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**COOPERATIVE LEARNING IN COMPUTER SUPPORTED
CLASSES**

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Abstract

Many studies have been reported on the benefits of group work to incorporate the use of Information Communication Technologies. Teachers too are said to perceive the benefits of group work at computers, which include peer support and the development of communication skills. However, if groups are to learn with support from their peers, they must perceive the importance of working together. This paper examines students' discourse patterns and skills and behaviours when working at computers. The findings are part of a wider doctoral study on how teachers implement cooperative learning with computers.

Introduction

This paper interprets how groups of students working at computers engage in cooperative work practices to arrive at joint understanding of the task requirements. The research builds on the investigator's interest in sociocultural theory, which draws attention to the ways in which talk and joint activity are used by teachers and students to share knowledge. The introduction of computers into schools has created new opportunities for cooperative and collaborative learning to occur. Since this behaviour is often overt, research focus has shifted from the more rigorous empirical evaluation of the benefits of ICT in the classroom (using specifically tailored software such as LOGO) as a tool for individualised learning to its use in cooperative and collaborative arrangements (Mevarech & Light, 1992; Underwood & Underwood, 1990). At the same time, psychologists have begun to be interested in the cognitive potential of cooperation and collaboration since human cognition and learning are embedded in specific contexts and many of the activities students engage in are mediated by the computer. This brings together two research agendas - investigations into cooperative and collaborative learning and ICT.

From a review of the literature there appears to be little research on the social skills that students require when working at the computer (Rockman, 1993). What are the features that characterise group (involving at least two students) interaction and a computer? If students are to work together in groups rather than individually seated at their desks, then the need for social skills is vital. Teachers cannot assume that students bring to the classroom basic social skills such as listening when others talk, taking physical turns at the mouse and keyboard, providing encouragement and using

appropriate voice levels. Understanding the nuances of non-verbal behaviour will encourage active listening when students ‘hear’ what group members say. Helping students understand why social skills are important and what the skill “looks like and sounds like” ensure greater success with the acquisition of the skill. Students also need to know how to arrive at a shared understanding of the task requirements. Further, if students are to become more autonomous, active, responsible and self-directed learners, cooperation is a necessary precursor to collaboration (Rowe, 1993).

Cooperative learning

Traditionally, with the emphasis on individualised instruction and on student-teacher relationship, the pedagogical value of group interaction was largely ignored and viewed as discouraging academic achievement and encouraging off-task, disruptive behaviour in the classroom. More recently, the growing interest in the process of learning in social activity reflects a theoretical shift in perspectives to learning and teaching and which emphasise the social and contextual nature of learning (Brown, Collins, & Duguid, 1989; Greeno, Collins, & Resnick, 1996; Lave & Wenger, 1991). Cooperative learning provides the social setting in which such learning can take place.

Cooperative learning though is more than just group work. One of the important distinctions is that in traditional groups, students are asked to work with little attention paid to group functioning or interaction, whereas in cooperative learning, group work is carefully prepared, planned and monitored (Jacobs, 1997). Facilitating small group learning means group members perceive the importance of working together. Although most cooperative learning research has been conducted in non-computer settings, the benefits of cooperative learning appear to transfer to students working at the computer (Hooper, Temiyakarn, & Williams, 1993). Various conditions promote cooperation and are seen as critical elements of cooperative learning (Johnson & Johnson, 1990). These include:

- Positive interdependence
- Individual accountability
- Group processing
- Face-to-face accountability
- Interpersonal and small group skills

Of particular importance to this paper are the interpersonal skills necessary for group work. Group work places considerable social as well as cognitive demands on students (Corden, 2000) and cooperation requires students to share how they think and to act as mediators of other students' thinking. At the heart of this is the thinking involved in cognitive processing. Students need to reflect not only on what they think about the task, but they must also consider how they arrived at such thoughts. Similarly, Perkins (2003) stresses the importance of making thinking visible in the classroom. He argues that to ensure that students learn what we would really like them to, we need to "take responsibility for building that culture, making it a strong culture of thinking" (p.4). Perkins further offers educators a number of ways they can make visible the language of thinking in classrooms. One way in which learners may gain from working closely with group members is to make their thinking visible and explicit through talk. Group members' opinions, predictions and interpretations will need to be articulated for the benefit of joint activity (Crook, 1994). The strength of cooperative learning in self-reflective processes arises from the responsibility of group members to justify and declare their ideas. Consequently talking about the learning process – what students know, what they don't know, and why they are doing what they are doing – also assists in transferring this knowledge (Abbott & Godinho, 2001).

