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Journal Item

Deliberation with computers: Exploring the distinctive contribution of new technologies to collaborative thinking and learning.

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Stand alone computers supporting learning dialogues in primary classrooms

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Abstract

This paper focuses on three distinctive ways in which educational software can support learning dialogues in primary classrooms. After a re-capitulation of published research on Initiation *Discussion* Response Feedback (I*D*RF) exchanges, where the computer is used to stimulate discussion and then direct it through using feedback, we ask if there are other ways in which educational software and pedagogy can combine to support learning dialogues. We describe the effect of combining preparation for exploratory talk at the computer with group strategy games played against the computer and then we discuss, with examples, the role of software (in this case Bubble Dialogue) that allows groups to externalise their thoughts in order to reflect upon them. We argue that these three types of educational activity exemplify distinctive ways in which the computer enters into and supports educational dialogues.

Introduction

In this paper we explore some distinctive ways in which stand alone computers can enter into primary classroom learning conversations. For children working in small groups the concrete physical presence of the computer is important as a focus of joint activity and in many respects computers are treated by children as being like a person that can think, act, know things, play tricks on them, get confused etc. It is also evident, however, that even young children are aware that computers are not people but machines. In this paper we explore ways in which this ambivalent nature as - being both an object (a machine) and yet subject-like (interactive) - can, with appropriate pedagogy and software design, give computers a unique and distinctive role in mediating learning conversations (Wegerif, 2004). While one strand of this work, the idea of Initiation, *Discussion*, Response, Feedback (I*D*RF) exchanges, has been published before the remainder is based on new research.

Stand-alone computers and pedagogy: *The Thinking Together Approach*

Research based at the Open University can shed light on how computers 'fit' into the ongoing classroom-based dialogical processes of joint knowledge construction. This work has revealed that the way in which teachers prepare for and frame computer activities is crucial if the computer is to be used as a support for learning dialogues. This research, which constitutes a series of design studies, has investigated the effect on children's learning of explicitly discussing and teaching ground rules for productive, 'exploratory talk' such that these ground rules operate in ongoing classroom talk. Crucially, children are reminded of the ground rules their class has agreed before working together in small groups around computers. Using matched control classes the impact of this preparation for computer work on the educational quality of the talk around the computer has been shown to be dramatic (Wegerif, 1996: Mercer et al, 2004). Those groups of children who had learnt ground rules for 'exploratory talk' through a series of 'talk lessons' engaged more critically but constructively with each other's ideas than equivalent groups of children in matched classes. A key theme that has emerged from these studies is that, for conversations around computers to contribute significantly to learning over the longer term teachers need to integrate and contextualise the experience of working and talking together around a computer with the larger, ongoing process of the guided construction of curriculum knowledge. For example, it is particularly important for teachers to share and explicitly discuss the curriculum aims of each computer-based activity with the children. This is typically best undertaken in whole class introductions before group work, with key aims re-visited at the end of the session in whole class plenaries, to re-inforce what has been learnt.

Through these projects we have developed the '*Thinking Together Approach to using Computers*'. This can be summarised in four points each of which assumes the crucial importance of teachers in framing and contextualising the computer-based learning experience:

- The class participates in an ongoing process of explicit teaching and learning of talk skills which promote thinking;
- Computers are used both to scaffold children's use of these skills and to bridge them in curriculum areas;
- Introductions and closing plenaries are used to stress aims for talk and for thinking as well as to review progress;
- Teacher intervention in group work, and their talk in introductions and closing plenaries are used to model exploratory talk.

(Wegerif & Dawes, 2004)

In the remaining sections of this paper three specific ways in which computers can enter into and support learning conversations between children working together in primary classrooms, within the broad framework afforded by the *Thinking Together* approach, are discussed. The first of these concerns the use of specially designed software for prompting and directing conversations.

1. I*D*RF: A way of learning with computers

Several researchers (e.g Fisher, 1992; Cazden, 2001, p 124) have pointed out that the activity around much educational software often fits the IRF - Initiation (by a teacher) Response (by a student) F (follow-up by a teacher) – educational exchange that has been referred to as 'the essential teaching exchange' (Edwards & Westgate, 1994). Thus, whether pupils are working with a piece of tutorial software or an 'edutainment' package, there is often an Initiation by the computer, a response by the user(s) and feedback or follow-up from the computer However, if children in a pair or group respond to a prompt from the computer by 'sitting back' to discuss together their response the educational content of this interaction exchange can be transformed. This is what has been referred to as the I*D*RF educational exchange (Wegerif 1996).

