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The effect of technology-based lessons on primary school students working in mixed and single-gender groupings

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THE EFFECT OF TECHNOLOGY-BASED LESSONS ON PRIMARY SCHOOL STUDENTS WORKING IN MIXED AND SINGLE-GENDER GROUPINGS

By

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B.A. (Ed); Grad.Dip.Science (Computers); M.Ed

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ABSTRACT

This study investigated primary school students working in mixed and single-gender groupings around a computer during technology-based lessons. In particular it observed the patterns of peer interaction that took place when students worked co-operatively in groups in lessons. In so doing, this study attempted to explain the effects of gender of the student and gender composition of the group, on peer interaction in such a situation. The study also focussed on the effect of gender groupings on the motivation of students and children's collaborative behaviours.

The subjects for the study were twenty-nine students (sixteen boys and thirteen girls) in year 5/6 with an age range of ten to eleven. These students were randomly assigned to different groups: Male-Gender Groups, Female-Gender Groups and Mixed-Gender Groups. A series of lessons on finding information about endangered animals provided the context. The students were taught to use PowerPoint (Microsoft Office, 1998) to make slides on endangered animals, and Web sites were used as sources of information on endangered animals.

This research method adopted was descriptive and analytical and aimed for broad as well as specific understandings. Data that was analysed included data collected through interviews and observations, as well as the quantitative analysis of Peer Interaction Categories (Lee, 1990). The results of the analyses showed whether the students' interactions were primarily task-related, collaborative, and positive or not and whether girls and boys had significantly different experiences across groups of varied gender composition in regard to the specific categories of interaction as well as the total interaction.

In conclusion, the findings have led to a number of assertions which potentially can guide primary classroom practice in fostering technology-based learning.

DECLARATION

I certify that this thesis does not to the best of my knowledge and belief:

(i) incorporate without acknowledgement any material previously submitted for a degree or diploma in any institution of higher education;

(ii) contain any material previously written by another person except where due reference is made in the text; or

(iii) contain any defamatory material.

Signature 

Date 16th January 2004

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Table of Contents

List of Tables

List of Tables (continued)

List of Figures

Chapter One

INTRODUCTION

The Background to the Study

Since the early 1980s, when microcomputers were first generally available in Australian schools (Hooley & Toomey, 1995, p.354), there has been a steady increase in the amount of small group activity around a computer in schools, particularly in primary schools (Wild & Braid, 1995). While there has been significant research into small group learning with computers, with some findings to suggest that grouping students at the computer can be associated with learning benefits (Baron & Abrami, 1992; Hooper & Hannafin, 1991; Hoyles, Healy & Possi, 1994), there is no large body of research which can facilitate planning for the conditions necessary to maximise quality small group interactions at the computer. Indeed, the greater proportion of small group learning research has been in non-computing environments (Wild & Braid, 1996).

A number of studies have examined the specific patterns of peer interaction among students, that take place when they work together in small groups in non-computer settings (Lee, 1993). The studies have suggested that individual and group characteristics are important factors that influence how students interact verbally with each other during small group learning. Gender is a possible key variable and of particular interest in this study are gender of the student and gender composition of the group.

Most small group studies around the computer have shown that while females and males in same-gender groups are equally involved in the verbal activity, especially in task-related interactions, males tend to dominate the verbal activity in mixed-gender groups (Nicholson, Gelpi, Young, & Sulzby, 1998). Furthermore, Webb (cited in Lee, 1993) found that in mixed-gender groups the female and male students had considerably different experiences in regard to specific categories of interaction. Hence, these studies have suggested that gender of the student and gender composition of the group tend to exert differential effects on the interaction that students have with each other while working together in small groups.

By introducing computers for instructional uses, research leaves open the possibility that during computer-based small group work female and male students may experience interaction patterns that are different. This is because as an instructional medium the computer presents students with different types of tasks (Lee, 1993) that promote varied interactions to different gender groups. For example in programming classes and in computer game playing activities, girls compared to boys tend to be underrepresented and do not interact frequently as much as the boys. However, in word processing tasks girls are often well represented and interact more than boys (Volman & Eck 2001).

