisions
- reasons are expected
- challenges are acceptable
- alternatives are discussed before a decision is taken
- everyone in the group is encouraged to speak by other group members.

The first three ground rules in the list were shared with cumulative talk - rules that served to bind the group, share information together and construct knowledge together through seeking agreement. The next two rules focused on the explicit reasoning that characterises exploratory talk as opposed to the other types of talk. The sixth ground rule, that alternatives are discussed, reflected the findings of research on collaborative problem solving, which has found that the groups that do best are those that consider alternatives before making decisions. The researchers added rule seven in the light of their experience of working with groups of children. They found that simply offering the right to participate wasn't enough - in practice, children needed their peers to actively encourage them to speak and put forward their views.

How did the teachers prepare the children for working together?
Working closely with primary teachers, the research team produced a series of nine 'Talk Lessons' to teach the social ground rules and to apply them within normal curriculum teaching and learning. Each lesson lasted for about one hour and focused on one or more of the ground rules of exploratory talk. The first few lessons dealt with skills such as listening, sharing information and co-operating. Later lessons encouraged children to make critical arguments for and against different cases. The children were given opportunities to practice discussing alternative ideas, giving and asking for reasons and ensuring that all members of the group were invited to contribute.

Teachers taught the children how to use the ground rules through explicit modelling and coaching in whole group and small group discussions. They also gave the children opportunities to use the rules when working in small groups without the teacher. The explicit modelling involved the teacher at the front of the class illustrating the ways in which s/he wanted the children to talk together. These included:

- asking 'why?'
- using 'because' to give reasons for statements
- asking other children what they thought, and
- reaching agreement before making a final decision.

A key lesson in the programme involved eliciting the ground rules in the children's own words. This was the third lesson after the children had all had some practice in collaborative activities. In a guided discussion the teacher drew from the class the kind of rules that they thought should be used in group work. The resulting list was displayed on the wall. During the rest of the programme and in other lessons where collaborative learning was used, the teacher or children could then refer to the rules on the wall and say 'remember our rules'. Although each class produced a different set of ground rules they were all similar to the ground rules for exploratory talk identified by the researchers. For example, one class composed the following ground rules for talk:

Class 5D's Ground rules for talk

- Discuss things together. That means:
- ask everyone for their opinion
- ask for reasons why
- listen to people.

- Be prepared to change your mind.
- Think before you speak.
- Respect other people's ideas - don't just use your own.
- Share all the ideas and information you have.
- Make sure the group agrees after talking.

The children worked in mixed ability groups of three for the talk lessons. This provided groups with a range of opinions and ideas and ensured that each group had a fluent reader/writer. To encourage a perception that all contributions to the group work were equal, there were no set 'roles' within the groups, other than that of occasional scribe or reader. Practitioners may like to read a case study of how a teacher decided on the composition of one particular group of children and what they learned from working with each other.

How did talking together help the children learn to think better?
The researchers' analysis of discussions by groups of children when working together revealed how the programme of talk lessons helped to improve the children's thinking skills. For example, the researchers examined the talk of George, Trisha and Susan as they worked together to solve a reasoning problem. The group had scored eight more correct answers on the reasoning tests after the programme than they had before it. The researchers compared the talk that resulted in an incorrect answer on the test with the successful talk after the programme that led to the group achieving the correct answer. The problem involved deciding which of six possible shapes (a black diamond, a circle, a square, a circle within a square, a black diamond within a square or a diamond within a circle within a square) completed the sequence.

Unsuccessful talk before the programme
In the pre-programme talk, the discussion started with a series of exchanges typical of disputational talk, in which the participants simply assert their opposing views without giving their reasoning - 'It's 2'. 'No it's not'. 'It is 2'. 'No it's not'. Susan then suggested, 'It's that one, 6'. This was taken up by Trisha and both she and Susan offered reasons:

Trisha: It's that, it has to be that ... it has to be 6 because look, they've only got that (pointing to the pictures).
Susan: Look, first they are starting with one of them things over there (pointing) and then it has to be black.

The (wrong) answer '6' was apparently agreed upon and George wrote it down. However, Susan then appeared to change her mind, although she didn't give a reason for her new opinion. A dispute then followed about who should write the answers on the answer sheet.

Successful talk after the programme
The discussion after the programme contained more exploratory talk and longer, more elaborate explanations than the earlier discussion had done. For example, Trisha opened the discussion with an elaborated hypothesis and a question that encouraged debate:

'That has got to be a diamond, a square with a diamond with a circle, number 6, do you agree?'

George asked for more explanation, challenging Trisha not into conflict, but to encourage her to be more explicit: 'No, what do you mean?' In her effort to be more explicit, Trisha appeared to see that she was wrong and changed her claim. The group then came to agree on an answer:

Trisha: Look. That's got a square with a diamond with a circle in, that's got a square with a diamond in and that's got a square with a circle in, so that's got to be a square.
Susan: It's got to be a blank square. Yeh it is.
George; Do you agree on number 5, do you agree on 5?
(George writes '5', which is the correct answer).

How did the Thinking Together approach make classrooms more inclusive?
The researchers noticed that when there was no explicit focus on talk, children for whom English was an additional language (EAL) often sat in groups without speaking or became disruptive out of boredom. They found that having ground rules for talk encouraged the children to draw others in. The researchers gave an

example of the interactions before and after the programme of a group of three children that included a normally quiet girl with EAL (Nuresha). The children were videoed as they worked together on a reasoning problem. The problem involved selecting one picture of a jigsaw piece out of six possible pieces, which they thought would fit into a blank space on a geometric pattern.

Before the programme
In the first video, Nuresha did not speak at all and was disengaged from the task - she sat back from the table, sometimes looking around the room or playing with her ruler. Shortly after starting on the task, Vijay and Kyle started to disagree over the answer and who should record it, without attempting to provide reasons for their opinions or seek each other's views (disputational talk):

Vijay: It's this one, isn't it?
Kyle: No.
Vijay: It's this one, isn't it?
Kyle: No.
Vijay: Yes.
Kyle: No.

After the programme
The children worked on exactly the same task in the follow-up video, but in a different way. This time, Nuresha became more involved in the group's shared reasoning - encouraged by the other two children, who now listened to one another and accepted each other's viewpoints:

Vijay: (to Nuresha) You have to say 'what do you think, Vijay or Kyle?'
Nuresha: I think that (number 2).
Kyle: I think that (number 4).
Vijay: Nuresha, look.
Nuresha: I think, that, that, that.
Kyle: No, because, look, because that goes round. It goes out. It goes out.
Vijay: Or that one.
Kyle: No, because it hasn't got squiggly lines.
Vijay: It has to be that.

The researchers also gave an example of how the Thinking Together approach helped two pupils in a special school for children with emotional behavioural difficulties - pupils who often find it difficult to articulate their thoughts and feelings or appreciate the thoughts and feelings of others. The pupils worked together at a computer to fill in speech and think bubbles for two characters who were squaring up for a fight over a skateboard. Their dialogue showed how they realised that even though the characters felt angry, apologising or asking nicely would diffuse the situation. We explore other ways of combining the Thinking Together approach with computers on the following pages.

Practitioners may like to read a case study that explored other benefits of collaborative group work, as perceived by the students themselves.

How were computers used to support the Thinking Together approach?
The researchers suggested that the computer offers an important way of supporting children's learning when working in small groups. They argued that children often treat computers as a person that thinks and knows things. But children are also aware that computers are machines and not people. The researchers suggested that this ambivalent nature - being both an object (a machine) and yet subject-like (interactive) gives the computer a unique and distinctive role in mediating learning conversations. The fact that computers are really objects, infinitely patient and without judgement means they can provide a safe context for children to try out ideas, while their ability to behave as interactive partners in games and conversations enables them to focus and direct children's learning dialogues.

