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Beyond discovery: A case study of teacher interaction, young children and computer tasks

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Abstract

The integration of computer technologies into everyday classroom life continues to provide pedagogical challenges for school systems, teachers and administrators. Data from an exploratory case study of one teacher and a multiage class of children in the first years of schooling in Australia show that when young children are using computers for set tasks in small groups, they require ongoing support from teachers, and to engage in peer interactions that are meaningful and productive. Classroom organization and the nature of teacher-child talk are key factors in engaging children in set tasks and producing desirable learning and teaching outcomes.

Introduction: The promise of Information and Communication Technologies (ICT)

For some time now, developments in information and communication technologies (ICT) have been touted as transforming education, but expectations have not been realized in either the magnitude of change or the time taken for change to occur (Yelland, 2007). Beside the investment in infrastructure and policy initiatives sit exhortations that ICT can make a distinctive contribution to the kinds of thinking that are required by the knowledge society (Loveless, 2002; Yelland, 2007) and that use of ICT under certain conditions can raise achievement in primary school classrooms (Wegerif & Dawes, 2004). However, long term investment in curriculum development or research into the use of ICT has not been a priority (Reynolds, Treharne & Tripp, 2003) and the much-speculated transformation of teaching and learning has proved to be more difficult than originally envisaged.

Children too, have been included in assumptions about the appeal and use of new technologies. As Selwyn (2001) noted, the UK National Grid for Learning initiative was established on the "underlying assumption that children will quickly and effortlessly adapt to using new technologies" (p. 245). In preschool settings a tendency to let children engage in free play with computers has been observed and this, along with a lack of focused interaction from practitioners and little peer support suggests that there are not only issues of teacher competence and confidence involved, but also that practitioners seem to think that children know intuitively how to use computers (Plowman & Stephen, 2005). As more is learned about using ICT in classrooms, the drive has been to integrate technologies in ways that are closely associated with teaching and classroom practices. Key to this has been the idea of making explicit the links between teaching and learning with technologies (Meier, 2005), the significance of good teaching (Fox, 2000; Wegerif & Dawes, 2004) and the recommendation to rethink learning with technologies (Yelland, 2007).

The research discussed in this paper investigated ways in which children in the early years of school were using computers in everyday classroom activity. The school was involved in a school renewal project, one aspect of which was a focus on multiliteracies and communications media. The project sought information about teacher-child interaction, peer interaction and classroom organization that related to mutiliteracies and communications media, and recorded children's actions, decisions and language when using a range of software. In an exploratory case study, fieldwork and data collection are often "undertaken prior to the final definition of study questions" (Yin, 2003b, p. 6). Accordingly, research aims and questions were broad. Yin (2003a) suggests that 'what' type questions are suitable for

exploratory approaches. Consequently, the following question was posed for Nicole's classroom: What can be learned from a teacher recognized by the principal and peers as knowledgeable about computers and associated technologies?

Following an exploration of literature about teacher-child interaction, small group work and critical incidents, the research design is explained. In the findings section, an analysis of a transcript explores what occurred with one child and a teacher during a half hour session of set small group tasks. The paper concludes that on this occasion, the approach to small group organization and the rule about peer help in the classroom affected task engagement and interfered with successful completion of the task to a significant degree.

What matters when children use computers?

What seems to matter most is the amount of involvement of teachers when children are using computers (Fox, Montague-Smith, & Wilkes, 2000). When children are assigned to complete small group tasks and left to explore and discover with little or no interaction from teachers, not much is achieved in terms of tasks teachers have assigned, quality of talk with others and knowledge gained (Wegerif & Dawes, 2004). Wegerif and Dawes (2004) found that most discussion was about the social orientation of group members to one another including turn taking, fairness, and friends working together. In short, children were trying to work together but had not been taught skills of how to do this effectively and so learning outcomes were compromised. However, more than this, the nature of teacher-child talk and the role of the teacher are crucial factors in enhancing children's learning when using computers.

According to Alexander (2000) there are three predominant patterns of teacher-child talk in classrooms around the globe: rote, recitation and instruction/exposition. In each of these patterns, children are positioned to listen to the teacher and expected to respond to prompts that require them to contribute, after which inevitably comes another response from the teacher. This type of asymmetric discourse (Myhill, Jones & Hopper, 2006) is often a feature of the classroom interaction pattern known as IRF (Initiation, Response, Feedback). The IRF sequence usually consists of initiation by the teacher, often in the form of a question, which is followed by a response from a student to attempt to answer the question. The final part of this triadic dialogue (Lemke, 1990) consists of feedback (F) provided by the teacher to the student's response. As the teacher commands two thirds of the interaction and generally controls it, the dialogue is asymmetric.

