Children's discourse and software use in a Western Cape Primary School

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COMPULSORY DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

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ABSTRACT

This study aims to contribute to a broader understanding of how learning takes place in under-resourced South African schools where networked computer labs have recently been made available for the first time. In this context, it is tempting but ultimately counter-productive to believe that computers can allow a rapid form of social redress for educational inequalities.

Children's discourse and software use were studied during computer lab sessions in a primary school in Athlone, South Africa. Conversation analysis and multimodal discourse analysis are used to study variations in children's discourse as they used email, a search engine and numeracy software . The children's limited range of discursive roles suggest a 'schooled' use of the software, since most of their activities are framed within the Initiation, Response, Feedback (IRF) pattern dominant in 'conventional' classroom discourse. Observations suggest that software is used in socially situated ways, thus challenging assumptions about the 'digital divide' and the determining power of technology. Software use is nonetheless associated with variations in discourse, marked by different configurations of an IRF discourse structure. Computer labs are unconventional classrooms, but not necessarily in ways that fulfill the radical claims of those who imagine that computers are a straightforward channel that allows children direct access to 'content' or 'the curriculum'. Consequently, 'ordinary' software applications such as search engines, browsers and email acquire different meanings in this context of use, marked by the power differentials implicit in South African educational practices, resourcing, and local classroom discourse.

Transcribed video recordings of children's interactions in the computer lab allow a nuanced analysis of the nature of the work of schooling and learning in this context. These recordings reveal social negotiation, institutional and other power relations, and a marked scarcity of resources for communication via this channel. The observations suggest that teachers and children engage in complex discursive interactions around school, learning, and play as they use computers. Power relations established through these discourses are significant features of the children's experiences.

Notions of 'access' are central to discussions of social equity and ICTs. This study reformulates 'access' to draw attention to the importance of children's limited access to certain discursive roles, and to the complex patterns of conflict and collaboration in the use of semiotic and other communicative resources in the computer lab. This study argues that the 'rules' of particular genres curtail children's access to particular discursive roles. The institutional 'rules' of classroom discourse play a central role, as do the algorithmic rules of the software. The analysis presented in the study will help teachers to understand the linguistic and semiotic processes central to children's learning in such environments. Workplace and consumer applications take on a particular discursive character in classroom use. The communicative possibilities of these applications are limited unless the children are initiated into the social groupings and discursive practices associated with their use. Although children often display creativity in exploiting the affordances of different types of software, there is an additional tension between the discourses they are assumed to be accessing (such as knowledge as inquiry or mathematical register) and the interplay of discourses suggested by the children's actual software use.

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Chapter 1: Introduction

This study investigates children's discourse and software use during computer lab sessions in a primary school in Athlone, South Africa. The term *discourse* is used to describe 'communication that is socially situated and that sustains social "positioning"' (Hicks, 1996:49) through the relations between participants in interaction. How children are positioned by their teachers and peers in classroom discourse as well as by different types of software affects their software use and thereby, their discursive engagement with these new resources. Contrary to normative assumptions about software use which imply that children use software in predetermined and universal ways, children in under-resourced South African schools with little initiation into the discursive practices associated with the use of different kinds of software make use of these resources in locally situated ways. Although children's software use can be described as situated, the findings in this study suggest a more nuanced perspective: software is used in locally situated ways, but the 'situatedness' comes about through a reshaping of or a conformance to the rules of engagement in classroom discourse as well as various configurations of resources and roles which constitute different patterns of interaction. This thesis addresses the following question: "What configurations of resources and roles can be identified when children use different kinds of software in the school's computer lab?"

This study suggests that children's discourse and software use can be characterized by different configurations of the IRF (Initiation, Response, Feedback) structure which is dominant in 'conventional' classrooms where the teacher is in front of the class doing the 'teaching'. The IRF is a form of institutional discourse. Sinclair and Coulthard (1975) argue that the basic exchange structure of classroom discourse has the following form: Initiation (by the teacher), Response (by the pupil) and Feedback (by the teacher). The IRF is considered to be a formula for the patterns of interaction in classrooms where the teacher occupies a predefined teacher space in front of the class. By contrast, the computer lab combined with the software and the absence of a predefined teacher

space (since the teacher walks around the lab rather than staying in one space) suggests that the computer lab is an 'unconventional' classroom. This study poses the question of what this new space does to social power in classroom discourse. The findings suggest that although the IRF may be considered as too formulaic in classrooms without a predefined teacher space, the power of that structure is still apparent. How the teacher frames the activities in the lab and how the software is set up to support that (such as drill-and-practice software which simulates classroom discourse) suggests that classroom discourse (considered as being defined by its IRF structure) is pervasive in this new space. The classroom discourse in the computer lab suggests that teachers fit this familiar structure onto a different educational space with its new affordances: software not designed for classroom use (such as search engines and email) gets reshaped in this educational context.

This study argues that patterns of interaction in the computer lab can also be described in terms of a configuration of resources and roles, which entails asking the question of who is allowed to do what. For example, when children use Google the teacher initiates the topic (for example, finding 'facts' about the Southern Cross) and the children copy the teacher's words on the board into the search engine's query field, followed by writing down 'facts' in their workbooks. Therefore, the children respond to their teacher's request for 'facts' about a topic by copying down information. This may be regarded as 'reproductive writing' (Kress, 1982:20). Kress argues that the use of writing is unevenly distributed in society and that much of the writing that children do at school is 'highly routinized' (1982:9). The teacher's directions ('find the facts') not only shape the writing that the children do, but also how they use the search engine and engage with information. The children use the affordances of the search engine's 'smooth question-and-answer exchange' (Walton, 2008); its simulated dialogue; to get 'facts'. Therefore, the children's roles as respondents, coupled with the search engine's simulated dialogue which assists them to find 'facts', allows the children's discourse and use of the search engine to take a particular form. This study finds that the children's discourse and software use suggest that different kinds of software involve different patterns of interaction through complex configurations of resources and roles.

This study is part of a broader research project entitled 'Children's and young people's engagement with digital literacies in marginal contexts' (Walton, 2007a). The project seeks to explain the 'situated responses to the digital literacies of electronic communication in marginal school settings' (Prinsloo & Walton, 2008:1). Prinsloo and Walton argue that 'computerized and networked media resources operate in these settings in specific ways that are sometimes ignored in the discussion of "digital divides" and calls for the expansion of physical access' (2008:1). Similarly, I propose an extension of Warschauer's definition of *access* to include discourse(s): the physical resourcing of schools through the provision of computers and software needs to be accompanied by a range of discursive practices in order for software use to have potential educational benefits. This involves rethinking the power relations and rules of engagement in classroom discourse and how they can be challenged to improve children's learning through 'access' to discourses. The rules of engagement which accompany the IRF, which places children in the role of respondents, can be limiting children's 'access' which is reformulated in this study to include discursive roles and 'access' through apprenticeship to discourses outside the classroom. If most of the children's interactions are defined by answering questions or finding 'facts' through the routines of classroom discourse, it is unlikely that they will be apprenticed into different discursive roles associated with discourses such as 'being' a scientist or a mathematician and the discourses which accompany these positions.

This study also makes a contribution to understanding multimodal discourse by suggesting that researchers in the field of multimodality could consider the influence of power in discourse in more detail. Conversation analysis and multimodality can be married in interesting ways to help explain how classroom discourse impacts on learning as sign-making. Conversation analysis draws attention to the institutional character of discourse and the power relations made salient in interaction (as a spoken phenomenon), whereas multimodality highlights the multimodal nature of discourse. The two approaches can be drawn together to complement one another. In the following sections I will discuss children's access to resources in South African education and introduce Mountainside Primary, the school where this study was conducted.

Children's access to resources in South African education

The discourse of redressing past inequalities figures prominently in post-apartheid South African education as an attempt to reverse 'more than a century of race-based educational practice' (Samuel, 1993:11). Prior to democracy, children were 'victims of Bantu Education, a racially segregated, unequal system of education enforced during the apartheid years, in which African children were trained to fulfil the white minority's need for certain forms of labour' (Stein, 2008:39). Reinforcing oppression, 'curricula and pedagogies were implemented which constructed students as passive, rote learners, authority dependent, uncritical and obediently subservient to white rule' (Stein, 2008:39).

The post-apartheid vision of educational reconstruction in South Africa also encompasses 'redress in the quantitative sense, making up for past neglect or deprivation' by providing 'access and educational mobility for those who have been marooned by past exclusion or poverty' (Samuel, 1993:12). From this perspective, literacy guarantees access to education and economic empowerment. However, Stein argues that there is a tension between 'children's creativity and capacity for meaning-making which builds on their everyday worlds, and the limits, denials and silences imposed on these capacities in classroom spaces' and that 'this is especially the case for poor children who live on the margins of this society and who do not have access to the cultural capital and networking strategies of the privileged classes' (2008:10). One may argue that class-based inequalities present a new 'apartheid'.

Stein argues that in post-apartheid South Africa, 'children under 18 years constitute almost half (44 per cent) of the population' (2008:41) and that 'more than half of South Africa's children live in extreme poverty, in homes which are too poor to buy basic necessities and where the average household income is R800 or less' (Morson et al., 2006 cited in Stein, 2008:41). Thus, the majority of South Africa's children live in households where 'they do not get enough food, social conditions are unhealthy and education is often absent or below standard' (Stein, 2008:41). Leatt (2006 cited in Stein,

2008:41) attributes such high levels of child poverty to the country's apartheid legacy, the high levels of unemployment in the country, and the fact that poor communities and households are the most seriously affected by the HIV/AIDS pandemic.

In this context of deprivation, the Western Cape is one of the 'richer' provinces in South Africa, where better resourcing leads to a higher matriculation pass rate. In a report presented to the Education Labour Relations Council, it is claimed that the Western Cape[1] is a 'richer' province whose resourcing is reflected by a high matriculation pass rate[2] (Phurutse, 2005). Compared with the rest of South Africa, education facilities in the Western Cape Province are of a relatively high standard although, by the global standards of developed countries, the education is characterised by high pupil-teacher ratios and overcrowded schools. The Western Cape Education Department's (WCED) annual report for 2006/2007 states that it has 'increased the total number of teaching posts by 747, from 30,872 in 2007 to 31,619 in 2008' and the planned increase in the number of Foundation phase teachers should 'reduce class sizes in Grades 1 to 3 – from a learner:teacher ratio of 39:1 to 37,5:1'. Large classes are seen as the norm in South African public schools[3]. Therefore, teachers and even space may be considered as 'scarce resources'. Public hearings by the Human Rights Commission into violence in Western Cape schools acknowledged the extent to which inadequate resourcing of schools can affect children's educational experiences in the province. 'Overcrowding in classrooms causes competition among children for physical space and resources' and 'such a dynamic may exacerbate or even create hostility among learners' (SAHRC

[1] The Western Cape Province has the highest adult literacy rate in South Africa (95%), with Gauteng being the next highest at 93%. This figure is derived from the Central Statistical Services (CSS) and based on education levels beyond standard 2 for persons 15 years and older (CSS, 1996). Approximately 60% of the adult population in the Cape Metropolitan Area (CMA) has achieved an education level above Std. 6 (Provincial Development Council, 1996). (Cape Metropolitan Area State of the Environment Report, 2004)

[2] Compared with the other provinces, the Western Cape Province had the highest pass rate, as well as the highest proportion of candidates who passed with university exemption. (Cape Metropolitan Area State of the Environment Report, 2004)

[3] 'The overall average pupil:teacher ratio for the CMA (Cape Metropolitan Area) was 29:1. All of these are below the national targets, 40:1 for primary school and 35:1 for secondary school set up in 1996. In 1997, these national target ratios were abolished by the National Department of Education' (Cape Metropolitan Area State of the Environment Report, 2004)

2006, p.33). As a result of overcrowded classrooms, children often receive little personal attention from their teachers.

The province has a history where only 'white' or 'model C' schools made much provision of Information and Communications Technology (ICTs). Thus, computers figure prominently as part of a redress to educational inequalities. Since 2001, school connectivity projects in the province have been providing 'poor' schools with ICTs. Louw *et al*. argue that 'to qualify for inclusion in the project, schools had to be ''poor'', according to the WCED poverty index of schools, and reasonably well-managed, again according to the Department's ''management index'' of schools' (2008:42). Once a school qualified, 'a secure room (''the computer laboratory'') had to be found that was able to house approximately 40 computers per school, again meeting certain minimum criteria' and 'in some schools, computers were installed in the classrooms' (Louw *et al*., 2008:41).

The MEC for Education in the Western Cape, Cameron Dugmore, provided a summary of delivery to date in his 2008 budget speech in which he asserted that 'there are 681 new computer labs (2004 to present) impacting on 399 343 learners' and that the regional connectivity project 'outlay from 2004 to 2007 was R230 189 million'. The government is not the only financial contributor to the project, as much of the funding comes from donor partners. A recent press release stated that schools affiliated with the connectivity project now have a total of 32 011 computers of which the project or donor partners have funded 19 259, while schools have procured 12 752 themselves (Khanya Project, 2008). Additionally, it is claimed that the project has ensured that 19 750 teachers can use technology optimally for teaching and that a total of 663 852 learners are currently benefiting from the project. This ICTs delivery and training project in the province was originally launched in 2001 to look at ways to complement teaching, given the shortage of teachers in Western Cape schools.

Public schools in the Western Cape have more physical resources such as computers and teachers than most public schools in other provinces in South Africa.

In a report presented to the Education Labour Relations Council, Phurutse (2005) noted striking differences between and within provinces (according to annual school fees, class size, formal contact hours and the performance of learners in matric) in his discussion of factors affecting teaching and learning in South African public schools. Additionally, 'these typical characteristics of public schools in South Africa give credence to the thesis of President Thabo Mbeki who, borrowing from the work of Langston Hughes, has observed that South Africa is made up of two nations – one that is rich, predominantly middle class and urban-based and one that is poor and rural based' (Phurutse, 2005). According to Phurutse (2005), the picture that emerges indicates serious challenges to equal access to educational opportunities and learning.

Phurutse (2005) draws on the work of Bernstein who notes that access to resources affects access to knowledge: 'the maldistribution of resources, certainly outside the school and often within it, affects access to and acquisition of school knowledge' (1996:8 cited in Phurutse, 2005). Phurutse asserts that 'the challenge is to ensure that learners in the deprived inner areas of the cities and remote rural areas have the same access to the acquisition of knowledge' and that 'to eradicate inequalities within the education sector, attention needs to be paid to the distribution of resources, because skewed distribution of resources results in skewed access to knowledge acquisition' (2005). However, Phurutse argues that while resources are critical for teaching and learning (and obviously the resource base of schools in poor provinces should be expanded and increased), the quality of instruction 'does not inhere in teachers' formal qualification or the caliber of materials, but in how the knowledge and skill is deployed to frame tasks and use of instructional resources' (Cohen et al., 2003:16 cited in Phurutse, 2005). Thus, Phurutse suggests that the distribution of and access to resources involves more than the presence of physical resources: the deployment of these resources is equally important.

Mountainside[4] Primary

This study is located in a broader context where a large majority of South African children had no access to computers at school until very recently (Walton, 2007). Mountainside Primary is categorized as a 'poor' school according to the WCED poverty index of schools. It qualified for inclusion in a schools connectivity project based on this index as well as meeting the criteria of a reasonably well-managed school 'according to the Department's ''management index'' of schools' (Louw *et al.*, 2008:42). It is important to note that this school is not representative of all schools in South Africa, nor in the Western Cape. It is quite an exceptional school because it is one of the school connectivity project's pilot schools and those who manage the project consider Mountainside Primary as a benchmark of success with regards to the integration of ICTs into the national curriculum.

The school is situated in Athlone, a part of Cape Town, in the Western Cape. There are 632 children in the school and 18 teachers. Class sizes vary from 27-30 children in the reception Grade (Grade R), up to 43 children per class in the higher Grades. Most classes have over 30 children and the largest class has 43 children. The deputy principal at the school reported that 60 to 65 percent of the children's parents pay school fees. This suggests that many of the children come from poor homes, as their parents are unable to afford school fees.

The school does not have a school hall, library or a sports field. However, the school has access to a range of ICT resources: in addition to the computer laboratory with twenty-four student computers (with two pairs of headphones at each computer) and a teachers' terminal, the school also has a sound laboratory and four interactive whiteboards which are not located in the lab. Facilitators from the schools connectivity project visited the school regularly and in the early stages of the ICT integration, provided the teachers with ICT training – perhaps even more so than in other schools

[4] The name of the school has been changed to ensure anonymity.

since Mountainside Primary was one of their pilot schools. When I first became acquainted with the school during the start of 2007, the principal reported that all the teachers were comfortable teaching with ICTs, as ICTs had been running in the school for the past two years. Although Mountainside Primary's computer lab is nearly three years old, the school made use of a classroom (which has now been converted into a sound lab) with a few computers in it for teacher training for a long time before and while the computer lab was built. Thus, the teachers had access to ICTs prior to the installation of the computer lab, whereas the children did not.

The lessons reported on took place in Mountainside Primary's computer laboratory. The computer lab is fully-functional: the majority of the computers are always in working order and time-tabled lessons ensure that all classes and grades receive equal opportunities to make use of the computers. According to the time-table, each class receives 90 minutes (1½ hours) of lab time per week. The children work at the computers in pairs and they often use more that one type of software during a single lab session (see Chapter Three). The majority of the lessons are spent completing drill-and-practice numeracy and literacy exercises. The situation in the computer lab and the children's software use is discussed in greater detail in Chapters Three to Six. Chapters Four to Six report on observations of children's use of different kinds of software.

Chapter Four discusses children's use of Cami Maths, a drill-and-practice program, and considers children's meaning-making practices when using the software and its relationship to classroom discourse. This study argues that this type of software is the most restrictive, as an IRF discourse structure is encoded in the software and the interface affords teacher surveillance. The children value 'correctness': achieving a high score is seen as a priority and the children often work against one another in order to attain it. Additionally, they cue into the evaluative nature of the software and use it to construct identities for themselves and their peers as learners.

Chapter Five reports on two lab sessions where the children used Google. During the first lesson discussed, the teacher initiated the search by telling the children to find ten

'facts' about the Southern Cross and to write them in their workbooks. The children try to bypass the difficult language of the websites by using different shortcuts. They write down visually foregrounded information instead of engaging with the meaning of the texts that they find. The second lesson differs from the first, as the children use Google to answer questions about medical pioneers. The worksheet functions as a scaffolding agent. The chapter discusses how the children transform the questions into search queries and the complex strategies that they use to select information. A particular form of classroom discourse is instantiated during the Google sessions which influences the children's orientation towards information.

Chapter Six discusses children's emailing practices during different activities: emailing the teacher, creating and emailing an attachment, responding to a relative via email and sending messages to peers in the class. Emailing takes place on the fringes of classroom activity. This study finds that the children use email in many different ways compared to drill-and-practice software and a search engine. The children also engage in productive writing. Emailing is not framed as 'school work' or assessed and is therefore largely outside of the IRF discourse structure. The children's discourse and email use suggests the presence of a residual space where they can exercise their communicative rights.

Conclusion

This chapter has introduced the study and contextualized Mountainside Primary through a discussion of children's access to resources in South African education. The following chapter suggests rethinking physical 'access' and extending the notion of 'access' in education to include discourses which children need to acquire for learning. The chapter discusses the importance of accessing discourses through apprenticeship. Classroom discourse is discussed in relation to children's unequal communicative rights and writing rights and the importance of accounting for power in discourse is highlighted. The chapter suggests that researchers in multimodality need to account for classroom discourse and how it forms part of children's meaning-making practices at school.

Chapter 2: Discourse and Learning

Defining discourse

'Discourse' is a key concept in this study and necessitates taking a specific theoretical position. Hicks argues that 'many educators who explore relations between classroom communication and children's learning draw upon a model of language as a cognitive resource' (1996:52). Similarly, Lemke argues that most theories of discourse are not social theories: most theories of discourse are 'mainly linguistic and psychological, paying relatively little attention to the question of who says what when, why and with what effects' (1995:21). According to Lemke, the social context of discourse and issues of discourse as social action are largely ignored: instead discourse is mostly seen as 'the product of autonomous mental processes, or it is simply described as having particular linguistic features' (1995:21). Lemke asserts that we need a social theory of discourse in order to understand 'how the discourse of every moment shapes the changing resources and patterns characteristic of a community' (1995:19). Halliday's conception of language as social semiotic enshrines a social theory of discourse: 'language does not consist of sentences; it consists of text, or discourse – the exchange of meanings in interpersonal contexts of one kind or another' (1978:2).

Hicks argues that the use of the term *discourse* implies 'a decision about how classroom communication is to be theoretically positioned in research on teaching and learning' (1996:51). According to Hicks, *discourse* 'implies a dialectic of both linguistic form and social communicative practices' and she argues that 'one can talk of discourse in terms of oral and written texts that can be examined after the fact and socially situated practices that are constructed in moment-to-moment interaction' (1996:51). Therefore, discourse includes both textual products (both oral and written) and constitutive discursive practices' (Hicks, 1996:52). For example, discourse includes the emails that children write (texts) and emailing as a discursive practice which involves the children's awareness of the social action involved in writing to a particular audience

– whether it is a teacher, an aunt or his or her classmates. According to Hicks, 'this duality of discourse has been manifested in research on both the social interactional processes constituted by discourse and the discourse organization or thematic content of texts produced from those interactions' (1996:53).

Gee makes a similar distinction between discourse as textual products and practices when he differentiates between *discourse* as 'connected stretches of language that make sense, like conversations, stories, reports' and *Discourse* which involves 'more than just language' (1990:142). Gee asserts that to appreciate language in its social context, we need to focus on 'Discourses' as combinations of 'sayings-doings-thinkings-feelings-valuings' (1990:xv). Gee argues that 'a Discourse is a socially accepted association among ways of using language, of thinking, feeling, believing, valuing, and of acting that can be used to identify oneself as a member of a socially meaningful group or "social network", or to signal (that one is playing) a socially meaningful "role"' (1990:143). According to Gee, 'discourses are ways of being in the world' and 'a discourse is a sort of "identity kit" which comes complete with the appropriate costume and instructions on how to act, talk, and often write, so as to take on a particular social role that others will recognize' (1990:142).

Gee argues that 'Discourses are mastered through acquisition, not learning' because 'Discourses are not mastered by overt instruction, but by enculturation ("apprenticeship") into social practices through scaffolded and supported interaction with people who have already mastered the Discourse' (1990:146-147). Gee asserts that this is how we acquired our home-based Discourse and how we acquire additional or secondary Discourses. He notes that "if you have no access to the social practice, you don't get in the Discourse, you don't have it" (1990:147). According to Gee, 'a person's primary Discourse serves as a "framework" or "base" for their acquisition and learning of other Discourses" and 'beyond the primary Discourse, there are other Discourses which crucially involve social institutions beyond the family (or the primary socialization group as defined by the culture), no matter how much they also involve the family' (1990:151). Gee argues that 'Discourses beyond the primary Discourse are developed in

association with, and by having access to and practice with (apprenticeships in), these secondary institutions' (1990:151). Gee asserts that the key point about secondary Discourses 'is that they involve, by definition, interaction with people with whom one is either not "intimate" (with whom one cannot assume lots of shared knowledge and experience) or they involve interactions where one is "formal", that is, taking on an identity that transcends the family or primary socializing group and relates one to the wider spheres of the cultural (or sub-cultural) group as a whole – its tradition, or the institutions by which it either perpetuates itself or relates itself to outside groups' (1990:152).

According to Gee, 'it is in school that each of us is socialized into practices which go beyond the home and peer group and initiate us into the "public sphere", at least in much of the Western world' (1990:46). Schooling involves more than becoming literate in the traditional sense because 'a student is involved in learning a set of complex role relationships, general cognitive techniques, ways of approaching problems, different genres of talk and interaction, and an intricate set of values concerned with communication, interaction, and society as a whole'(Gee, 1990:57). Children engage in school-based secondary Discourses, and learning the role relationships of classroom discourse is only one of these.

Hicks argues that 'classroom discourses are not "givens" but, rather, social constructions' and that classroom contexts 'can be examined in terms of how they are constituted by discourse and joint action' (2008:52). Hicks argues that the following comments by Erickson and Shultz (1981) about the meaning of context could be equally true of discourse:

> Contexts can be thought of as not simply given in the physical setting – kitchen, living room, sidewalk in front of drug store – nor in combinations of persons (two brothers, husband and wife, firemen). Rather, contexts are constituted by what people are doing and where and when they are doing it. As McDermott (1976) puts it succinctly, people in interaction become environments for each other. Ultimately, social contexts consist of mutually shared and ratified definitions of situations and in the social actions persons take on the basis of these definitions (Mehan et al., 1976). (Erickson and Shultz,1981:148, cited in Hicks, 1996:53)

The term *discourse* is used to describe 'communication that is socially situated and that sustains social "positioning"' (Hicks, 1996:49) through the relations between participants in interaction. Social positioning by people in interaction allows them to 'become environments for each other' (Erickson and Shultz,1981:148, cited in Hicks, 1996:53). In classroom contexts, teachers and students play an important role in constituting this context through the interplay of discourses and joint action. Teachers and children mutually ratify the classroom situation and what social actions are allowed through an understanding of the role relationships in classroom discourse. Similarly, software simulates dialogue by encouraging the children to take up certain roles in a coded interaction, particularly drill-and-practice software which simulates classroom discourse (Walton, 2007).

Additionally, discourses 'can never be "neutral" or value free; discourses always reflect ideologies, systems of values, beliefs, and social practices' (Hicks, 1996:53). Discourses also reflect power relations between participants in interaction. Gee asserts that discourses are 'identity tool kits replete with socially shared ways of acting, talking, and believing' and he uses 'the term *Discourse* (as opposed to its lowercase variant) to describe the "tool kit" that participants in a community share' (cited in Hicks, 1996:53). Hicks argues that Gee and other social theorists also point out that 'social actors can participate in multiple Discourses, some of which may be conflicting identities for them' (1996:53). Hicks asserts that 'viewing discourses as value-laden ideological systems has become a major theme within the field of research on discourse and classroom learning': learning to *talk mathematics* for example, 'involves more than just learning a set of linguistic forms; it also involves learning values and beliefs' (1996:54). Yet, while being apprenticed into secondary Discourses at school, children are also being initiated into role relationships implicit in classroom discourse and the power relations involved. I will not differentiate between *discourse* and *Discourse* in this study

Classroom discourse

According to Mercer and Wegerif, 'the teacher-student relationship is, by definition, asymmetrical' (1999:89) and research has shown that teachers' questions commonly constrain pupils' contributions and discourage extended responses. Barnes argues that 'the very presence of a teacher alters the way in which pupils use language, so that they are more likely to be aiming at "answers" which will gain approval than using language to reshape knowledge' (Barnes, 1976:78 cited in Mercer and Wegerif, 1999:89).

Similarly, Fisher argues that teacher-pupil discourse has the following distinguishing features:

> Teachers ask a lot of questions; they often initiate discourse topics and they attempt to control the content of classwork by a variety of discourse strategies such as feedback (Sinclair & Coulthard, 1975) and through elicits, reformulations, reconstructions and selected emphasis through repetition (Edwards & Mercer, 1987). We also know from this and other research that the pupil's role in these discourse processes is often one of mere respondent, where the skill of the exercise tends to be more related to 'finding out what the teacher wants to hear' than to any pursuit of understanding. This is not to say that pupils never take the leading or even an equal role in talking with their teachers; but merely to emphasise that the necessarily asymmetric relationship between them means that, when seeking out or formulating new ideas, there is a tendency for pupils (and perhaps teachers too) to see the teacher's ideas as the ones which should be accepted. (1997a:22)

Fisher argues that institutional talk, such as talk in educational contexts, is 'constrained by the particular rules of talk in that setting' and teacher-pupil talk assumes that 'a particular professional of that institution will ask questions and that those questions will be answered within certain boundaries by the recipients' (1997b:39). According to Fisher, teachers have professionally identifiable strategies and usually ask questions to which they require a particular "right" answer. Successful respondents in classrooms are 'those who learn to play the relevant game and thus develop an appropriate "communicative competence"'(1997b:39).

Sinclair and Coulthard (1975) proposed that the basic exchange structure of classroom discourse had the following form: Initiation (by the teacher), Response (by the pupil) and Feedback (by the teacher). These discourse analysts used this pattern to describe interactions between teachers and pupils in classrooms. Wegerif argues that 'although Sinclair and Coulthard's IRF coding of classroom exchanges has been criticized as an analytic tool, it is generally accepted as a description of a structure fundamental to classroom discourse and is a structure which has been transferred to a great deal of computer-aided instruction' (1997:106). Drill-and-practice software simulates classroom discourse by initiating questions which require children to respond by typing in or selecting answers and the software provides feedback on 'correct' and 'incorrect' answers. Mercer and Wegerif argue that 'it is generally accepted that the IRF exchange is a fundamental feature of teacher-centred education, and one associated with teachers' power to direct, shape and control the learning of students' (1999:89). Therefore, software which encodes an IRF structure its set up to support the asymmetric power relations between teacher and students.

The notion of a *normal* classroom discourse appears to exert a strong influence on much research. Sinclair and Coulthard (1975) explained their choice of setting in the following terms:

> With…many…problems inherent in conversation we decided to begin again with a more simple type of spoken discourse, one which has much more overt structure, where one participant has acknowledged responsibility for the direction of the discourse, for deciding who shall speak when, and for introducing topics. We also wanted a situation where all participants were genuinely trying to communicate and where potentially ambiguous utterances were likely to have one accepted meaning. We found the kind of situation in the classroom. (Sinclair & Coulthard, 1975:6)

According to Edwards and Westgate, classrooms were chosen at the outset as being likely to give rise to tidier, more visible patterning and the researchers deliberately sought out a particular kind of classroom, where 'the teacher was at the front "teaching" and therefore likely to be exerting the maximum amount of control over the structure of the discourse' (Edwards & Westgate, 1987:139). Edwards and Westgate argue that

there is a danger that researchers may 'reinforce too narrow a view of normality if they avoid the more unconventional classrooms as being too difficult for their available methods of recording or analysis' (1987:139).

The IRF is considered to be a formula for the patterns of interaction in classrooms where the teacher occupies a predefined teacher space in front of the class. By contrast, the computer lab combined with the software and the absence of a predefined teacher space (since the teacher walks around the lab rather than staying in one space) suggests that the computer lab is an 'unconventional' classroom.

This study poses the question of what this new space does to social power in classroom discourse at Mountainside Primary. The findings suggest that although the IRF may be considered as too formulaic in classrooms without a predefined teacher space, the power of that structure is still apparent. The data for this study suggest that classroom discourse (as defined by its IRF structure) is still a powerful force in these new spaces. This is seen in the way in which teachers frame the activities in the lab and the choices that have been made in setting up the lab environment to support learning (such as the drill-and-practice software which simulates classroom discourse) . The classroom discourse recorded in the computer lab suggests that teachers fit their familiar activities onto a different educational space despite its new affordances: even software not designed for classroom use (such as search engines and email) gets reshaped in this educational context.

'Educational and educated discourse' or secondary Discourses?