The researchers' studies showed that if computers were to support learning dialogues effectively, teachers needed to remind the children of the ground rules for exploratory talk that their class had agreed upon before

asking them to work together in small groups around computers. The researchers' video evidence showed that when children were not prepared for working together before working with a computer, they did not work effectively together. For example:

- one child appointed him/herself as leader, sat centrally to the keyboard, and read out and entered instantaneous responses to questions
- quiet and less confident children watched, agreed or withdrew from the 'discussion'
- friends tended to agree readily with each other, while other children always disagreed
- the most heated debates were about who pressed the next key or used the mouse etc
- the children chatted about other things rather than complete the task
- the children competed against each other.

The researchers found that when children had been taught to use the ground rules, computers effectively supported learning conversations between children. Their findings showed that different types of computer activity supported learning in different ways. For example:

- group strategy games played against the computer motivated and supported the development of joint reasoning, and
- computer software learning activities prompted Initiation Discussion Response Feedback (IDRF) exchanges, where the computer was used to stimulate discussion and then direct it through giving feedback.

We explore these ways of supporting learning conversations with computers on the following pages.

How did playing strategy games against the computer motivate and support joint reasoning?
The researchers found that working together to try to beat the machine was a motivating context for shared reasoning and problem solving, provided the children knew the ground rules for exploratory talk. The researchers gave examples of discussions by two groups of pupils that showed the difference that preparing the children for working collaboratively at the computer made. The children were expected to locate an elephant in a grid-map, by keying in co-ordinates. After each guess, the programme provided information about how near the guess was to the actual position of the elephant.

In the first example, the two boys took turns to make random guesses, not really based on the information the computer offered. Their talk was disputational - they laughed or made derisory comments when their partner made an incorrect guess. They were sufficiently motivated to keep trying until one of them guessed the right answer and could say with satisfaction, 'I won!' Their exchanges did not help them learn about co-ordinates or to develop problem-solving strategies together:

Lester: I know where it is. (Sean takes his turn and fails to find the elephant)
Lester: I told you it weren't over there. (He then takes his turn also without success)
Sean: Eh, heh heh heh (laughing gleefully).
Lester: Which one just went on? I don't know. (Says something unintelligible).
Sean: 1, 2, 3, 4, 5, 6. (Counting squares on the screen).
Lester: I know where it is.
Sean: I got the nearest.

In the second example, the children were expected to find a rhino on a grid with negative as well as positive co-ordinate squares. This time, the children's class had worked through the Talk lessons. The children's interaction at the computer was quite different. The children collaborated to beat the computer. They discussed and agreed pairs of co-ordinates before one of them typed them into the computer.

Working together to find the rhino
The children had just been told by the computer that the rhino was 12 squares away.

Andy: 1,2,3,4,5, ... 12 ... (pointing to screen).
Baz: What, oh - 2, -5.
Andy: Maybe then, cos look .... Cos when you went 12 you went that way but if you go that way it's 2 away and it makes 12, look see it goes 1,2,3,4,... So I think it's that one, do you?
Baz: Yeh, OK, let's try it: -1, -3.

Andy: No, it can't be actually, no ...
Baz: -2, -4 it might be.
Andy: Yeh, it's got to be that, if it's not I'll be surprised.

How did computers prompt and direct discussion between pupils?
The researchers argued that the activity around much educational software often fits the kind of exchange known as IRF which involves Initiation by the teacher, Response by a pupil and Follow up by a teacher. There is often an initiation by the computer, a response by the user and feedback or follow-up from the computer. They gave examples of how this kind of exchange was transformed when the computer prompted the children to discuss their response together - the IDRF exchange (Initiation, Discussion, Response, Feedback). During their discussion, pupils came up with ideas and supported them with reasons before testing them out on the computer.

An example of an IDRF exchange prompted by a piece of tutorial software

(On the computer screen)

Rough surfaces cause:

a) as much friction as a smooth surface?
b) more friction than a smooth surface?
c) less friction than a smooth surface?

Rachel: Which one do you think it is?
Cindy: 'c'
Rachel: I think 'b' (Laughs).
Cindy: I don't. Look 'changes more surfaces than a smooth surface' (Misreading the screen).
Rachel: Yeh I know but - wait, wait - listen, if you rub two smooth surfaces together right, will it be slippery or stable? (Rubs hands together).
Cindy: Stable - depends how tight you've got it.
Rachel: Cindy listen! If you've got oil on your hands and you rub them together will they be slippery or not? (Rubs hands together).
Cindy: Well you see (She rubs her hands in a parody of Rachel but in a way that makes them miss each other) 'cos they don't rub together they go ...
Rachel: Cindy! (in mock exasperated tone) If you've got ...
Cindy: Yeh, they will be slippery! (laughs).
Rachel: Yeh, exactly. So if you've got two rough surfaces and you rub them together it will not be as slippery will it?
Cindy: No.
Rachel: So that proves my point doesn't it?
Cindy: mmm.
Rachel: Yes, do you agree? Good. (She clicks on answer 'b').

In this example, Rachel appeared to know the answer and persuaded Cindy by giving her reasons. The researchers pointed out that although this discussion seems to be one-sided, Cindy was genuinely persuaded, and in other interactions Cindy was the one persuading Rachel, so their relationship was more balanced than this episode implies.

Practitioners may like to read a case study that investigated how a computer helped to structure discussions between older students. The students were prompted by the computer to predict the flight path of various projectiles such as a ball rolling off a table, before watching a digital video clip of the experiment. The study examined how the tasks promoted meaningful discussion between the students.

What training and support did the teachers receive?
The researchers outlined the training and support they provided for the teachers taking part in the intervention

programme. They first introduced the teachers to the Thinking Together programme in an after-school session that was designed to inform the teachers about the background and aims of the approach. All head teachers, advisory teachers, participating teachers and learning support staff in the target schools were invited.

The introductory session was followed by a full day of professional development and two further after-school sessions for the teachers in the target schools. All learning support staff in the target schools also participated in a half-day of in-school professional development. During this time, the researchers worked with the teachers to plan lessons that focused on developing the children's awareness and skills in using spoken language.

The researchers visited all the target schools regularly to support the project teachers and collect feedback on activities as well as observe and gather data. This informal support was strengthened by two more after-school sessions.

The approach to professional development adopted by the researchers in these studies echoes the findings of three systematic reviews of continuing professional development which we described in two earlier RfTs. We reported how the reviewers found a link between the provision of a mix of teacher-to-teacher collaboration plus input and support from specialists and a positive impact on teaching and learning. The use of specialist expertise took a number of forms including:

- instruction by the specialists
- continued support during the intervention
- observation and feedback
- coaching in new techniques and strategies.

Practitioners can find out more about the kind of specialist expertise that made a difference in our RfT summary of the first review of collaborative CPD and our RfT summary of the second and third reviews.

Practitioners may also like to read a case study that details the professional development provided by other university researchers and its impact on collaborative learning. They ran a two-day workshop to introduce the teachers to the basic principles of collaborative learning and provided training in specific communication skills that challenged the children's thinking. The case study shows how the children then used the communication skills modelled by their teachers in their discussions with each other.

How was the research conducted?
We have focused on three of the researchers' studies: a study that involved KS1 children, a study that involved KS2 children and a study that explored ways computers provided support for learning conversations.

The researchers gathered a range of complementary data for their studies:

- the children's scores on two non-verbal reasoning tests (completed before and after the programme had ended)
- video recordings of focal groups from the target classes taken at the start and end of the programme, in which the children carried out a reasoning test activity or worked with a piece of computer software
- observations and written notes of how the children in the target schools worked with each other
- interviews with the teachers, head teachers and support staff (where possible) in the target schools.