The role of interaction

Throughout the 1980s and 1990s a wealth of experimental studies on computer-based interactions have appeared (King, 1989, 1991, 1992; Littleton & Hakkinen, 1999; Matovinovic & Nocente, 2000; Means, 1994; Mercer & Fisher, 1992; Teasley, 1995; Teasley & Roschelle, 1993; Tudge, 1992). Researchers have used different theoretical backgrounds and methodological approaches and have emphasised different facets of interaction. Some researchers (Howe & Tolmie, 1994; Underwood & Underwood, 1990, 1999) see learning in terms of conceptual understanding at an individual level, demonstrable through appropriate individual post-tests, with talk and social interaction a means to this end. Others see talk and social interaction as a social mode of thinking (Resnick, 1991; Wegerif & Mercer, 1997; Wegerif & Scrimshaw, 1997). By focusing on the group it is possible to provide descriptions of interactions that capture the interplay in meaning-making in discourse between and among students.

Further, most of the empirical research on the relationship between helping behaviour and learning in small groups has found that giving and receiving elaborated help are more strongly positively related to achievement than are giving and receiving non-elaborated help (King, 1992; Webb, 1986; Webb, Troper, & Fall, 1995). However, criticisms have been labelled at such approaches that use pre-defined coding. Instead Dawes, Fisher and Mercer (1992) and Wegerif and Mercer (1997) offer an alternative interpretative approach for understanding how talk is used by students to 'think together' in class. Their neo-Vygotskian approach is a process of *teaching-and-learning* since it treats learning as culturally based, not just culturally influenced, and social rather than individual. Consequently how cognition is represented in conversation can be examined. The types of talk have been defined in terms of fundamental orientations that are possible among students. Students act out these orientations by following, usually implicit, ground rules for selecting speech acts, which have been acquired in cultural practices. Significant types of talk when students work together are offered by Scrimshaw and Perkins (1997) and Wegerif and Scrimshaw (1997):

- Cumulative talk is where students construct, uncritically, a common knowledge by accumulation. Speakers define themselves through identification with other group member. Cumulative talk maintains group cohesion, but does not produce critically grounded knowledge; and
- Exploratory talk is where students engage critically but constructively with others' ideas. Suggestions are made for joint understanding, challenges are justified, and alternative hypotheses offered. This type of talk is characterised as the embodiment of critical thinking.
- Disputational talk which is characterised by disagreement and individualised decision-making. Speakers define themselves through their differences with each other. There are few attempts to pool resources or to offer constructive criticisms;
- Tutorial talk is where one student takes on the role of the tutor and direct or corrects the work of the other. Unlike the earlier modes of thinking, the relationship between students is not seen as an equal one, because one of them

is “mutually accepted as an expert relative to the other (Scrimshaw & Perkins, 1997).

This brief overview of key literature grounds the twofold purpose of this paper which is to:

- analyse students’ talk when working in groups at computers; and
- identify the skills and behaviours students engage in when working in groups at computers.

The Study design

Both qualitative and quantitative methods were employed to increase the trustworthiness of the study. Qualitative data included semi-structured interviews and videotaping. Quantitative data was limited to frequency counts and used as a starting point for analysis. Ethnographic methods of inquiry were used, consequently reliance was placed upon interpretative processes to reconstruct meaning about what was occurring within group discussions at the computer.

Data collection

Data was collected from the school sites between January 2002 and June 2003. Groups of students working at computers in Studies of Society and Environment (SOSE) and Science classes in Years 5 and 6 were video-recorded using semi-professional digital audio and video equipment suitable for data collection and CD-ROM development. Groups were either teacher-selected or student-selected. Data collection also included 40-minute interviews with classroom teachers and 20 minute interviews with the groups of students video-recorded.