Mitchell and Reed (2001) also indicated that interaction patterns tend to be different when using computers because students found some aspects of group work using computers to be challenging compared to some non-computing settings. For example, some students felt that an arrangement which assumed that more computer-oriented students should tutor students with less computer knowledge was burdensome, as the more computer literate students had to spend time in "teaching" others. This caused problems in some groups who felt that their work was being hindered, as they were unable to get on with their tasks. Team members then began dividing tasks among team members which was often an efficient allocation of team members' time, but, some students felt they never got a fair chance around the computer (Mitchell and

Reed 2001). On the other hand, for those few teams who had no member with previous experience in computing, they had to allocate significantly extra time to learn. This created some stress for a few team members. Mitchell and Reed (2001) also observed that some team members seemed reluctant to share their thinking with their counterpart team members for fear that the other team's members would "take" their ideas.

One of the new applications of computers in education, which was the subject of a great deal of attention in research in the 1990s, is the use of computers in problem solving by students working in pairs or small groups (Volman & Eck 2001). Working together on the computer is unavoidable in many schools because there are not enough machines for students to work on individually. Moreover, positive cognitive and social effects are expected as a result of working together on the computer. The gender composition of small groups is one of the points of interest in experimental designs and intervention studies (Volman & Eck 2001). However, separating the effects of various characteristics of students and of the tasks to be performed is extremely complex; to date, research has not produced unequivocal recommendations for classroom practice (Volman & Eck 2001).

This study describes the patterns of peer interaction that take place when students work co-operatively in mixed and single-gender groups in computer-based lessons. In so doing, this study attempts to explain the effects of gender of the student and gender composition of the group, on peer interaction in such a situation, and to find differences in the ways in which different groups are motivated, and how they collaborate and interact with each other.

The above aspects are addressed in this study in which Year 5/6 children worked with computers on a project 'Endangered Animals'. The students worked with PowerPoint (Microsoft Office, 1998) to make slides on endangered animals. Access to web sites was provided for the children to get information on endangered animals.

According to Kulik (cited in Lee, 1993) research trends regarding the pedagogical use of computers have focussed mainly on the effects of computer-based instruction on academic achievement and attitudes of students, computer literacy, cost-effectiveness of computer-based instruction, impediments to implementation of computers in the schools, and projections of computer uses in education. Few studies have systematically investigated peer interaction among students while working co-operatively in small groups in computer-based learning settings (Lee, 1993). Mitchell and Reed (2001) investigated the value and challenges in using computers as a research tool in improving computer literacy in a collaborative learning environment. The multimedia environment was the focus of Hudson's (1998) study while students worked collaboratively around the computer. Hudson (1998) structured the multimedia-based activity so as to encourage this mode of working, and investigated whether the medium would support and sustain collaborative learning. Svingen (cited in Mitchell & Reed, 2001) reviewed various technologies with respect to their ability to facilitate co-operative learning.

According to Kumpulainen & Wray (1999) in order to improve the quality of children's collaborative work around the computer, it is important that some attention is paid to the nature of group interactions around the computer, because such interactions can reveal important information about the learning processes and the impact of the computer. Whilst we know that co-operative group learning using computers encourages students to talk, we know little about this talk (Hooper, 1992a; Hooper & Hannafin, 1991; Kumpulainen & Wray , 1999), particularly in relation to group structures, tasks and software types (Wild & Braid, 1997) and how it impacts on learning.

Even fewer studies have examined the effects of gender of the student and gender composition of the group on peer interaction in computer-based learning settings; furthermore, these few existing studies have shown inconsistent findings (Barbieri & Light, 1992; Lee, 1993). Some researchers found that girls do better in small groups of single-gender girls; some researchers argue in favour of such groups on theoretical grounds (Kirkup cited

in Volman & Eck 2001). Others show that girls perform better in mixed-gender groups (Kutnick, 1997) than working together in single-gender girl groups, or that girls benefit more than boys do from working together in mixed-gender groups (Littleton, Light, Joiner, Messer, & Barnes cited in Volman & Eck 2001). An explanation for girls working better or achieving better results in mixed pairs is that they have more opportunity to spend time with the often-more-experienced boys. The question, however, is whether this solution has negative side effects. It may all too easily confirm the image that girls are less competent when it comes to computers. Another solution may be that working in segregated groups compensates for the differences in experience. Tolmie and Howe (cited in Volman & Eck 2001) argue strongly for working in small mixed groups because of the differences they identified between the approaches taken by groups of girls and groups of boys in solving a problem.

A qualitative study on primary education found that interaction in the classroom was an obstacle for girls working in mixed-gender groups (Hanor, 1998). Girls said that the boys in the class belittled them when the girls were using the computer. Factors that the girls mentioned that restricted their access to computers included verbal and physical aggression by boys, not knowing that the computer was free, and lunchtime supervisors letting the boys have priority. Elkjaer (cited in Volman & Eck 2001) observed that boys dominated lessons in the optional subject of computer studies in mixed-gender groups. Boys made spontaneous comments more often, and boys were more active in the classroom discussion, even when the teacher explicitly directed his or her attention to the girls.