The researchers transcribed their videotapes of the focal groups' talk. Their analysis of the transcripts revealed that the children used words such as 'because', 'if', 'I think', 'why', 'which', 'what', and 'you' to put forward reasons and encourage the inclusion of each other's perspectives. These words were then included in a computerised search for key features in the talk of the focal groups that indicated exploratory talk. They were used to provide a quantitative measure for comparing transcripts, both before and after the programme and between the target and control classes.

Practitioners considering conducting their own classroom research may like to read a case study which describes how a group of teachers investigated ways of encouraging exploratory talk with Year 8 and Year 10 students during collaborative group work in mathematics lessons.

References:

Wegerif, R., Mercer, N., and Dawes, L. (1999) From social interaction to individual reasoning: an empirical investigation of a possible socio-cultural model of cognitive development. Learning and Instruction 9 (5) pp.493-516

This study involved 124 children aged 9-10 years from six middle schools. Sixty pupils from three middle schools took part in the Thinking Together programme. Each of the target classes was matched with a control class of the same age in another middle school (64 children).

Wegerif, R., Littleton, K., Dawes, L., Mercer, N., & Rowe, D. (2004) Widening access to educational opportunities through teaching children how to reason together. Westminster Studies in Education 27 (2) pp. 143-156

This study involved six teachers and their Y2 classes (aged 6-7 years) in three target schools and five teachers and their Y2 classes in three matched control schools. One of the target schools and one of the control schools had a high proportion of children from low income families who had fairly recently arrived from the Indian subcontinent and for whom English was an additional language.

Wegerif, R. (2004) The Role of ICT as catalyst and support for dialogue. NALDIC Quarterly 1 (4) pp. 4-12

The researchers analysed over 50 hours of video recording of groups of children from a range of schools working with different pieces of computer software. They identified examples of exploratory talk (such as asking probing questions or giving reasons for opinions) and analysed the impact of the software on supporting or inhibiting this kind of talk.

What are the implications of the research?
Teachers wanting to promote collaborative working and improve their pupils' thinking skills may like to consider the following implications of the findings of this research:

The researchers stressed the importance of eliciting ground rules in the children's own words. Would watching videos or listening to audio tapes of themselves or other pupils working together help with this? How could you develop their comments into rules for discussion for their class?

The teachers involved in the studies organised their classes into mixed gender groups of three. How do you group children for learning? Is this a key area to think about when you are planning for group work? (You may find it helpful to read case study 1 which shows the criteria one teacher used for deciding which children to group together).

Could you make more use of computer activities to create opportunities for learning conversations, whilst supporting your pupils' in learning how to work collaboratively?
Could you work collaboratively with some of your colleagues to help you investigate ways of promoting exploratory talk with your classes? Would classifying your children's talk into disputational, cumulative and exploratory types create a framework for developing your thinking about the way the children interact with each other? (You may find case study 5 a useful starting point because it shows how a group of teachers went about exploring and analysing the talk their classes engaged in).

Would your pupils benefit from reflecting on their experiences of working collaboratively with you and each other? How might you plan and organise such debriefing sessions? (You may find case study 2 a useful starting point because it shows a way of collecting and analysing students' views of collaborative group work).

Leaders may wish to consider the following implications:

The researchers stressed the importance of teachers modelling how they wanted children to talk together. Would your colleagues find it helpful to have the opportunity to practise and reflect on their skills of questioning, and giving and asking for reasons, through taking part in role-plays with each other etc? (You may find case study 4 a useful starting point because it shows how teachers were trained in how to challenge their pupils' thinking and understanding during group activities).

Does improving communication feature sufficiently within your proposed development plans as a means of promoting social inclusion? Could your school do more to exploit enhancing talk skills as a social inclusion strategy?

The teachers involved in the projects reported in the RfT benefited from professional development focused on structured group work. Could you do more to support colleagues trying to improve collaborative working in their classrooms, by for example, organising workshops and inviting practitioners from university education departments or other schools?

The researchers found that certain kinds of computer software could support learning dialogues (provided children were prepared for working together beforehand). Would your colleagues find it helpful to have opportunities to share with each other their experiences of using the computer in this way?

Filling in the gaps
Gaps that are uncovered in a piece of research have a useful role in making sure that future research builds cumulatively on what is known. But research also needs to inform practice, so practitioners' interpretation of the gaps and follow-up questions are crucial. We think three kinds of studies would usefully supplement the research we have reported on:

- studies designed to gather evidence of collaborative group work in other areas of the curriculum, such as literacy, history and music
- a review of different approaches to supporting group work, and
- case studies of other external devices for supporting learning conversations, such as interactive whiteboards.

What is your experience?
Do you have any evidence about initiatives aimed at promoting collaborative group work? Do you have action research or enquiry based development programmes running that explore, for example the group work in different areas of the curriculum or making use of technology? We would be interested to hear about examples of effective activities, which we could perhaps feature in our case study section.

Your feedback
Have you found this study to be useful? Have you used any aspect of this research in your own classroom teaching practice? We would like to hear your feedback on this study. Contact research@gtce.org.uk to share your views with us.

Back to top

Case studies

We have selected five independent case studies to illustrate aspects of the research reported in the RfT. The first shows how a teacher decided on the composition of one particular group of pupils and what the children learned from being in the group. The second case study examines students' perceptions of the benefits of structured group work. The third case study examines how a piece of computer software supported students' learning dialogues. The fourth case study explores the impact on teaching and learning of collaborative professional development supported by external specialists aimed at promoting co-operative group work. The fifth case study describes the experiences of a group of teachers who conducted research with their classes to find out ways of encouraging exploratory talk.

Developing children's collaborative working skills

We chose this study because it shows how a teacher purposely selected three children to work together so they could help develop each other's thinking and discussion skills. The study was undertaken as part of the National Oracy Project (1987-1993) which involved teachers in 27 LAs working to promote pupils' oral skills. This study focused on three Year 5 children - Mark, Annabel and Tom as they played 'a game of

digits'. The teacher invited the children to sit together in the carpeted area of the classroom and gave them a set of instructions for how to play the game. The teacher did not stay with the group, but listened in to the children's discussion periodically, occasionally joining in. A coordinator from the Croydon Oracy Project observed the children and audio taped their discussion.

The children's discussion

The children were given a set of instructions for playing the game.

Instructions for playing the game of digits:

You need three players - A, B & C
On the count of three, each player displays their hand with either 1, 2 or 3 fingers extended.
Player A gets 1 point if all three players match.
Player B gets 1 point if two players match.
Player C gets 1 point if there are no matches.
Play the game a number of times.
Is this game fair?
If not, how could you make it fair?

This transcript shows how the group's thinking developed during the activity:

Tom: I don't think this is fair.
(Mark agreed and gave reasons)
Mark: I don't think this is a fair game 'cos there's only three possibilities of you getting a point.
(Tom started to think aloud and explore ideas for a fairer game)
Tom: I get a point 'cos she puts up the same as me, she gets a point 'cos she puts up the same as me, you didn't get any points 'cos no one's the same ...
Teacher: So what's wrong with your instructions?
(Mark sums up the group's thinking)
Mark: I didn't get any points 'cos there's only one possibility ... so I don't think it's fair.
Teacher: So what are you going to do, are you going to re-write the rules or re-state the rules?
(Mark and Tom start to develop their thinking)
Mark: Not re-write them, re-state them, 'cos that would be a different game.
Tom: Or you take it in turns ... so I'm A the first game and B the second ...
Mark: Actually that's quite good.
Annabel: Yeh, try it.

The children played the game again. The teacher then asked the children whether they could guess what the results would be if they played the game again. Tom used the word 'probability' in his answer - although the teacher had not yet introduced the word to the class. He had made a link with experiences outside the classroom:

Tom: The probability really is, when you have a turn at being B you get a point, 'cos when we were playing it, when I was B, I got most points.