The IRF sequence has been used in many studies of classroom interaction and has been praised as well as criticized (Wells, 1999). The reason for this difference of opinion lies in a tension between the two main goals of education found within sociocultural theory:

cultural reproduction and cultural renewal (Wells, 1999). In studies where the goal is for educational institutions to reproduce what has been valued in the past, the IRF sequence has been lauded. However, where educational institutions are charged with the responsibility of cultural renewal and for "the formation and empowerment of its individual members to deal effectively with future problems" (p. 168), the use of triadic dialogue has been maligned. Nevertheless, Wells (1999) claims that triadic dialogue can be used by the same teacher in different contexts for different purposes. The difference between using the IRF exchange as a way toward individual empowerment and the potential solution of future social problems, and simply as a means of cultural transmission occurs at the follow up (F) stage of the interaction. This part of the exchange was called "evaluation" by Mehan (1979), who talked about triadic dialogue as IRE (initiation, response, evaluation). In this sense, evaluation is conceptualized narrowly (such as checking basic understanding) and does not allow for the scope offered by follow up. When used in follow up mode, Wells (1999) suggests there is a point of departure that offers opportunities for co-construction of knowledge "on the basis of ideas and experiences contributed by the students as well as the teacher" (p. 206). Furthermore, Wells links use of follow up mode to the achievement of broader goals of education that include a social constructivist approach replacing ideas of schooling as transmission of knowledge.

Using the IRE sequence has the potential to limit further discussion and exploration. Conversely, using the IRF format has the potential to engage children in valued interactions such as sustained conversation that leads to deep knowledge and deep understanding. However, not only teacher-child interactions need consideration. The interactions occurring between children and computers are important because when children interact with computers, the same possibilities exist as when they are interacting with teachers (Wegerif & Dawes, 2004). That is, just as teachers can and do, computer programs also use IRE and IRF formats that produce particular types of exchanges. To ensure that IRF formats are used when children are interacting with computers, Wegerif and Dawes changed the sequence of IRF to IDRF, inserting discussion time in the IRF format and thus offering opportunities to transform the "whole educational experience…It introduces a pause for reflection and for thought" (p. 15). Discussion also introduces possibilities for learning dialogues where children engage in questioning, challenging and extension with peers and teachers (Wegerif & Dawes, 2004). Once sustained dialogue is established in a social context, the potential for higher order thinking and critical analysis is increased, as is the likelihood that deep understanding of concepts will occur.

There are critical moments in classroom talk (Myhill et al., 2006) that can make a big difference to what eventuates from classroom dialogue. Critical moments are defined as "a moment in which a teacher's utterance was significant either in the way a child's understanding was developed or in the way it was confounded" (p. 105). However, many such moments go unnoticed in classrooms. Myhill et al. (2006) found that it was only in retrospect and on reflection with the aid of video recordings of their classrooms, that teachers were able to identify these critical moments as windows of opportunity to enhance learning. The crucial part is recognizing critical moments as they occur and being able to capitalize on them as chances for "shared learning and thinking" (Myhill et al., 2006, p. 119). A similar idea, "just in time" delivery of skills, knowledge, and extension requires teachers to have threshold knowledge in core fields and understand developmental taxonomies of skills, competences and knowledges (Luke, 2005). Teachers also need to understand student variability in terms of cultural, linguistic, socio economic and individual factors; and be able to use their knowledge about children and their learning situations to make pedagogical judgments on the spot (Luke, 2005). Good teaching weaves these together, drawing on what is needed at the right time (just in time) to move between conceptual, knowledge and skill levels within lessons, across units of work and projects; in intentional ways (Luke, 2005). An associated idea is "just in time learning" (Wegerif & Dawes, 2004, p. 116), which occurs spontaneously when groups of people use computers. It is especially helpful for technical knowledge required while working on computers and is best provided by interacting with others as the need arises (just in time).

By way of contrast with teacher-child talk and critical moments, a meta-analysis of 71 experimental or statistically controlled studies of small group and individual learning with technology (from K to college and adult students) showed that on average, those learning in small groups tried a greater number of tasks, used more strategies and had more positive attitudes toward small group learning; but needed more completion time than those working individually (Lou, 2004). An earlier meta-analysis (Lou, Abrami & d'Apollonia, 2001) found that small group learning had more effect on individual achievement when learning occurred with tutorial and practice programs as opposed to exploratory and tool programs (for students from year 3 to college). Lou et al. (2001) also found that on average students working in groups had a significantly higher frequency of positive interaction and using appropriate learning strategies, persevered longer and had a more positive attitude toward group work and other students in the class. Students working individually on average interacted more with

computer programs, required significantly more help from the teacher, and completed tasks faster than those in group situations.

To sum up, when children are using computers in classrooms, opportunities for feedback and substantive conversation are important factors in the quality of interaction that occurs, and subsequently the level of child engagement with the task. The organization and management of the small groups also affects what occurs among members and the eventual productivity of the group. Taking advantage of critical moments and providing information at the right time are other factors that affect the level of engagement and outcomes. These are exemplified in the case presented.