Dickhauser & Stiensmeier-Pelster (2002) indicated that numerous studies showed a significant difference between males and females with regard to computer attitudes while interacting around a computer. Girls had less favourable attitudes toward using computers (Dickhauser & Stiensmeier-Pelster, 2002). However, Tsai (2002) during his study of 155 boys and girls working in groups around the computer, indicated no significant difference was found in students' computer attitudes due to the gender factor. Neither

Doornekamp (1993) nor Durndell and Thomson (1997) found gender differences in the use of computers at school. Volman's and Eck's (2001) research analysed the complex meaning of computer attitudes as both a cause and a consequence of differences in the participation and performance of girls and boys working around a computer. The extent and nature of these differences varied from application to application. A preference of girls and women for working together is one of the few gender differences identified with any consistency in the research on gender and learning styles (Severiens & Dam cited in Volman & Eck 2001).

Sutton (cited in Volman & Eck 2001) concluded her review of 10 years of research on gender in K-12 educational uses of computers, with the observation that there was still a great deal for researchers to do in this field. She identified a need for a deeper understanding of the complexities of inequities in computer use in schools to more research on gender. Howe (1997) has also indicated further research on gender and classroom interactions around the computer.

The apparent lack of research and the inconsistent results from research in the area of gender differences in interaction among students working in small groups at the computer support the need for the present study. We have yet to establish how or if single-gender or mixed-gender groups collaborate around a computer.

Summary of the Literature Review related to the Research Questions

The literature review has quite often indicated that students, working in small groups around the computer, interact not only with the computer but also with each other and this enhances group work because it has the potential for promoting interaction, collaboration and motivation among students (Volman & Eck, 2001). Research findings on the first research question what patterns of peer interaction take place when children worked in mixed and single-gender groups within a computer-based learning environment? generally indicated that during peer interaction in mixed and single-gender groups, female and male students had considerably different experiences in regard to specific

categories of interaction (Lee, 1993; Volman & Eck, 2001). Different gender parings mostly produced different patterns of interaction for example, marked dominance patterns in the mixed-gender pairs were recorded (Cassidy & Eachus, 2002; Butler, 2002).

Reviewing the literature on the second research question how did the technology-based learning environment impact on children's collaborative behaviours while they worked in mixed and single-gender groups? frequently established that collaborative group work was often an appropriate and powerful means of elevating the quality of children's work (Yelland, 1999). Group members provided support and encouragement in learning basic computer skills and completing assignments (Lomagnino, NickNicholson & Sulzby, 1999).

Research findings on the last research question how did the technology-based learning environment impact on children's motivational behaviours while they worked in mixed and single-gender groups? usually indicated students working in small groups were mostly motivated by their partners or team mates by receiving feedback about their performance, or model and compared their own abilities with those of their peers. Research has shown that structured controversy during group work is more likely to increase motivation, task-involvement, and self-efficacy (Nastasi & Clements, 1993).

The Purpose of the Study

The purpose of the study is to investigate patterns of peer interaction that take place when primary school children work in single and mixed-gender groups around a computer. In so doing, this study attempts to explain the effects of gender of the student and gender composition of the group on peer interaction in such a situation. It examines aspects like motivation and collaboration while mixed and single-gender groups interact around the computer.

The findings of this investigation, have significance for the classroom teacher, since they will allow the teacher to plan for and perhaps determine the amount

and type of talk generated by students when placed in a co-operative group using computers, by taking into account factors like the gender of the group, numbers of students in the group and the structure of the group.

Research Questions

Research Question 1: What patterns of peer interaction take place when children work in mixed and single-gender groups within a computer-based learning environment?

Research Question 2: How did the technology-based learning environment impact on children's collaborative behaviours while they worked in mixed and single-gender groups?

Research Question 3: How did the technology-based learning environment impact on children's motivational behaviours while they worked in mixed and single-gender groups?

Chapter Two

REVIEW OF LITERATURE

Introduction

This chapter describes the development of a framework upon which this study of primary school children working in groups with computers is based. Peer interaction in general is reviewed. In order to accommodate the needs of the different groups, peer interaction, gender, collaboration and motivation are reviewed. A review of relevant literature on the methodology is also presented, so that a cohesive plan for conducting the research can be presented. The chapter then concludes with a summary of the extant literature as it relates to primary school children working in groups in a computer-based environment and provides a framework for the research questions to be explored in this study.