Mark suggested the game 'could be fair'. After further discussion, Annabel made what turned out to a significant contribution to the group by sowing the seeds of feasibility.

Annabel: This is the sort of game that young children could play so we don't want to make it too complicated.

The group spent a further half hour trialling games with a variety of numbers of players (played using two hands) and with a variety of scoring systems, judging each game for fairness and feasibility with young children. Eventually, the group arrived at a new version of the game that had the same instructions as the original, but a modified scoring system.

Mark: We can just copy their idea, but A gets 2 points, B gets 1 point and C gets 2 points.
Tom: The thing that's most probable gets the least points.

What did the pupils learn from working collaboratively?
It was clear that this group developed their mathematical understanding through playing the game together. When the teacher asked the children what they thought they had got out of the activity, Mark answered for the group:

'Well, it was only by doing it that we realised it was about probability'.

But the group gained more than mathematical understanding. In previous lessons, Annabel's teacher had noticed how Annabel tended to play a dominant role in group discussions, establishing her own ideas and 'steamrolling' those of others. The teacher made a point of praising Annabel each time she saw her actively listening to her peers. For the observed lesson, she had deliberately grouped Annabel with two other children who had equally forceful ideas to give Annabel the experience of learning from and building on other people's ideas. The strategy was successful - Annabel's active listening encouraged Tom to think aloud and Mark to build on his ideas. Her suggestion half way through the activity that the game should be kept simple because it was for young children was a thoughtful and significant contribution to the group.

The teacher recognised that Tom was used to following his own line of thinking in mathematical investigations. By thinking aloud in this activity, he offered his ideas to the group and was able to build on their ideas of fairness and feasibility.

The teacher had noticed at the beginning of the year that Mark found it difficult to make positive, helpful contributions to group discussions. During the year, she had encouraged him to reflect on his role in a variety of groupings. In this investigation he demonstrated how he had learned to wait for appropriate moments to make contributions, building on and valuing the ideas of others and summing up the group's thinking.

Reference
Yard, L. (1990) Talk in mathematics *Language Learning* 3 pp.13-15

Students' reflections on working collaboratively

We chose this case study because it explores students' views and opinions of collaborative small group work. All of the students involved in the study had experienced small group collaborative work that encouraged exploratory talk in mathematics lessons for 2-3 years prior to the study. Three classes of students were interviewed:

- a Year 8 (12-13 year olds) middle attaining class
- a Year 10 (14-15 year olds) high attaining class
- a Year 11 (15-16 year olds) low attaining class.

The interviews were audio taped and transcribed. Each student's response was systematically coded for a particular category or categories. Four clear benefits emerged from the students' responses:

- working together as a process
- enjoyment
- allowing the teacher to gain insights into their learning
- developing mathematical understanding.

Working together as a process
The students commented how working together helped them to build on other people's ideas:

'You put all your ideas together and by putting everyone's ideas together, you come up with good ideas'. (Middle attaining Y8)

'Even if one person did say yeah this is the right answer, we wouldn't just write it down, you'd you know, make it more deeper and everybody's put more to extend the answer'. (Low attaining Y11)

' I think it was K came up with one idea, and then we sort of started working on that and then other people sort of put in other ideas on top of it so we were always sort of building up'. (High attaining Y10)

Enjoyment
A sense of enjoying collaborative group work was evident in all the student interviews:

'I mean it was fun, actually. I liked working with those people, so ... we got on really well'. (High attaining Y10)

'It's a lot more enjoyable to work in a group'. (Middle attaining Y8)

Allowing the teacher to gain insights
The students recognised that working collaboratively in groups allowed the teacher access to the 'informal' learning process.

'I suppose you get the chance to hear us talking ... I suppose it gives ... you an insight into what we're doing, 'cos if we were working by ourselves, we wouldn't be talking ... working in groups lets you, sort of, listen in'. (High attaining Y10)

Developing mathematical understanding
This theme was identified throughout the interviews, but it was expressed in different ways at each attainment level:

'[Collaborative learning is] to encourage us to ask about things we don't understand, instead of just worrying about it, always think things out'. (High attaining Y10)

'You understand the question better than you would just working by yourself ... because its like that, you get a deeper meaning, you know, you know what you're doing, you don't just skim it over the top, you can go into the question and know what the questions' asking from you'. (Low attaining Y11)

Reference:
Edwards, J-A & Jones, K. (2001) Exploratory talk within collaborative small groups in mathematics in Winter, J. (Ed) *Proceedings of the British Society for Research into Learning Mathematics* 21 (3) pp.19-24. Available at: www.bsrlm.org.uk/IPs/ip21-3/BSRLM-IP-21-3-4.pdf

Peer-learning conversations with computers

We chose this case study because it shows how a piece of computer software was used to prompt collaborative discussion between students. The study involved Year 10 and 11 students (18 girls and 26 boys). Working in collaborative pairs, the students completed 16 computer-based 'Predict-Observe-Explain' (POE) tasks during two physics lessons at the start of a unit of mechanics. Each class was already familiar with co-operative group work and POE tasks led by their teacher. The POE tasks prompted students to:

- predict the result of a demonstration and discussing the reasons for their predictions
- observe the demonstration
- explain any discrepancies between their predictions and observations.

The computer POE tasks incorporated video clips of real life events designed to promote discussion of the students' ideas about force and motion. The clips included a child releasing a ball so that it fell to the ground, a tennis ball rolling slowly off a table and an astronaut on the moon releasing a hammer and a feather simultaneously. The students were prompted by the computer to predict and discuss what they thought would happen to the flight path of each projectile before watching the video clip. They then compared what actually happened with their predictions, discussing any discrepancies. The researcher created the POE tasks using multimedia authoring software. He filmed some of the video clips used in the tasks himself and took some from commercial VHS tapes.

The researcher argued that the computer could help to support peer learning conversations by giving students control over the pacing of the POE tasks and the presentation of the video demonstrations, whilst the real life physical settings depicted in the video clips provided interesting and relevant contexts. The autonomy involved in the computer tasks could give students the flexibility and time to discuss their ideas thoroughly, whilst the video clips provided the stimuli for students to review their ideas critically, especially if their prediction was incorrect.

The researcher collected a variety of data including observation, audio and video recordings, and interviews with the students and teachers to find out the extent to which the computer-based POE tasks promoted meaningful discussion between the students. He found evidence that the computer-led POE tasks were as successful as the teacher-led tasks. The students:

- articulated and justified their own ideas
- reflected on and tested out the viability of their own and their partner's ideas
- built new ideas and shared meanings together.

How students articulated, justified and reflected on their own ideas
The students articulated their views of the problems posed by the computer by making drawings of the predicted flight path and discussing the reasons for their prediction. Disagreements between them gave the students opportunities to justify and defend their viewpoints. For example, Dave's disagreement with Pat's prediction caused Pat to justify his view in this discussion:

Pat: It's going to go down more than out.
Dave: No. My prediction is it's going to go down heaps faster. It'll go out a little bit and then go down. Not much though. How do you like that? (Dave made a daft drawing showing the ball moving a considerable distance from the table).
Pat: But the thing is it's going slowly - go back a bit - I reckon it's going a lot slower than that Dave.
Dave: Like that? (Dave edited his drawing, reducing the predicted horizontal range of the projectile).
Pat: Yeh - I reckon it's more like that Dave.
Dave: Oh yeh? OK. (Not quite convinced).
Pat: It's going so slow, it'll only get pushed out from the table a little bit before it goes down. (Defending his view).