An exploratory case study

The data reported here are drawn from a larger exploratory case study (Yin, 2003a) of school renewal over 2.5 years and focus on involvement in one teacher's class at Linvale State School (all names are pseudonyms). Linvale is a public, P-7 (preparatory to year 7) multi-age school situated in the capital city in the state of Queensland, Australia. The student population is about 900 and the school has a history of high staff turnover, with some teachers transferring because they did not want to work in a school with multi-age grouping. The renewal process was concerned with educational rejuvenation rather than cultural reproduction. Students were expected to develop critical thinking, problem solving and lifelong learning skills and apply them to real-life tasks and activities. Teachers were required to use productive pedagogies (see Appendix A) in classroom instruction, which consist of 20 teaching strategies that are aimed at focusing instruction and improving outcomes (Education Queensland, 2000b). One of them, substantive conversation, asks teachers to consider whether classroom talk moves beyond the IRE/IRF pattern to engage students in sustained dialogue with teachers and each other. The multiaged class consisted of children aged between five and eight years who were in the first three years of schooling. The teacher, Nicole, graduated with specialist early childhood qualifications and has since completed a qualification in special education. She has over 20 years teaching experience and has always taught in multi-age settings in the first years of primary school.

Part of the school renewal project concerned multiliteracies and communications media and because the principal recommended Nicole as knowledgeable in these areas, her class became a focus of data collection for 2.5 years. Given that there are those who oppose the use of computers in early childhood and elementary classrooms (Alliance for Childhood, 2002; Healy, 2004), detailed study of Nicole's classroom over time provided an opportunity to investigate what was potentially an atypical case (Yin, 2003a). Transcript data reported

here were gathered in Nicole's classroom during March 2004. This example is illustrative of what was occurring in terms of classroom organization for small group activities in this classroom and two other classrooms. It was chosen because it shows how off task behavior is connected to the way in which the small group activities were organized; the difficulties associated with the peer assistance approach in the classroom, and the teacher-child interaction that occurred. During 2004, data were gathered in Nicole's class for approximately two hours per week for a period of 24 weeks. Nicole participated in two informal interviews, about 22 informal conversations and had intermittent email contact. Between one and two hours of video excerpts of children using computers were recorded each visit. After each visit field notes documented informal conversations, classroom routines, daily events and atypical occurrences.

All interviews were audio taped and transcribed and email conversations were saved and logged. Analysis was inductive and codes were assigned to categories and themes that emerged from the data (Hatch, 2002). Tables were formulated to show full details of interviews, observations, and video records, and each data record was read and then examined independently. Interview data and field notes were read chronologically and then combed for major themes, culminating in the development of a matrix that combined chronology and themes (see Miles & Huberman, 1994). All video data were categorized into themes and sub themes. Transcript data in this paper draw from one of the video data sub-themes, which focused specifically on teacher-child and child-child interactions while children were using computers. A segment from one week in a sequence of five weeks of children working in small groups is analyzed and Nicole's interactions with the children in the small group are a focus of the analysis.

Findings: "I'm there to point them in the right direction, but they're there to work out the solutions"

This section begins with data that show how Nicole talked about her teaching approaches and practices. Then the task that the children were required to complete is described and a transcript excerpt of the teacher-child interaction that occurred during one 30-minute session of small group activities is presented. Following that the transcript is analyzed and read against the productive pedagogies (see Appendix A), Wells' (1999) reevaluation of the IRF sequence of classroom interaction, and the ideas of critical moments and just in time teaching.

Teaching approaches and practices: "I know about technology, I am comfortable with it"

The school renewal project focused on multiliteracies and communication and required active involvement with computers and ICT. These are areas in which many early childhood teachers feel less than comfortable (see Yelland, 1999). In contrast, Nicole felt secure with computer based technologies and was seen as an authority by other teachers:

> …I know about technology, I am comfortable with it…I have spent at least one afternoon in every week this term helping Eve [teacher] next door who doesn't have any skills and I just had to get her up-to-date with the basics… She can open files. I had to teach her about saving files, moving files across to folders, using Front Page, *everything* with Front Page… I give them [other teachers] support. I don't class myself as that good at technology but I do know my way around it…a year three teacher…rings me on the phone to ask me questions. The fact that she knows to ring me to ask me that question makes me feel good because I know that she trusts me to answer the question. (Interview; 31 March, 2004)

Here Nicole talked about how she is viewed by other teachers as skilled with technologies and that they seek her advice. She supported her colleagues by offering practical help and ideas both informally and in organized after school sessions, was confident in her ability with computers, and enjoyed working with them herself.