School settings

Using purposive sampling (Merriam, 1998), four schools were selected from a cohort involved in the Successful Implementation of Learning Technologies (*SILT*) project. The schools were government, co-educational and primary.

Teacher and student participants

Eight teachers were recruited from the four primary schools, two from each upper primary year level (Years 5-6); it was not possible to attain gender balance as primary

teachers are predominantly female. The age of participating teachers ranged from early twenties to early fifties. There were 16 groups of students (approximately 38 students) with each group comprising either two or three students. Student gender varied.

Study findings

The findings are presented in three sections to provide snapshots of students' e-Talk and behaviours at the computer. First, quantification of the types of e-Talk is examined to provide insights into students' communicative orientations. This is followed by examples of the different types of e-Talk engaged in by students. Finally, a taxonomy of social and task skills embedded in e-Talk are provided.

e-Talk

Interaction at the computer provided invaluable information for understanding how students think and learn together. The investigator found a further type of 'task' talk which will be discussed later. The findings presented in Figure 1 show the distribution of types of talk in the videorecorded sessions.

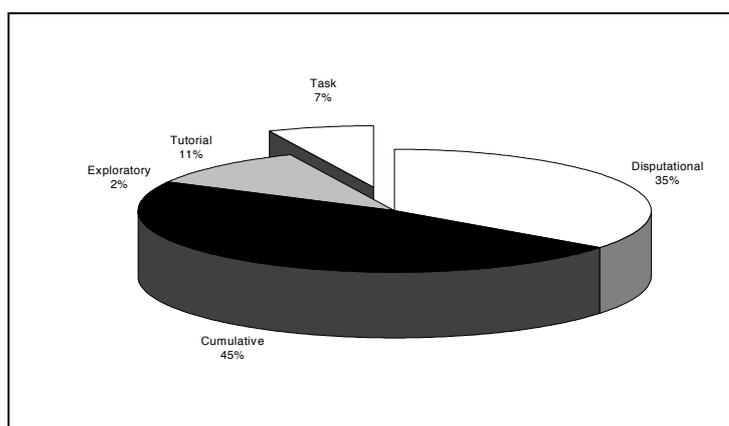


Figure 1 The categorisation of talk using Scrimshaw and Perkins' (1997) and Wegerif and Mercer's (1997) dialogical framework

The large percentage of cumulative talk (45%) indicated that students worked cohesively together through building and accumulating ideas. Disputational talk also indicated that competition and individual decision-making was present. Only two

percent of the talk was categorised as exploratory talk. The percentage of tutorial talk (11%) demonstrated that more knowledgeable students were assisting others with understanding, whilst task talk (7%), a new category found in this analysis, indicated that planning and clarifying task features benefited the completion of the task. Typical qualitative examples of the various types of talk found in this study are provided below.

Cumulative Talk

In this sequence from Didsworth Primary School, Erica and Anna were preparing a questionnaire for teachers. Information was gathered for creation of a link, Teachers' Profiles, to be included in the YearBook CD.

- 22 Erica: .How about...what's the...have you always...no...what else should we do? Should we do, have... like... you always wanted to be a teacher? (*looks at Anna*)
- 23 Anna: What was your dream?
- 24 Erica: What was your dream? How about what is your dream for the future? (*looks at Anna*)
- 25 Anna: Yeah. What were your dreams for the future?
- 26 Erica: What were your dreams for the future or what's your dreams for the future?
- 27 Anna: What were your dreams for the future
- 28 Erica: (*Typing*) That's not how you spell 'future'! So what were your dreams for the future? How about have you always wanted to be a teacher? (*looks at Anna*)
- 29 Anna: Or do you enjoy your job? (CVNB-1)

In line 23 Anna does not *listen* to Erica's earlier suggestion; instead she proposes another idea which Erica expands. Erica uses *questioning* to try and clarify the tense of the sentence, which Anna gets wrong. In line 28 Erica speaks aloud to herself (*self-questioning*) and again repeats her earlier proposition, to which Anna offers a superficial amendment that does little to develop the idea. In this example, there is no evidence of critical discussion, and reasoned argument about the merits of each question being proposed is by-passed in return for building ideas for the questionnaire.

