THINKING TOGETHER – USING ICT TO DEVELOP COLLABORATIVE THINKING AND TALK IN MATHEMATICS

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In this paper I describe some recent research taking place in primary schools in Milton Keynes and London using the 'Thinking Together' approach and SMILE software to promote collaborative thinking and talk in the maths classroom.

THINKING TOGETHER

Thinking Together is a project that began in the mid 1990s at the Open University growing out of research in applied linguistics. The research is founded on 'a sociocultural conception and analysis of education, which focuses on the ways that children can be induced into the communicative and intellectual activities of the classroom as a 'community of enquiry' (Rojas-Drummond and Mercer, 2003: 99). Central to the approach is the belief that collaborative thinking skills can and indeed should be explicitly taught and a crucial goal arising from this is to enable teachers and children to conceptualise talk as 'thinking aloud with others'.

THINKING TOGETHER AND MATHEMATICS

Whilst the Thinking Together approach was initially applied in literacy and PSHE settings in KS2 it has now been successfully applied across the age range and in a number of curriculum areas, including mathematics. As Wegerif and Dawes (2004: 102) point out:

Maths is not only a way of thinking inside an individual mind; it is also a kind of language. That is, maths can offer a form of social communication between people. To become fluent in that language, as with any language, children need guidance and opportunities to practise.

This principle has guided the work of the project team reported on here in a number of ways.

GROUP WORK AND EFFECTIVE TALK

It is well known that the good intentions that underpin group work are not always matched in classroom practice (Galton, Simon & Croll, 1980). Students may well be found working *in* groups but not *as* groups. What the research and classroom experience of the Thinking Together team and teachers involved in its various projects has shown is that the key identifying conditions and features of effective talk are: everyone is encouraged to contribute; everyone listens actively; ideas and opinions are treated with respect; information is shared; challenges are welcomed; reasons are required; contributions build on what has gone before; alternatives are discussed before decisions are taken; the groups work towards agreement before an action is taken; it is possible for participants to change their mind; discussion is understood to be a way of learning

Inevitably, these 'truths' are as evident in the breach as in the observance and this observation has led to the identification of three types of talk commonly found in the classroom when students are engaged in group work:

Disputational Talk

This type of talk is characterised by assertions, disagreement, short exchanges between participants in which there is little evidence of any explicit reasoning.

Cumulative talk

This type of talk is characterised by self-repetition and elaboration leading to uncritical agreement, again with little evidence of shared meanings being created

Exploratory Talk

This type of talk is characterised by critical but constructive engagement between partners in which suggestions and opinions are actively sought and evaluated and relevant knowledge is shared. Challenges are accepted but will be justified by reasoning and the group takes responsibility for an agreed decision.

Exploratory talk is the most likely to result in the features of effective talk described earlier, but why is it so uncommonly evidenced in group work? The simple answer is that students are rarely taught how to engage in this kind of talk. In collaboration with teachers the Thinking Together team has devised a series of lessons in order to provide a framework for both them and their students.

In the current project, due to time constraints, students were given three (as opposed to the usual five) introductory lessons – two devoted to the topic of talk and the third an introductory maths activity around the computer in which they practise the approach.

Lesson One: Talking about talk

The focus is on identifying what makes a good talker/listener and considering the implications of this for the classroom.

Lesson Two: Agreeing the ground rules for talk

The focus here is on the development of a set of five or six ground rules that the class has agreed on for use in their work.

Here is a set of Ground Rules produced by one class:

Class 5D Rules for Talk

- Everyone should have a chance to talk
- Everyone's ideas should be listened to
- Each member of the group should be asked
- What do you think?
- Why do you think that?

- Look at and listen to the person talking
- After discussion, the group should agree on a group idea

It is interesting to note how well they accord with the features of effective talk identified previously.

Lesson Three: Practising the Ground Rules

The objectives for this lesson are to use the ground rules for talk on mathematical problems, in this case 'Magic Squares'. The students worked on this in groups of three (mixed gender, attainment, and preferably not based on friendship) and the teacher's role was to monitor and intervene in their activity, always keeping the focus on using the ground rules for talk.

Subsequent lessons followed a similar pattern, starting with a review of the ground rules; an introduction to the objectives (which always included a 'talk' objective) and the activities; group work around the computer; and a plenary to discuss the outcomes. In these lessons, students worked on SMILE programs that involved strategic thinking and allowed the students to play against the computer rather than each other, more of which later.

OUTCOMES

Previous studies have established the benefits of the Thinking Together approach on a variety of measures. In one of these (Wegerif, Mercer and Dawes, 1999) students were recorded doing a non-verbal reasoning test prior to the Thinking Together lessons and again afterwards. The following table emerged indicating significant changes in the use of key words associated with collaborative thinking:

Key word	**Pre**	**Post**
Because	25	100
Agree	7	87
I think	7	87
Would	1	15
Could	2	14

In this project we were more interested in examining the kinds of effective interactions and strategies that emerged and initial analysis of the transcripts of the lessons has revealed some interesting lines for further study.