Although Nicole made herself available to support colleagues, she had a different strategy with the children, which she suggested was in harmony with the multiage approach of peer tutoring, or having children teach and learn from others:

> Computers - I have taught 3 kids how to use the computers, and this was years ago, and those 3 kids, they're actually in year 5 now, those 3 kids taught 3 kids, and I've always had my computer experts, right through. I've got two Year 2 computer experts now, that will be the computer experts next year; that will be training the other kids. The children go to them for help: it's the same thing with maths...anything that we're doing…the kids know who are experts in that area [and] to go and ask them. So by them asking them, the kids have to explain it, so the kids are clarifying in their heads, what it is that they're doing…to explain it to someone else...we've always done that in our classroom. I see me as…I don't know if facilitator is the right word. I'm there to point them in the right direction, but they're there to work out the solutions. (Interview; 25 June 2004)

An integral part of Nicole's classroom was the requirement that children help others when needed. In the excerpt above, Nicole almost dissociated herself from providing assistance to those who needed it. This is reminiscent of child-centered approaches where teachers can

avoid a focus on skills and are reluctant to engage in 'instruction' (Schickedanz, 1994). Nicole justified using the 'experts' in the class on the basis that understanding comes with providing an explanation to another child. There also appears to be a lack of recognition of those who are not considered experts in providing explanations to others. It seems that not all children are able to become experts, which begs the question, using Nicole's logic, of how such children are able to understand if they do not have experiences of explaining to others. What is omitted in Nicole's account is the responsibility of the teacher (in accordance with the productive pedagogies used in the school renewal project) to provide leadership in higher order thinking, to use metalanguage, to engage children in substantive conversation, and to ensure children are engaged meaningfully in their learning.

The task and the transcript: 30 minutes of classroom life

With another class, the children in Nicole's class participated in small group activities one afternoon per week for approximately 30 minutes. They were organized into eight groups and each group completed one activity per week. One activity always involved a computer task, which in this case required children to design a quilt pattern using the program *Kidpix*®. They could work individually or in pairs. The quilt task was a lead in to an assessment task of designing and sewing a quilt with the whole class. Its aim was for the children to understand quilt patterns and what they would have to do to when engaged in the active design and actual sewing of the class quilt. The children were given an instructional sheet to guide them in the computer task, which asked them to draw a rectangle, draw lines over it to create a grid, and then fill in the small rectangles with colours to create a pattern similar to that found on a quilt.

As Nicole was usually teaching a focused lesson during part of the group time to one of the eight small groups, the children working on the computers were required to ask each other for help if they needed it. Five examples over consecutive weeks of children undertaking computer tasks during small group activities show the time Nicole spent interacting with individual children and the time children spent interacting with peers (see Table 1). With the exception of Chris and Kyle, Nicole's

Insert Table 1 here

comments during these times were management oriented, very brief and consisted of giving instructions or asking questions (see Table 1). The video recordings show that teacher interaction with Andy and Jill, Steven and Keenan, and Jason is minimal.

To ascertain in more depth how Nicole interacted with Chris who is in Year 3, an abbreviated and annotated transcript has been complied from video footage and field notes.

Chris was working alone on the computer task, but close to others who were working in pairs. Chris started the activity without reading the instruction sheet. He drew one horizontal line across the blank page on the screen and then walked to the teacher to ask for help. No assistance was given, so Chris came back and drew another line but it went in a diagonal direction. The teacher came to his desk.

1. T: That's not a quilt pattern, do you want them [lines] that close? (I).

2. Chris: I'm just …… [erased the lines]. (R)

3. T: Have you done your rectangle to start with? (I) Where's your instruction sheet? (I).

4. Chris: I don't know. (R)

Chris left to find an instruction sheet, returned with one and said: "I can't do this." He did not read the instructions before drawing some straight lines, which he then erased. He went to the teacher again for help and was told to read the instruction sheet. He returned and tried again and soon the teacher joined him.

5. T: [Pointed to instruction sheet] Right, what does the first thing say? (I)

6. Chris: I don't know. (R)

7. T: Well read it [T pointed to the sheet] (E).

After telling Chris to read the sheet, the teacher left. Chris wandered off again without reading the sheet. When he came back he clicked on the rectangle tool and began to make a black rectangle, which he erased. He stood up and pointed to the computer screen.

8. Chris: Mrs E?

9. T: Did you use the rectangle tool? (I). [From across the room]

10. Chris: That one? (R)

11. T: Yes – make a big rectangle (E)

12. Chris: White? (R)

13. T: Do you want it in white? Will you see a white rectangle on a white background? (E)

14. Chris: Red one Mrs E? (R)

After creating a red rectangle, Chris left again to ask the teacher what to do next. He returned with the teacher talking to him.

15. T: Read the instructions Chris, you've seen how to do it, all the other kids over there are doing it – go and ask one of them what you have to do next. (E)

Nicole reminded Chris of the strategy for getting help (ask another child). Chris looked at what the others were doing and went immediately to tell the teacher that the

children weren't using the rectangle tool (R). The teacher said, "Look, they're doing it" (E) and sent him back to the other children. Nicole had not realized that the other children had found a short cut to creating a grid, and to Chris they were not following the instructions on the sheet (which he had been told to do several times). The children pointed to the screen and said: "This is how you do it" (draw a grid automatically on the page), but did not show Chris *how* to do it. Jill had learnt how to do it using one of the pattern tools in Kidpix® and showed the children, but they didn't show Chris how they created it, or explain how to do it. Chris went back to his computer and drew a line but it was too big. The teacher returned to Chris' computer and Chris showed the teacher that the line was too big.