Exploratory talk

The following sequence is from a group at Caterham Primary School who were investigating teeth marks in the unit on Forensic Science. The students ate into a slice of bread, photographed this and then scanned it into the computer. The group was

now analysing these teeth marks. (A large part of the discourse is included here since the exchanges have lead to the development and exploration of ideas. Further, to enhance clarity of the discourse, extraneous talk as identified by line numbers, has been omitted).

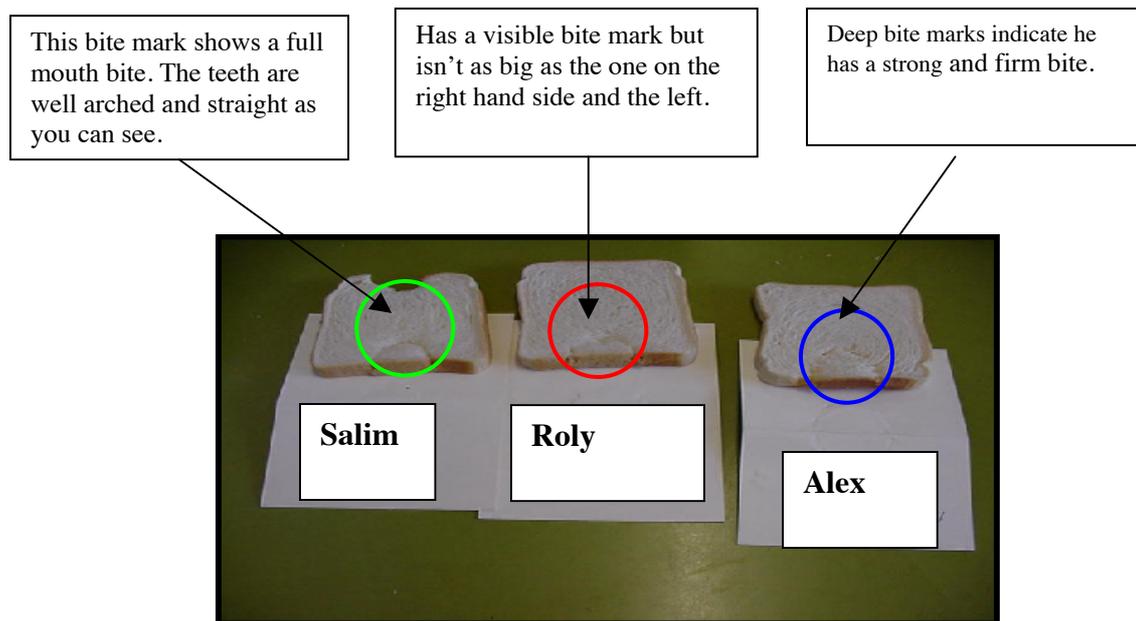
- 2 Roly: 'Alex's bite indicates' (*Salim is typing. Alex is sitting behind the two of them*)
- 3 Alex: So what are we doing here?
- 4 Roly: We're describing the bite.
- 7 Alex: There is no 'r'. It's 'indicates'
- 8 Roly: Indicates that...your bite... it's like an egg (*uses hands to describe. Alex and Roly look at him*). Look (*points to screen*).
- 9 Alex: I know. My mouth is...
- 10 Salim: It looks like a... (*inaudible... points to screen. Roly finishes typing*). Alright that's Alex's done.
- 11 Alex: (*Roly starts talking over Alex. Alex reads from screen*) 'Alex's deep marks indicate'. 'Alex's deep **bite** marks indicate' because otherwise you're looking at anything... Deep bite...
- 38 Roly: Wait let's analyze Alex's first. (*All three stop typing or using the mouse*). How am I supposed to describe it? 'Has a visible bite mark...but not as visible as Alex's'. (*Salim starts typing*).
- 39 Alex: But not as deep or something like that...
- 40 Roly: Yeah I don't think it says deep.
- 41 Alex: Mine is the deepest (*leans forward to look at the screen*) - it's just yours has the most shadow so it looks...
- 42 Roly: Yeah yours is the deepest.
- 43 Alex: He's got a lot of shadow in it so it looks deeper.
- 44 Salim: Roly, yours is not even deep...you've only got two teeth in there (*Alex gets up to look at the slice of bread on the next desk*).
- 45 Roly: This is ...wait... (*picks up slice of bread*). Oh I think it's the wrong one. Where's Alex's?
- 46 Salim: (*looks at Roly*) Ate it...
- 47 Alex: In here (*laughs, points to stomach*).
- 48 Roly: We need to have a precise look at this (*points to screen. Salim types and Roly reads*). "But it isn't"...um hello...
- 49 Alex: "Is not as strong as either of the two on the other side" (*looks at Roly*). Just because we talked about mine first we don't have to talk about that about me again.
- 50 Roly: As big and deep. Not as big as Alex's, I think.
- 51 Alex: But it isn't as strong as the other two (*looks at Roly*).
- 52 Roly: (*Getting irritated*) Make up your mind.
- 53 Alex: (*Looks exasperated. Leans forward*)...as Alex's or Salim's.
- 55 Alex: You don't just have to just put my name in.
- 56 Roly: (*Ignores Alex's comment*) As the one on the right hand...just as the one on the right hand side...(takes over typing from Salim).
- 57 Alex: (*Leans forward to try and get Roly to listen*) Yeah but also it's not as deep as Salim's.
- 60 Alex: Hey it's not as big as Salim's (*looks at Roly to get attention*).
- 61 Roly: It's not as big - big as the one on the right hand.
- 62 Alex: And Salim's.
- 63 Roly: Really?