Extract 1: An example of I*D*RF

Q3 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 if you rub

Cindy: (*inaudible*)

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'*)

Commentary

Here Rachel appears to know the answer and persuades Cindy. She does so with reasons and an analogy of the effect of adding oil to ones hands when rubbing them. Rachel's response to an initial disagreement is to give reasons and attempt to persuade her partner. Although this could appear to be rather one-sided, Cindy is genuinely persuaded and in other interactions Cindy was the one persuading Rachel, so their relationship overall was more balanced than this episode implies.

The interface here is ‘tutorial’ in design; yet it has the potential to support a productive teaching and learning interaction through the the I**D**RF (Initiation, **Discussion**, Response, Feedback) structure of the talk, where instead of responding immediately to the computer prompt the children sit back from the computer and discuss their possible response amongst themselves. In this case the contextualising pedagogical framework has facilitated the transformation of a simple computer-user interaction into a complex, interactive learning experience. The computer-based educational activity does not, therefore, reside in a piece of software; rather, the software supports an educational activity, that is constructed through the situated interaction of the pupils, teachers and the technology. Note that feedback from the computer is also integrated within the children’s discussions, with such feedback affording valuable opportunities for the students to have their responses either confirmed or disconfirmed. In the case of the latter, subsequent discussion of an incorrect response can result in further valuable opportunities for questioning, discussion and learning.

Computer-supported I*D*RF educational exchanges enable directive teaching and active learning to cohere within a single activity. Software prompts, information and questions can provide directive teaching while opportunities to engage in learning dialogues enable children to actively construct new understandings and generate their own questions. It is thus the purposeful integration of discussion (the ‘*D*’) within the ‘IRF’ sequence that is critical. The ‘IRF’ part of I*D*RF refers only to the student - computer interaction. If we look at the IRF exchange alone, the computer appears to direct the learning and the student appears to be relatively passive. The computer gives some information and then asks a question about it with a multiple choice answer. On the other hand the '*D*' part of I*D*RF refers only to the spoken pupil-pupil discussion. Here pupils may come up with ideas and support them with reasons before testing them out on the computer. Discussion of this kind provides an opportunity for the joint construction of meaning by pupils. The I*D*RF exchange structure as a whole therefore unites directed teaching with active learning in a way that draws children to construct pre-defined curriculum knowledge for themselves. I*D*RF goes beyond the opposition of transmission teaching versus discovery learning in a combination that Mercer has described as 'the guided construction of knowledge' (Mercer, 1995; Mercer, Littleton & Dawes, 2003).

2. Strategy games against the computer

Competitive strategy games can motivate reasoning. However, unless the children are inducted into effective ways of working and talking together, competitive games *between children* usually prove destructive of the collaborative ground rules that are important for effective shared thinking. We have evidence of this extracted from over fifty hours of video data of children, in a range of schools, working together around different pieces of software (Wegerif, 1997).

For example, Mercer (1995, p 100) described children working with co-ordinates software produced by SMILE Mathematics (http://smilemathematics.co.uk/) to locate a 'hidden elephant' in the grid-map of New York city. The software provides a grid representing New York City. An elephant is 'lost' in the city and the aim is to locate it by keying in co-ordinates. After each guess, the programme provides information about how near the guess is to the actual position of the elephant.

Extract 2: Find the Elephant

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.

The two boys - Sean and Lester - treated the programme as a competitive game (Mercer, 1995, p 102). They took turns to make random guesses not really based on the information the computer offered. They laughed or made derisory comments when their partner made an incorrect guess. They were motivated enough to keep trying until by chance a correct guess was made: at which point either could say with satisfaction 'I won!' - while the other might insist that the game 'wasn't fair'. It was clear that they were not thinking together to work out a winning strategy.

Eight years later we were able to observe children using very similar co-ordinates software as part of a collaborative project with SMILE mathematics. This time the children's class had worked through the Talk lessons and the interaction between the children at the computer was quite different. They are working on a 20 by 20 grid with negative as well as positive co-ordinate squares. As we join them they have been told by the computer that the hidden animal (a Rhino this time) is 12 squares away.

Extract 3: Thinking together to find the Rhino

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 way 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 is not I will be surprised.

This recording came from a typical group of three boys. It is noticeable that, unlike Sean and Lester, they are discussing and agreeing pairs of co-ordinates before one of them typed this into the keyboard. They give reasons for their ideas and question each other, and as a result they are developing their mathematical reasoning and their use of co-ordinates.

Our current research with SMILE suggests strongly that once children have been inducted into the *Thinking Together Approach* playing strategy games *against the computer*, where a small group of children work together to try to beat the machine proves to be a highly motivating context for shared reasoning and problem solving. It re-inforces the use of exploratory talk because, as one young girl put it: ‘talking about our moves really helps us win against the computer’. Again this role for the computer takes advantage of its dual nature. As agent-like it is able to take the role of a partner in a competitive game in which it is perceived as trying to win. However, the fact that it is a machine means that the children can unite together to try to defeat it in a competition that supports social cohesion and motivates collaboration.