     16. T: How are you going to fix it? (I) [To researcher: "He's not normally this slow on the computers, he's normally one of my good computer kids"].

Chris started to try to erase the line. (R)

     17. T: Don't you go to the oops? [key to clear the screen] (I)…you know the one at the bottom, the oops. [Talked to another pupil, Stella]. You go and help Chris.

Stella came to help: "Do you know how to do it? I'll show you - press that" [to clear the shape]. Chris said: "No I don't want to get rid of this. You can't get rid of the rectangle…and then the rectangle disappears". Chris left again, heading in the direction of the teacher; returned and started to draw again. He went to the teacher again and told her that Stella hadn't done the task yet. Nicole told him that Stella knew how to do it (E).

Chris returned and discussed the situation with Stella. She suggested he erase the rectangle but he was adamant that it had to stay, as that's what was written on the instruction sheet. He told Stella that he'd made the rectangle tool but she said he didn't do it correctly. Stella tried to tell Chris how she did it but he wouldn't listen to her. He told her to get the teacher and tried again; read the instruction sheet and then left his desk to speak with the teacher.

     18. T: [Teacher returned to Chris' computer] Ok, now you've got the ones ...[going across], you draw the lines going down. (I)

     19. Chris: But they're not like this. (R)

     20. T: Then why did you draw them that way? (E)

     21. Chris: [tried to do 'oops' to get rid of some lines] I can't do oops, it only takes down the bottom one. (R)

     22. T: You can't do oops again to get rid of the next one? (I)

     23. Chris: It just goes like this. (R)

24. T: Well, your choices are either you leave it like that, and work with it that way, or you blow it all up and start all over again, its your choice, its your quilt. (E)

Chris erased his work yet again and started from scratch. The teacher spoke to him as he was about to start.

25. T: Now don't make the lines so close together this time. Make sure you start on the outside of the rectangle, for when you use your fill tool…Start on the outside of the rectangle. (I)

26. Chris: Here, start here, and there Mrs E? And then do I go…(R)

27. T: Yes, now leave a bigger space before you do your next line, that's it. (E) [Teacher leaves]

In the meantime, Chris continued to draw horizontal lines and made a comment about "how hard is this…". He managed to draw the vertical lines but not to the very edge of rectangle. He left his desk to ask the teacher what the next step was. She pointed out the problem, which was that when he used the fill tool, the colour spilt over to a number of the squares because the lines did not go over the edge of the rectangle.

29. T: [Returned to Chris' computer] Now have these gone outside the rectangle? So you need to make them all go outside the rectangle like that, otherwise look what happens [T demonstrated]. When you go to the fill tool, if I want that to be yellow, when I click on this one look what happens, because the lines don't go all the way up. Not going to get rid of that now are we, so what are you going to do; you're going to have to do yellow now, or you can change it to another colour after. You've got to draw all your lines up over the top, so they all come over. (F)

Chris filled in the missing parts of the lines (R) and finally started to fill in the colors and make an alternating pattern. He was then told to pack up but did not have time to complete the colours in the pattern, and saved the file to his folder correctly. The time taken for this episode was almost half an hour (29:53) and Nicole interacted with Chris for less than five minutes (4:58) of this time.

Transcript analysis: Just in time?

In using Wells' (1999) reevaluation of the IRE/F sequence of classroom interaction, attention was paid to whether Nicole checked basic understanding in her evaluative responses (E), or whether feedback (F) was provided which scaffolded children's ideas and encouraged substantive conversation (see Appendix A, Productive Pedagogies). A search was made for critical moments (Myhill et al., 2006) and evidence of just in time learning (Wegerif & Dawes, 2004) and just in time delivery (Luke, 2005). Other significant factors are the way the

classroom was organized for small groups and the way that the school multi age philosophy that was enacted in the classroom.

To recap, Chris started the task without reading the instruction sheet and when he asked Nicole for help she was insistent, telling him five times to read the instructions and work out for himself what to do by following them. He left the computer eleven times during the session, seven times to seek assistance from the teacher, once to find an instruction sheet, twice when he seemed to wander off, and once to seek help from other children after speaking to Nicole. Following his requests, Nicole returned to Chris' computer on six occasions. However it was not until about seven minutes before the session ended that Nicole understood what the difficulty was (just before line 29) and then demonstrated what to do (line 29). Despite about 22 minutes of failed attempts and requests for assistance from both teacher and other children, Chris showed remarkable persistence and remained engaged with the task until asked to finish and save his work.