How the students reflected on and tested the viability of their own and their partner's ideas
A feature of the students' conversations was the way they frequently performed mini-experiments, particularly during the prediction and reasoning stages of the tasks. The students dropped or threw objects such as coins, pencils and pieces of paper into the air, or rolled them off tables. The students also frequently made use of hand gestures - they pointed to the video clips on the screen, and traced pathways of objects with their fingers or their pen. These physical actions were often collaborative and provided evidence of students reflecting on and testing their own ideas. Sometimes they led to the students reconsidering their own views.

There were many incidents where students discussed their partner's ideas about the POE tasks. Their conversations were characterised by frequent questioning and silent pauses. For example, Michelle initially disagreed with Cath's drawing. After evaluating each other's ideas, both students attempted to provide a

detailed description of the ball's pathway. In particular, Michelle tried to justify her own idea that the pathway was steeper than the pathway that Cath had observed.

Cath: OK - play it (the video clip) again.
Michelle: When she throws it, it sort of comes up a bit and then comes down. Do you think or not?
Cath: Um ... Well she throws it underarm, she doesn't throw it straight out.
(The students watch the video clip again).
Michelle: See it sort of goes up, then it comes down. (Drawing picture).
Cath: It curls up just a tiny bit, maybe not up like that (pointing at Michelle's drawing). When it starts to drop a bit, it comes down more gradually.
Michelle: Isn't it more than gradually: it's a bit more than gradual!
Cath: Ah ... (pause as both students watch the video clip again).
Michelle: Don't forget she's a lot higher.
Cath: That's all right, we'll change it.

How students built new ideas and negotiated shared meanings with their partner
Whilst there were many examples of students' reflecting on their own and their partner's ideas, few groups showed evidence of genuine building and negotiation of new ideas. One pair of students that did, bounced ideas off each other in the process of formulating a reason for their predicted pathway of the slow ball rolling off the table:

Anne: Wouldn't it (the ball's trajectory) arch more half way down? I guess it would arch more ... it leaves the table. Roly, poly ... (Anne continues to draw the pathway).
Jane: Or would it dip or would it just go straight down? I don't know what do you think?
Anne: Yeh.
Jane: It'll just like roll a bit.
(Jane performs a mini-experiment by rolling a pencil slowly off the table).
Anne: Sort of like out a bit.
Jane: OK not as much as that but - OK well um - so the ball initially arches slightly away from the table then just drops? (Looking for support).
Anne: Yeh, the ball's motion is still going this way, but due to gravity it's dropping. It doesn't land straight down because it's got (forward) motion.

Although the researcher found many examples of peer learning with computers, generally the students did not conduct rich conversations during the (final) explanation stage of the POE tasks. He suggested two possible reasons for this:

there were some instances where students would not admit to incorrect predictions
students from both classes were more familiar with teacher-led POE tasks where the teacher provoked quality comments during the difficult explanation stage.
Consequently, he suggested that whilst the computer can usefully facilitate collaborative discussion, it may be more appropriate for teachers to facilitate the final explanation stage during a whole class plenary to give groups the opportunity to share their beliefs.

Reference:
Kearney, M. (2004) classroom use of multimedia-supported Predict-Observe-Explain tasks in a social constructivist learning environment *Research in Science Education* 34 pp. 427-453

Collaborative professional development for co-operative group learning

We chose this case study because it provides details of a professional development programme and the impact the teachers' CPD had on collaborative pupil learning. Teachers were invited to participate in a two-day workshop run by the researchers (academics from a university education department) designed to introduce them to the basic principles of co-operative learning. The workshops included information on how to establish problem-solving tasks that were open and discovery-based so the children would be required to interact about

the task, and share information and ideas as a group. The workshop also gave the teachers the opportunity to:

- interact with other teachers
- discuss issues concerning the implementation of co-operative learning in their classrooms
- reflect on the benefits for themselves
- receive ongoing support from their colleagues
- as they contemplated transforming their teaching practices to include the new approach to learning.

One group of teachers were also trained how to challenge children's thinking and promote meaningful engagement with the task. These included the skills of:

- reflecting meaning (for example, commenting 'It sounds as though ...')
- tentatively offering suggestions (for example, commenting 'Have you thought about ...?')
- reframing statements to enable children to consider an alternative perspective (for example, commenting 'On the one hand, I hear you saying that you're stuck, but on the other, you seem to be indicating that you've found the solution. I wonder what it is?')
- validating efforts and focusing on key issues and solutions (for example, commenting 'You've worked that part out after a lot of hard work. I wonder what you may need to know now if you want to find the solution?').

These interactions were non-directive, yet designed to challenge the children's understandings and perspectives with the intention of helping them to focus more clearly on the problem to be solved. The teachers took part in role-plays with other teachers to practise the skills. In their groups, they were asked to:

- think and talk about their reactions to the role-play situations
- assess the quality of the skills they were practising
- hypothesise about how the children would react to the specific communication skills.

The researchers moved between the groups encouraging them to think and talk about their reactions to the use of communication skills and how they might be used in classroom settings to promote discussion and thinking among group members.

The teachers who were not given the communication skills training spent an equal amount of time with the researchers and each other to embed co-operative learning activities into specific classroom lessons. This included discussing curriculum issues, resources needed for planning these lessons and ways of evaluating the effects of co-operative learning.

What difference did the professional development make?
All the teachers were audio-taped during lessons in which they used co-operative learning activities and their interactions were coded into categories such as instructing, prompting, questioning, disciplining, and praising pupils. The study found that the teachers who had received additional training in the specific communication skills designed to challenge children's thinking prompted the children and asked questions nearly twice as frequently as the teachers who had only been trained to embed the co-operative learning activities into their lessons. The teachers who had received the communication skills training were also four times less likely to have to discipline their groups than their peers.

The teachers who had practised and reflected on the specific communication skills extended their pupils' understanding and thinking in a variety of ways, including:

- probing and challenging the children to identify issues
- tentatively offering suggestions

- acknowledging, clarifying and validating children's ideas and understandings
- confronting discrepancies in the children's thinking
- focusing on key issues.

For example:

'What makes you think [having a long breeding season] might be adapting?' [Challenging the pupils to extend their thinking and see if there are other issues they might consider].

'Because you think that's how they cope with the environment' [clarifying the children's ideas] ... 'Did the information you read give you any information why? [Probing and suggesting the further information they might need].

'So you think it gives them longer to look after their young so they can adapt'. [Acknowledging and validating the pupils' understanding].

'Right, well done! [Acknowledging effort] 'Excepting, Georgia just read this bit of information here'. [Confronting discrepancies].

'Now what you as a group have to decide is whether you want to put it under adaptation or under another feature'. [Helping the group to focus on the key issue].

The study also found that the children used the verbal behaviours modelled by their teachers in their discussions with each other. They encouraged each other, challenged each other's thinking and sought each other's opinion. This is an example of one such discussion that took place when a group of children worked together to write a report about penguins:

'What do you think about this? I wrote down [gives information about penguins]'.

'That's pretty good'. [Encouragement of another pupil's efforts].

'What are you going to write down?' [Challenge to group member].

'I found they go further north - north of Antartica'.

'Enemies would be? What do you reckon enemies would be?' [Challenge to group's thinking].

'Yeah that's what I'm thinking'. [Validation of idea].

'It has many enemies. Put many enemies'. [The children engaged in a discussion about predators].

'Any other features? What do you reckon?' [Seeks group's opinion on other information to be included].

Reference:
Gillies, R.M. & Boyle, M (2005) Teachers' scaffolding behaviours during co-operative learning *Asia-Pacific Journal of Teacher Education* 33 (3) pp.243-259

Investigating ways of encouraging exploratory talk during collaborative group work

We chose this case study because it shows how a group of teachers went about researching collaborative group work with their own classes. The teacher researchers investigated how different ways of grouping

students affected the dialogue they used. They also developed and evaluated strategies designed to promote exploratory talk. The study involved six teachers, two Year 8 classes (54 students) and a Year 10 class (26 students).