- 64 Alex: Yeah look (*points to screen*).
65 Salim: Mine's way big...deeper than yours.
66 Alex: You need to talk about...it's just because we haven't talked
about it yet.
67 Salim: Yeah mine's way bigger. (SVFA-2)

This extract is suggestive of both, cumulative and exploratory, talk. Whilst the students frequently exclude others' contributions through interrupting their talk, and *active listening* appears to be a problem, the discourse is generally characterised by 'reasoned' argument with propositions challenged and reasons given. In line 11 Alex uses cumulative talk to elaborate on the ideas developed by Roly and Salim about his bite marks. In line 38 Roly endeavours to *plan the task* by suggesting that they need to analyse Alex's teeth marks first. This discussion goes no further though since he then proposes that his teeth marks are visible but not as visible as those of Alex. Alex challenges this proposition, and *builds another idea* by suggestion that Roly might want to comment on its depth (39). In line 41 Alex asserts that his bite marks are the deepest and justifies why Roly's are not as deep (43). Roly confirms this in line 42. Yet Salim's confirmation of Alex's proposition in line 44 makes Roly seek proof of this without success (45-47).

In line 49, Alex *builds another idea* by suggestion that Roly's bite is not as *strong* as either his or Salim's, however, Roly challenges this again and repeats his earlier proposition of comparing the *depth* and *size* of his bite with Alex's but he was not quite sure (50). Alex tries to draw Roly's attention and in lines 51 and 53 justifies his earlier proposition about the bite's strength. Roly ignores this and extends his proposition about depth and size (56). In line 57 and 60 Alex proposes that Roly's bite is also not as deep or big as Salim's as well as his, but Roly ignores this and continues the comparison of his bite mark with Alex's (61). Finally in line 63 Roly "listens". The crux of the problem in this sequence is clearly expressed by Alex in line 66 where he *clarifies the task*. It is interesting to note here Alex's use of pronouns - he moves from "you" to "we" as if he has suddenly realised that this is a group task. Overall though in this vignette the group naturally but deliberately manages the talk so that they exchange views, challenge, reason, justify and extend ideas.