One of the noticeable things about this transcript is the frequency of IRE (Mehan, 1979) as opposed to IRF (Wells, 1999) interactions between the teacher (Nicole) and Chris. Using Wells' distinction between evaluation and follow up, Nicole engages in much more evaluation than follow up. In fact many of her interactions with Chris are statements that give information or ask questions about the topic and the learning purposes (cf. Mehan, 1979); and provide instruction about what to do, either in terms of the task or Chris' behaviour (see Myhill et al., 2006). Far fewer interactions are statements of explanation, where Nicole makes "connections between ideas, or introduces and explains concepts" (Myhill et al., 2006, p. 141). For example, questions were mostly factual and required a predetermined answer and instructions generally related what needed to be done in the set task. Therefore questions and instructions were aimed at checking basic understanding so that Chris could proceed with the set task. There was little evidence of scaffolding and very few comments made connections between ideas, or enabled the co-construction of meaning, as Nicole relied mostly on evaluative comments in response to the problem Chris was experiencing. Providing limited or no opportunities for co-construction of meaning has a flow-on effect for subsequent achievement of broader goals of education that include individual empowerment and the solution of social problems (Wells, 1999). The nature of the interaction between Nicole and Chris did not allow for the scope offered by follow up and thus did not uphold the tenets of the school renewal approach.

Nor did the interaction between Nicole and Chris encourage "just in time delivery" of skills and knowledge, or extend Chris' understanding on the basis of intentional pedagogical

judgments made on the spot about what was needed at that precise time (Luke, 2005). Instead, the IRE format limited the talk to factual questions and the issuing of instructions to be followed, with the exception of the end of the session, where Nicole did demonstrate and explain to Chris how to use the 'fill' tool (line 29). This was the crucial piece of information that Chris needed to know (better late than never?) and was provided by the teacher in the only example of follow up (F) or scaffolding in the 30 minute small group session. It came about seven minutes before the end of the session and enabled Chris to insert the lines for the pattern, but there was not enough time for him to add the colours. The possibilities of sustained conversation (see Appendix 1) occurring were minimal because classroom talk rarely broke out of the IRE pattern.

There were a number of critical moments (Myhill et al., 2006) that were not capitalized on in this transcript, which was unfortunate as Chris would have benefited from having the crucial piece of information about the 'fill' tool much earlier in the session. There were at least six critical opportunities – the six times that Nicole came to the computer where Chris was working - for Chris' understanding to be developed (or confounded). It seems to be a case of "just in time learning" gone begging, as the technical knowledge needed by Chris was not forthcoming from his interactions with the teacher when he really needed it (Wegerif & Dawes, 2004). It could however, have been provided by Stella, but Chris refused to listen to her (just before turn 18) even though Nicole had sent Stella to help Chris. Nevertheless, the information about the 'fill' tool came in handy a couple of weeks later when Nicole advised Kyle (just in time) about how to use the shortcut to create the grid lines (see Table 1). This suggests that the instruction sheet was not altered after the experience with Chris to enable the children in the weeks that followed to use the short cut to create the grid lines. The reasons that critical moments were not recognized as such in the transcript and Nicole's continued use of the IRE sequence are now considered.

Discussion: Continual compromises

Group activities are common occurrences in the early years of Queensland primary schools. In many instances they provide opportunities for children to engage with ideas and practice skills. As happened in Nicole's class, the teacher worked with one group of children teaching a focused lesson, and the other groups of children completed the assigned tasks in their groups. This could involve individual, pair or small group work. Due to the small amounts of time Nicole devoted to helping children with the computer task on March 10, 17 and 31 (see Table 1) and the provision of an instruction sheet, it seemed that she was expecting that the instruction sheet would provide the necessary guidance for the children to compete the task.

The class rules required that children ask peers for support before going to the teacher, but Chris ignored this rule on seven occasions in this 30 minute episode. Perhaps this was because Nicole classed him as "one of my good computer kids" (line 16), and Chris wanted help from Nicole as opposed to peers. But Nicole was busy with her own small group of children and had to interrupt what she was doing each of the seven times Chris went to ask her a question as well as the six times she left her group and moved to his computer.

Table 1 shows that over the sequence of five weeks all children received peer assistance for the computer quilt pattern task that ranged from a minimum of 15 seconds for Kyle to a maximum of eight minutes for Jason. As well as receiving the teacher's attention for nearly five minutes, Chris was in receipt of peer assistance for another five minutes, receiving help for just over ten minutes of the 30-minute session. Over the five weeks, Kyle was the only other child to receive sustained attention from Nicole while completing the computer task and this was for the duration of two minutes. Small group activities place enormous pressure on teachers if a situation arises where children are unable to solve the problem themselves and teachers are involved in teaching a focused lesson to their small group of children.

The classroom organization of small group activities was not conducive to Nicole engaging in sustained conversation with the children who were working on the computers or in any other small group, except perhaps the group with which she was working. It was however, conducive to 'just in time learning' but this did not eventuate because Chris made Nicole his first point of contact from the beginning of the session and sustained this throughout. Nicole did direct Chris to peers for help but he resisted their attempts and returned time and again to Nicole. Given the nature of Nicole's interactions with Chris (instructions and factual questions), she seemed unaware as to when critical moments might present themselves and was probably compromised in her interactions with her own small group because of Chris' continued demands for assistance. What prevented Chris from getting the information he needed in this episode included the classroom organization of small group activities and the lack of awareness of critical pedagogical moments. Myhill et al. (2006) acknowledge that critical moments are notoriously difficult to pinpoint on the spot, but do have suggestions for how teachers might raise their awareness of when they occur and how to capitalize on them. Chris' continued presence and questioning, as well as Nicole's responsibility to her own group would have put considerable pressure on Nicole during the small group activity time. She had to divert attention from her small group of children to attend to Chris.