Mercer argues that 'one of the most important goals of education is to help students acquire, recognize and develop specific ways of using language' (1995:79). According to Mercer, *discourse* is a useful concept that offers an inroad to understanding the special nature of classroom education: he defines *discourse* as 'language as it is used to carry out the social and intellectual life of a community' (1995:79) and argues that 'discourses are forms of language which are generated by the language practices of a

group of people with shared interests and purposes' (1995:81). Mercer argues that teachers in schools and other educational institutions use language in some typical and conventional ways as they go about their business: 'they involve students in Initiation-Response-Feedback (IRF) exchanges, they use the techniques of reformulation, repetition, cued elicitations and so on to try to guide the learning of their students' (1995:79-80). According to Mercer, this is the 'discourse of teaching-and-learning in classrooms, which can be called *educational discourse*' (1995:80). Gee's definition of Discourses as 'ways of being in the world' (1990:142) which involve combinations of 'sayings-doings-thinkings-feelings-valuings' (1990:xv) tied into a discursive knot may be regarded as much broader than Mercer's definition of discourse, as its concept of language as social action, identity and group membership goes beyond 'specific ways of using language' (Mercer, 1995:79).

Mercer argues that the important goal of education is not to get students to take part in the conventional exchanges of educational discourse (even if this is required of them on the way), but to get students to 'develop new ways of using language to think and communicate, "ways with words" which will enable tem to become active members of wider communities of *educated discourse*' (1995:80). Mercer argues that *educational* and *educated* discourse is not one and the same thing, but they are interwoven. He asserts that 'learners can only develop confidence in using new discourses by using them' (1995:81) and that 'while all students engage, as a matter of course, in *educational discourse*, they need opportunities to practise being users of *educated discourse*' (1995:81-82). Mercer argues that one of the problems with most teacher-led discussions in the classroom is that they only offer students the opportunity to make brief responses and therefore 'there is a mismatch between the educational discourse they are engaged in and the educated discourse they are meant to be entering' (1995:82).

Gee's notion of secondary Discourses does not make this distinction which entails a value judgment in classifying discourses as 'educated' or not. For Gee, education involves an interplay of secondary Discourses which are acquired through participation

(apprenticeship) and the mismatch or tension arises when school-based Discourses privilege those who have 'mastered them and do significant harm to others' by implying that children who fail in school 'mean less than other children' (1990:191). Gee argues that upper-class children do well at school because 'they have a school that has been set up both to meld its Discourse with the upper-class student's primary Discourse and to establish a school-based secondary Discourse (actually a set of them) which fits with the sorts of elite jobs these students will have' (1990:190) whereas minority or non-elite children's primary and peer-based Discourses are not only not complicit with the process of school-based Discourse, but 'actively opposed and resisted' (1990:190). This may suggest a problem inherent in township schools in South Africa: teachers struggle to make connections to elite secondary discourses to which they themselves often have little connection. Gee notes the relationship between social class and children's ability to access secondary Discourses at school and thereby pushes the notion of social power in discourse further than Mercer does: unequal power relations do not only exist between children and teachers in classroom discourse, but also between the kinds of Discourses students have acquired and the kinds that schools assume they have already acquired. As pointed out above, Gee argues that 'Discourses are mastered through acquisition, not learning'. Teachers who have mastered school-based secondary Discourses need to scaffold them for minority or non-elite children so that these children may become apprenticed into the social practices associated with these Discourses.

Mercer also acknowledges the importance of supported interaction when he asserts that teachers can scaffold students' participation in educated discourse, arguing that it is crucial that the language practices of the classroom (educational discourse) scaffold students' entry into educated discourse. Mercer suggests that an important characteristic of educated discourse is that 'speakers must make their ideas *accountable* to specified bodies of knowledge and do so by following "ground rules" which are different from those of most casual, everyday conversations' (1995:82). Mercer argues that 'we can think of each teacher as a *discourse guide* and each classroom as a *discourse village*, a small language outpost from which roads lead to

larger communities of educated discourse' (1995:83). Mercer explains the role of the teacher as a discourse guide in the following way:

> Teachers are expected to help their students develop ways of talking, writing and thinking which will enable them to travel on wider intellectual journeys, understanding and being understood by other members of wider communities of educational discourse: but the teachers have to start from where the learners are, to use what they already know, and help them go back and forth across the bridge from "everyday discourse" into "educated discourse". (1995:83-84)

Mercer argues that the concept of *scaffolding* is useful for describing 'how one person can become actively involved in another's learning activity, in such a way that the learner has an active role and yet is able to progress further and more easily than they could have done alone' (1995:84-85). He cautions that the use of the concept must take into account the nature of formal education where teachers are professionally responsible for teaching a curriculum which does 'not simply consist of subject knowledge of a factual kind, but embodies ways of using language – discourses – which students need to be enabled to understand and to use if they are to become educated' (1995:85). However, one may argue that teachers also have 'a moral obligation to reflect on and gain meta-knowledge' (Gee, 1990:191) about children's Discourses and Discourses in general and thereby become 'reflexive performers' by understanding their power in classroom discourse and, in educational parlance, how they can 'scaffold' access to secondary Discourses for the children in their classes. These practices of scaffolding are themselves a form of classroom discourse and are worth investigating more carefully.

Scaffolding: Discourse and multimodal strategies that support learning

According to Sharpe, 'scaffolding is a term that has become widely used in educational contexts to describe the precise help that enables a learner to achieve a specific goal that would not be possible without some kind of support' (2006:212). Sharpe argues that Bruner originally used this metaphor to 'describe the form and quality of intervention

by a “learned” person to assist the learning of another person’ (Maybin *et al*., 1992 cited in Sharpe, 2006:212). Bruner asserts that scaffolding ‘refers to the steps taken to reduce the degrees of freedom in carrying out some task so that the child can concentrate on the difficult skill she is in the process of acquiring’ (1978:19, cited in Sharpe, 2006:212).

Sharpe draws on Systemic Functional Linguistic (SFL) theory to articulate the kinds of discourse and multimodal strategies that constitute the nature of scaffolding and the ways these function in discourses to support children’s learning. According to Sharpe, scaffolding is ‘a much more subtle phenomenon, one that involves a complex set of social and semiotic dynamics’ (2006:212). She argues that ‘the notion of scaffolding is congruent with the essentially social nature of learning and affirms the importance of language in making meaning within this process’, but that ‘other semiotic systems such as visuals, gestures and actions also act as agents of scaffolding’ (Sharpe, 2006:212-213). Sharpe argues that discourse strategies recontextualise students’ discourse in order to support conceptual understanding as well as apprentice students into the discourse of the subject. She draws on the Vygotskyian concept of the Zone of Proximal Development (ZPD) to explain how learning occurs within a social context. Vygotsky defines the ZPD as ‘the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers’ (1978:88-89). Sharpe argues that the ‘construction of the ZPD occurs not only through the semiotic modality of language that enables students to actively participate in a dialogue with teacher, texts and peers, but also through other semiotic modalities such as body language, voice, diagrams and activity’ (Sharpe, 2006:229).

Scaffolding plays an important role in allowing children ‘access’ to discourses, since this kind of ‘access’ happens through apprenticeship. Wells argues that part of the teacher’s responsibility is to ‘engage the students in a semiotic apprenticeship into the “actions” and discourse genres that constitute ways of making meaning in the different disciplines’ and he asserts that ‘it is this intended outcome that should guide the choice

of activities within curricular units, as it is only when students engage in activities in which these 'actions' and genres constitute the appropriate tools for mediating the achievement of the activity goals, that they will have the opportunity to master them through genuine participation' (Wells, 1996:84). Thus, children acquire discourses through apprenticeship, but master them through participation. This resonates with Halliday's language-based theory of learning in the sense that children's experience of using discourses (or language in Halliday's terms) becomes knowledge.

Learning to talk, talking to learn: Halliday's language-based theory of learning

Halliday (1993) approaches learning educated discourse as learning the register of schooling. Although this approach can be faulted as being too language-centred, it nonetheless provides key insights. Halliday argues that 'when children learn language, they are not simply engaging in one type of learning among many; rather; they are learning the foundations of learning itself' because 'language is not a domain of human knowledge; language is the essential condition of knowing, the process by which experience becomes knowledge' (1993:94). According to Halliday, 'despite the fact that educational knowledge is massively dependent on verbal learning, theories of learning have not been specifically derived from observations of children's language development' (1993:93). Halliday argues that language development is learning how to mean and that all human learning is essentially semiotic in nature: 'the distinctive characteristic of human learning is that it is a process of making meaning – a semiotic process; and the prototypical form of human semiotic is language' (1993:93).

This formulation could be criticized as being too language centred, as people learn to mean before they learn language or how to speak. In "Learning how to mean" (1975), Halliday analyses his baby son Nigel's protolanguage and found functions emerging from his 'talk': an instrumental function to obtain goods and services, a regulatory function to influence the behaviour of others, and an interactional function to maintain emotional ties with those closest to him. Thus, Halliday provided evidence that infants

are able to mean (i.e. communicate) even though they are not able to communicate in a way that a more mature language user is able to. Nonetheless, Halliday asserts that 'we might, therefore, seek to model learning processes in general in terms of the way children construe their resources for meaning – how they simultaneously engage in "learning language" and "learning through language"' (1993:93).

Halliday argues that when children learn to read and write, they enter a new phase in their language development, moving on from the general to the abstract and this 'enables them to attend to language itself, a necessary condition for becoming a reader and writer' and 'in the process of becoming literate, they learn to reconstitute language itself into a new, more abstract mode' (1993:109). Halliday asserts that 'reconstituting language means reconstituting reality' (1993:109) because children have to reinterpret their experience in the new mode of written language. He argues that this is not just a matter of mastering a new medium, but 'mastering a new form of knowledge: written, educational knowledge as against the spoken knowledge of common sense' (1993:109). Thus, Halliday's language-based theory of learning which conceptualizes learning as learning language, suggests that 'children's transition to school and its demands of literacy involve an important reconstruction because children have to reconstitute their meaning potential in a new, more abstract mode and therefore, schooling involves the development and reconstruction of meaning' (Wells, 1994: 69-70).

Halliday conceptualizes children learning 'educated discourse' (Mercer, 1995:80) as learning the register of schooling. Registers 'involve new styles of meaning, ways of developing an argument, and of combining existing elements into new combinations' (Halliday, 1978:196). It can be suggested that the register of schooling or formal education consists of further registers for different school subjects. Just as Halliday refers to a 'mathematics register' (1978:195, discussed in Chapter 5), one may also speak of a 'Science' or 'English' register since these different subjects involve different forms of abstraction (such as subject specific terminology or configurations of everyday words as technical terms), and thus, a reconstitution of children's meaning potentials.

Unequal communicative rights and 'writing rights'

According to Alexander, 'researchers have been sensitive to the risk that, if we are not careful, classrooms may be places where teachers rather than children do most of the talking; where supposedly open questions are really closed; where instead of thinking through a problem children devote their energies to trying to spot the one "correct" answer; and where the supposed equality of discussion is subverted by what Tony Edwards calls the "unequal communicative rights" of a kind of talk which remains stubbornly unlike the talk which takes place anywhere else' (2006:14). Alexander argues that classroom talk needs to move beyond the 'acting out of such cognitively restricting rituals' (2006:14) if it is to make a meaningful contribution to children's learning and understanding. Alexander asserts that researchers have built up a comprehensive picture of classroom life, especially in primary schools and he argues that:

> Among the features on the debit side which seem particularly resistant to change are the relative scarcity of talk which really challenges children to think for themselves, and especially the low level of cognitive demand in most classroom questions; the continuing prevalence of questions which remain closed despite our claims to be interested in fostering more open forms of enquiry; the habitual and perhaps unthinking use of bland, all-purpose praise rather than feedback of a kind which diagnoses and informs; the seeming paradox of children working everywhere in groups but rarely as groups; the rarity of autonomous pupil-led discussion and problem-solving; and the tendency of classrooms to be places of risk and ambiguity rather than security and clarity, in which children devise strategies to cope and "get by" rather than engage. (2006:14-15)

According to Alexander, these findings mirror the dominance of the question-answer *recitation script* which continues to rule 'unless we work on the deeper layers of teaching and learning talk and the assumptions by which they are steered' (2006:17).

However, students' *unequal communicative rights* are not only verbal manifestations of classroom discourse, but extend to other modes of communication. Kress makes a similar case for writing. Transcriptive or 'reproductive' writing is 'highly routinised' and the 'most dominant form of writing that children do at school' (Kress, 1994:34, 41) such as writing down information from the board, a textbook or even a website. Children

"copy" content and rarely engage with their own ideas by expressing them in writing. Therefore, by framing school activities as acts of "reproductive" writing, teachers place limits on their students' 'writing-rights' (Kress, 1994:21).

Jewitt argues that although speech and writing may be considered as the "standard" resources that children use to make sense of curriculum knowledge, children move across and between modes in the course of learning. She asserts that although children draw on additional modes of communication such as sound, images or gestures, they have to interpret and then "translate" and "transform" the resources they are using for meaning-making 'into primarily written (occasionally spoken) textual forms for the purposes of assessment' (2007:280). Therefore, the *unequal communicative rights* between teachers and students does not only involve students' limited opportunities for engaging in practices associated with educated discourse, but extends to the fact that students also need to use modes of communication valued in formal education to demonstrate educated discourse or school-based secondary Discourses. Drawing; for example; is not valued in the classroom in the way that writing is: drawings are often not assessed or considered as demonstrations of educated discourse. Thus, children have to use valued modes in order to participate in and display educated discourse (i.e. to assert his/her 'communicative right').

The findings in this study suggest that children only ever engage in 'productive' writing in the computer labs when they use email, which teachers treat as a marginal activity on the fringes of the curriculum. The data confirms Walton's finding that 'reproductive writing' practices are associated with the classroom use of Google in this context because children transcribe search terms suggested by the teacher, and similarly use the search engine to collect and 'copy' information (2008).

Learning as multimodal social semiotic

According to Stein, 'multimodality as a field of study is concerned with how human beings use different modes of communication, like speech, writing, image, gesture, and

sound, to represent or make meaning in the world' (2008a:871). Thus, multimodal social semiotics reframes instructional practices as multimodal: 'teaching and learning happens through the modes of speech, writing, sound, movement, gesture, image, and space' and 'these modes work in different ways with different effects, to create multilayered, communicational ensembles' (Stein, 2008a:871). Stein argues that these different effects affect what it means to learn and teach in contemporary classrooms.

Jewitt argues that drawing attention to modes of communication in addition to language does not mean 'that all forms of meaning-making should be "equal" in formal education' (2007:280). She notes that although 'language, spoken and written, is the most socially valued form of communication in most contexts', it is 'embedded in an ensemble of modes, and all modes play a central part in meaning-making' (2007:280). According to Jewitt, it may be useful for the purposes of teaching 'to know if a student is expressing scientific understandings across a range of modes and to consider how different resources challenge, extend or constrain thinking about scientific concepts to be learnt' (2007:280).

Similarly, Stein explores how key ideas in multimodal social semiotic theory have been applied to questions of learning and teaching. She asserts that 'social semiotic theory is concerned with how human beings make meaning in the world through using and making signs, always in interaction with someone' (2008a:874-875) and signs are multimodal because 'they can draw on language, image, gesture, sound, and action, in different configurations for different effects' (2008a:875). Signs are 'always conjunctions of meaning and form' and 'they are never neutral but socially and culturally produced and motivated – meaning is always made and read *in* culture' (Stein, 2008a:875). People produce signs according to their interests and this interest 'gets its focus from factors in the environment in which the sign is being made' (Kress, 1997:11).

According to Stein, the application of this theory of signs to learning has been called a 'multimodal social semiotic approach to learning' (2008a:875). This perspective entails the following:

> It assumes that pedagogical environments, in and out of school, are semiotic environments: teachers and learners are constantly engaged in reading and creating signs across a range of genres, modes, and discourses. All texts are multimodal. Pedagogic processes can be understood as the selection and configuration of the semiotic resources available in the learning environment (Jewitt, 2006; Kress et al., 2005). Another basic assumption is that language is not the only mode sufficient and possible for representing meaning. Increasingly, image is as important as language. This has important implications for teachers' attention to and understanding of the visual in the curriculum (Unsworth, 2001). (Stein, 2008a:875)

Stein argues that the notion of *design* is central to a multimodal social semiotic approach to learning because teachers and students are 'designers of meaning' (Stein, 2008a:875) and this means that teachers are involved in making particular choices about how and what to teach, whereas students make decisions about how to represent what they understand and wish to communicate. Stein asserts that 'in all instances, the idea of design means that people choose how to represent meanings from a range of possible options' and 'these options are continuously shaped within the history of a culture and its available technologies for representation, as well as by an individual's relationship to identity and history' (2008:875-876). However, Stein notes that 'how people represent their meanings may be limited by the semiotic resources available, what Kress (1997) called "what is to hand" and by students' competence in design' (2008a:876). Stein argues that these choices communicate important information to teachers about students' learning and have implications for instructional and assessment practices.

Stein sees classroom practices as involving the selection and configuration of semiotic resources and the resources available are seen in terms of access and competence. Power relations are also an important consideration, because the teacher often decides 'what is to hand' by framing activities in a particular way. This study discusses the importance of different configuration of resources and roles involved in children's software use: the semiotic resources 'to hand' are not all important, as the role relationships in the class influence how these resources are configured.

Multimodal theory has helped to establish the importance of non-verbal modes of communication. This study extends these insights and tries to account for the unequal communicative rights of children and how multimodal communication via software is shaped by the complex dynamics of classroom discourse. Children often design their meanings according to their perceptions of their teachers' expectations, using modes of communication deemed appropriate within the culture of the classroom. In this sense, their design of meaning reflects an awareness of such communicational constraints. Therefore, although the classroom can be seen as a semiotic environment, it is not free of power relations. Classroom power relations shape how software is used. This study argues that patterns of interaction in the computer lab can also be described in terms of a configuration of resources and roles. These configurations are important. The rules of engagement which accompany the IRF place children in the role of respondents who are perpetually under evaluative scrutiny. While this may improve their performance in certain limited forms of classroom discourse, this may be limiting children's 'access' to socially valued discursive roles and elite discourses.

Scarce resources, access and context

In this study, the context of children's use of technology is viewed as a shifting set of communicative possibilities, rather than something that is determined solely by the physical presence or absence of computers. Many discussions of the 'digital divide' assume that children will make use of software in predetermined ways based on the availability of certain types of software in the computer laboratory. Children approach these tools from a particular situated position, which includes negotiating and communicating around *scarce resources* in their environment, which include but are not limited to the hardware in the computer lab.

Jones redefines Goffman's term "*Umwelt*", the German word for "surround", more broadly as 'an individual's environment of communicative possibilities' (2002:11). This is a helpful way to understand how scarce resources are shared and claimed by the children – the computers, teachers, software and usernames all have communicative

possibilities, as well as a role to play in the negotiation of discourse. Internet connections, software and other devices have communicative possibilities, but these are limited unless one is initiated into the discursive practices associated with their use.

I use the words 'scarce resources' in the two senses of the word: (1) resources that are physically scarce such as computers, keyboards and the mouse; and (2) other resources in the environment with finite communicative possibilities (such as the teacher, or coded semiotic resources such as scores in drill-and-practice mathematics software and usernames that the children use to log-in to computers). Thus, scarce and shared resources are not limited to the physical equipment in the computer lab, but include the communicative possibilities offered by software and other individuals.

This shift in emphasis challenges thinking in fields which over-emphasize the physical presence of resources such as computers when describing context. Fink and Kenny (2003) suggest four possible interpretations of 'digital divide' which appear in the literature:

> (1). A gap in *access* to use of ICTs—crudely measured by the number and spread of telephones or web-enabled computers, for instance.
> (2). A gap in the *ability* to use ICTs—measured by the skills base and the presence of numerous complimentary assets.
> (3). A gap in *actual* use—the minutes of telecommunications for various purposes, the number and time online of users, the number of Internet hosts, and the level of electronic commerce.
> (4). A gap in the *impact* of use—measured by financial and economic returns. (2003:2)

Digital divide literature focuses on the scarcity of physical resources such as machines, bandwidth, and sometimes a lack of skills in ICT use.

Contesting this technologically determinist perspective, Warschauer has argued that 'a digital divide is marked not only by physical access to computers and connectivity, but also by access to the additional resources that allow people to use technology well' (2002). Warschauer argues that new media are no silver bullet and not instantly able to solve the problems of poverty and skewed development (cited in Prinsloo & Walton,

2008:2). Warschauer developed a model of what kinds of resources are required to help promote meaningful access to and use of technology which 'included physical resources (e.g., computers and Internet access); digital resources (e.g., online content and tools in multiple languages and appropriate to the needs of diverse users); human resources (e.g., knowledge and skills developed through instruction emphasizing critical inquiry and situated practice); and social resources (e.g., enhanced social capital developed through in-person, online, and institutional support' (cited in Prinsloo & Walton, 2008:2-3). He also notes that 'the original sense of the digital divide term—which attached overriding importance to the physical availability of computers and connectivity, rather than to issues of content, language, education, literacy, or community and social resources—is difficult to overcome' (2002). Thus, he suggests a continuum between the binary of the "haves" and "have-nots". Prinsloo and Walton argue that even this expanded model still suggests 'the idea of a divide to be bridged that does not explicitly take account of the social resources, norms, practices and technologies that marginal individuals, groups of people, nation states and regions already hold' (2008:3).

This study necessitates a further reformulation of the notion of *access* in order to draw attention to the importance of semiotic and other resources in the environment of the computer laboratory and how these resources are configured in relation to issues of power and learning. The study turns to discourse to analyze how children use the communicational possibilities of the resources available to them in their environment. Attention to discourse allows one to identify the social resources available to primary school children as well as their current discursive practices with different types of software.

This study also pays attention to how classroom discourse gets reshaped in the computer lab. Discourse is treated as 'talk-in-interaction' and provides evidence of children managing the limited resources available to them. I found that variations of classroom discourse are manifested in the computer laboratory: children's use and negotiation of the resources in their environment suggest that they are constrained to

manage these resources in specific ways by the teacher and the simulated dialogue of the software. Thus, classroom discourse involves access to (including management and negotiation of) resources in the unequal terrain of the classroom: asymmetrical power relations are treated as part of the environment, thereby enabling or constraining communicative possibilities. In effect, context is negotiated through discourse.

Rethinking resourcing as redress: Access to Discourse(s)

From the perspective of the Department of Education as well as school connectivity projects or ICTs delivery and training projects in the Western Cape, computers are predominantly seen as mechanisms for content delivery: *resourcing* is seen as a redress to educational inequalities in South African schools, thus assuming that the presence of computers will level the educational playing field. However, education does not merely involve content or curriculum delivery, because it is constructed by children (and their teachers) through their discourse(s).

Discourse plays a central role in teaching and learning. Mercer argues that 'one of the main aims of education is giving students access to discourses, even if one of its other important aims is the encouragement of innovation and creativity' (1995:83). This study suggests that the concept *access* needs to be rethought in relation to education: *access* does not only involve access to physical resources, such as computers, but access to discourses. In this study, secondary discourses are used by the children and their teachers in particular ways within the school's computer lab.

This study aims to contribute to a broader understanding of how learning takes place in marginal contexts, where recently acquired networked computer labs provide new affordances to both teachers and children. It is tempting but ultimately counter-productive to believe that computers can 'deliver' curriculum directly to children and thus improve learning. A more nuanced view of the nature of the work of schooling and learning can be developed by studying recorded data of interactions in the computer lab, and trying to understand how teachers and children engage in the complex discursive interactions of school, learning, and play as they use the computers. The

data collected for this study suggests that the power relations at play in these discourses are significant features of children's experience. Close analysis of the interactions can be helpful in allowing teachers to engage with the linguistic and semiotic processes which help children to learn in such environments.

In this study, children's discourse and software use suggest *variations* of classroom discourse. Firstly, 'variations' implies that classroom discourse may be reshaped in the school's computer lab in a way that deviates from classroom discourse (with a predominantly IRF structure, discussed earlier in the chapter) which occurs in 'conventional' classrooms. Secondly, the children's interactions with different types of software suggest variations in the nature of the discourse and this is where Gee's notion of secondary Discourses discussed earlier in the chapter, is helpful. This study argues that children's interactions with computer software; as well as with their teacher; suggest variations of classroom discourse and that although the children often display creativity in exploiting the affordances of different types of software, the roles they are allocated and the social actions they are encouraged to perform seldom go beyond a limiting form of classroom discourse .

Engaging in subject-based discourses was a minority practice, rarely structuring the children's interactions. I did not see children being apprenticed to the activities and inquiry associated with 'being' mathematicians or historians. There were some occasions where the children's discourse suggested that they were communicating mathematically by explaining calculations verbally and using gestures. Similarly, using a more academic register of language such as 'biography' may indicate the presence of a school-based secondary discourse of history, but the fact-finding tasks emphasized by the teacher did not allow the children a scaffolded experience of 'being' a historian or being apprenticed into the role. Instead, the classroom discourse in which the children were engaged structured their interactions with the different types of software in various ways, foreclosing some of its possibilities, and emphasizing others. Thirdly, 'ordinary' applications (such as search engines and email software) take on a particular discursive character in classroom use. For example, without the discourse of inquiry or research

when using Google, children using these tools are likely to use them in situated ways, shaped by local discourses. By contrast, drill-and-practice software simulates classroom discourse and is designed for the convenience of teachers as administrators.

Accounting for power in discourse: Conversation Analysis (CA) and Multimodality

Researchers in the field of multimodality have tended to focus on the shifting power relations between semiotic modes such as images and writing (e.g. Kress and Van Leeuwen, 1996). Writing, which has traditionally dominated many powerful genres of discourse in Western culture, is increasingly used together with other modes, and powerful genres are increasingly multimodal. .For example, Kress and van Leewen argue that semiotic modes 'may reinforce each other by communicating the same idea in different ways, they may fulfill complementary roles or they may be hierarchically ordered in that certain modes are dominant over others' (2001:20). Kress and Van Leeuwen argue that 'there is never just "heteroglossia"… instead there is a role distribution among different semiotics, a role distribution in which some semiotics are given a greater deal of social power…' (Kress and Van Leeuwen, 1996:26). Multimodal texts are not heteroglossic: although they are fractured and stratified – different semiotic modes coexisting in the same text – not all of these modes fulfil equal functions or have equal importance. Thus, not all semiotic modes have equal social power.

It is not only the semiotic modes that do not have equal social power, but also those who use them. This has been considered in relation to classroom discourse to an extent by Kress when he discusses 'writing-rights' (1994:21) because he suggests that the dominance of reproductive writing in classrooms limits students' expression. The influence of classroom discourse on learning as sign-making has not been adequately considered by researchers in the field of multimodality. Current theories of multimodality background power relations between people in interaction as well as the institutional nature of discourse.

Conversation analysis considers power in discourse as very important. Heritage argues that 'the conversation analytic study of institutional talk is concerned with how these institutional realities are evoked, manipulated and even transformed in interaction' (1997:162). Heritage notes that interactional asymmetries are a place to begin examining the specific institutionality of interactions and he argues that in many forms of institutional discourse 'there is a direct relationship between institutional roles and tasks, on the one hand, and discursive rights and obligations, on the other' (1997:176). According to Heritage (1997), power inheres in the interactional practices of institutions and their incumbents as well as in the discretionary freedoms which those practices permit for the incumbents of institutional roles. However, conversation analysts treat discourse mainly as a verbal phenomenon and the primacy of 'talk-in-interaction' reinforces this, whereas multimodality investigates multiple modes of communication. Conversation analysis draws attention to the institutional character of discourse and the power relations made salient in interaction, whereas multimodality highlights the multimodal nature of discourse.

Conclusion

This chapter has discussed the importance of discourse as social action and how discourses are acquired or 'accessed': discourses are mastered by apprenticeship into social practices through scaffolded and supported interaction. Warschauer's (2003) definition of 'access' can be extended as access to discourses which allow children to use technology for potential educational benefit. While children are being apprenticed into school-based secondary Discourses, most of their activities revolve around the role relationships implicit in classroom discourse and its distinctive power relations. Here conversation analysis and multimodality both contribute insights, but theories of learning as sign-making need to account for power in classroom discourse. Chapters Four to Six of this study analyse children's discourse and software use in terms of different configurations of resources and roles in classroom discourse.

The computer lab is discussed as an unconventional classroom. This study suggests that although the IRF may be too formulaic when applied to classrooms without a predefined teacher space, the power of the institutional roles associated with that structure is still apparent. This chapter has also contrasted Mercer's idea of the need for children to learn educated rather than merely educational discourse with Gee's critical notion of apprenticeship into social practices and the differential levels of social power associated with secondary Discourses. Finally, the unequal communicative rights and writing rights of children in classroom discourse is explored by analysing how children's software use is accompanied by the use of other semiotic resources, particularly writing and gesture.

Chapter 3: Methodology

Introduction

My research question is: 'what configurations of resources and roles can be identified when children use different kinds of software in the school's computer lab?' This involves studying how children's discourses adapt as they use different kinds of software which necessitates the consideration of the role of classroom discourse. This chapter discusses data collection, recording, transcription and analysis as different stages of research in this study. Key issues about the use of video cameras for data collection will be discussed in relation to my research question which entails a focus on discourse as social action. This chapter also discusses my criteria for sampling video data as well as my approach to multimodal transcription. Conversation analysis and multimodality will be compared in relation to how they allow for an analysis of discourse and context. In this study, I made use of conversation analysis and multimodal discourse analysis to identify how children's discourses adapted as they used email, a search engine and drill-and-practice mathematics software. Validity concerns in research on institutional interaction will also be discussed and related to my research question.

Data Collection and procedure

Mountainside Primary was chosen according to certain factors. Firstly, the ICTs delivery and training project in the province identified Mountainside Primary as a benchmark of success. Secondly, my supervisor had conducted a pilot project (Walton, 2007) at the school and highly recommended it: because lessons in the lab were time-tabled and occupied for the majority of the school day, I would be sure to collect lots of interesting data. Lastly, ICTs were not entirely novel resources in this school, as they had been available for two years prior to this study and the principal had taken unusual steps to

ensure that computers had been well integrated in the school as well as in relation to the national curriculum.

Thirty-five lab sessions were observed in Mountainside Primary's computer lab over a period of eleven days between April and August of 2007. These thirty-five sessions often involved the use of more than one type of software. I observed thirteen Grade 4 sessions, nine Grade 5 sessions, eight Grade 6 sessions and five Grade 7 sessions. In total, ten teachers were observed. Twenty-two pairs of children, a girl working alone and a group of four boys working together were both observed *and* recorded (see Table 1 for grade level, ages, and gender of participants). Thus, the participants in this study consisted of 49 children (25 boys and 24 girls from Grade 4 to 7) and ten teachers.

Grade:	**Number of children:**	**Male:**	**Female:**
Grade 4 (aged 9-10 years)	19	5	14
Grade 5 (aged 10-11 years)	16	11	5
Grade 6 (aged 11-12 years)	12	7	5
Grade 7 (aged 12-13 years)	2	2	0
Total:	**49**	**25**	**24**

Table1: Children observed and recorded in this study.

The lab sessions often involved the use of more than one type of software application (54 instances of software use were observed, see Table 2). Four days were spent on planning where to set up the camera and familiarising myself with the setting. I only used the video camera from my fifth visit onwards, and so, in total, I collected seven school days worth of video data. Table 2 lists the different kinds of software that I observed the children using in the computer lab along with the number of lessons I observed where the children were using a particular software application.