THE STUDENTS AND THE COMPUTER

A classic feature of classroom talk is the three-part IRF (Initiation, Response, Follow-up) interaction (Sinclair & Coulthard 1975; 1992). In the Thinking Together approach we have developed the notion of I*D*RF around the computer:

Initiation - by the computer

Discussion – between the students

Response – by the students together

Follow-up – by the computer

Although computers (like teachers) prompt, respond and frame the dialogues with the students, their infinite patience and non-judgmental (inter)face enables this second phase of discussion to become a powerful space in which the students can talk and think their way to a solution of the problem they face. By setting the students to 'play' against the computer, their group work has a clear purpose and reduces the personal tensions within the group itself.

OUTSMARTING THE COMPUTER

The following transcript is taken from a group of students working on a program called 'Lines', which involves using co-ordinates to place counters on a grid and attempting to win by getting four counters in a line:

B: I knew he'd do that.

J: I agree with (3,3) because then you can go there.

B: Exactly. He'll go there.

C: Doesn't really matter.

J: But then we can block him. (3,6) I agree with (3,6).

B: I agree definitely with (3,6).

C: I agree because then you're blocking him all the way down there and then he'll have to start something new.

B: Exactly. And then we can go on with our line. Exactly. I agree.

The opening statement, 'I knew he'd do that', positions the computer as a cunning adversary. This pattern occurs over and over again in the data, probably the result of their experience of adventure games. J, who is learning English as an additional language, seems to use 'agree' to mean 'suggest'. His partners don't correct him on this but use the word correctly, modelling how it should be used. C's final utterance, in which she sums up the advantages of the (3,6) move, leads to B acknowledging her reasoning. Their use of the pronouns 'you' and 'we' shows both the individual contributions their partners are making and their collective identity as a team.

Later in the same transcript there is a good example of the ground rules in action, inter-thinking and a creative use of terminology taken from chess!

B: We've checkmated him. Then go there (2,2).

J: I agree with (2,2).

C: Why?

B: Because we checkmated him.

J: Because we'll checkmate him and then he'll have no chance of winning.

C: Oh yeah, yeah, yeah, yeah. Now I'm getting it. Yeah, (2,2).

This linguistic creativity is a common feature in the transcripts, which provide other examples such as 'the two-way trick', coined by a student to describe placing a counter in such a way as to leave a winning line open at two ends, thus ensuring victory. J has now used 'agree' correctly and both he and B justify their moves.

THE ROLE OF THE TEACHER

Teachers provide a crucial role in modelling appropriate language and behaviour to the students. In the following extract the teacher both models and rehearses the sort of language and conduct that is expected, as is seen in the following extract taken from the start of a lesson:

T: Anything else I might hear?

Ss: I disagree because.

T: 'I disagree with you because,' good, well done. Esme?

E: Have we got any more ideas to share?

T: 'Have we got any more ideas?' Maybe they're not the only moves we can do. Maybe there are different ideas?

S: Don't think in your head, think aloud.

The final remark could serve as the motto for the whole venture!

Another crucial role for the teacher is that of monitor. Moving around the classroom, the teacher is able to observe points at which an intervention would help, e.g. to check the students' understanding and probe for shifts in thinking, as in this extract:

T: Can I ask you a question? Did you place your counter in the middle?

Ss: Yes.

T: Brian was the only one of you three who said you should … Have you changed your idea about that?

J: Yes.

T: Why?

J: Because then you can anywhere. You can go there, there and there…

T: What do you think Claire?

C: If you do it (4,4) you've got more chance. You can do it anyway. You can block the computer too.

The teacher here is not only checking their mathematical strategies and ability to justify their reasoning, she is also making explicit the advantages of thinking together. In addition to this sort of direct intervention, teachers have also found other

ways to support the Thinking Together approach by providing students with cue-cards on post-it notes stuck to the computers so that the children can refer to the ground-rules during the lesson.

CONCLUSION

At this point in the project we have not undertaken any detailed and comparative analyses of the transcripts we have gleaned from the numerous lessons we have recorded but early indications are positive. The brief extracts above provide some evidence about the development of strategies, advantages of group work, and students' conception of the computer as 'partner'. Further research is needed to flesh out these themes and to investigate the advantages of the Thinking Together Approach in the mathematics classroom. We are confident, however, that it will bear out the following observation from Wegerif and Dawes (2004: 102):

Children working in groups can offer one another chances to explore their conceptions, to employ their new vocabulary, and an audience for explanation, planning, suggestion and decision-making. In this way children learn to speak the language of maths. Challenges and explanations in groups, guided by teachers, can lead children to learn more expert ways of talking …. [The] combination of talk and computers is a powerful way of helping children to develop their thinking.

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