Peer Interaction in a Computer-Based Learning Environment

There were initially fears from some teachers and parents that computers have an anti-social effect on students (Au and Bruce, 1990). Despite these fears, the evidence is to the contrary. A strong and consistent research finding shows that children's "social interactions increase as they co-operate in certain computer environments." (Nastasi & Clements, 1993). Children in primary schools often use computers in small groups for both pragmatic and well-established educational reasons (Pritchard, 1993); indeed, group use of computers is a tradition that has grown up in stark contrast to early and popular fears about the likelihood of computers increasing learners' isolation.

Initial questions raised about the effect of computers on children's socialisation tended to be dichotomous. Do computers lead to social isolation or do they have potential social benefits? Research has shown that children prefer the social use of computers (Nastasi and Clements, 1993). Even when instructed to work alone, they talk to each other about their work and help each other. There is barely sufficient evidence for computer use leading to social isolation

(Clements and Nastasi, 1992). Instead there are numerous studies that suggest that the computer setting enhances group work because it has the potential for promoting interaction and collaboration among students (Lee, 1993).

One of the key features that characterise co-operative group learning settings and distinguishes them from other learning settings is the increased opportunity for interaction among students in small groups in the learning process (Slavin, Sharan, Kagan, Hertz-Lazarowitz, Webb & Schmuck cited in Lee, 1993). Traditionally, with the emphasis being on the individualisation of instruction and on the teacher-student relationship, the pedagogical value of peer interaction was largely ignored and viewed as discouraging academic achievement and encouraging off-task, disruptive behaviour in the classroom (Johnson & Johnson cited in Lee, 1993).

However, the potential for individualised instruction may be limited due to the difficulties associated with identifying individual differences and translating them into instructional prescriptions (Simsek & Tsai, 1992). Furthermore, individualised instruction has its own shortcomings. An important pitfall is that individualisation often implies isolation. Also working alone for long periods may cause boredom, frustration, and anxiety. As a consequence of this sterile approach, students may think that learning is impersonal. Secondly, individualised instruction does not allow students to form small groups and interact with and learn from each other because it limits students to the resources provided by the learning environment. Finally, individualistic use of emerging interactive technologies greatly increases design and utility costs. Financial implications are particularly obvious when instruction requires a computer for each learner (Hooper & Hannafin, 1991). It seems that small groups, that work co-operatively by interacting with each other, have the potential to overcome many of these limitations (Simsek & Tsai, 1992).

In primary schools, the predominant model for computer use is one of small group activity (Mercer, 1994, p.24; Watson, 1993, p.59). Mercer (1994) observed

that computer-based activities in primary schools in UK were commonly effective for motivating interaction and stimulating talk, but that this talk varied considerably between activities in terms of its quality and educational value. The analysis of these observations suggested some ways in which the quality of talk and collaboration could be improved. Working in small groups, students can interact not only with the computer but also with each other - "social computing" (Chen & Paisley, 1985). This makes it possible for students "to solve problems together that neither could solve alone" (Nastasi & Clements, 1991). In a group learning situation, considerable importance is usually attributed to the role of interaction among students for their learning. Students in this situation are usually encouraged to interact with each other during small-group learning, so that they can help each other learn and collaborate on academic tasks through group discussion and inquiry, exchange of ideas and thoughts, and mutual support and feedback (Lee, 1993, p. 551).

Fisher (1992) describes and illustrates three types of interaction of educational significance found in observations of children working with computers: disputational talk, cumulative talk and exploratory talk. She describes exploratory talk in a way that distinguishes it both from cumulative talk and from disputational talk. In disputational talk, initiations are followed by challenges without any development of the initiation, in cumulative talk initiations are accepted without challenges, while in exploratory talk the initiation may be challenged and counter-challenged but with hypotheses which are developments of that initiation. Fisher writes that exploratory talk "offers a potential for learning not obvious in the other two types".

There has been a number of studies of collaborative group learning in the experimental tradition which lend some support to Fisher's (1992) claim that exploratory talk supports learning (Wegerif, 1996). Light (1991; 1993) concludes from a range of studies of group work on computer-based problems that having to use language to make plans explicit, to make decisions and to interpret feedback, seems to facilitate problem solving and promote understanding. Other studies agree that the quality of talk between children as they work in

groups is a crucial factor in the educational outcome of collaborative work (Howe, Tolmie, Anderson & Mackenzie, 1992; Whitelock et al., 1993; Azmitia & Montgomery, 1993). A study by Kruger (1993) sheds more light on the kind of talk most effective for shared knowledge construction. He found that learning was linked to the quality of the dialogue, particularly the amount of 'transactive reasoning' described as 'criticisms, explanations, justifications, clarifications and elaboration of ideas' while children worked in groups.