Cami Perceptual Skills Builder is a drill-and-practice program which allows children to practice their spatial skills and complete puzzles which require colour and shape recognition. Cami Reader is a drill-and-practice literacy program whereas Cami Maths allows children to practice numeracy. Maths Circus Act is a drill-and-practice program which allows children to engage in various kinds of problem-solving by completing puzzles. Talking Stories is a reading program which allows children look at pictures and read along to an audio clip of an adult reading the story. Pegasus Mail is the email software used in the lab. 'Taal Bank' (meaning 'Literacy Bank') and Literacy Bank are Afrikaans and English drill-and-practice literacy programs. 'Fifi and Fritz' (the names of the dog and cat in the program) is an educational program about taking care of pets and contains a few problem-solving activities. 'Feroza's Story' is a pilot version of an educational program about HIV/AIDS which aims to provide a form of simulated counseling through animation. Feroza is the name of a young girl who thinks that her puppies are ill because they have AIDS and she goes to the clinic where Nurse Nosipo educates her about HIV/AIDS. The program allows the children to complete multiple choice and click and drag exercises to answer questions related to HIV/AIDS such as the immune system and nutrition for a healthy body, whether certain statements about the contraction of HIV/AIDS are true or false and so forth.

During my observation period at Mountainside Primary, 'Cami Maths (a drill-and-practice Mathematics program) was used most often followed by 'Cami Reader' (an English 'literacy' program), 'Pegasus Mail' and Google. Although the list suggests that emailing was one of the dominant activities in the laboratory, it was actually quite marginal as the children were mostly given permission to use it after they had completed their drill-and-practice exercises. Based on the number of lessons I observed for the different types of software, I decided to focus on three of these software applications: 'Pegasus Mail', Google and 'Cami Maths'. I decided to devote a chapter to each of these applications because the fact that they were used so much indicated that they had an established status in the computer laboratory. I decided not to focus on Cami Reader as an example of drill-and-practice software because I had observed more numeracy lessons and Cami Maths appeared to be used the most in the lab.

Software:	Number of Lessons:
Cami Perceptual	1
Cami Reader	8
Cami Maths	14
Maths Circus Act	2
Talking Stories	6
Encarta	2
Google	7
Pegasus Mail	8
Taal Bank OR Literacy Bank	3
Fifi & Fritz	1
Microsoft Power Point	1
Feroza's Story	1
TOTAL:	**54**

Table 2: Total observations per software over a period of eleven days

Recording

I used a video camera with radio microphones to record the children's interactions with the software. The process of recording was informed by Jewitt's (2006) suggestions for multimodal data collection. The following key issues were considered about the use of video data collection: ethical considerations, the effect of video cameras in the classroom, 'pointing' the camera, using more than one camera, turning the camera on and off and supplementary data.

Multimodal data collection

According to Jewitt, 'a multimodal approach to learning needs a method of data collection that enables a focus on all modes of representation and communication that are being used in the classroom during learning' (2006:32). She suggests that video recording offers such a method for recording classroom interaction. The use of video enables 'repeated viewing of the data and provides a record from which all the modes

can be transcribed' (Jewitt, 2006:32). However, Jewitt (2006) argues that observation with a video camera involves making some decisions because how a person sets up their 'lens for looking' is a matter of what it is they want to ask about the activities or sites they are studying. Therefore, I had to make analytical decisions when choosing my 'lens for looking': I decided to focus the camera on the screen to record what the children were doing with the software and relate it to what they were saying. As my research question is focused on discourse as social interaction, capturing the children speaking about what they were doing was essential.

In contrast to Jewitt's (2006) approach, the focus of this study is not on the interaction of modes on the screen. The research question involves looking at discourse in the extended sense as social interaction, noting variations in discourse and patterns in children's interactions with software, peers and teachers. This involves making important decisions regarding issues to consider when using video to collect data.

Ethical considerations to consider when using video cameras

Although ethical issues permeate all aspects of research, the use of video data 'highlights questions of anonymity simply because of the way it displays identity: of a place, school, teacher and students' (Jewitt, 2006:33). Not only must consent be obtained to video schools, teachers and students – the researcher also has to be clear about who it is that will be allowed to see the video tapes.

For this study, the teachers and the school principal signed consent forms and I explained the ethical implications to them so that they understood what the research would involve. Some of the teachers were slow in returning their forms, but once they were aware of the ethical implications along with the fact that I required their consent in order to proceed, they returned them. The teachers and the principal consented on behalf of the students, and consent to do research at the school was granted by the Department of Education. The consent form states that the school, teachers and

students have the right to anonymity and thus pseudonyms are used in the study to protect these identities. The teachers and the principal were also informed that the videos would be used for academic purposes only and that the data would be seen by myself and my supervisor and that it would be archived for use in a larger academic project. They were also told that their faces and those of the children would not be recorded and that the computer screen and the children's voices would be the focus of the recording.

While this promised anonymity, it also convinced the teachers that I would try to be as unobtrusive as possible. As will be discussed in the next section, the attempt at unobtrusiveness was not always realized in practice: the children's interest in the camera made my presence obtrusive to a certain extent. Anthropologist and cinéma vérité filmmaker, Jean Rouch, argued that the filmmaker is a provocateur, not observing life as it is, but life as it is *provoked*. Colleyn asserts that Rouch 'never tried to be the unnoticed observer, the invisible witness, or the neutral narrator' and 'he hated the metaphor of a filmmaker as "a fly on the wall"' because 'his camera dove right into the center of the action, changing it, and provoking reaction' (2005:113). Rouch believed that 'to get access to what is happening in real life you need to participate in it' (Raijmakers *et al.*, 2006:231) which is why he preferred to co-operate with the people he filmed. By being in the computer lab as a researcher with a camera documenting the children's software use, despite the fact that I tried to minimize my intrusion, I was also a participant in that space as well as a provocateur. I often asked the children questions to clarify my understanding of what they were doing.

The effect of video cameras in the classroom

The effect of the video camera in the classroom was an important factor in this study. Jewitt argues that 'video data is not a representation of life as it would have happened if the researcher had not been there but nor is what it presents so "contaminated" by the research process as to make it invalid' (2006:33). However, Jewitt (2006) notes that it is hardly possible to observe the world without being in it in some way. According to Lomax and Casey:

> In relation to video-based methods, the researcher is an active participant in the situated activity that is being recorded. But the camera too, is socially significant given both its ability to preserve interaction for re-presentation and participants' awareness of that ability (a characteristic which sets visual data apart from other forms of observational data). (1998 cited in Jewitt 2006:33-34)

Jewitt (2006) suggests that researchers consider how they are being positioned by the teachers and the students in the classroom they are observing and how this may be shaping the data they are collecting. Jewitt argues that 'people position researchers through their experiences and expectations of the technologies being used' (2006:34). She notes the difference between using an enormous high quality VHS camera associated with broadcasting (the children asked when they would be on television) and a small digital camera which did not produce a frenzy as one child commented that his/her uncle had one just like that.

When I first entered the computer lab to get more familiar with the setting, I used a small digital camera to take photos, short video and sound clips. However, the sound and video clips were of a poor quality. Because I wished to focus on the computer screen and the children's voices, I required a camera which could be set to minimize the effect of the computer's refresh rate as well as record the children's voices in a way which backgrounded the noise of the classroom. This is why I used a bigger, high quality camera and a microphone. Thus, the data one chooses to collect depends on the questions posed by the study. Although my choice of technology allowed me to collect the data I had hoped for, the large camera mounted on its tripod did play a role in the data I collected. Some of the teachers; when walking around the computer laboratory; avoided the pair of children that I was recording. On the other hand, some of the teachers did not seem to mind the camera and responded to the children's questions or came over to help them.

The children positioned me in relation to the technology in interesting ways which highlighted an additional feature of video recording, not taken into account by many researchers from technology rich societies: the novelty of a certain type of technology in

a particular context. It should be noted that cameras are more of an exotic object in this context than in other parts of the world. Recorded data reveals that the children sometimes spoke about the radio microphone behind the keyboard, asking their partner what it was, followed by debates about whether it was a speaker or a microphone. These interactions highlighted the novelty or 'exotic-ness' of the camera and related technical accessories in this environment. When I recorded the children I would say things like "I'm just recording what you're doing on the screen" and "May I see how you guys are playing at the computer?" and they seemed to welcome the attention and 'perform their skills'. This is partly because receiving attention from an adult is a scarce resource: children have to compete with their classmates for their teacher's attention.

Some of the children were even under the false impression that I was from ETV; a privately owned, free-to-air South African television channel; and asked me questions such as, "Are we gonna be on E, Miss?" and tried to get my attention and pose for the camera. This was because one of the teachers said during a lesson in the lab, "You better behave, you might be on E." The teacher therefore used the children's perception of the camera as an exotic object in the classroom in the hope that it would result in the children being on their best behaviour. Therefore, the camera could be regarded as disruptive in this context, because many of the children had never seen someone using a video camera before, especially in the school. It is plausible to suggest that this may have been the first time most of these children saw a video camera 'up close', watching it being used by someone and they expressed delight when looking at the LCD screen to see what was being recorded. Disruption aside, my data collection experience highlighted the idea of scarce resources (such as a video camera) taking on a special significance in a context like this and it was also an experience for the children because they received adult attention and learnt a bit more about video cameras by observing me and having their questions answered.

The children's interest in the camera further justified my decision to make use of only one camera. The consideration of the effect of the video camera in the classroom also relates back to ethical considerations. The extent to which the presence of the camera

disrupted the class involved speculating about whether the situation was different if I was not there with the camera. It is possible that more than one camera could have changed the class to such an extent that I arguably would have required a different level of permission such as obtaining parental consent for the children I recorded.

Using more than one camera and turning the camera on and off

Jewitt (2006) argues that she has used two cameras when one would not have enabled her to answer her research question: she used one camera to record the broader picture of interaction in the classroom and another to capture data displayed on the computer screen (what students were doing with a particular application). However, she notes that using two cameras added a new problem: 'how to watch the data simultaneously and how to transcribe it' (Jewitt, 2006:35). Additionally, Jewitt argues that collecting data on two cameras can be problematic in the way it fragments activities and participants and therefore 'the decision to use more than one camera needs to be sensitive to the structure of the interaction and context being studied' (2006:35). She argues that the number of cameras depends on how the relations and space being researched is organized by considering whether the layout of the classroom supports the idea of a 'teacher space and a student space' (2006:36).

Space in the computer lab is organized quite differently to conventional classrooms. In Mountainside Primary's computer laboratory the children sat in pairs sharing a computer and the teacher walked around the lab to assist the students. Rarely did the teacher address the children from the front of the class.This suggested that the teacher entered the 'student space' (Jewitt, 2006:36) and therefore, by using one camera to focus on this space, the interactions between the students and the teacher could also be observed without having to attend to the additional problems posed by using an additional camera to focus on the teacher. The teacher's instructions to the class could also be heard in the video recordings. Additionally, I often noted the teachers' instructions in my field notes.

Jewitt argues that when to turn a camera on and off is an important question, as it 'marks the start and the end of what is seen as data' (2006:36). I started recording the

children's interactions once they had settled in pairs and opened the application required for the lesson. I stopped recording once the bell rang and their teacher told them to log off. I used field notes to record any of the teacher's instructions while the children logged on to the computers.

'Pointing' the camera: a lens for looking

Jewitt (2006) argues that a video record is partial and that there is no need to 'capture it all': the researcher needs to decide what it is they want to collect by considering their research question and what data they need to attend to this question. She asserts that 'where to set up the camera is a matter of losses and gains' and 'one decision that is key to data collection is whether to focus on the broad picture or the detailed picture' (2006:35). According to Jewitt (2006), it is useful to think about the set up of the camera in relation to the aim of the research before data collection because whether to record a wide shot of an event, the detail of an interaction or to zoom in and out between these views comes down to what research questions are to be addressed.

As this study was focused on the children's discourse and software use, I chose to use one camera to 'zoom in' on what the children were doing on the screen. This was not only due to ethical constraints (not recording the children's faces to preserve anonymity), but also to afford a 'detailed picture' of the interaction. This enabled me to analyse their interactions on the screen in relation to what they were saying and relate it to discourse as social interaction. As discussed earlier, more than one camera was likely to cause disruption in the class considering the children's interest in the camera. I relied on field notes to supplement these interactions to get a better idea of the broader social dynamics in the computer lab. I found that using one camera sufficiently enabled me to answer my research question about variations in discourse patterns and the configurations of resources and roles associated with the use of different kinds of software.

Supplementary data

Jewitt (2006) argues that because video recordings are a partial representation of events, it is useful to take observational notes when possible to record interactions 'off

camera' which includes 'comments made by teachers and students and the spatial arrangement of the classroom' (2006:36). Jewitt (2006) suggests collecting texts that feature in the classroom if one is interested in the way texts are produced and circulated in the classroom. She notes that for her own research she collects 'students' texts, the applications used, worksheets detailing the task set by the teacher, along with documents that informed the lesson in a less direct way, such as the national curriculum' (2006:36).

Similarly, I collected a worksheets, took screenshots of the children's search results and webpages they visited as well as screenshots from the applications they were using. I also made copies of the children's workbooks where they wrote down their 'research' during the search engine (Google) sessions I observed. I made use of a field notes book which became a very important record of supplementary data, and also served a reflective purpose because I used it to make comments about the children's interactions at the time of observation. I later collated my field notes with the video data to produce detailed transcripts (discussed later on in the chapter).

Sampling video data

According to Jewitt (2006), using video to collect data produces very rich data and often a lot of it and because multimodal transcription and analysis are intensive, it is not feasible or necessary to analyse all the video of a lesson in detail. Thus, one needs to sample the video data to select instances or episodes for analysis. Jewitt (2006) suggests viewing video data in light of one's research question to generate criteria for sampling data.

I selected video excerpts to be transcribed based on the children's interactions with the different types of software and how these may suggest certain variations on classroom discourse (as discussed in Chapter 1). Identifying a specific interaction as signalling a 'variation' on classroom discourse involved looking at how the children's discourse suggested a particular configuration of the IRF structure (discussed in Chapter 1) when

they used different kinds of software. This involved analysing the children's discursive roles as they used different kinds of software: whether they were being encouraged to initiate the discourse or respond to the teacher's initiation and how their discursive roles were shaped by feedback. For example, children's email use suggests that they are accorded an initialing role (although they may initiate different genres such as insults, compliments and so forth), whereas they use Google to respond to their teacher's request for 'facts' about a certain topic: the teacher often supplies the search query and the children copy it into the search engine – the children are rarely the initiators of the search.

I also considered 'variation' in terms of how the children's software use suggested that the software was being 'schooled': children's use of the software in the lab was compared to generic assumptions about the use of these kinds of software in other contexts. For example, email is taken for granted to be a private and asynchronous form of communication. However, the children's use of email in the lab reshaped it so that it functioned in a public and often synchronous way. This study finds that 'ordinary' applications are given a particular discursive character in classroom use and although this indicates a situated form of use, it may also suggest that the different kinds of software are 'schooled' through different configurations of the IRF.

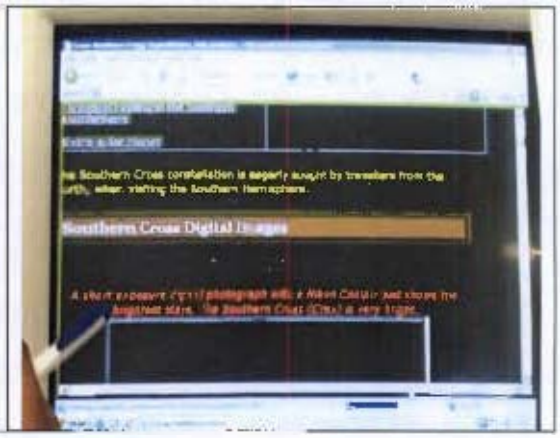
Transcription

Multimodal transcription

Jewitt (2006) argues that transcripts are a representation of an event and making a transcript marks what is important and unimportant to the transcriber: a transcript shapes analysis by making some aspects 'present' and others absent. However, "moving beyond language requires a transcription process that takes account of all modal resources" (Jewitt, 2006:38). Jewitt (2006) argues that conventions and methods of multimodal transcription are less established and there are different ways of organizing multimodal transcripts: although there is no right or wrong way of multimodal

transcribing, the 'right' method is a matter of what questions the transcript is setting out to answer.

The following is an example from one of my transcripts:

1 2	Tasha: There. This one.	Tasha points at a sentence written in red with her pen - "A short exposure digital photograph with a Nikon Coolpix just shows the brightest stars. The Southern Cross ('Crux') is very bright."	

The first column numbers Tasha's utterances which are presented in the second column. The third column describes Tasha's gesture in relation to the text on the screen. The fourth column contains a screen capture from the video data which acts as a visual representation of the information presented in the third column. By 'transcoding' the interaction in this way, I am also indicating that I see this form of transcription as most fitted to the purpose of communicating a certain feature of the interaction to my reader. This transcript is used in the Google chapter as part of a discussion about how Tasha and her partner did not engage with the meaning of the text. Instead they were focused on writing down visually foregrounded information. The discussion relates to discourse as social action and the girls' strategy indicates that they do so In order to bypass the difficult discourse of the astrophotography website which is not written at their level.

I decided to organize modes in separate columns for my multimodal transcriptions and the 'presence' of certain modes is based on their representation in the video data: since I had only used one camera I had access to the children's speech and gestures on the screen, but not their gaze which is why it is absent. The inclusion of certain modes was based on whether they were made salient during the children's interactions and

therefore whether they are important for discussing the interaction. I varied the format of the transcripts depending on the different types of software and what I intended to argue about the interaction. For example, when children pointed at visually foregrounded information and commented on it, their speech and gestures were noted as well as a screenshot of the webpage with the sentence they were pointing at typed beneath the screenshot. However, when the children were discussing their teacher's rule of using different webpages for different 'points of view', the transcript did not include a screenshot of the webpage because it was backgrounded during this particular interaction. All of the 'snippets' selected for analysis were contextualized in relation to the broader context of the lesson when discussed in the chapters.

An alternative approach to transcription

Norris (2002) discusses the implications of visual research for discourse analysis and argues that 'the incorporation of several modalities into transcripts and a shift in focus from primarily language to human action facilitate a better understanding of the multi-modal interaction involved' (2002:97). However, she notes that 'the use of conventional transcripts with a focus on language demonstrates that movie- and computer-mediated interactions appear fragmented' and that 'by contrast, an inclusion of images into the transcripts, representing central interactions and/or images of a movie or computer screen, demonstrates the significant visual modes that are imperative to the ongoing talk' (2002:97).

Norris argues that just as written words correspond to the oral language, 'images can exemplify the global interaction among the participants, or they can represent the images on the screen' (2002:97). Additionally, Norris argues that 'viewing an image is much faster than reading a description, so that these images also display the fast pace of the movie- and/or computer-mediated interaction' (2002:97). Norris proposes a different form of transcription, arguing that visual transcripts, in the form of videos, allow for a different understanding of the interactions involved.

This approach to transcription is less useful to me because I need to reproduce my transcripts in a written form for this thesis. Thus, the reproduction of the transcript needs to be considered. This is not possible with annotated videos: if one were to transcribe these visual transcripts into a written form it would be a transcript of a transcript. The issue of reproduction therefore goes hand in hand with my goal for these transcripts. My goal is to identify over-arching discourse structures, whereas Norris's goals are very different, such as using video to find the semiotic resources in gesture. This study is not interested in non-verbal modes in themselves for the sake of analyzing a specific mode such as gesture. This study is interested in the sequencing and configuration of children's interactions as a whole. The persistence of the medium is also necessary to consider. In the case of Norris's approach to visual transcripts, one ends up with a video to watch, but the problem is that one does not have everything in front of one in the same way as a printed transcript. Norris's approach does not have the same persistence of a written or printed medium.

Analysis

Discourse and context: Conversation analysis (CA) and Multimodality

Conversation analysis is 'a "microanalytic" approach which takes apparently mundane and unremarkable spoken interactions and finds intricate patterning in the way they are organized' and 'defamiliarizes what we normally take for granted' (Cameron, 2001:89). Conversation analysts label their object of study as 'talk-in-interaction' (Cameron, 2001:87). Doing a conversation analysis involves a certain relationship between talk and context: 'the context is in part brought into being by the actions people produce' (Pomerantz and Fehr, 1997:70). Heritage explains the relationship between talk and context in institutional interaction in the following way:

> Rather than starting with a 'bucket' theory of context (Heritage, 1987) in which pre-existing institutional circumstances are seen as enclosing interaction, CA starts with the view that "context" is both a project and a product of the participants' actions. The assumption is that it is fundamentally through interaction that context is built, invoked and managed, and that it is through interaction that institutional imperatives originating from outside the interaction are evidenced and made real and

> enforceable for the participants. We want to find out how that works. Empirically, this means showing that the participants build the context of their talk *in and through* their talk. (1997:163)

Thus, people's actions can be studied on their own terms, rather than trying to fit them into an 'abstract theoretical framework which may have no relevance for them' (Cameron, 2001:88). This emphasis on a predetermined notion of context is one of the criticisms of discourse analysis. Although this theoretical underpinning of conversation analysis accounts for context as it is negotiated at the moment of interaction (i.e. as constituted through discourse), it does not account for the wider physical context in which the interaction takes place.

Similarly, Jewitt (2005) expresses concern about the difficulty of accounting for a broader social context when working within a multimodal approach to classrooms and the design of pedagogic discourse. Jewitt argues that multimodality needs to look at meaning-making beyond the individual and that 'activity theory enables social, historical and cultural elements beyond the immediately observable classroom to be drawn into analysis' (2005:314):

> Social semiotics and multimodality offer conceptual tools for the analysis of meaning making but do not attend to its socially situated character. Multimodality is complemented by the heuristic framework of activity theory (Daniels, 2001; Engestrom, 1987) to give due attention to the socially situated character of meaning making. Bringing these theoretical approaches together enables them to be reconfigured in significant ways for thinking about discourses of school English and pedagogy more generally—one aspect of which is the design of classroom itself. (2005:311)

Thus, in order to account for the socially situated character of meaning-making, it is necessary to incorporate theoretical positions which allow one to draw on the broader social context for analysis. Thus, conversation analysis and multimodality share a common weakness: while both allow for detailed analysis of selected interactions, relating these to a broader social context presents a significant challenge.

Comparing approaches: Conversation analysis, Multimodal discourse analysis and Ethnography

Conversation analysis, multimodal discourse analysis and ethnography allow for different forms of analysis. According to ten Have (2006), conversation analysts should stay close to the actual, local relevancies of interactional partners as these are discernible in their "situated" reactions to one another. It is dangerous to impose external issues as an interpretation of what is actually being done in the interactional context. Thus, the general attitude in conversation analysis is to '"bracket" any preconceptions – conventional, theoretical, political or ideological – in order to study the orientations of participants as they become visible in their interactions' (ten Have, 2006). My own approach diverged from this in that I believe that one always has preconceptions related to the broader social context of the interactions and that these preconceptions inevitably encroach on one's analysis. In this study, for example, divorcing the children's discourse and software use from external knowledge about the educational situation in South Africa (overcrowded classrooms, the scarcity of physical and other resources) could not be "bracketed" out and thus unavoidably influenced my analysis. One needs to be reflexive.

Often key contextual factors remain unstated – such as, for example, the tacit agreement about children's and teacher's roles in classroom discourse. Nonetheless, starting with the data allowed me to see how aspects of classroom discourse and discursive roles were made relevant through the children's discourse and software use. The study was inductive, as I did not initially set out to find which features of the IRF matched children's use of different types of software of how different kinds of software in use may be associated with different configurations of resources and roles.

Conversation analysis allows a close focus on individual interactions, whereas an ethnographic perspective; such as that in the ethnography of speaking; allows for a broader form of analysis which may enable an interpretation of the relationship between different kinds of interactions. Gee and Greene argue that an ethnographic perspective to classroom research provides a 'conceptual approach for analyzing discourse data

(oral or written) from an emic (insider's) perspective and for examining how discourse shapes both what is available to be learned and what is, in fact, learned' (1998:126). Erisckson argues that one of the ethnographer's goals is to 'arrive at a holistic understanding of the overall historical, cultural, or social context, whether that whole be an entire society or the beginning of a single lesson' (cited in Gee and Green, 1998:126). Thus, an emic perspective allows for an understanding of the broader context which in turn, allows for a broader analysis. I did not aim for this depth of immersion for this study.

It is not necessarily the case that a conversation analyst's small-scale analysis does not allow for generalizability. In discussing the issue of generalizability of the results of case studies in conversation analysis, Peräkylä (1997) argues that case studies on institutional interaction have a very restricted generalizability, but that the question of generalizability can be approached from a different direction:

> The concept of *possibility* is key to this. *Social practices that are possible*, that is, *possibilities of language use*, are the central objects of all conversation analytic case studies on interaction in particular institutional settings. The possibility of various practices can be considered generalizable even if the practices are not actualized in similar ways across different settings. (1997:215)

Therefore, a study can show *how* certain practices are made possible through the very details of the participants' action: 'as possibilities, the practices are likely to be generalizable and there is no reason to think that they should not be made possible by any competent member of (at least any Western) society' (Peräkylä, 1997). In the case of this study, it is possible that South African children using the same kinds of software in a school computer laboratory are likely to make use of similar practices. Thus, the results are generalizable as descriptions of what children, along with their teachers, are capable of doing given that the children have the same interactional competencies as those at Mountainside Primary.

Like conversation analysis, multimodal discourse analysis has also been accused of ignoring or downplaying the importance of the physical context. Constantinou argues

that ‘there are fewer researchers, however, concerned to widen their analytic and methodological lenses to include analysis of the extra-semiotic, constraining features of a production or interactional environment’ (2005:615-616). Some multimodal discourse analysts are often primary concerned with analyzing the interactions between modes to the extent that they do not relate it to the significance of what people are actually doing in their interactions with texts. This approach has been criticized as being too focused on “the text” and reifying modes, despite its roots in Systemic Functional Linguistic theory (SFL) which pays attention to language in use. An ethnographic approach may help before doing a multimodal discourse analysis because it may aid the researcher in choosing aspects to analyse that relate to a broader social question. Thus, future studies may benefit from combining ethnography and multimodal discourse analysis, or ethnography and conversation analysis or perhaps all three.

The method that I found to be most helpful was conversation analysis, because it recognizes the power relations between speakers in interaction which is suited to a discussion of classroom discourse. Multimodal discourse analysis has not acknowledged the power differentials between speakers in interaction. Future research may fill this gap in multimodal discourse analysis by putting the power back into discourse, in addition to how discourses are realized through ensembles of modes. If researchers could focus on people in interaction and social power to the same extent that they have focused on modes in interaction, we may have a better understanding of how people truly communicate around and make use of texts.

Validity concerns in research on institutional interaction

A key issue for analysis is the relationship between what is observed in the discourse and how to relate it to contextual factors. Peräkylä (1997) argues that the interpretation of observations is very important: ‘whether or nor “the researcher is calling what is measured by the right name”’ (1997:207). The researcher’s chosen theoretical paradigm and the observations made need to correspond. This is known as construct validity and it involves the ‘relations between theoretical concepts and the observations that are supposed to represent those concepts’ (1997:212). For example, I cannot say

that a certain interaction represents an IRF discourse structure just because it has taken place in an educational context. There needs to be a fit between the interaction selected for analysis and the IRF concept which requires one to identify three different discursive roles being taken up by participants (children and teachers) in interaction. Additionally, the researcher needs to consider the grounds he or she has for claiming that the discourse they have identified is 'connected' to some institutional framework. This means that just because an interaction takes place in a school, it does not determine the institutional character of that particular interaction *per se*.

One cannot take for granted that a particular interaction is the way it is because of the context in which it occurs. Peräkylä (1997) notes two basic criteria for the validity of claims concerning the institutional character of talk as outlined by Schegloff (1987). Peräkylä (1997) argues that the first criterion concerns the *relevancy of categorization*: there is a danger in 'importing' institutional context to data and a researcher may be tempted to assume, without going into the details of the data, that this or that feature of talk is an indication of a particular context having affected the interaction. An example from this study is the care taken not to assume that a particular interaction is necessarily due to the asymmetrical power relations between teachers and their students.

The discourse of the participants needs to suggest which aspects of the context are relevant to them – it is not the researcher's place to decide for them without paying attention to local relevancies. According to Peräkylä (1997), the second issue involves the *procedural consequentiality of context*: 'it is not sufficient to say that a particular context is oriented to "in general" by the participants in interaction, but, instead, it has to be shown how specifiable aspects of context are consequential for specifiable aspects of the interaction' (Peräkylä, 1997:213). Thus, the goal is to make 'a direct "procedural" connection between the context…and what actually happens in the talk' (Schegloff, 1991 cited in Peräkylä, 1997:213). Peräkylä (1997) explains that while 'what is said, when it is said, and how, and by whom, and to whom, may invoke the context; the goal of the conversation analytic research is to explicate exactly how the things said brought

forward the context' (1997:213). These two concerns of conversation analytic research on institutional interaction 'constitute a validity test for the claims concerning the institutional character of interaction' (1997:213). Therefore, these two aspects are something to be demonstrated by the researcher.

Conclusion

This chapter has discussed data collection, recording, transcription and analysis as different stages of research in this study. Key issues identified by Jewitt (2006) about the use of video cameras for data collection were discussed in relation to my research question ('what configurations of resources and roles can be identified when children use different kinds of software in the school's computer lab?') which entails a focus on discourse as social action. This chapter has also discussed my criteria for sampling video data as well as my approach to multimodal transcription. In the section on analysis, conversation analysis and multimodality were compared in relation to how they allow for an analysis of discourse and context: while both approaches allow for detailed analysis of selected interactions, relating these to a broader social context presents a significant challenge. Conversation analysis, multimodal discourse analysis and ethnography were also contrasted. In this study I made use of conversation analysis and multimodal discourse analysis to identify how children's discourses adapted as they used email, a search engine and drill-and-practice mathematics software. Validity concerns in research on institutional interaction were also discussed and related to my research question.

Chapter 4

Keeping score: Children's interactions with drill-and-practice Mathematics software

Introduction

Drill-and-practice software is often referred to as 'first generation' software because it is one of the earliest approaches to computers in education. It conceptualizes literacy and numeracy as 'skills' which can be practiced until they are mastered. The focus of research on children's interactions with drill-and-practice software (apart from usability studies) has been on the improvement of grades, especially mathematics, by using methodologies employing pre- and post-tests. The focus has been on whether or not and how children learn from such educational packages – a preoccupation with skills. In contrast, this chapter considers children's meaning-making practices when using drill-and-practice software and its relationship to classroom discourse.