The photograph presents the final product developed by the group. As illustrated, Roly conceded that his bite marks were smaller than Salim's and Alex's, but did not concede that they were deeper.



Disputational Talk

Disputational talk can involve counter assertions that are rejected. Individual decision-making can occur when the speaker initiates a proposition that the receiver challenges with a counter hypothesis, but then concedes. In this sequence, taken from Ambrose Primary School, Sara and Amy were merging their individual reports on the steps involved in making Slime to produce one product.

- 54 Sara: Alright. C'mon. Equipment.
- 55 Amy: Okay.
- 56 Sara: And I'll do the colon.
- 57 Amy: Whatever. *(Uses one hand to type)* Where's the q?
Where's the q?
- 58 Sara: The Q? There *(presses key)*. U...oh I'll spell it for you
(Giggles. Picks up handwritten report). U I P M E N T
(presses colon key).
- 59 Amy: *(Not pleased)* I'm doing that next time.
- 60 Sara: *(Looks at handwritten report)* Okay icy pole stick or
popsicle stick... Popsicle stick? *(looks at Amy)*.
- 61 Amy: Popsicle *(laughs)*...Icy pole.
- 62 Sara: No Popsicle.
- 63 Amy: Okay Popsicle.
- 64 Sara: We're arguing over nothing. (DVMA-2)

In their individual reports, Sara has referred to the stirrer that is used to mix the borax solution and water as a 'popsicle stick', whilst Amy has referred to it as an 'icy pole

stick'. For their joint product, Sara proposed they use her term (60). When Amy laughed at this and proposed they use her term (61), Sara insisted with Amy conceding (62-63). Consequently there is little discussion about which term might be more appropriate for general understanding if the experiment is to be replicated (one of the goals of writing scientific reports). Amy and Sara's interaction is defined by their lack of cooperative skills. Amy's inability to *challenge* Sara's behaviour and Sara's *lack of inclusion* causes the disagreement though Sara does not understand this ("We're arguing over nothing").

Tutorial Talk

In tutorial talk, one group member is mutually accepted as being more expert than the other (Scrimshaw & Perkins, 1997). One member takes on the role of tutor and directs and corrects the work of the other. Talk can range from the purely directive and expository through to scaffolding to assist understanding. Seldom evidenced were patterns of tutorial talk in the videotaping, particularly with Microworlds programming. In this sequence from Baylor Primary School, Betty wants to make an object move in her individual Space report.

- 5 Tom: Alright just try and find the turtle (*points to screen*). No, it's down here somewhere (*points to screen*).
- 6 Betty: Oh down there.
- 7 Tom: No don't drag it...no click and drag (*points to screen*).
- 8 Betty: On that?
- 9 Tom: No, no, no (*pointing to screen*) not that, not that. That's alright. Start from about there (*points to screen*).
- 10 Betty: Okay.
- 11 Tom: And go right down to the corner. Now click on the turtle (*Moves his hand to get the mouse but stops. Points to screen*).
- 12 Betty: Okay where do I take it? (*looks at Tom*)
- 13 Tom: Just unclick. There you go. Now go to graphics (*points to screen*). This is just so we can see the turtle in the background. Now get the arrow (*points to screen*). There's just one Extra Information web page. Ah not a web page.
- 14 Betty: Web page...you got it mixed up.
- 15 Tom: Now drag it back down to the middle (*points to screen*).
- 16 Betty: It's coming.
- 17 Tom: Do you want to put anything on an Extra Information page?
- 18 Betty: Can you just hang on a second?
- 19 Tom: What are you doing?
- 20 Betty: I want to make it (*object*) move.
- 21 Tom: Move? (*looks at Betty*). How come? (*Types*)
- 22 Betty: I don't know, just for interest.
- 23 Tom: Do you want to make it move from side to side? (*points to screen*).
- 24 Betty: Yeah (*Tom completes the move*). (BVAA-2)