As well as its empirical aspect exploratory talk has a conceptual aspect. The term is used by Fisher (1992), as it was much earlier by Barnes (1976), to refer to the ideal of that way of talking which best supports collaborative knowledge construction. Applying the label 'exploratory' to children's talk implies more than a narrowly linguistic analysis, it also implies some assessment of the purpose served by the talk in the context of knowledge construction over time. While exploratory talk can be defined at the linguistic level through some of its characteristic speech-acts, like putting forward a hypothesis, justifying a hypothesis and challenging a hypothesis, this level alone is not sufficient. Intuitions are required as the implicit rules applied by speakers and their shared orientation, particularly a shared orientation towards rationally motivated agreement (Wegerif, 1993).

Summary on Peer Interaction in a Computer-Based Learning Environment

The computer setting enhances group work because it has the potential for promoting interaction and collaboration among students. Students, working in small groups around the computer, interact not only with the computer but also with each other. Research findings show that children's social interactions increase as they work in groups around the computer. This interaction facilitates problem solving and promotes understanding. Peer interaction can help each other learn through group discussion and inquiry.

Peer Interaction in Mixed and Single-Gender Groups

The Vygotskian (1978) view posits that aspects of interaction can be influenced by emotion, and that the social skills and social relationships of the participants

influence their ability to collaborate (Barbieri & Light, 1992). Factors such as the degree of friendship existing between the interactive partners become relevant (Nelson & Aboud, 1985). From this point of view, gender and gender mixes can obviously become an issue because males use language differently and differ in interactive styles (Baroni, 1983). For example girls using co-operative computer-assisted instruction make fewer goal-related statements, dominate other group members less frequently, and are more persistent than boys (Signer, 1992).

According to Lee (1993, p. 551) while females and males in same-gender groups around a computer are equally involved in the verbal activity, especially in task-related interactions, males tend to dominate the verbal activity in mixed-gender groups. Siann, Durndell, Macleod & Glissov (1988) and Volman and Eck (2001) reported that most of the times boy-girl pairs did not seem to collaborate because in these pairs boys were often socially dominant, causing females to be at a disadvantage in learning. Nicholson, Gelpi, Young, & Sulzby, (1998) noted that access to computers may be jeopardised for girls in their classrooms by boys. For example, boys have been observed to take over the computer, refusing to let girls have access (Kiesler, Sproull & Eccles, 1985). Similar results were reported by King and Alloway (1992) who observed that girls often found it difficult to secure a turn at the computer when they had to work with boys. Girls reported being easily discouraged when working with boys (Nicholson, Gelpi, Young & Sulzby, 1998, p. 5).

Underwood, McCaffrey and Underwood (1990), found that children of the same gender while working in pairs collaborated more in their work compared to children working in mixed-gender pairs. Underwood, Jindal and Underwood (1994) demonstrated the influence of group composition, and in particular the effects of mixed gender pairing on levels of co-operative interactions, finding that mixed pairs tended not to co-operate. Nicholson, Gelpi, Young & Sulzby, (1998) noted that in many cases females responded to the males' competitive remarks and actions with competitive behaviours, the males were less likely to respond to the females' collaborative and inclusive verbalisations and actions

with collaborative and inclusive behaviours. Thus, while the females often adapted to the male preferred style of interaction, the reverse was not observed.

Dalton (cited in Barbieri and Light, 1992 p. 20) reported that same-gender pairs around a computer performed significantly more efficiently in their work than mixed-gender pairs. Female students working in mixed-gender groups were more likely to have their competence and/or their work critiqued, laughed at, or publicly criticised, than when working alone or in all-female composing groups (Nicholson, Gelpi, Young, & Sulzby, 1998). Carrier and Sales (1987) noted that during co-operative computer-assisted instruction female pairs engaged in the most on-task verbalisations, male pairs engaged in the least verbalisations, and mixed-gender pairs engaged in the most off-task verbalisations. Females across both same-sex and mixed-gender groupings used language that projected a sense of inclusion of their peers' voices and contributions while the males were less likely to use an inclusive lexicon (Nicholson, Gelpi, Young & Sulzby, 1998).