Classroom power relationships are reproduced in the children's interactions with drill-and-practice mathematics software in several ways. First, an IRF discourse structure is embedded in the software and second, the interface affords teacher surveillance. Third, the dominant peer uses the teacher's discourse as a scaffold to assist his or her peer, which frequently includes evaluating the peer's performance. The children's interactions show that they are focused on the judgments implicit in the evaluation functions of the software. Kress's concept of the represented participant can be applied to software, as suggested by Walton (2008). Kress and van Leeuwen (1996) point out that there are two kinds of participants in communication: represented participants (the subjects of the communication) and interactive participants (the sender/producer and the recipient/consumer of the communication). Therefore, although the represented participant in the software is a single user (whose performance is evaluated by the software), the interactive participants are two children sharing a computer and software

exercise. This representation of the children through the scoring function plays an important role in structuring the relationship between the two children. They use the affordances of the software such as the score for assessment purposes as a resource for competition. In effect, using drill-and-practice Mathematics software tends to be as much (if not more) about power than it is about Mathematics.

The children's language use demonstrates that they are practicing mathematics (i.e. practicing a secondary Discourse already acquired) rather than learning new methods of calculation or mathematical concepts. Their interactions show them using additional semiotic resources such as the spatial language of mathematics as a 'gestural overlay' (Jewitt, 2006:88) in the process of answering questions initiated by the software. Therefore, these interactions highlight that learning mathematics entails more than learning through the use of spoken language: mathematics is multimodal and the children's deployment of the semiotic resources (such as spatiality) of different modes (such as gesture) plays an important role in 'doing' mathematics, although these other modes are barely supported in the software. As O'Halloran (2000) argues, these multi-semiotic resources are essential for children to able to communicate 'mathematically'. Understanding such practices requires us to extend Halliday's language-based theory of learning to other modes of communication.

Previous research on children's interactions with drill-and-practice software

Drill-and-practice software is one of the earliest approaches to using computers in education and is therefore often referred to as 'first generation' software or 'computer-assisted instruction'. According to Stahl *et. al.* (2006:5), computer-assisted instruction was associated with a behaviourist approach that dominated the early years of educational computer applications beginning in the 1960s and it conceived of learning as the memorization of facts. They argue that 'domains of knowledge were broken down into elemental facts that were presented to students in a logical sequence through computerized drill and practice' (2006:5) and that 'many commercial educational

software products still take this approach' (2006:5). Thus, drill-and-practice software carries a 'social meaning' (Kress, 1985:143) about how children learn because it is inscribed with a behaviourist conception of learning.

According to Luik, the term *drill* is 'used for practice, which repeats the material to be learned until it is mastered' and 'drills allow the learner to demonstrate that he/she is able to perform quickly or freely with few or no errors' (2007:56). Luik also argues that 'nowadays, drills are used for the differentiation and individualization of learning, especially at the elementary level and in obtaining basic skills in mathematics, but some researchers claim that drills also help to acquire vocabulary' (2007:56). Luik notes that 'as negative aspects, researchers have found that drill and practice activities on computers discourage cooperation and limit creativity' (2007:56-57). Luik cites previous research by Alessi and Trollip (2001) who assert that 'competition against oneself is less motivating than competition against a partner or against the computer' (2007:60), which suggests a possible reason for the children's lack of cooperation in my recordings: they may be preoccupied with competition.

Drill-and-practice software differs from other kinds of software with regards to the visual organization of the interface and user input. Replying with the keyboard is more difficult for students (Luik, 2007:63). Luik (2007:61) argues that questions and answers are the most important information in the drills – more salient than animations or illustrations. It is claimed that 'a variety of feedback and animation motivates students more, but it could lead students' attention away from the learning goal and reduce the speed of performance' (Alessi and Trollip, 2001 cited in Luik, 2007: 63). An analysis of the transcripts in this chapter appears to support this finding, as the salience of the score and the emphasis on 'correctness' through positive feedback plays a large role in structuring the children's interactions.

Discourse and Mathematics

Numeracy as a social and multimodal practice

Street and Baker (2006) argue that just as the concept of multimodality plays a key role in literacy, it is also crucial to numeracy. They argue that 'in numeracy the issue of modality is central since numerical principles and procedures are always represented in a variety of modes – from oral to written (using symbols) to visual (in mathematics education terms "iconic"), including layout and ordering as in a number square or number line, to actional (or "enactive"), as in the use of concrete apparatus for number or as in the movements across diagrams' (2006:219). According to Street and Baker, 'multimodal forms of meaning making in the learning and use of numeracy' (2006:222) are significant and they 'call upon work in multimodality to describe and explain these features of numeracy practice' (2006:225).

Street and Baker (2006) distinguish between the terms *mathematics* and *numeracy* to bring out the 'social' and multimodal features of practices: *numeracy* includes everyday practices and educational aspects, both of which have a mathematical dimension, whereas *mathematics* involves a more specialized and abstract set of practices. Street and Baker (2006) adopt the concepts of *numeracy events* and *numeracy practices* as an analogy to *literacy events* and *literacy practices*. Numeracy events are defined as 'occasions in which a numeracy activity is integral to the nature of the participants' interactions and their interpretative processes' (Baker and Street, 2006:221). Numeracy practices are defined as 'more than the behaviours that occur when people do mathematics/numeracy – more than the events in which numerical activity is involved – and so explore the conceptualizations, the discourse, the values and beliefs and the social relations that surround numeracy events as well as the context in which they are cited' (Street and Baker, 2006:221). Street and Baker argue that a social view of mathematics is needed, one which goes against viewing numeracy 'simply as skills or as universals that everyone should learn and acquire in the same way' (2006:223). This view of mathematics is different to the one implicit in drill-and-practice software which assumes universals by drilling skills until they are mastered. The children's discourse and use of drill-and-practice mathematics software also suggest that the software does

not only assume universal skills, but also carries a social value associated with being correct.

Street and Baker argue that there is a 'mathematics dimension' to numeracy as a social practice which 'privileges certain kinds of operation and procedure and certain specialist language and skills' (2006:224). They assert that 'much practice in mathematics calls upon different modalities, such as use of signs, whether in the form of number symbols or words or use of diagrams (like number squares) and inserting them into texts, with sequences, juxtapositions which indicate meaning and so on' (2006:225). For the purpose of this thesis, I will use the term *mathematics* as used by O'Halloran (2000). Her usage also allows for a social and multimodal view of mathematics without differentiating it from *numeracy*.

The impact of the multisemiotic nature of mathematics on classroom discourse

O'Halloran argues that mathematics is not construed solely through linguistic means: mathematical discourse is 'multisemiotic because it involves the use of the semiotic resources of mathematical symbolism, visual display and language' (2000:359). She argues that there is 'constant movement between these three resources as the primary code and with shifts between spoken and written modes in classrooms' (2000:359). According to O'Halloran, the problem of investigating 'mathematical language' 'extends beyond the examination of particular linguistic selections that occur in mathematical texts and classroom discourse', because 'a critical reading of any form of mathematical discourse must necessarily take into account the multisemiotic nature of its makeup' (2000:360). She argues that semantic shifts in meaning which occur with movements between semiotic codes in mathematics are perhaps not always recognized , especially those which occur as a result of the role of language as a metadiscourse for mathematical symbolic statements. O'Halloran (2000) argues that investigating the multisemiotic nature of mathematics may shed new light on difficulties inherent in the teaching and learning of mathematics.

Discourse structures implicit in Cami Maths

Fisher (1997c:81) asserts that the 'discourse accompanying highly structured programs conforms well to the IRF (Initiation, Response, Follow-up) structure identified by Sinclair and Coulthard in teacher-centred classrooms, with the computer often taking the initiating role' (1997c: 81). Walton (2007) argues that the IRF pattern is encoded in educational software (such as Cami Maths discussed in this chapter) in the form of multiple choice questions and computer-based exercises and therefore such software may be considered as a simulation of triadic discourse. However, she also argues that 'Fisher's model (whereby the computer plays an initiating role and children choose how to respond) does not really account adequately for all the discursive effects of triadic discourse in software' (2007:201). Walton (2007) asserts that such software is even more restrictive than classroom discourse, because it provides possible responses, rather than allowing children to generate their own.

Prinsloo and Walton argue that 'the drill-and-practice exercises of educational software simulates the interaction patterns of classroom discourse' and that it does this 'through the rule-governed sequencing of images, text, audio and sometimes video and animation' (2008:8). Additionally, although 'the "closed" questioning style works to shut down dialogic interchange and does not encourage children to provide justification and further information', it works 'well as an attention-focusing strategy for teachers who have limited subject knowledge, pedagogic training and who are dealing with large classes and with syllabus content to cover' (Prinsloo & Walton, 2008:6-7). According to Prinsloo and Walton, 'such educational software creates a representation of the learners and their learning by evaluating answers and summarizing them in a score or grade' (2008:7). As will be discussed in this chapter, the representation of learners through such evaluation has significant discursive effects on the children's interactions.

"Not with you doing it!"

The interactions discussed in this section illustrate how the children understand 'doing mathematics' in this context as well as the tension between turn-taking and 'doing

mathematics'. My classroom observations suggest that if teachers control children's turn-taking, this influences whether the children approach the exercises as individual or joint endeavours. This factor is more important than the bald fact that the children are sharing the computers: sharing the computer does not guarantee that the children are working together. The teacher in this class did control turn-taking by telling the children how many sums each child should do. The following interactions highlight how sharing the activity becomes a site for conflict.

I observed Brenda and Michael, two Grade five learners (aged 10-11 years) in Mr. Ernest's Mathematics class. Mr. Ernest instructs the class to do the exercise "Halving and Doubling (illustrated)" in Cami Maths. During the first few minutes of the lesson, Michael types in the answers and does not talk to Brenda. When he gets an answer wrong, Brenda points out his mistake – he was only counting the dots in one of the squares:

1 2 3	Brenda: There! *(points at the instructions "Count all the dots in the two squares" at the bottom of the screen)* Michael: We only got two right. Brenda: You must double (...)	Michael types '11'	("Double 11 = 11 dots + 11 dots")  Negative feedback: "Oops..." and "Double 11 = 11 + 11 = 22" in a red block next to a big red cross.

Transcript 1: Brenda and Michael (You must double)

The software accords importance to assessment and the evaluative discourse is reproduced by Brenda who comments on Michael's performance by drawing attention to his mistake and showing him why his answer was incorrect. Michael's talk in line 2

suggests that he is more interested in the score than in why his answer was wrong. By showing Michael the instructions at the bottom of the screen and telling him to double, Brenda's talk is focused on helping Michael to get the answers right. The negative feedback "Oops..." implies an accident and this verbal feedback may be considered as being 'softer' than the visual feedback – the big red cross implies that Michael is wrong, rather than just having made a mistake.

A closer look at the software's feedback on correct and incorrect answers reveals a similar emphasis on 'correctness'. Figure 1 shows what the interface looks like when Michael receives feedback on a correct answer: a green tick appears at the bottom of the screen with the word "Impressive!" next to it. However, receiving positive feedback is less visually salient than negative feedback. On getting an answer wrong (Figure 2), Michael not only receives a big, red cross with the word "Oops..." next to it, but the correct answer is displayed in a red block in the centre of the screen and the green bars on the left and top of the screen change to red. Thus, answering a question incorrectly results in a visual alarm. The salience of the score on the screen reinforces the importance of 'evaluation' and 'correctness'. Additionally, because of the size of the score and the fact that the teacher walks around the lab while the children are completing these exercises, the children are even more aware of being evaluated: their teacher is 'watching' them by checking their scores. The size of the score suggests that the interface has been designed to afford surveillance by a secondary user – the teacher, a real person who is an additional 'watchdog' for incorrect answers.

During this lesson, neither of the children logged in using their own Cami Numbers: they typed in a random number which appears to belong to a Grade R learner, Lugmaan Scott. Therefore, Brenda and Michael (interactive participants) are positioned as a Grade R (the reception grade) learner (represented participant). There is a disjunction between the represented and interactive participants, which lends an ironic tone to the

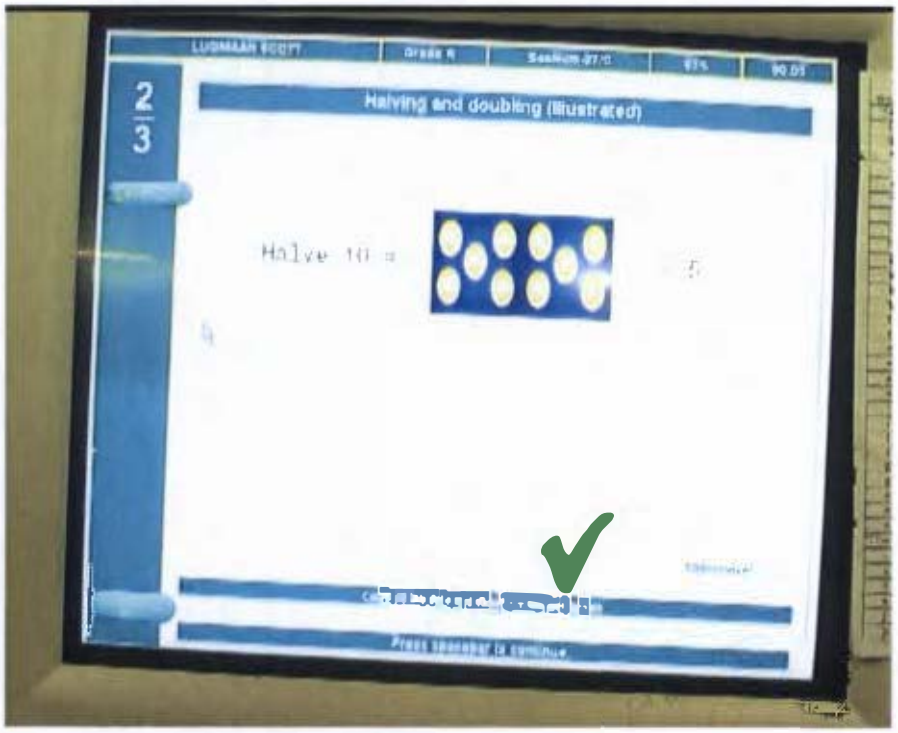


Figure 1: Software feedback on Michael's correct answer

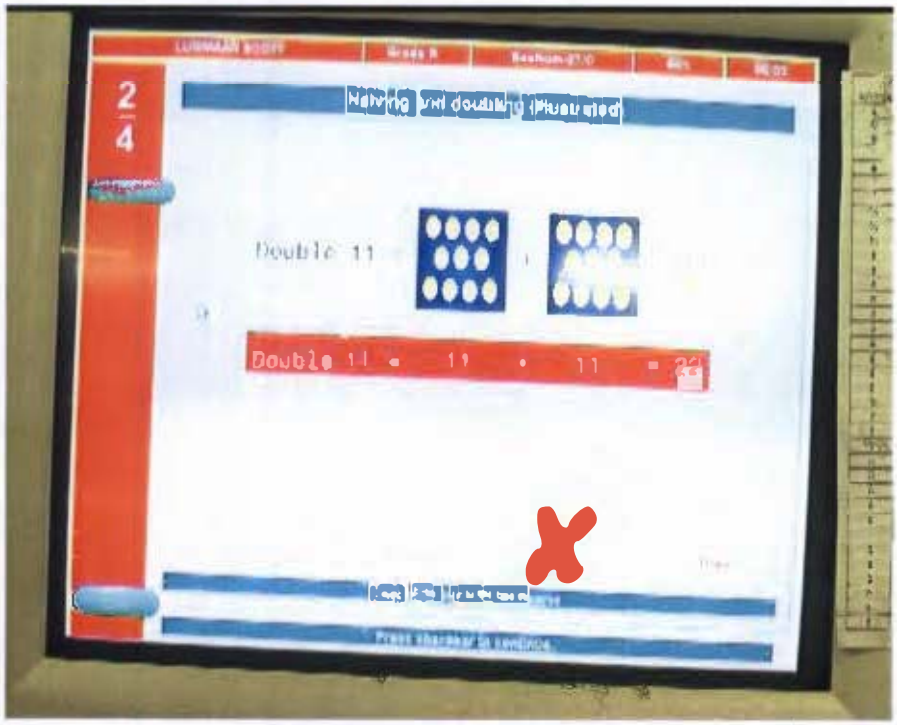


Figure 2: Software feedback on Michael's incorrect answer

software's formulaic feedback phrases such as "Go Lugmaan!" even though Lugmaan is not the one doing the exercises. Although neither Brenda nor Michael are personally identified by the software, and their score can thus not be recorded, they still accord importance to evaluation and 'correctness'.

A closer look at the interactions suggests that 'correctness' is not the only thing being evaluated. Even though the software's personalization of assessment during this lesson is incorrect, the children's interactions suggest that they use it to signify their mathematical ability. Brenda's comments are quite telling:

1 Michael: Let's finish these.
2 Brenda: Yes!
3 Not with you doing it!
4 Michael: Joh!

Transcript 2: Brenda and Michael (Not with you doing it!)

Brenda's comments suggest that she has evaluated Michael's mathematical performance and considers him to be less capable than herself. Brenda's comment in line 3 suggests that they will not be able to finish the exercise if Michael is the one answering the questions. Brenda's use of the words "doing it" not only suggests that she sees the person entering answers with the keyboard as the one "doing" the exercise, but "doing it" also involves answering the questions correctly and raising the score. Thus, "doing" Mathematics comes to be about 'correctness' and Brenda works against Michael by insulting his competence and casting doubt on his ability to achieve correct answers and a higher score.

The following interaction occurs a few minutes later after Michael has relinquished control of the keyboard to Brenda who is now typing in the answers:

1 Michael: Now you must halve sixteen! (points at the screen)
2 Brenda: I did!
3 I got it right!
4 Stupid!
5 Michael: No you must do it again…
6 Brenda: I know…

Transcript 3: Brenda and Michael (I got it right! Stupid!)

This interaction shows the activity as an individual endeavor: the children's use of 'I' and 'you' instead of 'we' signal opposition. Brenda's comment "I got it right!" serves to demonstrate power and control by turning to the software's evaluation and the score as evidence of her competence. She also maintains her dominance by insulting Michael again in line 4. The aggressive and competitive discourse identified so far reinforces the idea of conflict. Michael and Brenda's interactions also highlight conflict because they are positioned as a single user by the software. In effect, completing the exercise is transformed into a site for competition.

"Help your partner"

Zhira and Mark are another two Grade five learners in Mr. Ernest's mathematics class. These two children completed an exercise which required them to add two large numbers using columns for hundreds, tens and units. The observations discussed in this section suggest that some of the discourse patterns identified with Brenda and Michael occur here too, as well as some additional ones: 1) the role of the teacher as a secondary user and the children's awareness of his surveillance; 2) how the children invoke the teacher's discourse of the "struggler" to work against one another (teacher scaffolds unequal power relations); 3) how the emphasis on the score and personal evaluation structures the children's interactions with one another; 4) negotiating the disjunction between represented and interactive participants 5) giving one's partner the answers to ensure correctness, thereby bypassing the teacher's helping rules, 6) learning as learning through language and other modes of communication – the

children's language suggests practice and when they do explain calculations, they adopt the teacher's metaphor as a scaffold in addition to using 'gestural overlay' (Jewitt, 2006:88), thus highlighting learning through the spatial language of mathematics.

Mr. Ernest, the 'watchdog': Surveillance, 'correctness' and scaffolding helper-struggler relationships

Mr. Ernest manages turn-taking during this lesson by telling the children to do ten sums each for the first exercise. His talk functions to regulate turn-taking, control the pacing of the lesson and remind learners of the calculations:

1 Mr. Ernest: *(to class)* That should take you ten minutes.
2 Have you got it?
3 One minute a sum.
4 If your partner seems to struggle, help your partner,
5 but don't give your partner all the answers.
6 Have you got it?
7 And you need to carry some…uh…an amount over as well.
8 You have to remember the amount that you have to take over.

Transcript 4: Mr. Ernest (Have you got it?)

Mr. Ernest makes his expectations of the learners explicit: each learner is expected to take ten minutes to complete ten sums. The emphasis on "partner" (lines 4 and 5) suggests that he wants the children to work together, despite separate ten minute turns. Mr. Ernest's comment "If your partner seems to struggle, help your partner, but don't give your partner all the answers" suggests that the learner whose turn it is not may know the answer whereas their partner may be struggling. Mr. Ernest is also specifying a particular kind of help – not giving one's partner the answers – implying that the 'helper' needs to provide the 'struggler' with hints and assistance with calculations. The discourse of the 'struggler' positions the 'helper' as the more knowledgeable peer and thereby, scaffolds the children's understanding of the relationship between them and their peers: unequal power relations are suggested by the binary of 'helper' and 'struggler'. Therefore, Mr. Ernest's discourse suggests a tension between 'partners' assumed to have equal power and the asymmetrical power relations between a 'helper' and a 'struggler'.

A few minutes later, Mr. Ernest clarifies what he meant by 'ten sums'. The children each need to get ten answers *correct* (as indicated by the score) before changing turns:

1 Mr. Ernest: The top number must be ten before your partner can start.
2 So if you've only got nine out of twelve you must get to ten
3 before your partner can start.

Transcript 5: Mr. Ernest (The top number must be ten)

Mr. Ernest's discourse highlights the importance of the score ("the top number") and implies that 'doing' ten sums is not the same as getting ten sums 'correct'. Therefore, Mr. Ernest reinforces the software's emphasis on 'correctness' and thereby the meaning of 'doing' Mathematics implicit in the software discourse.

However, the score's function extends beyond allowing the learners to keep track of one another's correct answers and signaling when to change turns. Mr. Ernest uses the score as a means to monitor his learner's progress. Once he sees that a pair has reached twenty correct answers, he comes over to them and gives them a new exercise to do:

1 Mr. Ernest: *(to Zhira and Mark)* Well done.
2 Okay you got twenty Mark,
3 I'm coming to you now, hey.
4 *(teacher comes to them, clicks on 'exit' and then 'Subtraction of two large numbers')*
5 Okay.
6 You've got to do ten and she does ten.
7 Right – you do ten.
8 Zhira: Yes sir.
9 Mr. Ernest: Help him if he struggles, okay, and you…
10 um, you do ten…
11 and…
12 work together.

Transcript 6: Mr. Ernest (I'm coming to you)

This interaction again highlights the importance of the score, by demonstrating how Mr. Ernest relies on it to keep track of his learners' progress. However, by telling Zhira to help Mark if he struggles (line 9), Mr. Ernest is positioning Zhira as the more knowledgeable 'helper' and labeling Mark as the 'struggler'. As will be discussed in the following section, this kind of discrimination by the teacher which elevates one peer above the other becomes an issue of conflict between the learners themselves: by fighting about who the 'struggler' is, Zhira and Mark are simultaneously competing for the role of the more knowledgeable peer. Thus, while literally keeping score (of correct answers), they are also 'keeping score' of their roles, competing against one another to avoid being labeled as the 'struggler'.

Keeping score of 'correctness' and roles: Measuring Mathematics and power

After Zhira gets an answer wrong, the following interaction ensues:

1	Zhira: Huh? *(after typing in an incorrect answer and getting the sum wrong)*
2	Ha! *(gasps)*
3	Mark: Clever! Clever!
4	Teacher: *(to class)* Who's struggling?
5	Zhira: *(to Mark)* Lift up your hand.
6	Who's got the most answers wrong?
7	You…
8	Mark: You were only able to get two.
9	Teacher: *(comes to them without being hailed)* Struggling Mark?
10	Hey, are you struggling?

Transcript 7: Zhira and Mark (Clever! Clever!)

So far during the lesson Zhira had answered most of her questions correctly. However, she and Mark have been given a new exercise to do and for the first time she appears to be struggling a bit. On getting a sum wrong, Zhira's position as the more knowledgeable peer starts to be challenged. Mark insults Zhira with his sarcastic cries of "Clever! Clever!" (line 3), suggesting that perhaps she is not as 'clever' as she would like to think. Zhira returns Mark's insult: when she hears Mr. Ernest asking the class "Who's struggling?" (line 4) she tells Mark to lift up his hand (line 5). Zhira suggests that Mark is the 'struggler' because he "got the most answers wrong" (line 6): he is the

'weakest link'. Therefore, Zhira sees struggling as a role, rather than a current experience. Mark's remark that Zhira was only able to get two correct answers (line 8) on the new exercise, suggests that he sees struggling as a present condition, irrespective of past correct answers. Mr. Ernest comes to them after glimpsing the score and assumes that Mark is the one who is struggling (lines 9-10), whereas it is actually Zhira. However, the teacher's positioning of Mark as the struggler even though it was Zhira's turn to do the activity reinforces Zhira's insult and maintains her status as the more knowledgeable peer. This interaction demonstrates the importance accorded to 'correctness' in doing Mathematics in this context as well as the children's conflict over the role of the more knowledgeable peer: being 'clever' involves being 'correct' so that one is not labeled as a 'struggler'. Thus, the children compete against one another by appealing to current and past scores as evidence of 'correctness'.

"Don't give your partner all the answers": bypassing helping rules

Zhira and Mark do not always bully one another about their scores. The interaction discussed next shows them 'doing' the following sum:

```
  53 115
+30 918
  84  033 (correct answer to be calculated by students)
```

Zhira 'helps' Mark by giving him the answers which Mr. Ernest told the class not to do, but Mark does not refuse Zhira's help:

Line	Speech	Input with keyboard (Response)	Software (Initiation & Feedback)
1	Zhira: That's five…thirteen.	Mark types '3'	"Spot on!" (3)
2	That's three, okay another three.	Types '3'	"Precisely!" (3)
3	That's ten – nought.	Types '0'	"Go ALBERT!" (0)
4	That's three, that's…four.	Types '4'	"Excellent ALBERT!" (4)
5	That's eight.	Types '8'	"Hey, hot stuff!" (8) & green tick. [Score: 17/18]
6	Zhira: That's um…		
7	Researcher: You giving him all the answers?		

8	Zhira: No, I'm just helping him.		

Transcript 8: Zhira and Mark (I'm just helping him)

After I caught Zhira giving Mark the answers, she changed her 'helping' strategy by telling him what to add: Zhira is aware that giving answers is not allowed. However, it can be suggested that both Zhira and Mark care more about the score and being 'correct' than the means to achieve this. Mark does not contest bypassing the teacher's rule of not 'giving answers': he gets to receive a high score and avoid being labeled as a 'struggler'. Zhira on the other hand, gets to prove that she is not the 'struggler' because she is 'helping' Mark, thereby cementing her status as the more knowledgeable peer.

In effect, they bypass their teacher's helping rules and 'work together' to achieve a high score. This interaction shows that although it is Mark's turn to answer questions, this does not mean that he is 'doing' Mathematics: he is merely keyboarding Zhira's answers without question. The interactions discussed in the next section demonstrate more genuine 'helping' strategies.

Learning Mathematics by communicating mathematically

The following interaction shows Zhira adopting the teacher's 'borrow' metaphor and using additional semiotic resources to explain the calculations to Mark:

Line	Speech	Input with keyboard (Response)	Software (Initiation & Feedback)
1	Zhira: *(points at screen)* You can't now,		HTU
2	it's… you must **borrow**.		932
3	No Mark, **borrow** from the three		-429
4	*(points at the screen)*		503 (answer)
5	That is, not that is gonna be		
6	*(counts on hands)*		"Err…" (0)
7	thirteen – that's twelve,	Mark types '0'	"Err…" (1)
8	now twelve minus nine.	Types '1'	"Err…" (2)
9	No…	Types '2'	"Nice one
10	Wait – twelve – three.	Types '3'	ALBERT!" (3)
11	Two minus two.		

12	Mark: Two		
13	Zhira: Minus two		
14	Mark: Two minus two		"Excellent
15	Zhira: Nought.	Types '0'	ALBERT!" (0)
16	Nine minus four.	Types '5'	"Fantastic" (5) &
17	Mark: Yes!		green tick.
			[Score: 12/13]
18	Zhira: Now you can't, now that's		
19	*(pointing at screen)*		HTU
20	a nought now neh and that's		816
21	*(pointing at '1' – top middle number*		-519
22	*and '6' top right)*		297 (answer)
23	a sixteen.		
24	Sixteen minus nine.		
25	Mark: (…) *(mumbling to himself)*		"Spot on!" (7)
26	Okay, that's seven.	Mark types '7'	

Transcript 9: Zhira and Mark (You must borrow)

Firstly, Zhira and Mark's use of language suggests that they are practicing Mathematics subject matter that they already know (doing subtraction), rather than learning new concepts or methods of calculation. However, Zhira uses Mr. Ernest's 'borrow' metaphor in the process of telling Mark what to subtract from what. Therefore, Mr. Ernest's discourse scaffolds the process of calculation. This kind of scaffolding is not provided by the software. Zhira tells Mark to "borrow" from the three (line 3) in 932, pointing at the number on the screen, and explains that this gives them 12 minus 9. She explains the same method again (line 18 onwards), proceeding with the same logic. Her explanations of the method both start with the words "you can't" (line 1 and 18) meaning that 9 cannot be subtracted from 2 or 6. Her explanation of the method follows with borrowing a '1' from the tens column, pointing at the units column in both cases and saying "that's twelve" when explaining the first sum and "that's a sixteen" when explaining the second sum. Thus, the teacher's "borrow" metaphor is realized verbally as well as through gesture because Zhira points at the number that is increased by ten after borrowing from the next column.

Jewitt refers to this process of pointing at the screen as 'gestural overlay' (Jewitt, 2006:88) and discusses how children's use of modes of engagement (other than language) can be read as signs of learning. Jewitt argues that students realize different kinds of spaces on the screen 'through their gesture and gaze with/at the screen itself, and their interaction with and organization of the elements displayed on the screen' (2006:84). According to Jewitt (2006:86), students create an 'imagined-space' overlaying the screen through their gesture on the screen and they 'place' things (gesturally) where they want them to be and imagine their movement. Zhira is transforming Mr. Ernest's "borrow" metaphor spatially and modally through her use of 'gestural overlay' (Jewitt, 2006:88). Zhira uses gesture as a resource for explaining the calculations to Mark and thereby realizes a different kind of space on the screen. The role of gesture is central in this interaction. Zhira's gestures with the screen are represented in Figure 3.

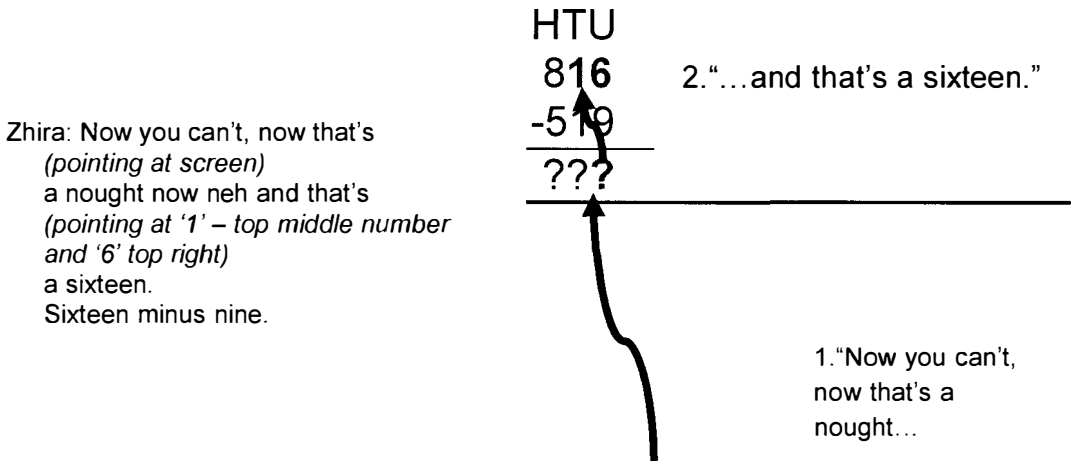


Figure 3: Zhira's gestures (pointing at the screen) are depicted by arrows. Her talk at the time of pointing is represented on the right of the arrows.