Due to Nicole's involvement and commitment to her own small group, there was little encouragement from Nicole for Chris to identify the problem and attempt to solve it. As a result there was little evidence of higher order thinking skills being encouraged or used (see Appendix A), or of critical analysis being used in troubleshooting to find the source of the problem. Time pressures connected with completing the tasks associated with the 30 minutes of group activities and the demands of her own small group compounded the problem, possibly resulting in Nicole's seeming reluctance to engage in substantive conversation with either Chris or the other children. However, this does not detract from the issue that in this model of small group activities, the teachers are continually compromised in any circumstances where children require more than a small amount of attention.

Being on task is an indication of student engagement and is one of the 20 productive pedagogies that the teachers were required to use as part of the school renewal process (Appendix A). Alvermann and Marshal's (2008) comments about engagement and literacy teaching and learning in the middle years are through provoking. They say that it is the "*level* of student engagement (including its sustainability over time)" that is the "mediating factor…through which instruction influences student outcomes" (p. 104). All students deserve learning opportunities that are interesting and varied, and which produce sustained engagement. Chris was off task twice when he wandered away from the computer. However, despite being mostly on task and engaged, his progress toward completing the set task produced efforts that were fruitless for 23 of the 30 minute session. Much of Chris' time was spent walking to and from his desk and asking for assistance from the teacher. He had doubts about his ability to complete the task as just after line 4 he made the comment: "I can't do this". However, at this stage he had not read the instruction sheet and Nicole sent him to find it. As the transcript progressed it seemed as though Chris was becoming frustrated, indicated by his constant requests to Nicole for help and his comment about the difficulty of the task toward the end of the transcript (just after line 27). In the end, although Chris was able to complete most of the task, there was no evidence that he had acquired knowledge associated with the task such as developing an understanding of how quilt patterns work. He did manage to understand the problematic aspect of the *Kidpix*® program and the instruction sheet well enough to complete the missing parts of the grid lines, which may well be a technical computer skill as opposed to a conceptual understanding of the intricacy of quilt patterns and how to make them. In this example, the finished electronic product is not necessarily an indication of an understanding of the process, or of the concept of designing a quilt pattern and making a quilt.

Conclusions: Implications for engagement

At the level of classroom interaction, using IRF as opposed to IRE sequences marks the difference between cultural reproduction and the potential to realise school renewal goals. At Linvale, school renewal goals included a focus on multiliteracies and communications media but what happened in classroom interaction with the quilt pattern making task was more akin to cultural reproduction than renewal. Chris and the other children stood to benefit significantly if discussion had been included in the IRF sequence (IRDF), as discussion has been shown to produce constructive learning outcomes for young children working with computers in small groups (Wegerif & Dawes, 2004). An upshot of adding discussion to the IRF sequence is that children need to be taught how to do this as they cannot be expected to know intuitively how to accomplish it. It may well be the lynchpin that makes the difference between cultural reproduction and potential for cultural renewal, and therefore the ability to learn to deal effectively with future problems.

There is no evidence from the data presented here to support ideas that children adapt easily and effortlessly to new technologies (Selwyn, 2001) and that children know intuitively how to use computers (Plowman & Stephen, 2005). These data do confirm that on this occasion in this classroom during small group activities, there was a lack of planned and focused interaction from the teacher as evidenced by the use of the instruction sheet and the class rule that children ask peer experts for assistance. Reliance on peers could have been more successful if the children had been taught how to use discussion as part of the IR(D)F sequence. Discussion introduces possibilities for learning dialogues, where questioning, challenging and extending ideas with peers and teachers are the focus (Wegerif & Dawes, 2004). Establishing such sustained dialogue in a social context increases the potential for higher order thinking and critical analysis, and therefore the likelihood that deep understanding of concepts will occur. However, as Fox et al. (2000) have pointed out, what matters most when children are using computers is the involvement of teachers.

Consistent with the findings of Lou et al. (2001), Chris interacted more with the computer program (approximately 20 minutes) than he did with the teacher and peers (about ten minutes) and required significantly more help from the teacher, receiving more than double the amount of teacher time than any of the other children over the five weeks. However, unlike Lou et al., on this occasion, Chris did not finish the task faster than those working in pairs, nor did he have a succession of positive interactions with Nicole and peers. In fact his interactions with Nicole and peers produced an ongoing degree of frustration that started early in the session with Chris indicating that he couldn't do the task. Because of the

number of times he sought help from the teacher, his behavior suggests attention seeking and perhaps even wanting the teacher to do the task for him. There is support for this idea because Chris rejected the information provided by Stella (prior to line 18), preferring instead to tell her to get the teacher. Had he listened to her, he may well have solved the problem. The strategies Chris used for attempting to complete the task consisted of seeking help from the teacher and peers, reading the instruction sheet, and trial and error attempts when assistance from the teacher, peers and the instruction sheet did not produce the desired result. His enduring attempts can be likened to a discovery mode of learning, but one that was frustrating, inefficient and unproductive.