Summary on Peer Interaction in Mixed and Single-Gender Groups

From the above studies it can be concluded, like Lee (1993), that in mixed-gender groups female and male students can have considerably different experiences in regard to specific categories of interaction. Lee's (1993) study investigated the patterns of peer interaction among students working co-operatively in small groups on a computer-based problem-solving task, named 'Where in the World Is Carmen Sandiego?' He examined the effects of student gender and group composition on peer interaction. Sixty-four students were assigned to four-person groups: same-gender, majority-female, equal-ratio, and majority-male groups. The instrument utilised in his study was a coding system (see Appendix 1).

According to Barbieri and Light (1992) different gender parings did produce different patterns of interaction for example, marked dominance patterns in the mixed-gender pairs. Their paper reports a study in which sixty-six eleven and twelve year old children worked in boy-boy, girl-boy or girl-girl pairs on a

problem-solving task implemented in HyperCard on a Macintosh computer. Interaction in the pairs was analysed from videotape in terms of verbally explicit planning and negotiation. Analysis focussed on the issue of gender.

Signer (1992) investigated a model of computer-based co-operative learning that resulted in findings that were confirmed by other computer-based co-operative studies: female teams engaged in the most on-task verbalisations; and females were more apprehensive about their answers than were males. The instructional model developed for this study is the Co-operative Learning Inter-group Competition Model. The student data source consisted of year four and year five students from two primary schools. The number of student teams by gender included in the study were eighteen female-gender pairs, thirteen male-gender pairs and eight mixed-gender pairs.

Nicholson, Gelpi, Young & Sulzby (1998) reported that gender differences quite often occur when investigating gender and computer use in primary and high schools. This study examined the relationship between gender and open-ended software usage in young children's use of computers. Ethnographic methods were used to observe 36 primary students composing stories on computers using Kid Pix (Hickman, 1994) over a period of 6 months. Differences in male and female social and physical interactive behaviours, discourse patterns, and story content were analysed. Results indicated that males dominated mixed-gender groups.

Volman's and Eck's (2001) article presented a review on gender differences and computers in primary and secondary education. The review provided insight into the background of gender differences in participation in computer activities and performance in relation to computers. The research reviewed focused on the role of teachers and fellow classmates, on the different approaches of girls and boys to computers, and on the preferences of girls regarding the structure and design of software. The research also analysed the complex meaning of computer attitudes as both a cause and a consequence of differences in the participation and performance of girls and boys.

It appeared that males were favoured more than females around a computer because teachers in the upper classes of primary schools enjoyed teaching boys more than girls (Volman & Eck 2001). Boys were seen by teachers to be more interested in computers than girls (Culley cited in Volman & Eck 2001). Rosengren cited in (Volman & Eck 2001) observed that boys were asked more questions than girls in computer lessons in primary schools and were given more feedback. Class interactions almost always favoured the male students (Hannor, 1998). The way in which teachers interacted with students could easily give students the impression that boys were inherently better at working with computers than girls were (Sanders & Stone cited in Volman & Eck 2001), and teachers may still be transmitting, even unconsciously, the message that girls don't need to participate in computer technology (Hanson 1997; Reinen and Plomp 1993; Koch 1994). This could be the reason why boys captured a majority of the computer time and girls were non-assertive in their demands for equitable computer time (Hannor, 1998). Inkpen, Booth, and Klawe (cited in Volman & Eck 2001) recorded that girls working in mixed-gender pairs got less chance to work on the computer and males showed significantly higher computer self-efficacy than females while interacting around the computer (Cassidy & Eachus, 2002). The implications for this study are the relevance to gender differences and gender influences in peer interaction where boys dominate the computer in mixed-gender groups (Butler 2002).

Motivational Learning in Small Groups

According to Nastasi and Clements (1991) group work in co-operative learning environments can enhance motivation for learning and children's self-concepts as learners. The construct effectance or competence motivation (Harter cited in Nastasi & Clements, 1993) is used to explain the influence of collaborative interactions on intrinsic motivation and perceived competence. Effectance Motivation, within a learning context, is the extent to which children want to direct their own learning (Nastasi & Clements, 1993), and is indicated by such behaviours as independent work, self-directed problem posing, persistence, and expressing pleasure at learning.

Harter is quoted by Nastasi & Clements (1993, p. 21) as claiming that when children successfully solve problems, they develop a sense of competence and an internal reward system that serve as a mediator of subsequent competence motivation and mastery-oriented behaviour. Children's perceived competence may be reflected in self-evaluative statements. Furthermore, their sense of efficacy may influence their attempts at task mastery, the amount of effort they expend, and their persistence in the face of difficulty of failure (Bandura cited in Nastasi & Clements, 1993, p. 21). Such beliefs have also been shown to influence academic performance by promoting children's active involvement in learning activities (Pokay & Blumenfeld, 1990; Skinner, Wellborn & Connell, 1990).