Jewitt (2006:87) argues that students' gesture can be analysed as one sign of learning. Firstly, Zhira's pointing at the screen gives a way into understanding how she may be thinking about the concept "borrow". Zhira points from the bottom space in the units

column (the blank signifying an answer which needs to be keyboarded) to the '1' in the top of the tens column. This suggests that she moves from the bottom to the top of the sum (vertical), from the answer after subtraction to the larger number at the top (816) which she has to subtract from. Her pointing also suggests horizontal movement across the columns: she moves left horizontally in order to "borrow" from the tens column. Therefore, one may suggest that Zhira thinks about the concept "borrow" mathematically in terms of adding a '1' from the tens column to the number in the units column as well as the fact that this is true for the larger number at the top and does not apply to the smaller number which needs to be subtracted. Also, Zhira's "borrowing" from the tens column suggests that she sees addition as necessary before subtraction: she can only subtract the '9' of '519' from the '6' in '816' once the '6' becomes a '16', thereby adding ten.

Zhira works with "borrow" in a way that suggests a particular kind of movement: taking from one place and putting it in another. Zhira's pointing enables her to imagine this movement which is then realized numerically by inputting an answer after applying Mr. Ernest's "borrow" metaphor. Thus, Zhira's 'gestural overlay' (Jewitt, 2006:88) with the screen allows her to calculate the sum: through her gesture with the screen, Zhira has created a space for making meaning that enables her to bring together her everyday knowledge of "borrowing" and its meaning in the context of doing Mathematics.

Before continuing with a discussion of the interaction, it is necessary to note that the word "borrow" is an everyday concept which has a specific meaning in the context of Mathematics. Halliday argues that 'we can refer to a "mathematics register", in the sense of the meanings that belong to the language of mathematics (the mathematical use of natural language, that is: not mathematics itself), and that a language must express if it is being used for mathematical purposes' (1978:195). According to Halliday (1978:195), we should not think of a mathematical register as consisting solely of terminology, as it involves reinterpreting existing words as in the case of "borrow" discussed in this section. Registers 'involve new styles of meaning, ways of developing an argument, and of combining existing elements into new combinations' (Halliday,

1978:196). Halliday argues that 'modern mathematics has tended to redefine simple words rather than coining new ones for its technical terms', but 'this in fact is part of the difficulty; the fact that a concept such as "set" has a precise mathematical definition may be obscured by the simplicity of the word itself' (1978:201). Halliday (1978:201-202) argues that modern mathematics involves relations with other aspects of life which are emphasized more explicitly, whereas in earlier days, mathematics tended to remain quite separate from the rest of a child's experience. One may suggest that Zhira has experience with "borrowing" in other contexts and is aware of how the word functions as a part of mathematical register. Halliday (1978:202) argues that the language of mathematics involves a great deal of metaphor, and that this is where difficulties often reside because a metaphorical guise is used to express abstract, formal relations. However, the interaction suggests that Zhira understands the word "borrow" in the metaphorical sense and is able to apply it to the sum. Although Halliday does not extend his discussion of mathematical register to modes of communication other than language, one may suggest that gesture forms part of it. Zhira is able to realize "borrowing" gesturally which suggests an expression of abstract mathematical relations.

Additionally, Jewitt (2006:88) argues that the space created through overlaying gestures on the screen allows students to display their intentions without having to engage with the constraints of the program. However, Zhira's use of gesture suggests that she is using it as an overlay to compensate for the constraints of the program. Cami Maths is programmed in a way which suggests particular conventions: some exercises allow children to visually represent "borrowing" by typing in the number in the form of a superscript, but the exercise that Zhira and Mark are doing does not. One may suggest that the software is designed for practicing Mathematics the students are already familiar with because calculations are not represented in the form of steps. While this could be an interactive feature of Mathematics software, it is not in the case of Cami Maths. There are no animations displaying calculations. Only the questions are displayed and the blank space where the answer needs to be inputted by the student. Thus, the space between questions and answers – problem-solving through calculation

– is ignored by Cami Maths through its programming conventions. However, Zhira's use of gesture suggests that she is creating this space herself.

In addition to pointing at certain places on the screen, Zhira also counts using her fingers (line 6). Halliday argues that 'everyday language embodies some mathematical meanings in its semantic structure – ways of counting, measuring, classifying and so on' but 'these are not by themselves sufficient to form the natural language component of mathematics in its modern disciplinary sense' (1978:195). Halliday considers counting as a 'point of departure for the initial learning of mathematical concepts' (1978:195). However, Zhira uses counting to support her argument or calculation: she uses her fingers to keep record of verbal counting, thus playing a checking function. Therefore, this interaction shows Zhira drawing on additional semiotic resources in the process of calculation and this suggests that 'doing' Mathematics also involves the deployment of modes of communication in addition to language in order to communicate mathematically.

Although Zhira and Mark have their own Cami Numbers, the entire class is told to log in using the teacher's number. This is why the feedback which affords personalized assessment assumes "Albert" (Mr. Ernest's first name) to be the user. The children do not comment about this, but giggle ever so often, noting the disjunction between the teacher as the represented participant and themselves as interactive participants.

"You do it"

Shane and Kyle are two Grade six learners (aged 11-12 years) in Mrs. Rosie's Mathematics class. Unlike Mr. Ernest, Mrs. Rosie does not establish any turn-taking rules during this lesson. Shane and Kyle devise their own turn-taking practice: after doing one sum, the one slides the keyboard to the other who enters the answer and then slides it back to his partner. However, the boys do not stick to this practice. Unlike Brenda and Michael (discussed in the previous section) who fight over doing the exercises to achieve a high score, Shane and Kyle's interactions suggest a different

scenario. Kyle constantly appeals to Shane to type in the answers by saying “Do this one Shane” and “Huh-uh, no – you must do it”.

After seeing their score of 42/44, Mrs. Rosie comes to the boys:

Line	Speech	Input with keyboard (Response)	Software (Initiation & Feedback)
1	Mrs. Rosie: Just exit there.	Shane clicks on ‘exit’	
2	Go to number six.	and selects “6.	(exercise opens)
3	You recognize that?	Complete the	2/? = 6/9
4	Shane: Yes Miss.	equivalent fraction of	
5	Mrs. Rosie: What you do to the	the given fraction”	
6	top,	from the fractions	
7	you do to the bottom.	exercises with the heading “Equivalent fraction of another fraction”.	

Transcript 10: Mrs. Rosie comes to Shane and Kyle

Once again, this interaction highlights the teacher’s use of the score to track the learners’ progress. Unlike Mr. Ernest, Mrs. Rosie does not instruct the boys to complete a certain number of correct answers individually. Mrs. Rosie also provides the mathematical rule “What you do to the top, you do to the bottom” pertaining to fractions in order to scaffold the process of calculation.

Shane appropriates Mrs. Rosie’s rule to scaffold his calculation:

Line	Speech	Input with keyboard (Response)	Software (Initiation & Feedback)
1	Shane: Two, four…		2/? = 4/6
2	Kyle: Six, twelve.		
3	Shane: Wait		
4	*(points at screen)*		
5	two times two is four		
6	Kyle: Four.		
7	Shane: So it’s…		
8	Kyle: Six, twelve		

9	Shane: No (…)		
10	*(points at screen)*		
11	Two times two is four,		
12	now **what you do to the top, you do to the bottom.**		
13	Kyle: So…		
14	*(Shane points at the '2', the blank, and then the '6')*		
15	Two times six.	Kyle types '3'	Feedback: "Spot on!" & green tick. [Score: 11/12]

Transcript 11: Shane and Kyle (What you do to the top, you do to the bottom)

Shane is unsure of Kyle's answer, so he applies Mrs. Rosie's rule. He realizes the rule by using the spatial language of Mathematics: he points at the 2 on top, then at the blank and then at the 6 on the other side of the equal sign. Therefore, in the process of calculating the equivalent fraction, Shane's gestures suggest a shift in attention between the top and bottom numbers of the fractions as well as left and right of the equal sign. The mathematical rule in the verbal mode is therefore realized visually through gesture. Shane's pointing functions as a 'gestural overlay' (2006:88), just like Zhira's pointing discussed in the previous section.

As with Zhira and Mark, the boys' use of language also suggests practice:

Line	**Speech**	**Input with keyboard (Response)**	**Software (Initiation & Feedback)**
1	Kyle: Four, eight, twelve, sixteen…		(score is 5/5 so far)
2	Shane: Four, eight, twelve, sixteen is four times.		4/? = 16/28
3	*(points at '28' on the screen)*		
4	What comes in there four times?		
5	Six… wait…		
6	Four go into there?		
7	Kyle: Four, eight, twelve, sixteen.		
8	Shane: *(points at the '4' and the '16')*		
9	Four goes into this four times,		
10	now this		
11	*(points at the blank space)*		

12	must also times by four.	
13	Kyle: So it's four, eight, twelve, sixteen, twenty-four, twenty-eight –	
14	seven times.	
15	Shane: Seven, fourteen, twenty-one, twenty-eight.	
16	*(points at the blank space)*	Shane types
17	Seven.	'7'

Transcript 12: Shane and Kyle practice their tables

This interaction shows the boys practicing their tables and applying this knowledge to fractions. The boys are both involved in calculating and checking their answer, unlike the pairs of children discussed in the previous sections. This interaction and the previous one both demonstrate the boys checking their answers, relying on one another to make sure that the answer is 'correct'. Therefore, although Shane and Kyle's discourse does not suggest competition against one another, the emphasis on 'correctness' still structures their interactions albeit in a different way to the other children observed.

Conclusion

The children's discourse and use of Cami Maths suggests that feedback largely defines the activity, as the IRF encoded in the software and the score sets up an identity for the children: the score provides an evaluation that brings up an identity of someone who is 'stupid' or a 'struggler'. The emphasis on evaluation shapes what it means to 'do mathematics' in this context: 'doing mathematics' involves being 'correct' and not being labeled as a 'struggler'. Additionally, the size of the score in the interface affords teacher surveillance. The interactions discussed suggest that children compete against one another for a high score and they often evaluate one another's performance. Therefore, the children are not only being evaluated by the software and their teacher, but also by their peers. Thus, the software's scoring system structures the children's interactions in significant ways.

The observations discussed in this chapter also highlight the importance of scaffolding and the semiotic strategies that children use when 'doing mathematics'. The children's use of the software suggests that 'gestural overlay' (Jewitt, 2006:88) with the screen is also an important part of 'doing mathematics' in this context. The children's discourse and software use discussed in this chapter demonstrates the multimodal nature of mathematics, but this also involves social meanings such as the value associated with correctness and how children use the score to signify identities such as that of a 'struggler'. Thus, communicating mathematically in this context also involves keeping score of correct answers and identities through the power or lack thereof associated with roles such as that of a 'struggler'.

Chapter 5

Googling an Education: Reshaping classroom discourse and learning?

Introduction

This chapter discusses the importance of language and other semiotic systems used in the search process: the language and other semiotic systems children use while searching for and selecting information online often suggest what and how they are learning. The two observations discussed in this chapter show how the children cope with a specific kind of information overload: they are thrown into the 'deep end' and expected to retrieve answers from websites written for a very different audience, and which use discourse that the children do not understand.

The first section of the chapter reports on a geography lesson where children were asked to find 'facts' about the Southern Cross and discusses how the children try to bypass the need to read the complex language of the site by looking for visually foregrounded information. The second section reports on a scaffolded history lesson about medical pioneers: this lesson is different to the first case study, and is somewhat unusual in that the children make use of worksheet with questions which structure or scaffold their searching. This sets the lesson apart from all the other searches observed for this study and for the broader research project e.g. those discussed by Walton (2008). The discourse scaffolding provided by the worksheet is explained in relation to how the children are able to transform their search queries. This is one of the reasons why the two Google sessions are so different. If we look at children's search practices from a discourse perspective and notice the importance of language and accompanying semiotic systems of communication, we gain the ability to understand searching as a sign-making activity which involves more than decoding language.

Finding the Southern Cross

Mrs. Rosie, a Grade 6 Geography teacher, enters the computer lab and tells me, "Last time they did the constellation of the Milky Way, today we are going to look at the Southern Cross". She draws the class's attention to the words "Southern Cross" written on the board and tells them, "We are going to do research" and "In your books, I want you to write down ten things you can find about the Southern Cross...guide people that are lost...so write down some facts".

This interaction between Mrs. Rosie and her students is an example of a characteristic form of classroom discourse in South African schools. By requesting ten written 'facts' from the students, the teacher is also asking them to engage in a transcriptive writing practice. The teacher's request implies her attitude towards the Internet as a repository of 'facts' that her students can use to transcribe information from, much as they would from a textbook or from the blackboard. As Walton (2008) explains, Mrs Rosie frames web searching as an act of 'reproductive' writing, thus setting parameters on her students' 'writingrights' (Kress, 1994:21). A power differential structures the children's writing: the teacher's words set the agenda and the children copy the words on the board into the search engine's query field. Additionally, the teacher's discourse suggests that the two activities; 'doing research' and 'writing down facts'; are conflated: for Mrs. Rosie, 'doing research' is equal to using Google to find and write down 'facts'.

I observed two girls; Tasha and Candice (aged 11-12 years); using Google to find information about the Southern Cross. They type 'southern cross' into the search bar, thus copying their teacher's words from the board as a search query. The search engine delivers the results page depicted in Figure 4. The set of results that they receive suggests that Google is not always the best choice as an information retrieval tool for young children. The search results contain the following links: the first link is "Crux – Wikipedia, the free encyclopedia", the second is "Crux: Southern Cross Constellation, with pointers", the third is "Southern Cross Healthcare Home" and these three results

are followed by "See results for: Southern Cross *lyrics*". Thus, there is a lack of fit between the target domain (geography) and the Google results.

The three *results* are followed by *suggestions* or *recommendations* by Google, with a line separating the *results* from the *recommendations*. The search engine acts as an 'information broker' (Fabos, 2008: 865) and its page ranking includes social recommendations: people who search for 'southern cross' also search for 'southern cross lyrics'. The children are thus confronted with other people's searches, despite the fact that there is a semiotic mismatch between the domain of 'Music' (Crosby Stills and Nash lyrics) and the 'geography' lesson in which the children's query is situated.

Figure 4: Search results for 'southern cross'.

It is unclear whether Mrs. Rosie wants to introduce the children to an investigative approach to knowledge by consulting a range of different sources or whether she sees the Internet as having a means in itself. Towards the end of the lesson she made her agenda for the searching activity explicit by walking around the lab and showing pairs of children a preselected website about how one can use the Southern Cross to find the time. As will be discussed below, the children have difficulty doing what Mrs. Rosie has asked (finding ten 'facts') because she has not scaffolded this task for them by specifying what *kind* of facts she wants them to find about the Southern Cross. The task requires the children to find simple factual information, rather than solving a problem or enter into a debate.

Matching keywords and bypassing discourses: Visual Shortcuts

The girls click on the first link (Wikipedia), but it takes too long to load and they go back and click on the second link "Crux: Southern Cross Constellation, with pointers". These first two links both foreground the word 'Crux'. Only the second link foregrounds the words 'Southern Cross' in bold in its title. Both site descriptions also contain the girls' query in bold. It may be that, by clicking on these first two links, the girls are using the semiotic strategy of matching their query with the words in the title and descriptions of the search results: they recognize the words 'Southern Cross' as salient, and they are made more salient by the search engine.

The fact that they select the second result rather than waiting for the first website to download suggests that they are following a matching strategy rather than reading the results carefully. The semiotic domain of the second website can be described as 'astrophotography' and although it does not contain 'facts' about the Southern Cross *per se*, the girls choose to use it as a source of information. The visual representation of the constellation (how to photograph it) is not considered as 'factual' in the context of geography, but the girls do not make this distinction. Candice clicks on the 'Southern Cross' link on the left of the homepage and then on 'Southern cross, brightest stars'. They then scroll down the page to the heading 'Southern Cross Digital Images',

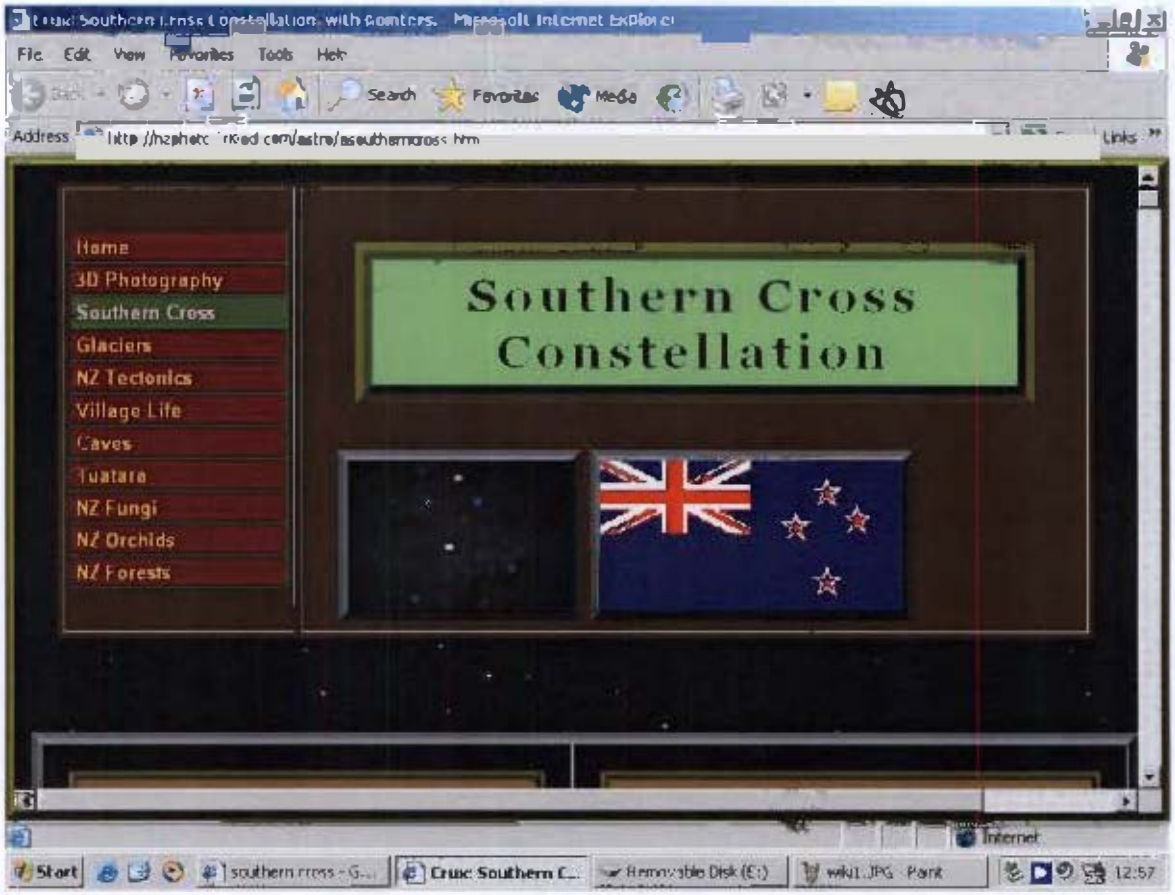
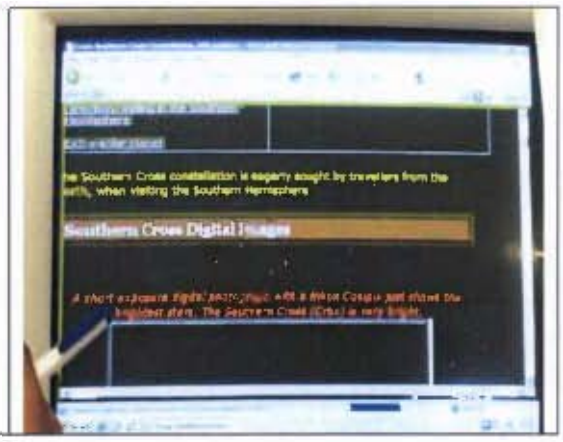


Figure 5: The homepage of "Crux: Southern Cross Constellation, with pointers".

Thus, the girls' strategy for finding information is to look for the keywords 'southern cross' and after using this method to find the site, they follow the navigational links which foreground these words. Furthermore, the "Crux: Southern Cross Constellation, with pointers" website also contains visual clues that match the semiotic domain of geography: the black starry background of the website and images of stars. Nonetheless, the website is mostly about *taking pictures of stars* (photography) and the different kinds of exposures required when capturing stars.

The following interaction shows the girls taking a 'visual shortcut': they take the content of the text for granted when relying on the visual foregrounding of the information. Tasha and Candice do not discuss whether the information they find counts as 'facts' or not. Tasha suggests writing down a certain 'snippet' of information. Candice agrees and they both write down the same sentence in separate workbooks:

1	Tasha: There.		
2	This one.	Tasha points at a sentence written in red with her pen - "A short exposure digital photograph with a Nikon Coolpix just shows the brightest stars. The Southern Cross ('Crux') is very bright:"	

Transcript 13: Tasha and Candice take a visual shortcut

After Tasha says "This one", she and Candice write down the sentence in their workbooks. When I asked what they were writing about, Tasha responded that they are writing about "the digital images of the Southern Cross". Here she transforms the heading of the website 'Southern Cross Digital Images' into an answer to my question. It is not clear whether Tasha knows that the information is not really about the Southern Cross *per se* ('facts') or whether her answer suggests that she considers this to be 'factual' information about the Southern Cross. The act of writing down the sentences ("A short exposure digital photograph with a Nikon Coolpix just shows the brightest stars. The Southern Cross ('Crux') is very bright.) indicates that the girls are in agreement that this information counts as factual. The visual salience of this sentence seems to be playing a key role in this interaction – it is written in red and located directly beneath the heading 'Southern Cross Digital Images', and is thus made salient by colour and layout. It may be that the girls are scanning the page for visually foregrounded information, assuming the most salient information (visually) to be the most factual (content).

This is not the case, as the sentence above the heading 'Southern Cross Digital Images' written in yellow can be considered to be more important or factual based on its content: 'The Southern Cross constellation is eagerly sought by travelers from the north when visiting the Southern Hemisphere'. This sentence suggests that people use the

Southern Cross to find directions when they are lost. The teacher has not provided the kind of scaffolding that would help the girls to make this kind of selection. At the start of the lesson, Mrs. Rosie does not narrow down the activity of 'find ten facts about the Southern Cross' to indicate which kinds of facts she has in mind: how to find the Southern Cross or using it for directions or telling the time (more empirical 'facts'), legends about these stars or how far it is from the earth.

Overall, then, the interaction does not show evidence of the girls engaging with the meaning or content of the text: they do not discuss what the criteria might be for sentences to be regarded as 'facts'. They appear to be evaluating information based on its visual salience, rather than its linguistic meaning. This suggests that they are coping with the unfamiliar discourse of astrophotography by bypassing it and taking a visual shortcut: the girls assume that because this information 'looks' important, the content must be too.

Not only are they trying to bypass the complicated discourse of astrophotography (the website is not written for children and thus they are engaging with a text beyond both their level and domain knowledge), but also the discourse of what counts as 'facts' based on the meaning of the text's content by relying on the visual mode. In effect, the teacher's request for 'facts' is also side-stepped because the girls are not able to evaluate the meaning of the text as factual or not because they bypass their misunderstanding and accommodate to the lack of discourse scaffolding by relying on the visual salience of information. Visual clues are used to accommodate to the lack of domain knowledge (i.e. the discourse of astrophotography).

Googling different 'points of view'

Candice suggests to Tasha that they should write down information from another page: so far they have only written down information from the astrophotography website. The following interaction highlight's Candice's awareness of Mrs. Rosie's 'rules' for doing research:

1 Candice: (to Tasha) Don't you think we must go to another one?
2 Another page?
3 Tasha: Huh?
4 Candice: Another page, like Mrs. Rosie say then you go to another page then you must get from all the pages.
5 See neh, we had this page, then we go to another page.

Transcript 14: Tasha and Candice (Another page, like Mrs. Rosie say)

Candice's explanation "you must get from all the pages" indicates how she sees the 'research' or 'fact-finding' activity: as writing down information from different websites. Candice's 'getting from all the pages' suggests an opposition to transcribing slavishly from a single website: her discourse suggests that they should be selecting 'snippets' from a number of different websites.

Tasha continues writing from the same page and Candice says, "Doesn't matter – the last time… (sigh)", implying her frustration with Tasha for not following her request to go to another page. Candice's comment hinted at a past experience, so I asked what happened the last time. She replied, "I wrote from one page and then Mrs. Rosie found out and then I was in trouble." I asked why she was in trouble and she replied, "Because I only took from one thing". I asked her why she had to take from more than one and she said, "I think it's to get from all the things so that you have… so that it isn't just one boring thing – it's from, it comes from a lot of points of view". Therefore, Candice wants Tasha to go to another page so that they can not only get information from "a lot of points of view", but also to avoid getting into trouble from Mrs. Rosie for "writing from one page". This may be regarded as another 'shortcut', as writing information from different websites does not guarantee different 'points of view'.

Candice's comments indicate an awareness of sources, the idea that the 'facts' they write down come from different places and that her teacher wants them to write down facts about the Southern Cross from 'a lot of points of view'. Candice thinks that she is getting different perspectives by reading and writing down information from different websites. However, there is a tension between 'finding facts' and finding information or

‘facts’ from ‘a lot of points of view’. Candice’s past experience of getting into trouble for transcribing from one website suggests that Mrs. Rosie monitors the process, not just the written page of ‘facts’ that the learners bring back to class – the teacher regulates the process by imposing the ‘rule’ of using different webpages. The notion of using different websites for different ‘points of view’ may be how the children understood a more complex kind of criteria. Different ‘points of view’ cannot be ‘snatched’ or ‘grabbed’ from different websites: writing down information from websites located at the top ranking of a list of Google search results does not equal the ability to access different ‘points of view’.

Shortly after Candice’s explanation about different webpages and ‘points of view’, Mrs. Rosie comes over to the girls saying, “Listen girls, you’re sticking to one page here” (Candice tells Tasha quietly, “I told you so.”). The teacher’s comment signals a warning and functions as a reminder to the girls to use different webpages. Mrs. Rosie takes control by directing the girls to another website. Mrs. Rosie tells Tasha to click on the third page of search results and scroll down. Mrs. Rosie takes the mouse to scroll and clicks on the link “Determining time from the southern cross”. This interaction suggests that Mrs. Rosie has found this page before and hoped that her students would too. Mrs. Rosie’s ease of finding the link suggests that she has shown this website to other members of the class and that the majority of them may have entered the same search query ‘southern cross’. Mrs. Rosie tells Candice and Tasha, “See, there’s the Southern Cross (mousing over the image), time from the southern cross, there’s the cross, you can draw that, (…) some notes on it, just read through that”. This suggests that images also count as ‘facts’. By directing the girls to this website more than halfway through the session, Mrs. Rosie is not only encouraging them to follow her recommendation and by extension, her ‘point of view’, but also making her agenda for the session more explicit: by choosing this website it can be suggested that Mrs. Rosie wanted her students to find the fact that the Southern Cross can be used to tell the time.

Taking the girls to a preselected website does not mean that the children are ‘searching’ the Internet. This interaction is an example of what Burnett and Wilkinson would

consider as 'colonized' Internet use in the classroom with "teacher-led, controlled activities" (2005:159). Mrs. Rosie not only controls the search activity through the provision of a search query that the children transcribe and her 'rule' of writing down information from different websites, but also imposes her preferred website on her students. By writing down information from this website, the girls are also engaging with their teacher's 'point of view' and entering a discourse deemed appropriate by her. Thus, there is also a mismatch between using different websites to find different 'points of view' and using a website preselected by the teacher which suggests a preferred 'point of view' and discourse she hopes her students are engaging.

Mrs. Rosie's preferred website contains information about the names of the top and bottom stars of the Southern Cross, the fact that stars rotate around the South Celestial Pole, and determining the time of night from the position of the Southern Cross. The method for calculating the time is too advanced for the students and it is unlikely that Mrs. Rosie wants them to know how to do this, since the discourse suggests the semiotic domain of mathematics rather than geography. Additionally, the web author is the winner of a competition run by the Australian ABC radio program 'practicalities' and the website functions to provide instructions on how to determine the time of night from the position of the Southern Cross.

The children are positioned as Australian by the content of the website. Only the Australian latitude is used in the method of calculating the time and the sentence "The Southern Cross is so much a part of Australia it is a good idea to learn how to recognize it" suggests the existence of an affinity group: the children are positioned as fellow Australians. This calls the classroom 'rule' of different pages for different 'points of view' into question. In effect, Mrs. Rosie is encouraging her students to engage with a text which posits a 'point of view' which does not apply to the geographic location of her students. The website also encourages empirical testing ('practicalities', calculating the time) which does not match the students' discourse of finding 'facts', even though the website does contain factual information about the Southern Cross such as the names of the stars. Visually, the website suggests that it has not been written for children: it is

Because the southern cross rotates around the south celestial pole like a clock, it is possible to determine the time of night from its' position.

Below are some instructions on how to do this. Also there is a kit you can make that does the mathematics for you (CRUX-CLOCK). The CRUX-CLOCK is my invention, it won first prize in a competition run by the Australian ABC radio program, 'practicalities'

Time From The Southern Cross

The southern cross.

The Night Sky

The Southern Cross is so much a part of Australia it is a good idea to learn how to recognise it. Acrux (A-kruks) is the brightest star in the cross as well as being the star at the foot of the cross.

The star at the top of the Cross is called Gacrux (ga-kruks).

The Southern Cross is not always upright as you see it on the Australian Flag. It rotates around the South Celestial Pole, and, in 24 hours will lie on one side, be upside down and lie on the other side before returning to an upright position.

The South Celestial Pole is a point in the sky around which all our stars rotate. There is no star there, just black night sky. You can point to the centre of this great celestial clock by facing true south and pointing up at an angle equal to your latitude. To face true south set 168° on your compass. Sydney, Australia is on a latitude of about 33°. If you raise your arm to 33° above the horizon you will be pointing to the South Celestial Pole. See now how a line through the Southern Cross also passes through the South Celestial Pole.

So regular is this rotation around the Pole that the Southern Cross can be used to tell the time. The method is outlined below, but if the maths seem a little daunting then there is a device called a "CRUX_CROSS" which does it all for you.

Time from the Southern Cross.

The night of the 29th of March is the best night of the year to use the Southern Cross to tell the time because there are no corrections to make.

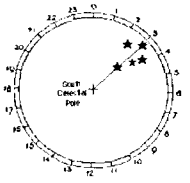
Internet 100%

Time from the Southern Cross

The night of the 29th of Marchis the best night of the year to use the Southern Cross to tell the time because there are no corrections to make

Imagine the Southern Cross to be the hour hand of a 24 hour clock. The South Celestial Pole is the centre of the clock. Thus 0/24 hours is directly above 6 hours and is normally where 3 hours would be on a normal clock, 12 hours is closest to the horizon where 6 hours normally is on a clock. The diagram shows this. On this night of the year (29th) wherever the Southern Cross points on this clock is the correct time.