3. ‘Slow-throwness’: the case of Bubble Dialogue

So far we have looked at the use of the computer’s potential as a support for face to face dialogue. Another way in which computers can support dialogues, however, is through offering a flexible way of externalising shared ideas. Talk in face-to-face dialogues exists only momentarily and only for those immediately present. Technologies that support drawing and writing can thus be thought of as a way of extending and deepening dialogues, by turning transitory talk and thoughts into external objects that are available to learners for discussion and shared reflection. (Olson, 1996). Computer documents can offer a kind of half-way stage between the ephemerality of talk and the permanence of written texts. This is part of what Harry McMahon, one of the originators of Bubble Dialogue software, refers to as ‘slow-throwness’ (McMahon and O’Neill, 1993). By this term he refers to the way that Bubble Dialogue can externalise the thoughts and feelings of the participants and also support shared reflection, shared construction and the possibility of a shared re-construction. The Bubble Dialogue software is designed to support dialogues by converting them into a more enduring and yet flexible medium. Although it does not take advantage of the computer’s capacity for simulated agency in the way that tutorial software and computer games do, it nonetheless makes use of the same ambivalent or intermediate status of computers between subjects and objects in that it allows users to create characters for themselves that can then be made to speak on their behalf. Arguably the extent to which children perceive their characters as speaking on their behalf is related to the degree to which they identify with that character, and so early studies of the use of Bubble Dialogue looked for and found evidence of such identification (Jones, 1996)

At the heart of Bubble Dialogue is the simple idea of combining pictures with speech and thought bubbles. The pictures are easy to load into the software and can represent dialogues in any situation. In addition to the bubbles there is a facility to review the dialogue created so far and to change it and also, of course, the option to print it out. In the latest variant there is also an option to record speech so that children do not need to type but can talk instead.

What Harry MacMahon called the 'slow-throwness' of Bubble Dialogue makes it particularly effective for exploring issues of values and social relationships. To give one example of this, Bubble Dialogue is in use in a special school for children with emotional and behavioural difficulties. Such children can find it particularly difficult to articulate their own thoughts and feelings and to appreciate others' thoughts and feelings. Previous studies at the Open University showed that Bubble Dialogue could be helpful here by making the characters' thoughts (as well as their speech) objects for reflection and discussion (Jones & Price, 2001). Teachers at the school believe that collaborative use of the software has great potential value. An example of such dialogue is provided in the Bubble Dialogues reproduced in Figure 2 and extract 4 below. This was created by Charlene and Rory, both aged 10 years, and both excluded from their previous schools because of behavioural difficulties. They are discussing a Bubble Dialogue scenario about a personal conflict involving characters called Joe and Greg. In the story Greg was using his new skateboard in the playground when Joe, a bigger boy, grabbed it from him.

In the first exchanges both characters 'square up' for a physical fight. However, the next set of think bubbles that Charlene and Rory produced (see Extract 4) indicate that while both parties are prepared to fight over the skateboard 'asking nicely' or apologising would diffuse the situation.

Extract 4 (Bubble Dialogue) : I'm not scared

Joe thinks: he just have to ask nicely

Joe says: I'll kick your head in you fat brat head

Greg says: yeah come on then, I'm not scared of you if im a big fat brat head what does that make you, you peebrain

Greg thinks: im not scared of him all hes got to do is give me my skateboard back and apologise to me, if he doesn't im going to break his big fat ugly bogied up nose