Social-process and task-related contextual factors may foster motivation and self-efficacy. Research has shown that co-operative, compared to individualistic, learning environments enhances motivation and goal orientation (Nastasi & Clements, 1993, p. 22). In addition, social factors, such as feedback, social comparison and modelling alter motivation toward, and sense of, competence (Schunk & Hanson cited in Nastasi & Clements, 1993). Thus, an environment that is likely to strengthen motivation and perceived competence is one that fosters collaboration, social feedback about the quality of performance, comparison of one's own abilities with those of peers, and/or modelling of motivational orientation and sense of competence. Co-operative learning contexts provide such opportunities through the continual presence of partners or team mates.

Furthermore, co-operative problem-solving environments that encourage cognitive conflict and its resolution may provide optimal contexts for enhancing motivation and perceived competence (Nastasi & Clements, 1991). Research has shown that structured controversy, compared to concurrence-seeking, during collaboration is more likely to increase motivation, task-involvement, and self-efficacy (Johnson, Brooker, Stutzman, Hultman & Johnson cited in Nastasi & Clements, 1993).

Task-related factors such as proximal goal-setting and performance-contingent reward may also modify perceived competence and motivation, which is a behaviourist view (Schunk cited in Nastasi & Clements, 1993). Co-operative learning activities can be structured to incorporate facilitative task-related factors such as goal-setting, rewards, and external feedback. In addition, the extent to which co-operative learning activities are self (pair)-directed, and thus rely on intrinsic motivation, may be consequential. Such self-directed activity, particularly within a single domain, may foster a sense of control and mastery (Nastasi, Clements & Battista, 1990). Collaboration within such contexts may further enhance effectance motivation and perceived competence through peer modelling (Schunk & Hanson cited in Nastasi & Clements, 1993).

Summary on Motivational Learning in Small Groups

Students working in small groups are motivated by their partners or team mates by receiving feedback about their performance, or model and compare their own abilities with those of their peers. Research has shown that structured controversy during group work is more likely to increase motivation, task-involvement, and self-efficacy.

Collaborative Learning in Small Groups

Collaborative small group learning refers to instructional methods of structuring classroom environments that facilitate positive interdependence and collaborative efforts among a small number of students (Lee, 1993). The students work together in small groups: their efforts are directed toward mutual, yet academically and socially beneficial, goals (Johnson & Johnson, 1987a; Slavin, Sharan, Kagan, Hertz-Lazarowitz, Webb & Schmuck,1985; Johnson, Johnson, Holubec & Roy, 1984). In general, extensive research on collaborative small group learning has shown positive effects on a wide range of students' cognitive and social-affective outcomes (Johnson & Johnson, 1987b; Slavin, 1987; Yelland, 1999; Haugland & Wright, 1997). Research has consistently shown that collaborative problem solving within learning environments can enhance motivation for learning and children's self-

concepts as learners (Nastasi & Clements, 1991).

Although collaborative learning in small groups is used to describe a variety of seemingly diverse activities, and has perhaps different meanings and purposes in different contexts and cultures, there is a common belief that it is a highly beneficial form of learning (Hodgson & McConnell, 1995). Collaborative group work in the learning process is often an appropriate and powerful means of elevating the quality of children's work (Tomlinson & Henderson, 1995; Blaye, Light, Joiner & Sheldon, 1991; Resnick, 1992; Goldman, 1992; Roschelle 1992).

According to McConnell (1994) the practice of small group work, and research into the processes and outcomes of collaborative learning, suggest that children working in small groups:

- help clarify ideas and concepts through discussion;
- develop critical thinking;
- provide opportunities for learners to share information and ideas;
- develop communication skills;
- provide the opportunity for learners to take control of their own learning, in a social context; and
- provide validation of individuals ideas and ways of thinking through conversation (verbalising), multiple perspectives (cognitive restructuring), and argument (conceptual conflict resolution).

Summary on Collaborative Learning in Small Groups

Collaborative group work is often an appropriate and powerful means of elevating the quality of children's work. Group members provide support and encouragement in learning basic computer skills and completing assignments. A collaborative learning environment is where children not only learn from computers, but also learn from each other while using computers. Students in collaborative learning groups appear to quickly develop independence from the teacher and have less distress in working through their problems.