You can use this method any time of the year but there is a correction to make if the date is not March 29th. Firstly read the time off the Southern Cross. Next deduct 2 hours from that time for each month since 29th March (April 1st is close enough and is an easier date to remember).



Example (see diagram above)

Date 31st May

Time on Star Clock, 3 hours

Borrow 24 hours (because we have a big number to take off)

3 hours + 24 hours = 27 hours

March 29th to May 29th = 2 months x 2 hours = 4 hours

May 29th to May 31st = 2 days x 4 minutes = 8 minutes

From 27 hours subtract 4 hours 8 minutes = 22 hours 52 minutes which is 10.52 p.m.

Internet 100%

Figure 6: Mrs. Rosie's preferred website "Determining time from the Southern Cross"

plain (black and white, no colour), has small illustrations and lots of text in a small font-size. Mrs. Rosie is encouraging her students to use a text which has not been designed with them in mind.

A scaffolded History Lesson on medical pioneers

The Googling session reported on in this section formed part of a Grade 6 History lesson on medical pioneers. Mrs. Rosie also teaches Grade 6 History, but this lesson is very different to the Geography lesson discussed previously. For this lesson the children make use of a worksheet with questions on it which structure their interactions in a way that sets it apart from all the web searches observed for this study and all the web searching sessions reported by Walton (2008). The worksheet provides adequate discourse scaffolding and allows the children to fashion their search by transforming the worksheet questions into search queries. These queries in turn scaffold their engagement with the texts (websites).

Discourse structures implicit in the worksheet

The implicit discourse structures in the worksheet materials contribute to scaffolding the children's interactions. The double-sided worksheet contains information from two sources: the "Grade 6 Social Sciences Learning Guide Unit 2" (designed for students) and the "Grade 6 Social Sciences Teacher's Guide Unit 2" (the accompanying guide for teachers).

The first page and the left side of the back of the worksheet contain the footer "Grade 6 Social Sciences Learning Guide Unit 2". These materials are designed for Grade 6 learners and it is therefore written at their level. The picture of the little girl in hospital with a nurse at her side suggests a discourse of personal attention and care compared to the impersonal nature of 'medical discoveries'. The picture of the girl in hospital may be considered as an attempt by the designers of the learning materials to bridge the gap between children's prior knowledge of medicine and healthcare, and 'medical

discoveries'. The picture is framed by the words "Medical Pioneers" above it and "1.1 Your teacher will tell you more about medical discoveries" below. The worksheet positions the teacher as an authority and a verbal repository of knowledge about medical discoveries, and the children as recipients thereof. The discourse of "your teacher will tell you" is followed by a heading "Inligting" (Information) which signals a shift to 'the worksheet will tell you': the worksheet as a site of information in addition to the teacher. The questions on the other side of the page refer to this section as the "information block" which reinforces this idea.

The subheading on the left of the first page is "Important medical discoveries" and the section which follows consists of dates and "important developments in the history of medicine". Interestingly, only Chris Barnard is allocated a place and a patient: "Chris Barnard transplanted the first heart Louis Washkansky in the Groote Schuur Hospital in Cape Town". Therefore, this South African pioneer is granted more importance than the likes of Curie, Jenner or Fleming whose origins are not mentioned. However, the right side of the worksheet 'zooms in' on three pioneers, although their discoveries are foregrounded in the headings and their names are bracketed: "The discovery of penicillin (Alexander Fleming)", "The discovery of radium (Marie Curie)" and "The first heart transplant (Chris Barnard)". While providing a better sense of the lives of these pioneers, these sections seem to accord more importance to the person than to the discovery, an opposite emphasis to the heading. Children are told that Fleming did research on septic wounds, that "while studying bacteria, he discovered penicillin" and that penicillin is used for the "treatment of septic sores". Children who understand the meaning of 'septic' are given quite a specific idea about what penicillin is, but the discourse in the section on Marie Curie makes fewer allowances to children's limited access to the discourse of science.

This section foregrounds Marie Curie's awards and achievements including "As a pioneer in the science of radio activity" and "a better understanding of radium treatment" but the worksheet does not explain what radium is, nor how it is connected to radio-activity. Chris Barnard is celebrated more than Fleming or Curie: "South African Prof

Christiaan Barnard, who achieved the practically impossible". The sentences in the next paragraph suggest a different emphasis:

> Eighteen days after the operation the patient died as a result of lung infection. The heart transplant, however, was a success. Prof. Barnard paved the way for many heart transplants that have been carried out successfully ever since.

This implies that the discovery was more important than the patient which goes against the personal care discourse suggested by the picture of the little girl and the nurse.

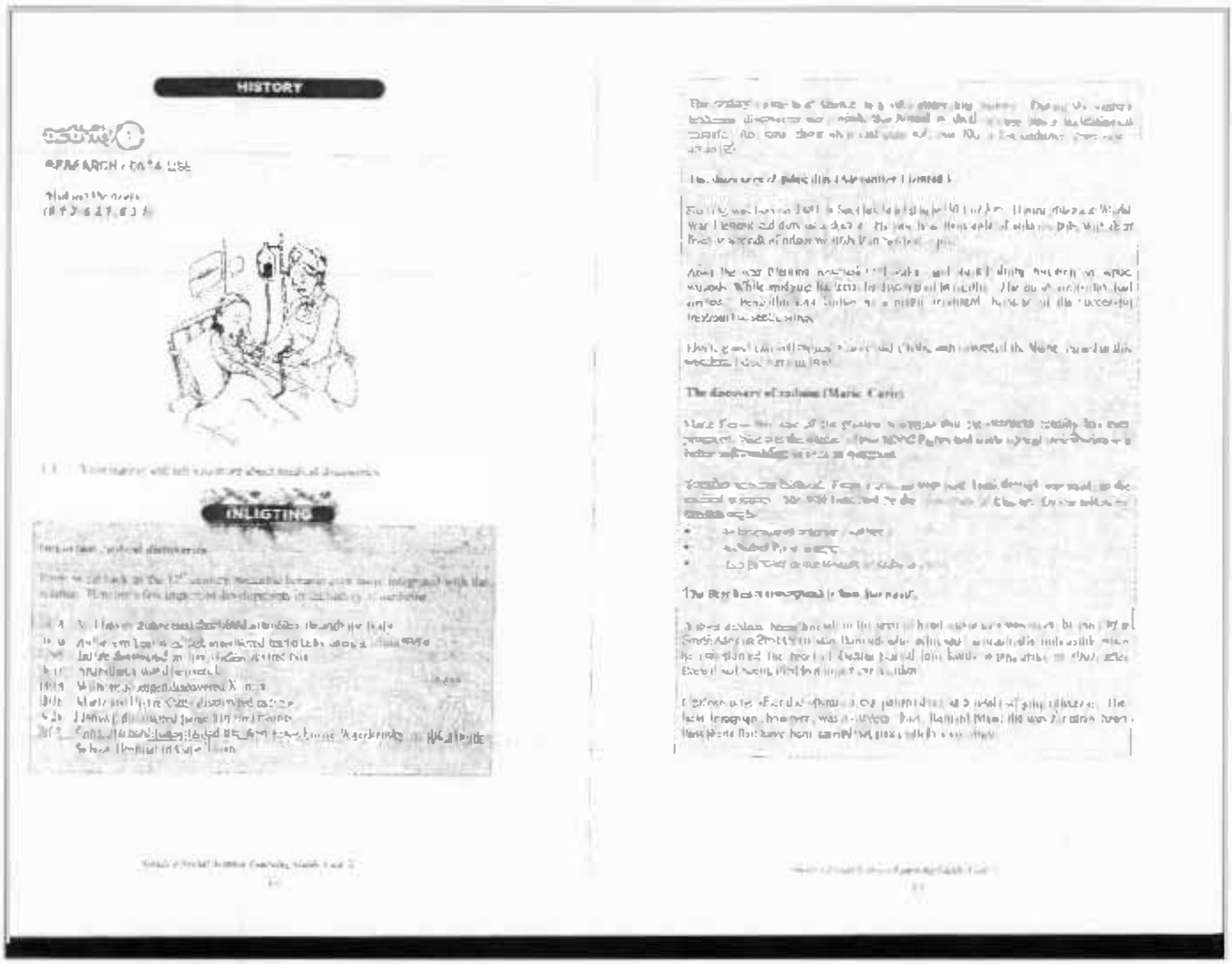


Figure 7: The first page of the worksheet from the "Grade 6 Social Sciences Learning Guide Unit 2"

The back of the worksheet contains page 18 from the "Grade 6 Social Sciences Learning Guide Unit 2" (designed for students) on the left and page 39 from the "Grade 6 Social Sciences Teacher's Guide Unit 2" (the accompanying guide for teachers) on the right side of the page. Page 18 shows a depiction of the S.A.M.A (South African Medical Associations) emblem followed by an image of a girl (from her shoulders up) with a speech bubble. This cartoon girl is positioned by the worksheet as a peer sharing information ("Did you know?"). Thus, an imagined peer becomes a repository of knowledge in addition to the teacher and worksheet. The information shared by the peer is about one of the earliest 'pioneers' (Hippocrates and how doctors today all take the Hippocratic Oath) rather than about medical discoveries. However, the speech bubble contains the information that by taking the oath, doctors "promise to do their best to save lives". Once again there is a tension between this personal/care discourse (saving lives) and the scientific discourse of medical discoveries suggested by the worksheet which is more about the individual pioneers than the people they treated and how.

The worksheet questions are located at the bottom of page 18. The first question commands the students to "study sources" (not specifying the medium) and it demands information from them about "what each one of these people did to contribute to the development of the medical sciences". The names of the pioneers Joseph Lister, Robert Koch, and Marie Curie are presented in a bulleted list following the first question. Thus, the first question foregrounds the discoveries made by these pioneers. By contrast, the second question focuses more on the pioneers themselves, their lives, and what they achieved and includes the commands "Name aspects" and "Say briefly". The third question starts with the words "When you have completed this activity", suggesting either that the first two questions make up the activity (implying that this third question is more of an 'afterthought' once the students are done with the 'activity') or that the third question is a separate activity that relies on the completion of the previous 'activity' or questions. The third question requires the students to "set up a timeline in which these three scientists and the others that are mentioned in the information block appear". This suggests an attempt (on the part of the designers of the worksheet) to make the dates meaningful to the students: the timeline will be able to function as a visual

representation of the history of medical pioneers and their discoveries which can assist students in tracing the developments in the history of medicine. The third question suggests that this exercise in visual literacy is a separate activity which relies on completing the previous questions. The timeline is also intended for assessment according to the assessment rubric (to be discussed next). This suggests that the worksheet does not marginalize the assessment of the students' use of the visual mode: both the written and the visual modes are assessed.

1.2

(a) Study sources and say what each one of these people did to contribute to the development of the medical sciences.

- Joseph Lister
- Robert Koch
- Marie Curie

(b) Name aspects such as their births and deaths, their life and work, what discoveries and inventions they made. Say briefly how they came to produce their inventions and what recognitions they received for these.

(c) When you have completed this activity, set up a timeline in which these three scientists and the others that are mentioned in the information block appear.

Figure 8: The worksheet questions.

Page 39 of the "Grade 6 Social Sciences Teacher's Guide Unit 2" at the back of the worksheet contains an assessment rubric. Beneath the heading "Assessment", teachers are instructed in an assessment block which states:

> For the teacher
> 1. Make copies of this rubric so that you have one for each learner.
> 2. Write each learner's name on separate rubrics.
> 3. Keep the rubric at hand from the beginning of the activity for assessment.
> 4. The learner will do the assessment.

Therefore, although at first glance it seems like the teacher is the one who will be using the rubric (since it comes from the teacher's guide), the students are the intended users

thereof: the teacher's job is to make the rubric available to the students so that they can do "self assessment".

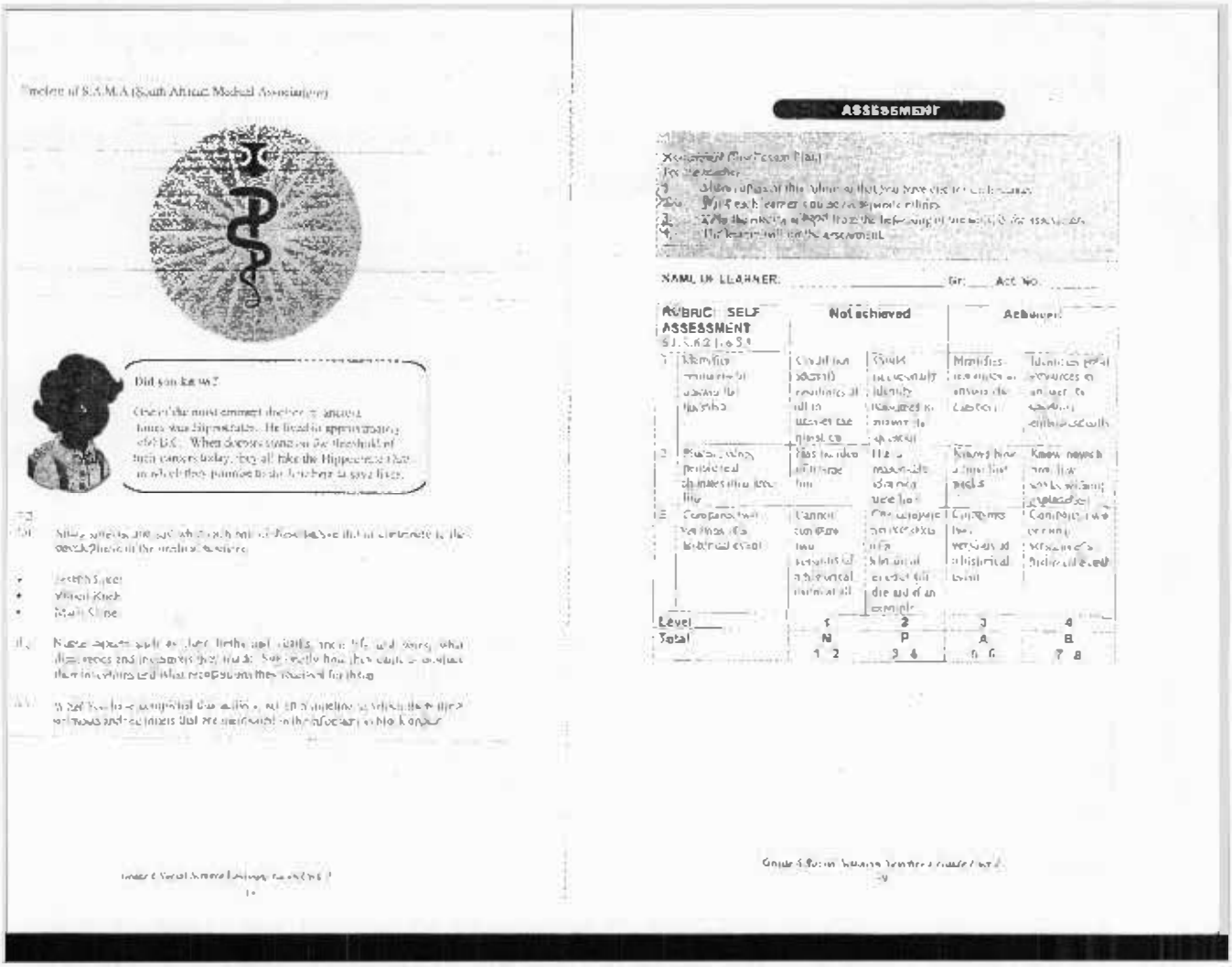


Figure 9: The back page of the worksheet: the left side comes from the "Grade 6 Social Sciences Learning Guide Unit 2" and the right side from the "Grade 6 Social Sciences Teacher's Guide Unit 2".

A closer look at the rubric reveals the following tensions. Firstly, the "resources" identified to answer questions are not specified: it is ambiguous whether "resources" refers to sources such as Internet sources (URLs) or the titles and authors of books or whether "resources" refers to information irrespective of its medium and source. "Resources" may even apply to information presented by the worksheet or a textbook. Secondly, the rubric requests that students compare "two versions of a historical event"

which echoes Mrs. Rosie's Geography session which accorded importance to using different websites for different 'points of view'. However, the questions provided by the worksheet do not lead students to make this kind of comparison. In terms of classroom discourse, this request for comparison is more complex than question-answer responses because the emphasis is not on a single answer, but requires the students to contrast different views of historical events. In effect, the discourse of comparing different versions of historical events suggests a different approach to 'facts', but the worksheet does not scaffold the process of finding and contrasting these differences of opinion.

By analyzing the discourse structures implicit in the materials it is clear that the worksheet establishes discourse scaffolding suitable for the Grade 6 level and the questions function to narrow the range of information requested from the students. The observation (discussed below) suggests that the worksheet enabled the children to use Google as a resource because it helped to provide them with suitable and focused query terms. Nonetheless this only assists them with the more factual questions. The students do not compare different versions of historical events as suggested by the rubric because this different approach to 'facts' has not been scaffolded by the worksheet questions.

Searching as sign-making and transformation: Language and searching strategies

I observed Wendy and Charles formulating their search queries. They were focused on the second question ("Name aspects such as their births and deaths, their life and work, what discoveries and inventions they made. Say briefly how they came to produce their inventions and what recognitions they received for these."). They type 'joseph lister when was he born' into the Google query field, noting the same dates in the descriptions of the search results so they write it down – they do not click on any of the links, treating the search results as their source, and instead they discuss their next search query:

1	Charles: ...**birth** – the fifth of April 1827	"joseph lister **when was he born**"

2	Wendy: Now you have to find **when did he die…**	typed into Google search bar, followed by "joseph lister **when was he died**".
3	**When was he died…**	
4	Charles: **When was he died** – I knew it!	
5	Come on!	
6	Wendy: Yes…	
7	**When he died, when he died…**	
8	(both giggle)	
9	Charles: The tenth of February nineteenth…	Charles reads from the descriptions of the search results and Wendy writes it down.
10	the…tenth of February	
11	Wendy: What?	
12	1912?	
13	Charles: 1912.	
14	Wendy: **His life…**	Click on a link with the words "**Early Life**".

Transcript 15: Wendy and Charles (When was he died)

This interaction exemplifies the semiotic principle *provenance* which is about 'where signs come from' and the idea is that 'we constantly "import" signs from other contexts into the context in which we are now making a new sign' (Kress & van Leeuwen, 2001:10). Wendy and Charles's formulated search queries can be understood as 'new signs' that are created by importing signs, in this case words (linguistic resources), from the worksheet questions.

They transform the word 'births' in the second question following the bulleted names of the three pioneers into the search query "joseph lister when was he born". The name of the pioneer is accorded importance through foregrounding and it is followed by the 'aspect' which in this case involves the transformation of 'birth' into 'when was he born'. The use of the word 'when' suggests that Wendy and Charles intend to find a date. Similarly, the word 'deaths' in the worksheet is transformed to formulate the search query "joseph lister when was he died". The interaction shows Wendy and Charles playing around with words while formulating their search queries.

Their talk shows that they know that "when he died" is grammatically correct while their search query is not. However, they keep "joseph lister when was he", only deleting

"born" and replacing it with "died". Once again, Wendy and Charles do not click on any of the search results, but get the answer by noting the dates in the descriptions of the search results. The words 'their life' in the worksheet is transformed by Wendy when she says "his life", followed by clicking on a link with the words "Early Life". The word 'life' becomes a keyword and the salience of this word in the search results causes Wendy to click on the link which includes the words "Early Life". In addition to transforming the words used in the second question of the worksheet into search queries, Wendy and Charles are also transforming the question's structure for many pioneers into queries that accounts for a single pioneer.

This interaction highlights the importance of language and shows traces of the children's learning in their transformation of the linguistic resources provided by the worksheet. The children are not searching the Internet *per se*: they are using the affordances of the search engine's 'smooth, default question-and-answer exchange' or its 'simulated dialogue' (Walton, 2008) to find 'facts'. One of their strategies which involved reading and comparing the descriptions of search results in the top ranking instead of clicking on a link reinforces this notion.

A short while later Wendy says "Now his work" and tells Charles "You must write now". Charles asks, "His work…what must I write?" Wendy suggests typing in another search query:

1	Wendy: No, rather write when the…	They were at http://www.ukonline.co.za/b.gardner/lister.html#el and then Wendy tells Charles to 'go back' and then she types "**joseph lister his work**" into the Google search bar
2	he did…	
3	let's go rather up then we type in **his work**.	
4	Charles: that is (…)	
5	Don't go there neh.	
6	Wendy: Try there – go out…	
7	go back…	
8	again back…	
9	Now we must type in…	
10	Charles: What must I write here?	
11	**When was he**	
12	(laughs)	
13	**when was he work**	
14	(laugh)	

Transcript 16: Wendy and Charles (When was he work)

Wendy and Charles use the word 'work' from the question to formulate the search query "joseph lister his work". Once again, the individual pioneer is accorded importance in the structure of the query, but this time Wendy deletes "when was he" and replaces it with "his work". Not only does her query indicate that Lister is the owner of the 'work' through the use of the word 'his', but this orientation shows that this time around they are not looking for a specific date like the previous time: this time they are looking for a description about "his work", thus requesting much more information than before. Charles's play with words indicates that he sees the task of formulating search queries as a site of linguistic creativity, perhaps noting that the incorrect grammatical structure of their earlier query "joseph lister when was he died" did not keep them from finding the answer.

Wendy and Charles continue by typing in the search query "joseph lister all his awards". The word "awards" is a transformation of the second part of the question ("Say briefly how they came to produce their inventions and what recognitions they received for these.") containing the word "recognitions". Thus, they are substituting "recognitions" with the synonym "awards". Wendy and Charles decide to look for information about the next pioneer, Robert Koch. Interestingly, they only type "robert koch" into the search bar which indicates that they do not use the same searching strategy consistently. Wendy says, "I had the Robert Koch already, I had everything already", indicating that she has done this search before. Charles asks her where she found the information and she says "on these pages", referring to all the websites in the list of search results. They appear to be impressed with their simpler search query because the first link contains nearly all the information they need to answer the second question.

Learning by using the scientific register of schooling

While Charles writes down information about Robert Koch from a website dedicated to nobel laureates (http://nobelprize.org/nobel_prize/medicine/laureates/1905/koch-bio.html), Wendy notices the heading "Biography" as being salient on the page. Wendy draws attention to this keyword:

Wendy: This google helped a lot, here's his biography…
do you know what's a biography?
Charles: Biography is mos that…
Wendy: A book of his life.
Researcher: What's a biography?
Wendy: The person writing a book about his life.
Like this is almost like his biography…

Transcript 17: Wendy and Charles (Biography)

Although Wendy's explanation of the word "biography" indicates some confusion with "autobiography", the idea of it encompassing the information they need to write a profile on each pioneer is there. Wendy presses the back button to return to the list of search results and I decide to ask her why she chose the top search result. Wendy answers, "Because here's his biography and a biography tells us when he was born and through his life, what happened through his life." When asked what they were looking for next, Wendy replied, "Marie Curie, now we want to see if she also have…has a biography page."

This interaction indicates that Wendy and Charles have changed their searching strategy. Firstly, because of their success with their previous search query where they only typed "robert koch", Wendy decides to type "marie curie" into the search bar. This may be seen as a shortcut as Wendy's choice of search query suggests that she is over-generalizing from the one example ("robert koch") to the other ("marie curie"), expecting the same success. Secondly, the word "biography" becomes a trigger. Wendy scans the search results and clicks on the first link because it contains the word "biography". Interestingly, she does not add this word to her search query which may result from over-generalizing: because this word was salient in the top ranking search results for "robert koch", she assumes that it will be salient in the results for "marie curie".

The first search result for "marie curie" does contain the word "biography" since it is a link to the same website as the one they used to find information about Robert Koch:

the website http://nobelprize.org ranked first for both of these search queries. Wendy and Charles do not discuss the source of the website and it is unlikely that they know what a Nobel prize is, because while reading aloud about the pioneers' awards they pronounce the words 'Nobel prize' as 'noble prize'. Although the Nobel prize website can be considered as a good, authoritative website, Wendy evaluates the information she finds based on the presence of the trigger word "biography" rather than the source of the information. Wendy and Charles do not write down the URLs of any of the websites that they transcribe information from, which suggests a tension with the assessment rubric's criterion "identifies resources to answer the question". The rubric does not address the particular skills involved in transforming the worksheet questions into search queries.

Additionally, the word "biography" is much more abstract than the previous keywords ("when was he born" and so forth) that they used to find information to answer the question in the worksheet. The worksheet does not say "find the biography", nor does it scaffold this form of discourse. By finding the word "biography" and using it as a trigger to find information as well as utilizing it as a part of her own discourse, Wendy's use of language suggests that a case of incidental learning has taken place. She appropriates an abstract concept which is part of the scientific rhetoric of schooling rather than everyday language and makes use of it as part of her searching strategy and speech. Wendy is 'talking her way in' to a mode of discourse valued in formal education.

Halliday's (cited in Wells, 1994: 69-70) language-based theory of learning which conceptualizes learning as learning language, suggests that children's transition to school and its demands of literacy involve an important reconstruction because children have to reconstitute their meaning potential in a new, more abstract mode and therefore, schooling involves the development and reconstruction of meaning. Wells argues that "in order to master this new mode, children need to perceive it as functional for them in relation to activities that they find both challenging and personally meaningful" (1994:82). The interaction discussed suggests that this may be exactly

what Wendy is doing: making the word "biography" functional in her searching strategy and in relation to the activity of finding information to answer the worksheet question.

While looking for information about Marie Curie's work, Wendy said, "She discovered the radioactivity… No, the discovery of radioactivity was by Henry – what's his surname? (asking Charles) Here, we can write that (pointing at information on the screen) – her early research is... 'cause research is mos work." Wendy's talk suggests that she is reasoning about the kind of information that would qualify as "work". However, her talk implies some confusion between "discovery", "research" and "work". The worksheet question uses the words "work" and "discoveries" and Wendy's talk suggests that she is trying to position "research" (a new term that she has found) under one of these. Additionally, Wendy cannot remember what Marie Curie is famous for discovering so she turns to Charles. First Charles answers her by saying "the use of radium" but then he gets side-tracked with writing down the information they found about Curie's work. When Wendy asks him again, he answers "rabies":

1 **Charles:** Rabies
2 **Wendy:** Turn that page… (referring to the worksheet)
3 **Researcher:** What about rabies?
4 **Wendy:** She discovered the illness Rabies
5 **Charles:** The vaccination neh?
6 **Wendy:** No, umm…
8 Wasn't it Edward Jenner nè?
9 Or the other one…
10 Ja, Edward Jenner discovered vaccination and Louis Pasteur discovered pasteurization.
11 **Charles:** Where's that now, where's that history page?
12 **Wendy:** Here's what she discovered on…
13 **Charles:** Give the paper…
14 **Researcher:** What does your paper say?
15 **Wendy:** She discovered…radium.
16 The discovery of radium.

Transcript 18: Wendy and Charles (Rabies/Radium)

Wendy and Charles are confused between “radium” and “rabies” because these words sound similar. Wendy asks Charles to turn the worksheet, signaling that she knows that this information can be found on the worksheet. It may be suggested that Wendy and Charles have a better idea of what “rabies” is than “radium”. Wendy links “rabies” to “illness” and Charles links it to the idea of “vaccination” (line 5). Even though this is not what Curie discovered, the children’s discourse suggests an everyday understanding of “rabies”. However, it is unlikely that they will be able to make similar associations with “radium” as the meaning thereof is not scaffolded by the worksheet and this may be one of the reasons why they have forgotten about it.

This interaction also demonstrates how the information printed on the worksheet came to function as a resource for problem-solving. Wendy and Charles turn to the worksheet for guidance rather than the Internet: this shows how the worksheet not only functions as a kind of ‘road map’ for finding information, it also contains some of the content they are looking for and therefore functions as a source. The learners accept what the worksheet says because it is an authoritative text in the classroom. In this instance the worksheet was used to find an answer, rather than guide learners to finding answers online. The interaction suggests that the children relate differently to information from different media (the worksheet and the Internet) as well as one another. Wendy requests information from Charles when trying to review the discoveries of the various pioneers, implying an orientation towards the joint construction of knowledge. She turns to Charles rather than the worksheet or the Internet.

Conclusion

Much of the literature on children’s use of search engines emphasizes the fact that children are not critical enough about the information that they find and have difficulties evaluating search results in relation to their queries. However, arguing that children are uncritical of information is not enough. This chapter shows what children actually *do* as they search and the interactions discussed attest to the fact that searching is a complex process. The children observed in this study do tend to adopt a ‘snatch-and-grab’

(Sutherland-Smith, 2002 cited inWyatt-Smith & Elkins, 2008:914) search strategy, possibly because they approach searching as a transcriptive writing task.

The children's interactions with the Google search engine suggest a particular kind of classroom discourse: they sit at the computer with their workbooks and pens, writing down information or 'facts' from the screen and they take their workbooks back to class as evidence to show the teacher that they have done 'research'. Therefore, a particular form of classroom discourse is instantiated during the Google sessions which influences the children's search practices. However, what information to 'snatch' or 'grab' during these sessions involves selection, an active process of semiosis. As discussed in this chapter, the children's discourse and software use provides evidence of the complex sign-making practices involved in searching.

The interactions discussed in this chapter highlight how Google is 'schooled' for classroom use. Google allows the children to find responses. The teacher initiates the children's search by providing search terms and the children are accorded the role of respondents because they have to find 'facts' about a topic set by the teacher or answer questions on a worksheet. However, when the children formulated their own search queries by transforming the worksheet questions into search queries they were initiating the search to a greater extent, as formulating a search query can be regarded as a form of productive writing. Yet, the search engine was used to get 'answers' which could be written down in their workbooks. Even an activity intended to involve a critical use of multiple sources and transcoding from verbal to visual representation (the timeline) was reduced to an act of 'transcriptive' or 'reproductive' writing.

Chapter 6

Scarce resources: Conflict and sharing in discourse around primary school email use

Introduction

This chapter proposes that a conversation analysis of children's interactions around email activities challenges assumptions about the digital divide. This approach suggests the advantage to be gained by viewing the context of children's use of technology as a shifting set of communicative possibilities, rather than something that is determined solely by the physical presence or absence of computers. Children negotiate and communicate around scarce resources in their environment. These scarce and shared resources are not limited to the physical equipment in the computer lab, but include the communicative possibilities offered by software and other individuals, such as the teacher, peers or relatives with email access.

This chapter discusses children sharing email addresses and using email's affordances of privacy to gain or avoid individual attention from the teacher. Children were also observed using anonymous email addresses as a site for play by sending riddles or insults to their peers, or subverting the privacy of anonymity by informing their friend of the incoming message before it was sent. These short exchanges suggest that the children's 'emailing' is more akin to instant messaging (IM) than to email as it is commonly used in the workplace: 'emailing' is generally thought of as a private and asynchronous form of communication. The children's use of email suggest that email can be used in a more public and synchronous way and this synchronicity makes their interactions more like a public form of IM or chat than 'email' in the generic sense.