A whole school focus on literacy skills had revealed how many students experienced difficulty when communicating their thinking and reasoning in extended mathematics investigative tasks and GCSE coursework (although mathematics GCSE and national test results exceeded national results). The school was aware of research which showed how getting children to talk with each other about tasks helped to enhance their ability to think about them, and teachers in the mathematics department were keen to see how they could encourage peer discussion during problem solving tasks.

The research team planned several 'research lessons' for their Year 8 and 10 classes to explore strategies designed to encourage students' use of exploratory talk when working in groups. The strategies included:

- developing ground rules for talk
- considering the composition of the groups
- using peer assessment with shared marking criteria and tokens.

Whilst the class teacher taught the lessons, two colleagues observed and made audio and video recordings of the discussions that took place in two focus groups. The teachers also used questionnaires with the whole class to find out the students' views of working in groups. After the lessons, the research team met to analyse the data they had collected. They then used the information to plan subsequent lessons designed to address issues brought to light by the data.

The Year 8 mathematics research lessons

In the first research lesson, the teachers asked the students to work together on a mathematical investigation. No guidelines for group work were provided. After the lesson, students completed questionnaires designed to find out their views about working in groups. The teachers also analysed audio recordings using the classifications of talk put forward by Neil Mercer (disputational, cumulative and exploratory). They found that most of the talk was cumulative (characterised by repetitions, confirmations and elaborations), with some disputational talk (involving disagreements and individual decision-making), but little exploratory talk, where students explained and justified their decisions.

To encourage more exploratory talk, the teachers started their second research lesson with a class discussion about working in groups. The class developed some ground rules for working in groups. For example, 'give reasons to back up anything you say'. In the light of the students' comments about their experiences of working in groups during the previous research lesson, the teachers restructured some of the groups so that the students worked with others of the same gender and similar ability to their own.

In the third research lesson, the teachers arranged the students into single-sex, similar ability friendship groups and reminded the students of the ground rules for group work. They gave the students 'Blip-Blop' problems which aimed to encourage them to discuss the processes they would use to solve problems. In the problems, all values had been replaced by nonsense words. For example, 'Sam has baba packets of sweets. Each packet has gaga sweets in it. Sam gives away nana sweets from each pack, then he eats a total of lala sweets himself. How many sweets does he have left?'

The Year 10 mathematics research lessons

In the first Year 10 research lesson, the students worked with a partner of the same sex and similar 'interpersonal' ability (based on teacher judgement) to solve a problem by constructing algebraic equations. They were provided with ground rules for working in groups. The students were provided with open-ended marking criteria and challenged to earn as many points as possible. Each pair of students then presented their solution to another pair to assess.

In the next research lesson, the students were given another problem-solving task and were reminded of the ground rules for working in groups. In this lesson, the students could 'buy' information using tokens - for each token used, 5 marks were deducted from their final total. The student groups completed a tally during the first five minutes of the activity to monitor whether their group was following the guidelines. Two teachers also monitored the occurrence of different forms of dialogue for two of the groups, using a similar tally sheet to that used by the students.

What did the teachers find out from the research lessons?
The teachers' observations revealed that arranging the students into groups based on friendships helped to encourage exploratory talk, particularly for girls and students with high interpersonal skills.

In lessons where the students were not in friendship groups, they found boys with low interpersonal skill tended to engage in very little exploratory talk, although there was some variation between the groups. In one of the groups, the student with high interpersonal skills managed to encourage the other group members to play a full part in discussions and high levels of exploratory talk were recorded. In another group, the boys dominated the decision-making and girl who was usually articulate made little contribution to the group's discussion.

The student questionnaires revealed that some students in mixed ability and mixed gender groups had felt either 'left out' of the group activity (one student reported for example, 'They wouldn't let me talk') or that other members of the group had not pulled their weight ('B didn't do any work').

We chose this case study because it shows how a group of teachers went about researching collaborative group work with their own classes. The teacher researchers investigated how different ways of grouping students affected the dialogue they used. They also developed and evaluated strategies designed to promote exploratory talk. The study involved six teachers, two Year 8 classes (54 students) and a Year 10 class (26 students).

A whole school focus on literacy skills had revealed how many students experienced difficulty when communicating their thinking and reasoning in extended mathematics investigative tasks and GCSE coursework (although mathematics GCSE and national test results exceeded national results). The school was aware of research which showed how getting children to talk with each other about tasks helped to enhance their ability to think about them, and teachers in the mathematics department were keen to see how they could encourage peer discussion during problem solving tasks.

The research team planned several 'research lessons' for their Year 8 and 10 classes to explore strategies designed to encourage students' use of exploratory talk when working in groups. The strategies included:

- developing ground rules for talk
- considering the composition of the groups
- using peer assessment with shared marking criteria and tokens.

Whilst the class teacher taught the lessons, two colleagues observed and made audio and video recordings of the discussions that took place in two focus groups. The teachers also used questionnaires with the whole class to find out the students' views of working in groups. After the lessons, the research team met to analyse the data they had collected. They then used the information to plan subsequent lessons designed to address issues brought to light by the data.

The Year 8 mathematics research lessons
In the first research lesson, the teachers asked the students to work together on a mathematical investigation. No guidelines for group work were provided. After the lesson, students completed questionnaires designed to find out their views about working in groups. The teachers also analysed audio recordings using the classifications of talk put forward by Neil Mercer (disputational, cumulative and exploratory). They found

that most of the talk was cumulative (characterised by repetitions, confirmations and elaborations), with some disputational talk (involving disagreements and individual decision-making), but little exploratory talk, where students explained and justified their decisions.

To encourage more exploratory talk, the teachers started their second research lesson with a class discussion about working in groups. The class developed some ground rules for working in groups. For example, 'give reasons to back up anything you say'. In the light of the students' comments about their experiences of working in groups during the previous research lesson, the teachers restructured some of the groups so that the students worked with others of the same gender and similar ability to their own.

In the third research lesson, the teachers arranged the students into single-sex, similar ability friendship groups and reminded the students of the ground rules for group work. They gave the students 'Blip-Blop' problems which aimed to encourage them to discuss the processes they would use to solve problems. In the problems, all values had been replaced by nonsense words. For example, 'Sam has baba packets of sweets. Each packet has gaga sweets in it. Sam gives away nana sweets from each pack, then he eats a total of lala sweets himself. How many sweets does he have left?'

The Year 10 mathematics research lessons
In the first Year 10 research lesson, the students worked with a partner of the same sex and similar 'interpersonal' ability (based on teacher judgement) to solve a problem by constructing algebraic equations. They were provided with ground rules for working in groups. The students were provided with open-ended marking criteria and challenged to earn as many points as possible. Each pair of students then presented their solution to another pair to assess.

In the next research lesson, the students were given another problem-solving task and were reminded of the ground rules for working in groups. In this lesson, the students could 'buy' information using tokens - for each token used, 5 marks were deducted from their final total. The student groups completed a tally during the first five minutes of the activity to monitor whether their group was following the guidelines. Two teachers also monitored the occurrence of different forms of dialogue for two of the groups, using a similar tally sheet to that used by the students.

What did the teachers find out from the research lessons?
The teachers' observations revealed that arranging the students into groups based on friendships helped to encourage exploratory talk, particularly for girls and students with high interpersonal skills.

In lessons where the students were not in friendship groups, they found boys with low interpersonal skill tended to engage in very little exploratory talk, although there was some variation between the groups. In one of the groups, the student with high interpersonal skills managed to encourage the other group members to play a full part in discussions and high levels of exploratory talk were recorded. In another group, the boys dominated the decision-making and girl who was usually articulate made little contribution to the group's discussion.