In this exchange, Tom is the tutor directing Betty's moves. Betty accepts Tom's expert role. Initially his approach is impersonal, pointing out moves without elaborating on why. It is only in line 13 that he gives a reason for using the graphics icon. In between his direction, there is talk about an 'Extra Information' page the group had created (13, 14, 17). In lines 18-20 an attempt at scaffolding (Wood et al., 1976) takes place as Betty moves away from the role of tutee to experiment in moving an object in her folio. However, Tom takes over the role of tutor again and, rather than directing her on how to do it, does it for her (23-24), a role with which Betty still appears comfortable. The exchange demonstrates a distinguishing feature of tutoring – both tacitly agree that there is a problem and the tutee accepts and allows the tutor to propose a solution and carry out the moves. Further, it demonstrates how a more capable student can scaffold the learning of a less capable student. An important social skill, *active listening*, which demonstrates cooperative behaviour, is evident by frequent eye contact

Task Talk

As mentioned earlier, a new type of talk relating to the completion of the task was found in this study. Task talk is where group members construct a "common ground" by clarifying task details. It is characterised by confirmation of task planning and task clarification features.

Clarifying features of the task can involve previewing completed segments of the task, a request heard frequently in the lessons videotaped. This is evident in the discourse between Liz and Sally from Ambrose Primary School.

- 215 Liz: Can we have a print preview to see how it's going to look?
(*Sally was typing*).
- 216 Sally: Yeah sure.
- 217 Liz: Can I do the mouse? (*Sally releases mouse*). Where's
Print Preview?
- 218 Sally: Right there (*points to screen*).
- 219 Liz: Oh yeah that's how it looks. (*Liz and Sally look at each
other*). We shouldn't do no more that size.
- 220 Sally: We should put it in the middle (*points to screen*).
- 221 Liz: Yeah. Can we move this over there?
- 222 Sally: Can't you put some on this side? (*points to screen*).
- 223 Liz: Hang on, I'm going see in a moment, alright?
- 224 Sally: Yep.
- 225 Liz: Now we move that there. (DVDA-1)

The talk is self-explanatory. Evident here is *resource sharing* as the students discuss the presentation features of the concept map that is being created.

Overall in understanding how cognition is represented in talk, the descriptive analysis indicates there was a large percentage of disputational talk, which demonstrated little joint activity by group members. There were slightly more instances of cumulative talk, demonstrating group members' intention to maintain social cohesion. Conversely, there were very few instances of exploratory talk, which would indicate little shared cooperative identity among group members. The few instances of tutorial and talk talks also showed other ways that peers can assist each learn – by transferring knowledge of computing skills and by clarifying how the task should be completed.

Social and task skills

In understanding how social and task skills were embedded in talk, the analysis revealed many cooperative learning skills and behaviours across the different types of talk. These included building ideas and including others, though offering supportive comments was non-existent. Listening to group members' diverse points of view frequently appeared to be an issue since the screen was often the focus of eye contact, and/or the mouse and keyboard territorialised by hovering hands. Whilst there was some evidence of clarifying the task and providing tutoring, there was little evidence of planning how tasks would be completed prior to commencing work at the computer. Further, evidence of explicit thinking skills appeared infrequent or could not be clearly identified. Evident from this is the need for teachers to develop a visible language of thinking in the classroom as recommended by Perkins (2003). Table 1 provides an extraction of the skills and behaviours found in e-Talk.