The children's interactions suggest that certain resources associated with email are scarce in this context: receiving PowerPoint presentations with a picture and a message

or having an email recipient who writes back to one is not something available to all children. When creating and sending an attachment, two boys used their personal email addresses and the file name of the attachment as resources to signal ownership of the attachment. They fight over the attachment and to which of their email addresses it should be sent to, orienting to it as a prized possession. A girl replying to her aunt via email 'shares' the aunt as a recipient, but does not divulge personal information about her: email recipients outside of school who respond to the children's emails are scarce, but because of the public nature of email in the classroom, seemingly 'private' exchanges with family members are not private. It is as though the children construct an extended family by 'sharing' access to relatives with their lab partners. Thus, the relative becomes a scarce resource which is shared in this context. When emailing the teacher, the children evaluate or scrutinize their teacher ('you are the best sir' and 'why are you so dum?'), but the teacher does not respond to their emails or engage in private dialogues with individual children. By treating discourse as 'talk-in-interaction' this chapter provides evidence of children managing the limited resources available to them in their environment.

Rethinking access: Email use and social context

In a national survey on 'Young South Africans, Broadcast Media, and HIV/AIDS Awareness', the Kaiser Family Foundation reported that:

> Few young South Africans (15%) live in a home with a computer, and even fewer (9%) have Internet access at home. In fact, just seventeen percent say they have ever used the Internet at all, and six percent say they use it daily or almost daily. Those who live in urban formal settings are much more likely than those in urban informal, tribal, and farm areas to say they have a computer and Internet access at home, and that they have ever used the Internet. (2007:9)

Thus, children's Internet access (other than mobile phone use) is more likely to occur at school than at home considering the influence of school connectivity projects. This chapter suggests that children's interactions with ICTs, and particularly email, show them managing 'scarce resources' and negotiating and constructing a particular version

of the classroom context as they do so. 'Scarce resources' are not limited to physical resources such as computers, but include communicative possibilities offered by software and other individuals.

Literature on the digital divide which foregrounds the presence of physical resources does not acknowledge additional factors such as space and turn-taking with computers. While press reports emphasize the competition and hostility associated with sharing resources, this is only part of the picture. This research project identifies the complex sharing practices which have evolved in these contexts: children often share the computers and other scarce resources and negotiate turn-taking to accommodate to the sharing of the computer. Their interactions and talk show them managing resources and negotiating context. The children's discourse reveals them sharing both physical and communicative resources, which are made salient in their discourse through conflict, collaboration and negotiation. This chapter also discusses less obvious sharing practices which can be discerned in the children's interactions with their teacher via email.

In the Mountainside Primary computer lab, there is only one computer for every two children in most classes. Consequently, children often share email addresses and sit together as they compose a message, even taking turns to use the mouse. In this context, email use is less private and more of a public event. It is often the case that more than one person uses a software artifact designed for a single user. The result is that *users* then adapt their practices, negotiating how they use the software and at the same time being constrained by its design. Additionally, although the IRF is a significant feature of classroom discourse, the children's email use at school may be considered as largely outside of this structure: emailing is not framed as 'school work'. This chapter questions whether the children's use of email in the computer lab is influenced by classroom discourse.

Email in the classroom

Van der Meij *et al.* (2004:418-419) acknowledge previous studies which suggest that children from Dutch elementary schools use email to engage in conversation by exchanging stories of learning experiences, but note that moments of dialogue as debate or inquiry were scarce. The focus in such research has been on how email dialogues can be used to support educational activities. A characteristic approach to email in the classroom focuses on learning content and classifying dialogues as being either 'on' or 'off task' (Van der Meij, *et al.*, 2004:419-420).

Some researchers may have been preoccupied with email as a tool for eLearning, and have thus far not appreciated email use as an event in and of itself. Few researchers have adopted conversation analysis to study email use. Van der Meij *et al.* (2004:419) point out that communication needs to be analysed in greater detail in order to see how aspects of email use work together to create these dialogues. This implies that normative assumptions about email use need to be challenged by such research.

Mountainside Primary: Email and the culture of the classroom

The children rarely use email in the computer lab since, as explained in Chapter 3, most of the time allocated to classes is spent on completing drill-and-practice exercises. Email is considered to be a 'non-event': it is not an assessed activity and the learners enjoy it because it is not framed by the teacher as 'school work'. Therefore, it may be considered as outside of the IRF structure because there is no evaluation. The majority of the children share computers, working in pairs: it is a rare occasion when a child has the computer to him/herself. Using computers in this setting is a social and collaborative activity and sharing plays a very important and often undiscussed role in the everyday practices of this classroom.

The student computers are numbered one to twenty-four: each monitor has a sticker with a number which indicates the number of the computer (see Figure 10). The

children use this number as the username to log on to the computers and the password on all of the computers is the same. For example, the children sitting at the computer numbered '21' will type "stud21" as the username and the password to log-on. The 'stud + computer number' usernames are also used for Pegasus Mail. The children can send emails within the class by sending the email to the numbers of their friends' computers. The 'stud-to-stud' system is mainly for the children in the lower grades who do not have their own usernames. Only from Grade four onwards do the children have access to personal usernames, since the younger children struggle to remember their usernames and passwords. The 'stud-to-stud' system makes logging in easier. When emailing, the lower grades use the 'stud-to-stud' system and the higher grades use their own usernames.

The use of personal versus anonymous usernames also offers insights into an interesting characteristic of children's email practices and how these form part of their classroom culture. These practices are highly public in nature, and although a personal username allows for a private communication it is transformed into a public practice in the lab because the children share the computers. The children in this context have to shift between the two identities depending on the username they use to login: anonymous student, one of many and individual student with his/her own name and personal log-in and password. The different logins also suggest different orientations towards the user. When logged in as 'stud' emails are made publically available in the lab: any student using the computer after one can read what one has written. When logged on with one's own username the emails are private and nobody else has access to them except if they have one's username and password or are sitting next to one, watching you as you write.

Email use in this primary school challenges assumptions around privacy and emails. One may argue that even if a student is logged in with his/her own username, the literacy practices around emailing can also not be described as private because students work at the computers in pairs. Emailing becomes a collaborative endeavor despite the login which is used or who is being emailed. In most cases, the student

doing the typing is the one with access to a relative or family member's email address and his/her partner provides verbal assistance in the process of textual construction. Emailing parents and relatives was a minority practice, as most children's parents did not have email access at home or work. This suggests power differentials between the children: it is likely that the children with family members who can receive email come from more advantaged backgrounds.

'To Sir, with love'

The analysis of the following observation will show how privacy and the boundary between private and public are salient for both the teacher and his students in their practice of emailing – sharing emails involves a negotiation and conflict about emails considered to be private and those deemed public: to be shared with the class. The teacher plays an important role here with regards to the 'rules of seeing' because he discerns which messages will form part of class dialogue. 'Rules of seeing' are about 'who can see what' (Walton, 2008:233). In this study it involves how users negotiate the 'rules of seeing' and it is suggested that those who act as gatekeepers (choosing to hide or display information), or those who model the 'rules of seeing' in the classroom such as the teacher, have more social power.

Mr. Ernest allows his Grade Five class (children aged 10-11) to use Pegasus Mail after they have completed their mathematics exercises using drill-and-practice software. Mr. Ernest tells the class, "You can send to me if you like on stud eleven". He is seated at one of the student computers instead of at the teachers' terminal. In the first sequence, Mr. Ernest reads one of the emails he receives aloud:

1 Mr. Ernest: Ha ha ha ha ha
2 Sir we love you but please move Mark
3 love from Zhira
4 [class laughs
5 She wants Mark away from her
6 Zhira, Mark loves you too (much)
7 [class laughs

8 (Next time) I'll put Mark out of the classroom Zhira.

Transcript 19: Mr. Ernest reads Zhira's email to the class

In line 1, Mr. Ernest laughs aloud and in line 2 he reads the email which he has received from Zhira to the class. His amusement in line 1 comes across as a performance which is followed by a reading of the email to provide a reason for his amusement (line 2 and 3). Mr. Ernest is not only providing a reason for his amusement, but also sharing this 'amusing' (to him) email with the class. Mr. Ernest does not tell the class that he laughed because he received a funny email, nor does he reply to Zhira face-to-face or via email. Instead, he shares the message with the whole class suggesting that he regards it to be of public interest to the class rather than a private matter. It is clear that he addresses the class because their laughter is followed by an explanation in line 5 that "She wants Mark away from her". Mr. Ernest is thereby sharing Zhira's reason for emailing him with the class. His utterance also relies on the shared knowledge of the class about Mark's behaviour: Mr. Ernest's utterance presupposes that the class shares his knowledge of Mark's reputation as a perhaps naughty and disruptive student.

After sharing Zhira's email with the class, he addresses her in line 6: "Zhira, Mark loves you too (much)". He thereby puts Mark and Zhira in the role of a heterosexual romance for the entertainment of the class. Mr. Ernest's utterance functions as a reason for why he cannot move Mark which is more of a joke: he provides Zhira with a reason while teasing her at the same time. Although Mr. Ernest was addressing Zhira, the class laughs in line 7. This suggests that his utterance functions as a public performance of an individual address. Although the utterance was directed at Zhira, the class found pleasure in Mr. Ernest teasing Zhira about Mark. In line 8 Mr. Ernest provides Zhira with the solution that he will put Mark outside of the classroom, but this solution could also function as an apology because Mr. Ernest realizes that he has embarrassed her enough and needs to close this conversation and direct the class's attention away from the topic of 'Zhira and Mark'.

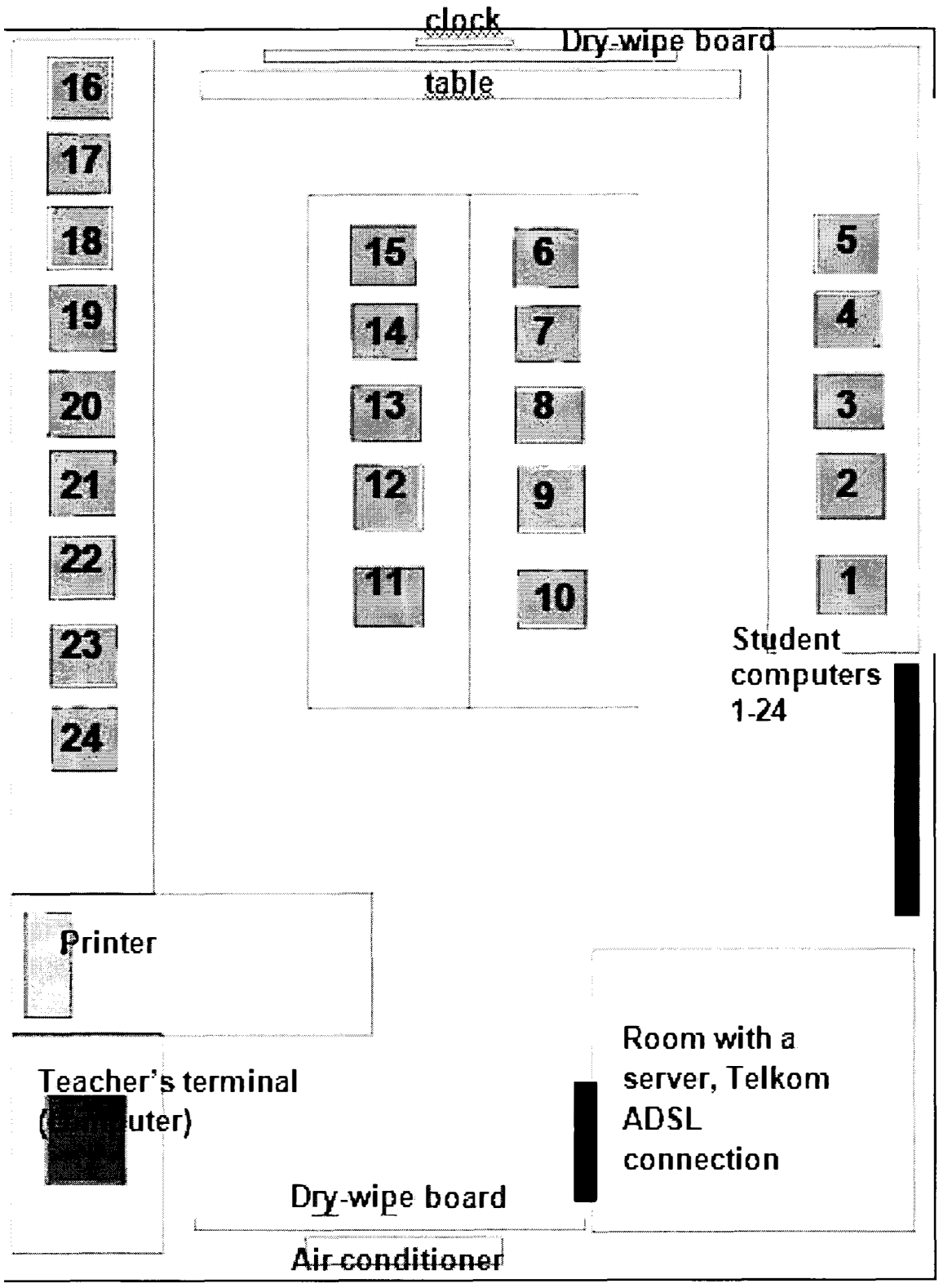


Figure 10: A 'map' of Mountainside Primary's computer laboratory

This sequence shows how an email from a student to a teacher is made public in the classroom. This exchange between the teacher and the children may be considered as out of the IRF, since Zhira has initiated the exchange and Mr. Ernest is responding. However, his response takes the form of sharing Zhira's email with the whole class, rather than responding to her email. One of the reasons for this is the asymmetrical power relations between the teacher and his students: he has the power to read emails aloud in class, whereas the students do not and the emails he receives from them are also subject to his decision about what information he can make public, and what he keeps private. Although the teacher's power in the class allows him to determine the nature of the interaction, it can be suggested that by requesting a response from the teacher (to move another child in this case), Zhira is not playing the expected role in classroom discourse.

The following interaction occurs one-and-a-half minutes later. Mr. Ernest is seated reading the emails he has received. He does not reply to any of the student's emails via email: he replies face-to-face (which often functions as a comment to the whole class) or not at all. This observation is transcribed as if the email messages are 'speakers' participating in a conversation with Mr. Ernest communicating using non-verbal activities, with Mr. Ernest's actions on the left and the emails he reads on the right:

1	((Mr. Ernest looks at the screen, reading the emails resting his chin on his hand))	
2		((Subject: Why did you))
3		((Sender: stud7))
4		((Message: sir why did u read it loud))
5	((Mr. Ernest clicks to read the next email))	
6		((Subject: none))
7		((Sender: stud6))
8		((Message: sir plse move me))
9	((Mr. Ernest clicks to read the next email))	
10		((Subject: message))
11		((Sender: stud12))
12		((Message: HEY..... SIR WATS UP? SIR YOU

		ARE THE BEST SIR EVER CAN YOU PLEASE BE OUR SIR AGAIN NEXT YEAR))
13	((Mr. Ernest clicks to read the next email))	
14		((Subject: we love u))
15		((Sender: stud7))
16		((Message: sir we love you but plese move Mark love from zhira))
17	((Mr. Ernest mouses around the word 'plese', drawing the researcher's attention to the spelling mistake))	
18	((Mr. Ernest clicks to read the next email))	
19		((Subject: you))
20		((Sender: stud9))
21		((Message: why are you so dum))
22	((Mr. Ernest clicks to read the next email))	
23		((Subject: hello))
24		((Sender: stud24))
25		((Message: hi there sir I like you are the best this is from someone you know))

Transcript 20: Mr. Ernest reading his emails from the class

Mr. Ernest's body language when reading the email in line 1 suggests focus and curiosity: he is interested to know what kinds of messages the students have sent him. The subject to the email sent by a student in line 2 ('why did you') suggests that the student is unhappy with something that the teacher has done and would like a reason. Although the email is from 'stud7', an anonymous student, the identity of the student can be discerned from the subject of the email in line 2 and the message 'sir why did you read it loud' in line 4: the email comes from Zhira. She seems to be unhappy with Mr. Ernest for sharing her message with the class. One could possibly appeal to external evidence to explain this interaction: Zhira is a muslim girl and her resistance to the teacher's banter about a romantic relationship might constitute an additional reason for her resentment of her teacher's actions.

This utterance would probably not have been produced in a face-to-face situation: a student would be unlikely to question the teacher's actions because he/she is an authority figure. However, the email suggests that Zhira challenges the asymmetrical power relations between her and the teacher. The teacher is the 'interactive participant' reading the emails, but 'stud11' is the 'represented participant' (Kress and Van Leeuwen, 1996). When the students send an email to the teacher in this specific interaction, they are not sending it to a teacher as such, but rather to an anonymous student because of the log-in on the student computer that the teacher is using. This does not mean that they see their emails to their teacher in the same way as emails to their friends, or that they consider their teacher to be a student or friend, but the non-threatening (because it is not face-to-face) nature of email may have a certain democratizing effect. The notion of sending an email to the teacher as represented participant does not encourage Zhira to align him with a student identity. In student-to-student emailing, an interaction like this would be quite normal because there is more equality between students (they all have anonymous student identities). However, this condition facilitates Zhira's expression of unhappiness with her teacher for reading her email aloud. Her message suggests that she is upset with him and did not expect or want him to share it with the class: she wanted Mr. Ernest to keep the message private. Her unhappiness also suggests that she intended her email to be considered as a private dialogue with her teacher, but from the sequences one is able to say that he did not interpret her email in the same way. Considering all the emails that Mr. Ernest has received, it is significant that he only chose to read one of these aloud.

The second email (lines 6-8) suggests that another student is also uncomfortable. It is likely that the email with the message "sir plse move me" comes from Matthew. This request to be moved suggests that space may be an issue: this child is not happy with sharing the computer with the girl he has been paired with. Thus, email is used in an attempt to negotiate sharing relationships in the class. By comparison, the other emails suggest that the children are evaluating their teacher: "sir you are the best sir ever" (line 12), "sir we love you" (line 16), "why are you so dum" (line 21) and "sir I like you are the best" (line 25) all suggest a personal evaluation of Mr. Ernest as a person instead of as

a teacher. Only one of these messages "why are you so dum" (line 21) may be interpreted as a child's attempt to scrutinize Mr. Ernest.

The message in line 21 "why are you so dum" would also probably not be communicated between a student and a teacher during a face-to-face interaction: perhaps uttered by a teacher to a student, but unlikely visa-versa. This interaction also suggests that the anonymous student, 'stud9', understands the email space as one of more equal power between him/herself because he/she has the power to insult their teacher. Once again, it is suggested that challenging asymmetrical power relations in this situation is permitted. However, the student could also be taking advantage of his/her anonymity[5], thereby using it to insult the teacher. Also, there are two students sitting at the 'stud9' computer, so the teacher does not really know who the message came from exactly.

Line 24 suggests that the sender of the email is known: 'stud24'. However, the message displaying a compliment and a child's adoration of the teacher in line 25 ends with 'this is from someone you know'. This suggests that the student wants his/her teacher to work out who sent him the message and at the same time it implies a sense of 'I am watching you, I know who you are but do you know who I am?'. The student uses his/her anonymity as a device for play: working out his/her identity is intended to be a game between the teacher and the student, where the student is the one who has initiated the game. Asymmetrical power relations are challenged again because the student is the one who is asking the teacher a question (the notion of 'who am I?') and not the other way around. The student's message suggests playing a game with the teacher which relies on privacy and identity, and the student feels that he/she can initiate a game with the teacher because their identities, and thereby the power relations between them have become blurred by the stud-to-stud login system. However, the teacher does not want to play 'who am I' with the students. He does not email any of the students in return, denying them the personal attention they seem to be seeking.

[5] This example is similar to online insults known as 'flaming' where an addressee is targeted with overtly hostile message content because social accountability is low (Herring, 2001:4).

'It's mine my bra[6]!'

Ken and Cole are using Microsoft PowerPoint to create an attachment to email. This activity differs from the previous observation because the whole class was making attachments, instead of emailing someone of their own choice. They were making the attachments without a sense of the recipient – the object was to learn how to make an attachment. Although the boys subsequently sent their attachment to Cole, this was an afterthought. The teacher walked around the class to help the students if they got stuck and he showed them how to use PowerPoint (how to add text and sounds to a slide). This activity can still be considered as a 'fun' activity because it was not assessed. The class was just told to create an attachment and email it. The teacher did not exercise editorial control and the students were free to write what they wanted to and include pictures of their own choice. This lesson was the only one observed where a whole class was spent on using PowerPoint. The creation of the attachment was framed as a 'writing' activity (writing a message, pasting pictures from the clip art onto a slide, adding sounds).

Ken and Cole negotiated turn-taking when making the attachment, but these turns do not only involve turns using the mouse. An analysis of the following observation shows how they collaborate and share the program to create an attachment and negotiate their roles through turn-taking as they do so.

1	Ken: This?	
2		((Ken points at an image of a yin-yang sign))
3	Cole: Yes, ja take that one.	
4		((Ken pastes the image onto the slide))
5	Ken: Must I leave it there?	
6	Cole: Mmm	

[6] South African slang for 'brother'.

7	Ken: Or take it down?	
8		((Ken moves the image higher on the slide))
9	Cole: Nah	
10		((Cole points at the middle of the slide where the clip was pasted first by default with his index finger))

Transcript 21: Ken and Cole (Take that one)

In line 1, Ken makes an offer to Cole about whether he would like to include the clip of the yin-yang which he shows Cole by pointing at it with the mouse. Although Ken has control over the mouse, his utterance shows that he is aware that he is not in control of selecting the clips and 'making' the attachment, even though he does all the 'technical work' (using the mouse to copy and paste clips). In line 3, Cole accepts Ken's offer and gives him permission to include the clip. In line 4, Ken pastes the clip onto the slide and this action is followed by a question about its placement in line 5. Ken is also orienting towards Cole's approval, because his utterances in lines 5 and 7 suggest that Cole is the one making the decisions about the placement of the clip even though Ken is involved in the physical act of placement – using the mouse to move the clip into the desired position on the slide.

In line 9, Cole disagrees with the alternative position of the clip suggested by Ken and uses his index finger to point at the screen in line 10 to indicate his preference with regards to where the clip should be placed. Ken is in control of the mouse and the arrow on the screen is the 'represented participant', and because Cole is not in control of the mouse, he uses his index finger to point – compensating for his lack of representation in the interface. Like the gestures discussed in Chapter 4 and 5, Cole's pointing may be regarded as a "gestural overlay" (Jewitt, 2006:88) which functions in two ways: to indicate his preferred clip and to insert himself into the interface. This sequence shows how the two boys negotiate turn-taking with the mouse as well as turns to make editorial decisions, thereby defining their roles through interaction and collaborating with one another to create the attachment.

In this sequence the boys defined their roles in interaction – one was responsible for the technical composition (physically using the mouse to select images) and the other was in charge of decision-making, playing an editorial role (verbal selection). In the next sequence, sharing practices become disturbed because the roles that they defined for one another for joint production makes ownership of the attachment problematic. The teacher comes to them and tells them to save the attachment before they send it. This interaction takes place while they are saving the attachment:

1		((Ken goes to 'File', 'Save as' , types 'Ken' as the file name))
2	Cole: Cole	
3	Ken: No, it's mine man.	
4	Cole: Are you mad! It's mine my bra! Yissus[7]. You can do yours now next . Mine is so kwaai[8]! Whooo ha ha (giggles)	
5		((Ken deletes 'Ken', types 'Cole' and clicks 'Save'.))

Transcript 22: Ken and Cole save the attachment

Cole saying his name in line 2 suggests that he is disagreeing with Ken's decision in line 1 to save the attachment as a file using his own name. Cole wants Ken to save it is as 'Cole' and not as 'Ken'. Cole considers saving the file using his name as an indicator of ownership, even though they have both 'produced' the attachment. Ken disagrees with Cole in line 3, saying that he will not save it under Cole's name because it does not

[7] 'Yissus' is an Afrikaans swear word (blasphemy) derived from 'Jesus'.

[8] 'Kwaai' means 'cross' or 'angry' in standard Afrikaans, but it has developed additional meanings of 'cool' or 'awesome'.

belong to him. This suggests that Ken thinks he is the rightful owner to the attachment and he shares Cole's perception that saving the file under one's name is a marker of ownership. Cole disagrees with Ken again in line 4, insisting that the attachment is his. Cole tells Ken, 'You can do yours now next', implying that Ken can make himself another one, his 'own' one despite the fact that Ken has been doing all the 'technical work' so far. Cole is impressed with the attachment when he says, 'Mine is so kwaai!' in line 4, but this utterance suggests that he is also bragging about the attachment being his and teasing Ken that he has 'won': he has won the ownership battle through his persistence. Ken 'admits defeat' in line 5 when he deletes his name and replaces it with Cole's, thereby agreeing to represent Cole as the owner of the attachment.

This sequence shows how conflict arose when the boys tried to negotiate representing ownership when saving the file. In this interaction, the boys considered their names to be markers of ownership. They were logged in on Ken's username and sent the email from Ken's address to Cole's. When Cole logs onto the computer using his username, opening his email and the newly received attachment, he displays a different understanding of ownership and seems to transfer ownership to Ken:

1	Cole:	That's your one Ken.
2		Look there, look there!
3		((points at the screen and giggles))
4		It's logged on your name.

Transcript 23: Ken and Cole (That's your one)

In line 1 Cole identifies the attachment they just created as Ken's, providing a reason for Ken's ownership in line 4: it is 'logged' on his name. Cole identifies Ken as the owner because he recognizes Ken's email address as the sender. This is because the boys logged into the computer using Ken's username when they entered the lab instead of the 'stud' username, so when they sent the email it was sent from Ken's address. This suggests that because Cole sees Ken represented in the email inbox as the sender of the email with the attachment, he is the true 'owner' thereof.

These sequences indicate that although the boys have jointly created the attachment, they do not see themselves as partners with joint ownership of their digital creation. They could have saved the attachment as 'ken and cole' but the fact that they did not may suggest that they perceive ownership as something individual. They orient towards the attachment as a prized possession, something to be fought over despite the fact that making the attachment relied on collaborative effort. Thus, the competitive discourse between the boys took priority.

'Responding back': Sharing Aunt Sandra

I observed two Grade 5 girls in Mr. Horn's mathematics class, Tammy and Rebecca, sitting together using Pegasus Mail while the rest of their classmates (except for one boy, Chad, and his lab partner) were completing drill-and-practice exercises using Cami Maths (as discussed in Chapter 4). I asked the girls why they were the only ones using email, and they explained that the children emailing were those who had someone with whom to correspond:

1	Researcher: You guys the only ones using email?	
2	Tammy: No, and him.	(Tammy points at
3	Researcher: Oh, him as well. Why are the others not using it?	Chad sitting
4	Tammy: 'Cause they have nobody to…	behind them)
5	umm…	
6	Nobody's responding back to them.	
7	Researcher: Oh, okay.	
8	So who are you responding with?	
9	Rebecca: With my aunty.	

Transcript 24: Tammy and Rebecca (Nobody's responding back to them)

Tammy's utterances in line 4 and 6 (accompanied by her hesitation in line 5) suggest that it is not the case that the rest of her classmates have nobody that they can email (the next section discusses the children in Mr. Horn's class emailing one another during a different lab session). Tammy's answer may suggest that her classmates are not emailing because the people they have emailed are not responding. Rebecca's aunty on the other hand, is 'responding' to her emails. It is unclear exactly what Mr. Horn's

criteria were, but children who had an outside correspondent seemed to be getting special treatment. The two children with "access" to a responding email recipient may be regarded as having greater social power than their classmates during this session, as they were exempt from doing drill-and-practice exercises and thereby accorded a 'special' status in the class. Such correspondents were yet another 'scarce resource'.

Rebecca had received the following email from her aunt Sandra[9]:

> Subject: RE: how are you doing
>
> Hello Rebecca*!
> I am well, thank you for asking! How are you doing? Hope you are working hard at your school work.
>
> Your dad is working at Old Mutual today. I should see him later this afternoon. I will tell him that you have sent me mail.
> Have a fab day
> Sandra*
> (smiley emoticon)
> p.s. I still have not seen your pics of your overseas trip

Figure 11: Aunt Sandra's email to Rebecca

Aunt Sandra acknowledges her niece's previous email, replies to her question about how she is doing, shares information (that she would be seeing Rebecca's father later that day) and requests to see photographs taken during Rebecca's overseas trip. Aunt Sandra is not only responding, but indicating an interest in her niece's life: she is interested in how Rebecca is doing at school and wants to share pictures taken of her trip. The fact that Rebecca went on an overseas trip suggests that she is from a different social class to most of the other children. She is also one of two children in the class using email because they have access to a relative with an email address. This suggests the relationship between social class and email use.

[9] The name of the aunty has been changed to preserve anonymity.

Rebecca asks Tammy what she should say and the following interaction ensues:

1	Rebecca: Can say I'm doing fine…	
2	Tammy: First the subject mos, neh?	(Tammy points at "Subj." on the
3	Rebecca: What can I say?	screen.)
4	Tammy: What subject…	
5	Rebecca: Hello?	
6	Tammy: Thank you.	
7	Rebecca: I'm doing fine and say I'm	Rebecca types in "thank you" next to
8	working at…	"Subj."
9	Tammy: Don't say I'm on the computer.	

Transcript 25: Tammy and Rebecca (What can I say?)

The girls' conversation highlights their awareness of an 'audience' and while they are discussing what Rebecca should write, they are simultaneously considering what information would be appropriate. Their discussion suggests that they are aware of the conventions of letter writing such as acknowledging the sender's reply followed by how or what one is doing as well as conversational interaction and the kinds of things one says when interacting in a dialogue. However, Tammy is the 'third party' in this exchange between Rebecca and her aunt: Tammy helps Rebecca with textual construction.

Rebecca offers Tammy a turn to type which Tammy declines. Instead, Tammy helps Rebecca with grammar and sentence construction:

1	Rebecca: Me and my friends…	Rebecca types 'me and my friends'
2	(to Tammy) Wanna type?	
3	Tammy: friend	Rebecca deletes 's' from 'friends', types 'is wor' but deletes 'wor' and types 'sending you and email we are
4	Tammy: (pointing at 'hardat' on the screen')	working very hardat'
5	Hard at –	Rebecca deletes 'at' from the end of
6	you must make a thingy…	'hardat' and inserts a space after
7	Rebecca: Oh…	'hard' followed by 'at school'
8	Tammy: A… what do you call it?	
9	A space.	

Transcript 26: Tammy helps Rebecca with textual construction

This interaction demonstrates how the email to Aunt Sandra became a joint endeavour. This kind of writing is different to what children often do in the classroom: it is not written for the teacher or assessed (as a letter would be as part of an English lesson) and it is a form of 'productive writing' (Kress, 1994:34, 41) because the children are engaging with their own ideas rather than copying down information. The girls are making use of their 'writing-rights' (Kress, 1994:21), but one may argue that nonetheless, a power differential underpins the interaction: Rebecca has "access" to a responding email recipient, whereas Tammy does not. This places a limit on Tammy's 'writing-rights' (Kress, 1994:21) because the email belongs to Rebecca who therefore has the final word. Although Tammy may help with the writing and editing by correcting Rebecca's spelling and grammatical mistakes verbally (which seems to be a mutual decision), Rebecca is the "editor" in terms of content as she seems to decide what information will be included in the email.