The student questionnaires revealed that some students in mixed ability and mixed gender groups had felt either 'left out' of the group activity (one student reported for example, 'They wouldn't let me talk') or that other members of the group had not pulled their weight ('B didn't do any work').

Reference:
Seal, C (2006) How can we encourage pupil dialogue in collaborative group work? National Teacher Research Panel summary. Available at: www.standards.dfes.gov.uk/ntrp/lib/pdf/seal.pdf
Back to top

Further reading

What else might I enjoy reading?

Barnes, D. & Todd, F., (1995). *Communication and learning revisited: Making meaning through talk*. Portsmouth: Boynton/Cook Publishers.

This is a revision of an earlier publication by the authors, 'Communication and learning in small groups'. The first three chapters give an overview and analysis of the original research, with illustrative, transcribed sections of audio-recorded talk. Chapters 4 and 5 provide advice on managing small group work in classrooms and on studying group talk. The final chapter provides a theoretical basis for the findings of the original research.

Barnes, D. (1975) *From communication to curriculum*. Harmondsworth: Penguin Books
This seminal work explores the relationship between talk in the classroom and the construction of knowledge. It is a historically significant work because it discusses peer talk, a previously unrecorded aspect of classroom talk and provides the first definition of 'exploratory talk' amongst children in the classroom.

Dawes, L. & Sams, C., (2004). *Talk Box: Speaking and listening activities for learning at Key Stage 1*. London: David Fulton Press.

Dawes, L. Wegerif, R. & Mercer, N., (2000) *Thinking together: Activities for Key Stage 2 children and teachers*. Birmingham: Questions Publishing.

Mercer, N. (2000). *Words and minds: How we use language to think together*. London: Routledge Falmer.
This book articulates the rationale underpinning the Thinking Together approach.

Wegerif, R. & Dawes, L. (2004). *Thinking and learning with ICT: Raising achievement in primary classrooms* . London: Routledge Falmer
Drawing on several of their research projects, the authors outline their strategy for enhancing the effectiveness of computers for teaching and learning through developing collaborative learning in small groups and using group discussion to improve thinking and reasoning skills.

Wegerif, R. & Scrimshaw, P. (1997) *Computers and talk in the primary classroom*. Clevedon: Multilingual Matters
This book provides examples of analyses of transcripts using the three categories of talk identified by Mercer - disputational, cumulative and exploratory. The book contains contributions from eleven researchers and teachers involved in the Spoken Language and New Technology (SLANT) project which observed and recorded children's talk at stand alone computers.

Online Further Reading

Related Research
A comprehensive and detailed bibliography of research about collaborative peer talk in mathematics is available on the Collaborative Group for Research in Mathematics Education website at:
www.crme.soton.ac.uk/biblios/talk.html

Project outputs
Various research papers from the projects outlined in the RfT summary are downloadable from Rupert Wegerif's website at:
www.rupertwegerif.name

Research review of pupil grouping practices
A literature review of classroom based research into pupil grouping practices. Kutnick, P., et al. (2005)The effects of pupil grouping literature review London: DfES RR688 Available at: www.dfes.gov.uk/research/data/uploadfiles/RR688.pdf

Resources

CPD pack
The researchers have developed a CPD pack to help teachers implement the 'Thinking Together' approach around ICT in mathematics. It is available from:
http://smile.open.ac.uk/CPDpack.htm

More thinking together resources
Teacher ideas and materials developed as part of the researchers' Talking for Success project are available at:
http://talking-for-success.open.ac.uk

Other practical strategies
Leicestershire County Council's English and literacy website outlines practical strategies for promoting effective talk at:
www.leics.gov.uk/index/education/support_for_schools/lgfl/lgfl_primary/lgfl_literacy/lgfl_literacy_ks4/ks4_speaking_listening.h
Thinking together resources
Further information about the Thinking Together approach, including downloadable software and lesson plans is available at:
www.thinking-together.org.uk

Summaries of research
Effects of small group learning
A short digest of a study that investigated the effects of co-operative learning on junior high school students during small group learning is available at:
www.standards.dfes.gov.uk/research/themes/pupil_grouping/ThuAug261107362004

Learning how to reason
A short digest of another study by Neil Mercer and Rupert Wegerif, 'Reasoning as a scientist: ways of helping children to use language to learn science' is available at:
www.standards.dfes.gov.uk/research/themes/science/language_science

Short articles
The NERF Bulletin 'Evidence for teaching and learning' has featured a number of articles related to co-operative group work, including:

- Using small-group discussions in science teaching (Issue 2)
- Learning in small groups. It's not just talking - it's what you say and how you say it that matters (Issue 3)
- Why group pupils and when does grouping work best? (Issue 5)
- Co-operative group learning. Supporting students to promote effective learning behaviour (Issue 6).

Within-class grouping
A short digest of a study that investigated how secondary school teachers choose within-class student grouping strategies is available at:
www.standards.dfes.gov.uk/research/themes/pupil_grouping/secondary_student_grouping

Related research

Improving effectiveness of pupil groups in classrooms project website
www.tlrp.org/proj/phase11/phase2a.html

Resources

Developing effective teaching of speaking and listening:
http://nationalstrategies.standards.dcsf.gov.uk/node/21178?uc=force_uj

Back to top

Appraisal

Wegerif, R., Mercer, N., and Dawes, L. (1999) From social interaction to individual reasoning: an empirical investigation of a possible socio-cultural model of cognitive development. *Learning and Instruction 9 (*5) pp.493-516

Wegerif, R., Littleton, K., Dawes, L., Mercer, N., & Rowe, D. (2004) Widening access to educational opportunities through teaching children how to reason together. *Westminster Studies in Education 27* (2) pp. 143-156

Wegerif, R. (2004) The Role of ICT as catalyst and support for dialogue. *NALDIC Quarterly 1* (4) pp. 4-12

Robustness

This RfT summary analyses the work of researchers who started from the premise that pupils could gain more from peer discussions if they were taught how to use dialogue effectively. The three studies by Wegerif, Mercer and colleagues on which the RoM is based build upon and complement each other. Between them they describe the elements of the researchers' specific approach to improving pupils' dialogue with their peers ('Thinking Together'). They report how the approach was implemented and evaluated and its impact on primary aged children in England. The three studies involved over 200 pupils and their teachers. The project was conducted with different samples of pupils drawn from the age range 6-10 years. Replicated findings from these different samples, in different contexts, provide strong evidence that pupils made significant gains in their reasoning and the quality of their dialogue.

The researchers gathered a range of complementary data for their studies:

- the children's scores on two non-verbal reasoning tests (completed before and after the programme had ended)
- video recordings of focal groups from the target classes taken at the start and end of the programme, in which the children carried out a reasoning test activity or worked with a piece of computer software
- observations and written notes of how the children in the target schools worked with each other
- interviews with the teachers, head teachers and support staff (where possible) in the target schools.

The study found that the intervention group children asked more questions and gave reasons more often, encouraged others to speak more, listened more carefully than control group children and collaborated more. In addition, target pupils, including those with low communication and social skills, increased their use of words associated with reasoning more than pupils in the control groups.

Relevance

The research is relevant to teachers, head teachers and curriculum coordinators in the primary phase who wish to improve childrens' communication and social working skills, and to include pupils who are otherwise likely to be marginalised. The fact that the research involves pupils from socio-economic and ethnic groups likely to be disdvantaged in mainstream education means that it has the potential to inform the issues raised by the national 'Every Child Matters' in England. Whilst the project was conducted with children in the early

stages of their schooling, the findings may also help practitioners in the secondary phase reflect on how their students use dialogue and begin to think about how they could develop structured dialogue for learning together in their own classrooms.