Table 1 Cooperative Computer Learning Skills and Behaviours

<i>Social Skills</i>	<i>Sounds like</i>	<i>Looks like</i>
Asking questions	What do we know about this already? Where could we find out more about this? How shall we describe this? When will we be able to apply this?	Relaxed body, friendly voice, Eye contact
Self-questioning	What do I learn from doing this? How can I use what I have learned? Where would I be able to use this? When would I be able to apply this?	Eyes on screen, leaning back to think
Active listening	Are you suggesting...? Can you say that again...? Do you mean that...?	Uses eye contact, friendly voice, turns to face speaker
Resource sharing	May I use the mouse for a second? Do you want to use the mouse now? May we switch sides so you can type/use the mouse	Uses eye contact, releases mouse, moves keyboard, swaps seats
Supportive comments	That's cool...great We like what you did there... That looks good like that...	Uses eye contact, claps hands, puts thumbs in the air
Including others	Let's try your idea first Let's talk about why our ideas are different What do you think?	Smiles, adjusts body to include others, eye contact
<i>Task Skills</i>		
Challenging assumptions	It doesn't make sense, so can we check that out? We don't think so, but tell us why you think that? Can you show us what you mean	Friendly smile, relaxed body
Building ideas	That's okay but... This is good because.... Let's try this because.....	Uses eye contact, friendly voice
Planning task	What do we have to do first? We need to do this first and then... How are we going for time?	Eye contact, reads task details, Looks at watch
Clarifying task	Let's preview what we've done... This means that we have to... We need to talk about this first...	Eye contact, points to screen, reading task details
Providing tutoring	You move the mouse there and ... So click on here because then you can see What do you think we should do next?	Friendly voice, hands away from keyboard/mouse

Summary and conclusions

This has been a small study embedded in the culture of particular schools and a school system. In addition, it focussed specifically on how cooperative learning theory is understood and implemented by teachers. The outcomes of the study may have been very different if it had been conducted in a different sociocultural context, or approached through action research. In this context, the investigator offers the

following suggestions for consideration based on the findings of the analyses of primary sources.

- The initial period after students receive their instructions and prior to commencing work at the computer, appears critical. Planning the task in terms of discussing the software programs to use and how it will be accomplished needs to be negotiated prior to using the computer. Creating planning spaces away from the computer would be ideal. With physical space constrictions in most primary schools, however, sitting at the computer without switching it on is another alternative. Use of flip charts or whiteboards can help groups focus on the task.
- Exploratory talk is characterised as the embodiment of critical thinking and is essential for participation in educational communities of discourse (Fisher, 1997). However, in this study, exploratory talk represented only two percent of the discourse at the computer. Elucidation of the significance of exploratory talk in shaping students' thoughts (Barnes & Todd, 1977; Bennett & Dunne, 1991; Mercer, 1995; Wegerif & Mercer, 1997) and its critical role in cooperative learning is recommended. Developing the teacher's role as a 'discourse guide' with the explicit teaching of exploratory talk as a way of jointly constructing understanding will also help students develop intellectual habits that will serve them in a range of situations (Littleton, 1999).
- The importance of teaching students to ask more task-related questions from each other to explore thinking has been raised by a number of educators and researchers (Abbott & Godinho, 2001; Department of Education Queensland, 1996; Department of Education Tasmania, 2002; Department of Education Training and Youth Affairs, 2001; Department of Training and Youth Affairs, 2000; Hardman & Beverton, 1993; King, 1989; McKnight, 2000; Presseisen, 1992). Oral language involves both listening and speaking, and asking questions is one representation of speaking. Consequently, in order to make questioning (both asking questions or self-questioning) a priority in 'e-Talk', it needs to be addressed as a social skill which is fundamental to the development of thinking.
- The quality of interactions during tutoring activities is critical in determining how much the tutee learns. However, 'providing tutoring' to peers is a new

experience for students. Students need to be prepared for peer work and explicitly taught the strategies for effective tutoring. Teachers can assist tutors learn how to:

- (a) Offer elaborated help, without doing the work for the tutee
- (b) Ask questions to assess comprehension
- (c) Monitor the tutee's progress
- (d) Provide supporting comments to the tutee for her/his efforts.

Students at all levels of education are increasingly being asked to work cooperatively and collaboratively. The increased emphasis on group learning is partly a reaction to societal changes with its emphasis on teamwork in the business sector (Millis & Cottell, 1998), and the realisation that in a rapidly changing information society, communication skills are becoming increasingly important. Developing students' awareness of the features of talk and gesture that are supportive and constructive or unhelpful and destructive is one way of enriching group experiences. Central to this awareness is an understanding of group interaction. The ability to monitor, control and reflect on their own use of oral and body language would enhance students' understanding and appreciation of group work. Action-research by teachers to test the generalizability of the skills and behaviours identified in Table 1 could be used as a starting point to develop research on the metalanguage of e-Talk.

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