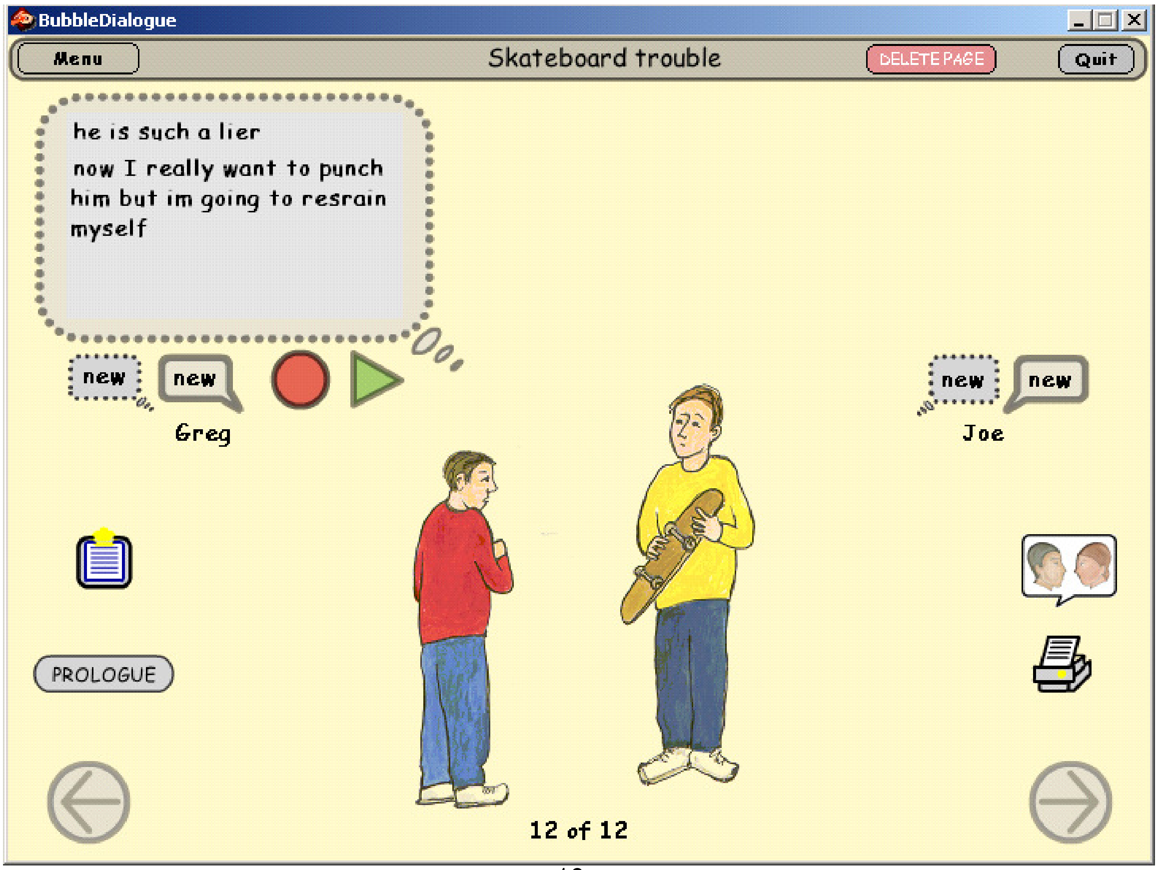
Charlene and Rory's story goes on to have Joe give Greg the skateboard back. When Greg insists on an apology Joe denies having taken the board and says that Greg should say sorry for threatening to punch his lights out when he was only playing. Eventually they both manage to apologise in a guarded way and agree to be friends. Their thoughts remain angry but their words are conciliatory.

They worked well together to resolve this dispute but towards the end of their interaction an issue came up about which they really did disagree. This was when Rory suggested, through the proxy Joe:

Joe says: 'After school do you want to brick the abandoned house where the poorman lives? It'll be fun!'

Charlene obviously disliked this idea and replied that her mother would not like her to do that. Throwing bricks through the windows of an empty house where a homeless person lived was apparently Rory's idea of a fun activity but not Charlene's. She suggested that Greg would pretend to go along with the idea but with no intention of turning up. In doing she was also perhaps finding a way for herself to cope with similar difficult situations when she might come under peer pressure to do something that she did not want to do (Figure 1).

Figure 1. Self restraint.



Summary and conclusion

Discursive and dialogic approaches to education raise the question of how computers enter into and support learning dialogues in the classroom. In this paper we have tried to provide a partial response to that question through describing three ways in which educational software running on stand alone computers can play a distinctive role in supporting learning dialogues in primary classrooms. First we outlined a general approach to integrating activities with computers into the teaching and learning of the classroom which has been supported by research. Then we discussed three ways in which, within this pedagogical framework, computers can support learning dialogues within the curriculum. First there are Initiation *Discussion* Response Feedback (I*D*RF) exchanges, already reported in earlier papers, where the computer is used to stimulate discussion and then direct it through using feedback; then we discussed group strategy games played against the computer which have proved to be a rich support to the development of joint reasoning, and finally, Bubble Dialogue, which allows groups to externalise their thoughts in order to jointly reflect upon them. All three types of educational activity exemplify distinctive ways in which computer software can participate in and support educational dialogues. The first two ways illustrate how the dual nature of computers as both like subjects and objects enables them to initiate and direct dialogues which, at the same time, they can resource. The fact that computers are really objects, infinitely patient and without judgement, allows them to play this facilitative educational role in a way that is hard for human teachers. The third way which, quoting Harry MacMahon, we called 'slow-throwness' illustrates how the provisionality of computers can be used to create a flexible support for dialogues allowing dialogues to be objectified as a shared object for reflection just distant enough from participants to allow for critical reflection while close enough to be manipulated and learnt from. The research reported here reproducing and confirming MacMahon's early work with Bubble Dialogue and new research on the effect of combining teaching Exploratory Talk with group strategy games in maths serve to expand the already published work on I*D*RF to give a larger picture of how the ambivalent, part subject, part machine, nature of computers can allow them to enter into and resource learning dialogues.

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