Tammy is not addressed or even acknowledged in Aunt Sandra's email, but nonetheless, Tammy displays an interest in Aunt Sandra. The following interaction suggests that there is certain information she needs to know in order to help Rebecca with writing her email in terms of suggesting content:

1	Tammy: Have you got cousins?
2	Rebecca: At school?
3	Tammy: No man -
4	have you got cousins,
5	have this lady got children?
6	Say hi to all…
7	say hi to whoever whoever.

Transcript 27: Tammy and Rebecca (Have this lady got children?)

Tammy's question to Rebecca about whether she has cousins or whether Aunt Sandra has children highlights Tammy's awareness of a 'cultural model' (Gee, 1999:59) of aunties and cousins and the kinds of conversations that take place between a child and his or her aunt. Tammy's request for more information about Aunt Sandra also suggests

that she wishes to know more about this person before making further suggestions: she is trying to match the "audience" with the appropriate discourse.

This is what the girls wrote in the email to Aunt Sandra:

> Subj: thank you
>
> thank you for sending me e mail. me and my friend is sending you and email we are working very hard at school I will ask my daddy to bring the photos of my trip hope you enjoy your day
>
> from rebecca* and friend

Figure 12: Tammy and Rebecca's email to Aunt Sandra

Tammy is written out of a message that she has helped to compose – she is reduced to an anonymous friend in Rebecca's email. One may suggest that Aunt Sandra is less anonymous to Tammy because she knows (from helping Rebecca to construct her email and asking her questions) that Aunt Sandra is Rebecca's father's sister and that she does not have any children.

Guessing games, 'writing rights' and playground discourse in children's email use

Mr. Horn allowed his Grade 5 class to email one another during one of their lab sessions. The children all made use of the 'stud' login system, using the numbers of the computers they were sitting at to log in. I observed two girls and asked them who they were emailing. Amy and Anna decided to email Tariq, a boy sitting on the opposite side of the computer lab. Amy said, "I'm going to send him something – like a puzzle – then he has to figure it out". The two girls sent: "hello. how are you. guess. this animal is long and it spits." Amy explained to me that the answer was "a spitting cobra". This

email can be likened to requesting an answer to a riddle. They received an email from 'stud 5' which said "Welcome to my world". Another pair of girls sitting across the lab called Amy and Anna and asked them whether they had received their message. Anna asks them, "What number?" to which they reply, "Stud thirteen". Amy and Anna look at their inbox and click on the sender "stud13". They read their friends' email which says, "WhatS Cracking". They close this email and return to their inbox, noting an email from "stud7". This email is from Tariq and his partner Mike and it says "To amy and anna you are happy and you look so sweet." The boys did not send an answer to their riddle, but sent them a compliment instead.

Similarly, Mr. Ernest also allows his Grade 5 class to email one another during a lab session, this time before doing their drill-and-practice exercises (usually he allows his class to use email after completing their exercises, which frames the emailing activity as a kind of reward, but this time they used email first). I observed Martin and Bradley. They call their friends sitting further down the row of computers and tell them that they are going to send them a message. Martin and Bradley send "hi boys what are you doing" even though they can see what their friends are doing. One of the boys sitting at the middle row of computers reaches back and taps Martin on the shoulder and says, "sent you a message". Martin and Bradley go to the inbox and spot a new message which says, "hello martin and bradley which team is going to win". Martin tells me that the message is from "stud four". I had observed Martin and Bradley using email before. During another session they received an insult "hello uglys" from one of their classmates. Noting the number of the student computer, Martin and Bradley looked around the class, counting the computers to work out who had sent them the message.

The interactions described suggest that this kind of emailing (and the email to Aunt Sandra discussed in the previous section) diverges from classroom discourse with an IRF structure and unequal power relations between the teacher and the taught. However, classroom discourse also involves how the children talk to each other. In many classes they are not supposed to be in communication with each other. This leads one to question what happens when children are given permission to communicate with

one another in an environment with different affordances such as email as a form of interpersonal communication and what they choose to do given this opportunity. On the one hand, this kind of emailing allows children to express themselves because the teacher does not place limitations on their 'writing-rights' (Kress, 1994:21) except for the occasional warning of "no rude emails". The children are not confined to rules such as who they are allowed to write to and what they are allowed to say as well as whether they are allowed to get a reply.

The children's email use involved a lot of face-to-face communication and perhaps even more communication took place verbally than via email exchanges. The children make use of email in a locally discursive way which transforms email into a performative medium. The children often stage their emails by telling their friends about the message before sending it. Most of this kind of email use happens in "real time" and is therefore closer to instant messaging (IM) with synchronous exchanges than it is to emailing as an asynchronous form of communication where there is much more of a time delay between sending and receiving a message.

The interactions can be described as a form of 'secondary orality' (Ong, 1982). The children can be thought of as sign-makers with different interests: sharing riddles, insulting or complimenting one another, talking about soccer teams and so forth. Such interests can be considered in relation to other discourses in which the children participate such as school-based secondary Discourses or their family-based or primary Discourse. The children's emails suggest that they are using their interests and 'writing-rights' (Kress, 1994:21) to explore playground discourses such as riddles and insults. This discussion relates to the idea of 'scarce resources' in the sense that engaging with peers in playground discourses in the space of the classroom is usually not permitted or tolerated by the teacher: children are given limited opportunities to express their own interests. Therefore, this kind or emailing – although being used in a locally discursive manner – suggests the presence of a residual space where children can exercise some freedom as well as their communicative rights.

Conclusion

Despite the limited range of resources available to children in their environment, email is used in a variety of ways compared to drill-and-practice software and Google. Another irony is that emailing happens on the fringes of classroom activity and yet it is the only kind of software use observed which suggests that the children are allowed to take an initiating role and engage in 'productive writing' (Kress, 1994 as discussed in Chapter 2).

This chapter offers teachers, teacher-trainers and lab administrators a perspective to rethink their assumptions about children's email use at school. Children are represented by the email software, such as by the different logins, and this influences communication: logins can be considered as communicative resources which forms part of children's email practices. This perspective challenges digital divide literature because the observations provide examples of non-physical 'scarce resources', such as a teacher's attention, shared student log-ins, and email correspondents which like the computer, function as 'scarce resources' in this particular environment. Access to such 'scarce resources' and their communicative possibilities are evidently as important as the presence of computers or bandwidth.

The discussions in this chapter are revealing about classroom practices involving email. Emailing is not a prefigured activity: teachers do not frame emailing as 'school work', they do not plan emailing as they would a lesson, and the children's emails are not assessed. However, what the children are able to do is subject to constraints because of the way in which the lab is set up (deciding which log-in system to implement) and the type of activity (emailing the teacher or classmates, or whether they email someone outside of the school) plays a large role regarding the communicative possibilities of email. When children use email at school, they are engaging in a set of social practices, but these practices go hand in hand with the communicative possibilities in their environment.

In relation to classroom discourse, email use moves outside of the IRF framework. This is largely because emailing is not framed as 'school work' and the children's emails are not evaluated by the teacher. Yet, evaluation plays an interesting role in children's email use: the children elect to use particular evaluation moves in their emails to their teacher ("we love you", "why are you so dum" and so forth). The children focus on personal affiliation or negation rather than discursive evaluation. In other emails to the teacher, children requested that the teacher move certain children or themselves, thus communicating a sense of discomfort with sharing the computer with a particular child. The children also initiate other kinds of interactions, such as riddles or insults with peers, thereby engaging in playground discourses.

Chapter 7: Conclusion

Noss and Pachler argue that the inclusion of ICT in the context of formal education 'impacts on the dynamic interplay between teachers and learners' (Noss and Pachler:1999:2). However, this study suggests that the reverse is also true: that the roles of teachers and learners in classroom discourse impacts on the use of ICT in school settings. Classroom discourse only allows children to access certain discursive roles and this impacts on their interactions with different kinds of software. By understanding classroom discourse in the computer lab, it is possible to see how children's discursive roles generate specific forms of engagement with the ICT resources available. This also suggests the possibilities of alternative pedagogical practices.

Resnick argues that 'in most places where new technologies are being used in education today, the technologies are used simply to reinforce outmoded approaches to learning' (2002:32). It is likely that Resnick is referring to drill-and-practice software which carries a behaviourist conception of learning (as discussed in Chapter Four). However, the IRF structure embedded in this kind of software also suggests a certain approach to learning. This study suggests that the IRF discourse structure prominent in 'conventional' classrooms is being fitted onto an educational context with new affordances. Although the IRF is not 'outmoded', it is definitely not new: it is a familiar approach used by teachers in the classroom and may be considered as one of the teachers' resources – a discourse that 'helps' to realize pedagogy. The children's software use described in this study suggests that software applications are 'schooled' (albeit in different ways) and that this rarely encourages new roles or engagement with knowledge (i.e. *vis-à-vis* fostering different pedagogical relationships). The IRF structure(s) in the classroom discourse of the computer lab and those simulated by software restricts children 'access' to discourses: instead of allowing them to participate as apprentices such as being a mathematician or a historian, they are positioned as respondents. The three different types of software discussed in this study afford different configurations of the structure, and only occasionally did I observe an

interaction underpinned by different social interactions. For example, children's email practices suggest that they are often the initiators of the interaction, rather than respondents.

The computer lab may be considered as an unconventional classroom and yet the structure of the IRF is still quite apparent in children's use of drill-and-practice mathematics software and Google. Children's email use may be considered as being 'outside' of the IRF because it is not framed as 'school work' and yet the children's emailing practices suggest a form of productive writing, unlike Google and drill-and-practice software. Children's software use can be described in terms of different configurations of resources and roles.

The children's discourse and software use suggest that the IRF is configured differently in relation to the software they use, and this accounts for the 'variations' on classroom discourse that ensue. Such 'variations' impact on the discursive roles accorded to children which in turn has implications for 'access': children are not necessarily 'accessing' school-based secondary Discourses intended by teachers or the curriculum, nor are they accessing ICTs as artefacts which are often designed and configured to support workplace literacy practices. Instead, a school-mediated conception of ICTs emerges which often 'schools' the software by situating it within classroom discourse. The three kinds of software reported on in this study establish distinctive 'variations' on classroom discourse, and are 'schooled' to different degrees. The use of each application is associated with a different set of 'scarce resources' which influence children's interactions.

A recap on the software: drilling, searching and emailing

Drill-and-practice mathematics software

Unlike email applications and search engines, drill-and-practice software is specifically designed for educational purposes. On one hand, classroom discourse is implicit in "Cami Maths": it encodes an IRF structure and the interface is designed to afford

teacher surveillance. On the other hand, classroom discourse is realized through the teacher and the children's interactions around the software. The observations reported on in Chapter Four suggest the following examples of classroom discourse. First, the dominant peer uses the teacher's discourse as a scaffold to assist his/her peer. Second, the teacher often controls turn-taking among the children. Third, the teacher acts as a watchdog for 'correct' answers in addition to the assessment provided by the software and thus monitors the children's progress by walking around the class. Fourth, the children compete to be 'correct' as well as for the role of the more competent peer; and fifth, the teacher establishes 'helping rules' (although the children were seen to bypass these in the interests of achieving a high score).

This study suggests that being 'correct' and achieving a high score plays an important role in the identities children construct, and children cue into the software's evaluation in that it communicates something about them to their teacher and their peers. 'Doing mathematics' in this context is not so much about conceptual development, because the affective side takes precedence. Children perform their identities as good learners (able to make a high score) by labeling their peers as 'stupid' or a 'struggler'.

Although this software is intended for school use (i.e. practicing mathematics), its use acquires additional meanings for the children. The children use the scoring system as a resource for competition (they work against one another for a higher score); and for identity formation by labelling themselves and their peers as certain kinds of learners (i.e. 'stupid' or 'struggler'). Such meanings and uses may not be intended by the software designers, but are realized through the children's interactions with the software and with one another. It is important to note that the program is intended for single users instead of children working in pairs. Thus, the disjunction between the 'represented' and 'interactive' participants may be seen as a contributing factor to this kind of classroom conflict.

A search engine (Google)

Search engines are not exclusively designed for school use and similarly, Google is not specifically designed for children. The search engine is also 'schooled' by classroom discourse. The children use Google to find 'facts' in response to search topics initiated by the teacher and 'copy' information found using Google, thus engaging in transcriptive or 'reproductive' writing. The teacher sets rules such as using different web pages for different 'points of view' and, finally, the teacher often sets the search task with a 'preselected' website in mind, hoping that the children will find it (similar to 'guess what the teacher is thinking' in IRF exchanges). Children occupy the discursive role of *respondents* because they use Google to respond to search topics initiated by their teacher or to answer worksheet questions. They are not using Google in a way that suggests apprenticeship into alternative Discourses: they are not 'being' academic researchers or historians or explicitly drawing on the discourses associated with these roles, or evaluating the resources they find via the search engine.

Search engines are intended for many different purposes such as research, inquiry, shopping online and so forth. However, the children's discourse and use of the search engine suggests that they use the affordances of Google's 'smooth, question-and-answer exchange' (Walton, 2008) to get answers or facts; and they bypass challenging features of the resources they find by developing their own ways of using websites and managing information (evaluating information based on visual foregrounding or salience, matching keywords and so forth rather than grappling with the verbal meaning of the texts that they find).

The discourse of constructing knowledge through inquiry is an important factor, because children use Google to 'copy' information rather than to 'construct' knowledge. If discourses around 'knowledge construction' and 'inquiry' are scaffolded adequately, children may be able to become more agentive learners. However, before learners are able to *initiate* such inquiries and construct knowledge through 'productive' writing practices, they need to first be *initiated* into these discourses as well as the discursive practices associated with the use of search engines. Recommended pedagogical

practices may involve teachers and worksheets which provide discourse scaffolding for the children's engagement with and evaluation of the information that they find.

Email software (Pegasus Mail)

Like Google, Pegasus Mail is also not designed exclusively for children or schools as a form of educational software *per se*. This study finds that classroom discourse does influence children's emailing practices to a certain degree, but less so than with Google or drill-and-practice software. Emailing usually takes place on the fringes of classroom activity and is considered to be a non-event educationally in this context, as there is no assessment. The children's discourse and email use also suggests that emailing is the most diverse kind of software use (compared to searching and drilling) because the email activities reported on are all very different to one another. This may be because emailing largely takes place outside the IRF: emailing is not framed as a school activity and this influences the practices which ensue.

The following characteristics of classroom discourse in children's use of email suggest certain adaptations to the IRF structure. In the first place, the teacher has the social power to decide whether or not to read the emails he receives from the children aloud to the rest of the class. This may not be considered as a classic form of classroom discourse, but the institutional power underpins the power relations that I observed. Most often the children do the initiating: they email their teacher or classmates first, although they seldom receive a written response. The teacher decides what counts as 'genuine' emailing – children may be exempt from doing drills if they have a relative or family member who responds to their emails. Notably, when children email one another they can explore their own interests (such as choosing to engage in playground discourse) and have more equal communicative rights. The children are given the opportunity to play an initiating role and they engage in more 'productive' forms of writing. Emailing involves a complex interplay between the software and a host of social factors. Thus, emailing involves a configuration of roles and resources which differs from the kinds of configurations which constitute drilling or searching.

The children's use of email challenges assumptions about email as a medium, because they transform it through their use. The children's discourse and software use develop a variant of emailing which involves both face-to-face communication and collaborative work. In the first place, email becomes an element of a synchronous multimodal face-to-face genre. Communication does not only take place online, but is interleaved with other verbal and gestural interactions in the classroom. Email also becomes a form of synchronous communication in 'real time', much like Instant Messaging, rather than only being used for lengthier forms of asynchronous communication. Finally, emails are authored and read collaboratively, which reshapes emailing as a public and not exclusively private activity.

The children's competitive interactions and collaborative practices in their email use suggest that they identify a number of 'scarce resources' in their discourse. Firstly, the teacher's attention to or willingness to participate in a private dialogue with the children is at stake, as is that of other email recipients (relatives, teachers, classmates). Privacy is another aspect of discourse which occasionally generated conflict, since private dialogue was scarce; and, finally, images (in email attachments) are considered as special and prized possessions.

Summary

Different types of software are marked by different configurations of roles and resources when used in the computer laboratory at Mountainside Primary. Features of the IRF structure are configured differently in children's use of drill-and-practice mathematics software and Google, although it is less influential in the case of email use.

The children's discourse and use of Cami Maths suggests that the affective side of evaluation is very important, as the IRF encoded in the software and the score sets up an identity for the children: the score provides a public evaluation that brings up an identity of someone who is 'stupid' or a 'struggler'. The emphasis on evaluation shapes

what it means to 'do mathematics' in this context: 'doing mathematics' involves being 'correct' and not being labeled as a 'struggler'.

The children's use of Google suggests a different configuration of resources and roles. The teacher initiates the children's search by providing search terms and the children are accorded the role of respondents because they have to find 'facts' about a topic set by the teacher or answer questions on a worksheet. However, when the children formulated their own search queries by transforming the worksheet questions into search queries they were seen to be initiating the search to a greater extent, as formulating a search query can be regarded as a form of productive writing. Yet, even in these cases, the search engine was used to find factual 'answers' which could be written down in their workbooks. Therefore, the activity was framed as an act of 'transcriptive' or 'reproductive' writing. This contrasts with the children's use of email which allows the children to take an initiating role and engage in 'productive' writing.

Children's use of different kinds of software is accompanied by different forms of writing: drill-and-practice software is most restrictive as the answers are predetermined by the software, the Googling lessons suggest that 'reproductive writing' is the most common configuration (although formulating a search query may be regarded as a minimal form of 'productive' writing), and finally, children seem to engage more in 'productive' writing and multimodal authoring when they use email.

The configurations of resources and roles associated with the children's use of different kinds of software have implications for 'access' and learning. It is particularly worrying that the rules of children's engagement in classroom discourse may be limiting their 'access' to expensive ICT resources and valuable learning opportunities. For example, children's use of search engines might differ if they were apprenticed into the role of an academic researcher or a historian and if the teachers emphasized the practices associated with these roles which involve a different relationship with information.

Finally, in order to understand how ICTs may contribute to the learning process, 'teachers need to possess not only the requisite technical skills but also to understand the relationship between the system and the learner as well as the implicit and explicit values and assumptions of ICT applications about the way that learning happens' (Noss & Pachler, 1999:2). Learning school-based secondary Discourses happens through apprenticeship and the teacher's provision of scaffolding is crucial to the supported interaction involved in this process. Software alone does not allow access to these discourses and computers cannot 'deliver' the curriculum. Children's experience of and access to dominant secondary discourses is just as important as their access to the physical resources of hardware and software.

References

Alexander, R. (2006). *Towards dialogic teaching: Rethinking classroom talk*. UK: Dialogos UK Ltd.

Burnett, C. & Wilkinson, J. (2005). "Holy Lemons! Learning from children's uses of the Internet in out-of-school contexts," *Literacy*, 39(3): 158-165.

Cameron, D. (2001). *Working with Spoken Discourse*. London: Sage.

Cameron, D. (2001). "Sequence and structure: Conversation Analysis" in *Working with Spoken Discourse*. London: Sage.

Cape Metropolitan Area State of the Environment Report. (2004). South African Government Department of Environmental Affairs and Tourism. Available: http://www.environment.gov.za/enviro-info/sote/citysoe/cape/educat a.htm. [16 August 2008]

Colleyn, J. (2005). "Jean Rouch: an anthropologist ahead of his time," *American Anthropologist*, 107(1): 113-115.

Constantinou, O. (2005). "Multimodal Discourse Analysis: Media, modes and technologies," *Journal of Sociolinguistics,* 9(4): 602-618.

Dugmore, C. (2008, May 22). "Education Budget Vote delivered at Provincial Legislature, Cape Town, Budget Vote of Western Cape Education." Available:http://www.search.gov.za/info/previewDocument.jsp?dk=%2Fdata%2Fstatic%2Finfo%2Fspeeches%2F2008%2F08052217451001.htm%40SpeechesandStatements&q=(+agriculture+%3CAND%3E+education+%3CAND%3E+policy+)&t=C+Dugmore%3A+Western+Cape+Education+Prov+Budget+Vote+2008%2F09. [16 August 2008]

Du Toit, I. (2005). "The effect of ICT curriculum support on the measured skills levels of learners of two subprojects of the Khanya project". Unpublished conference paper. WCCE 2005 Conference. Available:http://www.khanya.co.za/news/events/files/wcceisabel.pdf [4 August 2008]

Edwards, A.D. & Westgate, D. P. G. (1987). *Investigating Classroom Talk*. London: Falmer Press.

Fabos, B. (2008). "The Price Of Information: Critical Literacy, Education, And Today's Internet" in *Handbook of Research on New Literacies*, eds. Donald J. Leu, Julie Coiro, Michele Knobel & Colin Lankshear. New York: Lawrence Erlbaum Associates/Taylor & Francis Group.

Fink, C. and Kenny, C.J. 2003. "W(h)ither the digital divide?", *Info*, 5(6): 15-24.

Fisher, E. (1997a). “Educationally important types of children’s talk” in *Computers and talk in the primary classroom*, eds. Rupert Wegerif and Paul Scrimshaw. Clevedon: Multilingual Matters.

Fisher, E. (1997b). “Developments in exploratory talk and academic argument” in *Computers and talk in the primary classroom*, eds. Rupert Wegerif and Paul Scrimshaw. Clevedon: Multilingual Matters.

Fisher, E. (1997c). “Children’s talk and computer software” in *Computers and talk in the primary classroom*, eds. Rupert Wegerif and Paul Scrimshaw. Clevedon: Multilingual Matters.

Gee, J.P. (1999). *An introduction to discourse analysis: theory and method*. New York: Routledge.

Gee, J.P. & Green, J.L. (1998). “Discourse analysis, learning, and social practice: A methodological study,” *Review of Research in Education*, 23: 119-169.

Gee, J.P. (1990). *Sociolinguistics and literacies: Ideology in discourses*. New York: Falmer Press.

Halliday, M.A.K. (1993) “Towards a language-based theory of learning,” *Linguistics and Education,* 5: 93-116.

Halliday, M.A.K. (1978). *Language as social semiotic: The social interpretation of language and meaning*. London: Edward Arnold.

Halliday, M.A.K. (1975) *Learning how to mean*. London: Edward Arnold.

Heritage, J. (1997). “Conversation analysis and institutional talk: analysing data” in *Qualitative research: theory, method and practice*, ed. David Silverman. London: Sage.

Herring, S. (2001). “Computer-Mediated Discourse” in *Handbook of Discourse Analysis.* eds. Deborah Tannen, Deborah Schiffrin, and Heidi Hamilton. Blackwell: Oxford.

Hicks, D. (1996). “Discourse, learning and teaching,” *Review of Research in Education*, 21: 49-95.

Jewitt, C. (2007). “A multimodal perspective on textuality and contexts,” *Pedagogy, Culture and Society*, 15(3): 275-289.

Jewitt. C. (2006). *Technology, literacy and learning: A multimodal approach*. Routledge, London.

Jewitt, C. (2005). “Classrooms and the design of pedagogic discourse: A multimodal approach,” *Culture & Psychology*, 11(3): 309-320.

Jones, R. (2002). “The problem of context in computer mediated communication.” A paper presented at the Georgetown Roundtable on Language and Linguistics. Available: http://personal.cityu.edu.hk/~enrodney/Research/ContextCMC.doc. [28 May 2008]

Kaiser Family Foundation. (2007). “Young South Africans, Broadcast Media, and HIV/AIDS Awareness: Results of a National Survey.” Kaiser Family Foundation. Available: http://kff.org/southafrica/upload/7614.pdf. [27 August]

Khanya Project. (2008, January). “WCED/Khanya bridge the digital divide – Western Cape Education Department.” Khanya Project. Available: http://www.khanya.co.za/news/media/?pageid=409. [16 August 2008]

Kress, G., Jewitt, C., Ogborn, J., and Tsatsarelis, C. (2001). *Multimodal Teaching and Learning: The Rhetorics of the Science Classroom*. London: Continuum.

Kress, G. and van Leeuwen, T. (2001) *Multimodal Discourse: The Modes and Media of Contemporary Communication*. London: Arnold.

Kress, G. (1997). *Before Writing: Rethinking the paths to literacy*. London: Routledge.

Kress, G. and van Leeuwen, T. (1996) *Reading Images: The Grammar of Visual Design*. London: Routledge.

Kress (1994). *Learning to write*. London: Routledge

Kress, Gunther. (1985). “Socio-Linguistic Development and the Mature Language User: Different Voices for Different Occasions” in *Language and Learning: An Interactional Perspective*. eds. Gordon Wells and John Nicholls. UK: The Falmer Press.

Kress (1982). *Learning to write*. London: Routledge

Lemke, J.L. (1995). *Textual politics: Discourse and social dynamics*. London: Taylor & Francis Ltd.

Louw, J.; Muller, J. & Tredoux, C. (2008). “Time-on-task, technology and mathematics achievement,” *Evaluation and Program Planning*, 31: 41–50.

Luik, P. (2007). “Characteristics of drills related to development of skills,” *Journal of Computer Assisted Learning*, 23:56-68.

Mercer, N. (2000) *Words and Minds: how we use language to thinking together*. London: Routledge.

Mercer, N. (1995). *The guided construction of knowledge: Talk amongst teachers and learners*. Clevedon: Multilingual Matters Ltd.

Mercer, N. & Wegerif, R. (1999). "Is 'exploratory talk' productive talk?" in *Learning with Computers: analyzing productive interaction*. eds. Karen Littleton and Paul Light. London: Routledge.

Norris, S. (2002). "The implication of visual research for discourse analysis: transcription beyond language," *Visual Communication*, 1(1):97-121.

Noss, R. & Pachler, N. (1999). "The challenge of new technologies: doing old things in a new way, or doing new things?" in *Understanding pedagogy and its impact on learning*. ed. Peter Mortimore. London: Sage.

O'Halloran, K.L. (2000). "Classroom discourse in mathematics: A multisemiotic analysis," *Linguistics and Education*, 10(3): 359-388.

Ong, W.J. (1982). *Orality and literacy: The technologizing of the word*. New York: Methuen.

Peräkylä, A. (1997). "Reliability and validity in research based on tapes and transcripts" in *Qualitative research: theory, method and practice*, ed. David Silverman. London: Sage.

Phurutse, M.C. (2005). *Factors affecting teaching and learning in South African public schools: Report presented to the Education Labour Relations Council*. Cape Town: HSRC Press.

Pomerantz, A. and Fehr, B.J. (1997). "Conversation Analysis: An approach to the study of social action as sense making practices" in *Discourse as Social Interaction,* ed. Teun A. Van Dijk. London: Sage Publications.

Prinsloo, M. & Walton, M. (2008, forthcoming). "Situated responses to the digital literacies of electronic communication in marginal school settings". Unpublished paper.

Raijmakers, B.; Gaver, W. & Bishay, J. (2006). "Design documentaries: Inspiring design research through documentary film," *Proc. DIS 2006*, ACM Press, 229-238.

Resnick, M. (2002). "Rethinking learning in the digital age" in *The global information technology Report 2001-02: readiness for the networked world*. ed. Geoffrey Kirkman. New York: Oxford University Press.

South African Human Rights Commission (SAHRC). (2006). "Report of the public hearing on school-based violence." Available: http://www.sahrc.org.za/sahrc_cms/publish/cat_index_26.shtml. [24 March 2008].

Samuel, J. (1993). "Educational publishing for a democratic South Africa: an African National Congress perspective" in *Publishing for Democratic Education*. eds. Steve Kromberg, Meneesha Govender, Natalie Birrell and Mxolisi Sibanyoni. Johannesburg: The Sached Trust.

Sharpe, T. (2006). "'Unpacking' scaffolding: Identifying discourse and multimodal strategies that support learning," *Language and Education*, 20(3): 211-231.

Sinclair, J. and Coulthard, R. (1975). *Towards an analysis of discourse: The English used by teachers and pupils.* Oxford: Oxford University Press.

Smith, C. & Elkins, J. (2008). "Multimodal reading and comprehension in online environments" in *Handbook of Research on New Literacies* eds. Julie Coiro, Michele Knobel, Colin Lankshear and Donald J. Leu. New York: Taylor & Francis Group.

Stahl, G.; Koschmann, T. & Suthers, D. (2006) "Computer-supported collaborative learning: An historical perspective." Available: http://www.cis.drexel.edu/faculty/gerry/cscl/CSCL_English.pdf. [4 March 2008]

Stein, P. (2008a). "Multimodal Instructional Practices" in *Handbook of Research on New Literacies*. eds. Julie Coiro, Michele Knobel, Colin Lankshear and Donald J. Leu. New York: Taylor & Francis Group.

Stein, P. (2008b). *Multimodal pedagogies in diverse classrooms: Representation, rights and resources*. London: Routledge.

Street, B. & Baker, D. (2006). "So, what about multimodal numeracies?" in *Travel notes from the New Literacy Studies: Instances of practice*. eds. Kate Pahl and Jennifer Rowsell. Clevedon: Multilingual Matters.

ten Have, P. (2006). "Conversation analysis versus other approaches to discourse" (Review Essay) in *Forum: Qualitative Social Research*, 7(2) Art. 3. Available: http://www.qualitative-research.net/fqs-texte/2-06/06-2-3-e.htm. [12 August 2008]

Van der Meij, H.; de Vries, B.; Boersma, K.; Pieters, J.; Wegerif, R. (2004). "An examination of interactional coherence in email use in elementary school", *Computers in Human Behavior,* 21 (2005):417-439.

Vygotsky, L. (1978). *Mind in society: the development of higher psychological processes*, eds. Michael Cole, Vera John-Steiner, Sylvia Scribner and Ellen Souberman. Cambridge: Harvard University Press.

Walton, M. (2008). "Semiotic machines: Software in discourse". PhD thesis University of Cape Town, Cape Town.

Walton, M. (2007). "Cheating literacy: The limitations of simulated classroom discourse in educational software for children," *Language and Education*, 21(3): 197-215.

Warschauer, M. (2003). *Technology and social inclusion: Rethinking the digital divide*. Cambridge, MA: MIT Press.

Warschauer, M. (2002). "Reconceptualizing the Digital Divide." *First Monday*, Vol. 7(7).

Western Cape Education Department. (2006). "WCED: Annual report 2006/2007." WCED. Available: http://wced.wcape.gov.za/documents/annual-report07/ld.html#part1.pdf*e inf.html. [16 August 2008]

Wegerif, R. (1997) "Children's talk and computer software: a response to Fisher" in *Computers and talk in the primary classroom*. eds. Rupert Wegerif and Paul Scrimshaw. Clevedon: Multilingual Matters.

Wegerif, R. and Scrimshaw, P. (1997) *Computers and talk in the primary classroom*. Clevedon: Multilingual Matters.

Wegerif, R.and Mercer, N. (1997) "A dialogical framework for researching peer talk" in *Computers and talk in the primary classroom*, eds. Rupert Wegerif and Paul Scrimshaw. Clevedon: Multilingual Matters.

Wells, G. (1996). "Using the tool-kit of discourse in the activity of learning and teaching," *Mind, Culture and Activity*, 3(2): 74-101.

Wells, G. (1994). "The complimentary contributions of Halliday and Vygotsky to a 'language-based theory of learning'", *Linguistics and Education*, 6: 41-90.