Applicability
The findings are likely to be significant for practitioners trying to improve their pupils' communication and reasoning skills. The studies provide rich detail about the processes of the 'Thinking Together' strategy which classroom teachers should find helpful. Descriptions of the teacher's role show how the strategy worked in practice: making learning objectives explicit, providing time for reflection, direct teaching of key skills such as asking questions and guiding pupils to challenge one another, and helping pupils create ground rules for talk. Examples of rules for dialogue devised and agreed by the pupils help to contextualize the strategy further: for example, 'everyone in the group is encouraged to speak by other group members', 'reasons are expected'; and 'the group seeks to reach agreement.'

Writing
The writing is both lively and accessible to a range of readers within and beyond the primary phase. The findings and process are described in ways which are likely to appeal to practitioners.There are helpful section headings which signpost readers through the stages of the research. The researchers have included many illustrations of successful and less effective pupil dialogues that readers will be able to reflect on in relation to dialogue in their own classrooms. Conclusions, which are modest, are clearly separated from the findings.
Back to top

CPD leader resources: Diamond 9

Prior knowledge

- Essential: Some knowledge and experience of teaching
- Desirable: Some understanding and experience of small group work

Why use Diamond 9?
The Diamond 9 activity is designed to stimulate focussed discussion between professional learners. It provides a way for professional learners to engage in learning conversations that explore each other's perspectives about a topic or theme and to work together to prioritise issues related to it.

Why is it called Diamond 9?
Participants are given a list of statements and asked to discuss and agree which ones reflect the most important issues in relation to the theme of the activity. The participants have a large, diamond-shaped grid on which to place the statements (on cards). There are different ways of doing this but the usual pattern is for the most important statement to be placed at the top of the diamond and the least important at the bottom of the diamond. Statements in each row have equal status. The key point about this activity is the discussion that takes place among the participants.

Information about this Diamond 9
The purpose of this Diamond 9 is to help participants discuss key messages from the RoM on group work, so they can:

- deepen their understanding of pupil talk and learning
- connect new ideas with what they know already
- reach a shared agreement about the relative importance of the various features of pupil talk
- to consider possible implications for their students' learning.

Preparation for using the Diamond 9
Each group will need:

- a set of nine statement cards from the 'Raising achievement through collaborative group work' RfT
- an enlarged Diamond 9 base on which to place the statement cards in the order that represents the group's priorities.

Before the session:

- Download as many sets of Diamond 9 statement cards that you think you will need and a Diamond 9 base from the website.
- Use a photocopier to enlarge the base to at least A3 size and trim the edges.
- Make enough large copies of the base for each group to have their own.
- Cut the cards up and use a paper clip or elastic band to keep the sets apart.
- If you think your groups might like to display their base on a wall, you could stick the statements onto post-it notes before the session.
- Decide on the composition of the participant groups. Groups of between three and five seem to work best, including, if possible, people with a range of experience.

Focus

We suggest you introduce the activity by asking participants to reflect on what they know about the kinds of talk pupils' engage in while working in small groups. You could go on to say that the statement cards represent a range of issues that have been identified as behaviours related to pupil talk that can help pupils build their understanding. Work with a group of colleagues to discuss and agree the relative importance the behaviours for promoting learning through pupil dialogue.

Using the Diamond 9 in your CPD session

Timing for the activity:

- Introduction: 5 minutes
- Colleagues discuss and prioritise the cards: 15 to 20 minutes
- Debrief : 10 minutes

Introduce the game (5 minutes)

- Give each group a Diamond 9 base and a set of cards.
- Let them know they have 15 - 20 minutes to discuss the statements on the cards and to place them on the diamond base in the pattern they choose.
- Explain that they will then be asked to present their top three priorities and to say why.

Play the game (15 to 20 minutes)

If a group finishes early, facilitators might wish to suggest that they begin to consider the activities to take learning further (see below).

Debrief (10 minutes)

Invite each group to present their top three priorities to the whole group and explain briefly why they chose them. You may like to pick on any interesting or unusual feature of the priority order particular groups have chosen in order to stimulate whole group reflection and discussion.

Activities to take learning further

Ask participants to use the ideas they have been discussing to explore the RfT online.

Suggest that they consider how they can use what they have discovered while they were playing the games, the discussions and the exploration of the RfT summary. Some helpful questions for them to keep in mind might be:

- How much group-work involving exploratory talk do you use in their teaching?
- When could group-work involving exploratory talk be helpful in teaching and learning in your classroom/school?

- How might you set about changing your approach in order to make effective dialogue for learning a more regular feature in your lessons?
- What are the implications for your own and your colleagues' professional development?

Back to top

CPD leader resources: Matching activity

Prior knowledge
Essential: Some knowledge and experience of teaching.
Desirable: Some understanding and experience of small group work.

Aim of the activity
This activity invites you to consider in more detail your experience of pupil dialogue in small group work and to probe what the learning opportunities offered to pupils by different kinds of talk are.

Preparation for matching activity
You will need answer cards with summaries of characteristics of each type of talk. (These are for issue after the first stage of the activity).

Each group will need a set of three groups of statement cards from the Raising achievement through collaborative group work RfT:

- types of talk (3 cards)
- statements describing types of talk (9 cards)
- examples of types of talk (4 cards).

Before the session

- Download as many sets of matching activity statement cards that you think you will need.
- Cut the cards up and use a paper clip or elastic band to keep them in sets of three.
- If you think your groups might like to display their work on a wall, you could stick the statements onto post-it notes before the session.
- Decide on the composition of the participant groups. Groups of between three and five seem to work best, including, if possible, people with a range of experience.

Focus
We suggest you introduce the activity by asking participants to reflect on what they know about the kinds of talk pupils' engage in while working in small groups. You could go on to say that the statement cards represent the characteristics of three kinds of pupil talk identified in the RfT

Using the matching activity in your CPD session
Timing for the activity:

- Introduction: 3 minutes
- Colleagues discuss and match the cards: 15 to 20 minutes
- Debrief : 10 minutes
- Activity to take learning: further 10 minutes

Introduce the game (3 minutes)

- Explain that they will work together to discuss and identify the characteristics of three types of pupil talk.
- Next they will use this understanding to analyse some examples of primary pupils' dialogue in group-work settings.

- Finally they will discuss what they might do to improve the quality of pupil talk for learning.

Play the game (15 minutes)

- Give each group cards for types of talk (3 cards) and statements describing types of talk (9 cards).
- Ask them to consider how they would recognise different kinds of pupil talk. Ask them to discuss which description statements match the three types of talk and to group the cards accordingly.
- Reconvene as a whole group and ask each group to explain their choices and any insights they may have.
- Give out answer cards summarising the characteristics of the three types of talk for reference.
- Return to pairs. Give each pair the four examples of pupils' talk cards.
- Ask the participants to analyse and classify the examples of pupils' talk in the light of their understanding of the three types of talk. It may be helpful to add that the dialogues took place while the pupils were working together at a computer task.
- Encourage them to debate and discuss issues of agreement and disagreement, or to comment on new insights.
- If a group finishes early, facilitators might wish to suggest that they begin to consider the further activities (see below).

After the game: Debrief (10 minutes)
Choose a couple of groups who have interesting ideas to feed back a full explanation about how they analysed and classified the example of pupils talk. Encourage others to add their views.

Activity to take learning further (10 minutes)
This activity builds on participants' experience of the games and provides an opportunity for reflection on what participants have learned so far.

Suggest that participants may find, or have found, that pupils may be anywhere on a spectrum between disputational talk and exploratory talk.

In many of their interactions during group work individual pupils may display elements of different kinds of talk. Ask participants to work in pairs to come up with what 'rules' it might be useful to co-construct with pupils in order to help them move their talk in the direction of exploratory talk. Suggest they consider:

- conduct during discussion
- ways to encourage exploratory dialogue.

There is also a Diamond 9 activity that supports and extends the matching activity.
Back to top