The classroom organizational strategy of small group activities restricted the teacher's availability to children who were not in her small group, and impeded her attempts to provide the assistance when needed. The teacher was unable to spend time with the children to engage in sustained dialogue even though substantive conversation was one of the productive pedagogies and integral to the school renewal approach. It was also one of Nicole's favourite teaching approaches: "And I really love substantive conversation" (Interview; 25 June, 2004). However, it was difficult to identify examples of Nicole engaging in substantive conversation with the children while they were engaged in computer based activities. Further, opportunities for Nicole to engage in substantive conversation *unencumbered* by pressure to return to her small group provide potential for teacher recognition of, and appropriate responses to critical moments that occur as part of the conversation. In other words, some rethinking of the expectation for children to work without teacher assistance while engaged in computer tasks may be necessary. This is especially so when the importance of critical moments (Myhill et al., 2006), the involvement of teachers (Fox et al., 2000), including opportunities for discussion (Wegerif & Dawes, 2004), and just in time delivery and just in time learning are considered.

This snapshot of 30 minutes of classroom life is instructive when seen in the context of the rest of the school day and in the long term totality of the school year. Similar scenarios may have been repeated in previous and subsequent small group activities. The other four weeks of small group activities documented as part of this research showed even less interaction by the teacher than the instance considered here in relation to Chris (see Tale 1). In the complexity of daily classroom life, tried, tested and enduring teaching approaches need critical analysis not only because of the requirement for children to engage competently with new technologies, but also to ensure that time is used productively and learning outcomes are enhanced through the use of technologies such as computers. The level of student

engagement, including sustainability over time, is the mediating factor through which instruction influences student outcomes (Alvermann & Marshal, 2008). In this case, the level of student engagement was determined by teacher-child interaction and in particular, the type and timing of feedback provided by the teacher; the task, peers, and the way the small groups were organized.

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Child/Pair	Date (2004)	Teacher interaction	Peer assistance	Total assistance	Total time of session
Chris	3 March	4:58*	5:28	10:12	29:53
Teacher Nicole interacted with Chris for nearly five minutes, as per the transcript excerpt below (4:58).					
Andy Jill	10 March	0:10	4:23	4:33	18:30
Teacher Nicole gave Andy and Jill the instruction sheet and said: "There's your instructions". (10 seconds)					
Stella Keenan	17 March	0:10	3:00	3:10	25:20
Teacher Nicole walked to Steven and Keenan and said: "You don't need sound guys", and walked away (10 seconds).					
Kyle	24 March	2:07	0:15	2:22	22:39
Teacher Nicole showed Kyle a short cut for creating the grid and explained to Kyle how to stamp his name (2:07).					
Jason	31 March	0:10	8:00	8:10	23:48
Teacher Nicole walked to Jason and said: "Jason, your sheet is on the floor down here, I don't know why you're touching your brother's quilt programs?" (10 seconds).					
* Time in minutes and seconds					

Table 1: Five examples of teacher/child interaction and peer assistance

APPENDIX A

Productive pedagogies

Strategy	Focus Questions
Higher-order thinking	Are higher order thinking and critical analysis occurring?
Deep knowledge	Does the lesson cover operational fields in any depth, detail of level of specificity?
Deep understanding	Do the work and response of the students provide evidence of depth of understanding of concepts or ideas?
Substantive conversation	Does classroom talk break out of the initiation/response/evaluation pattern and lead to sustained dialogue between students, between teachers and students?
Knowledge problematic	Are students critiquing and second-guessing texts, ideas and knowledge?
Metalanguage	Are aspects of language, grammar, and technical vocabulary being foregrounded?
Knowledge integration	Does the lesson range cross diverse fields, disciplines and paradigms?
Background knowledge	Is there an attempt to connect with students' background knowledge?
Connectedness to the world	Do the lesson and the assigned work have any resemblance or connection to real-life contexts?
Problem-based curriculum	Is there a focus on identifying and solving intellectual and/or real-world problems?
Student control	Do students have any say in the pace, direction or outcomes of the lesson?
Social support	Is the classroom a socially supportive and positive environment?
Engagement	Are students engaged and on task?
Explicit criteria	Are the criteria for judging student performance made explicit?
Cultural knowledges	Are diverse cultural knowledges brought into play?
Inclusivity	Are deliberate attempts made to increase the participation of students of different backgrounds?
Narrative	Is the style of teaching principally narrative, or is it expository?
Group identity	Does the teaching build a sense of community and identity?
Citizenship	Are attempts made to foster active citizenship?

Source: New Basics: Theory into practice (Education Queensland, 2000a, p. 5)