Emergence of New Technologies

With the emergence of new technologies in recent years, the computer is increasingly becoming an integral part of personal communication systems. According to Gay & Grosz-Ngate (1994) there is a growing interest in using computers in education to enhance instruction and learning through collaborative group work. Some extrapolating from child development literature, in combination with the practical wisdom of the teaching profession, have suggested that peer-relationships contribute to children's long-term development (Haugland, 2000a; Haughland, 2000b; Berk, 2000a; Berk, 2000b). Furthermore, in recent studies of peer collaboration, different configurations of task, social partners and individual characteristics have been evaluated by examining different indices of conceptual change before and after social interaction, to discriminate which social context facilitates or impedes cognitive changes (Forman & Larreamendy-Joerns, 1995). Mevarech and Light (1992, p. 275) postulate that theoretically, the accumulating research on peer-based interaction at the computer, may clarify basic questions regarding the processes of cognitive change and social development. According to Boyd-Barrett and Scanlon (1991) peer-based interaction at the computer is when a more expert child may serve as a model for one who is less so around a computer.

Understanding the nature of young children's collaborative interaction while working with computers, that is students sharing equally in the interaction around computers (Boyd-Barrett & Scanlon, 1991), has been proposed to offer several potential educational benefits (Lomangino, Nicholson & Sulzby, 1999; Nicholson, Gelpi, Young & Sulzby, 1998; Haugland & Wright, 1997; Wright, 1998; Clements, 1998; Haugland, 2000). Collaborative use of computers may also provide potential benefits for both curricular and logistical reasons in primary classrooms. As most schools do not have the resources to provide a computer for each student, most children need to work in pairs or small groups (Sulzby & Young, 1990). According to Tomlinson and Henderson (1995) collaboration may in fact have been borne of necessity from the limited availability of computers in most schools. Levels of hardware and software

resources in primary schools in both Australia and the United Kingdom is likely to result in small groups in favour of other models of use (Sherwood, 1993; Watson, 1993; DES, 1991), and the culture of primary school education values children's small-group, collaborative activity.

Students working at computers improved their social orientation toward their team mates because social skills such as sharing were encouraged when pupils worked in pairs, or groups at the computer (Lai and Mace, 1989). Crook (cited in Boyd-Barrett and Scanlon, 1991. p. 162) asserts that "there is evidence for involvement and co-operation when young children work together at computer-based tasks". Collaborative learning groups refers to instructional methods of structuring classroom environments that facilitate positive interdependence and collaborative efforts among students (Lee, 1993, p. 550). The students work together in small groups: their efforts are directed toward mutual, yet academically and socially beneficial, goals. According to Keeler and Anson (1995) group members can provide support and encouragement in learning basic computer skills and completing assignments. Keeler & Anson (1995), working with primary school children, also noted that students in collaborative learning groups appear to quickly develop independence from the teacher and have less distress in working through their problems. Thus the teacher is able to provide more time to students in greater need.

In a study conducted on the social impact of the use of the computer, Hawkins, Sheingold, Gearhart and Berger (cited in Lee, 1993, p. 550) showed that students tended to interact a great deal and did so in a collaborative way when they were working with the computer than when they were doing other classroom activities. Other studies have also suggested that the computer setting is best suited for group work because it has the potential for promoting interaction and collaboration among students (Cosden & Lieber, 1986; Hannafin, Dalton & Hooper, 1987; McLoughlin and Oliver, 1998). However, this potential can be either enhanced or remain untapped depending on how teachers structure computer-based learning activities in school classrooms (Sheingold, Hawkins and Char, cited in Lee, 1993). In this regard, attention has been given to the use

of collaborative small group learning in the implementation of computers in most of the classrooms (Lee, 1993).

King and Alloway (1992) found that young children showed desired social behaviours when working on computers. These desired behaviours were collaborating with their partners during their computer tasks, reaching successful resolution of conflict during teamwork, and not imposing one's solution but mutually negotiating by trying each other's ideas. Computer technology can influence such behaviours because of the collaborative problem-solving environment it creates. It poses different solutions to a problem, and facilitates discussion on the relative benefits of the various solutions, making students then come to consensus regarding a single solution. Increasingly, a collaborative learning environment is emphasised where children not only learn from computers, but also learn from each other while using computers (King & Alloway, 1992). In arguing that computers can function as a medium for joint activity, Crook (1992) described how computers, depending on the software, helped children to get engaged in collaborative problem-solving activities.

According to Newhouse (1999) with regard to collaborative computer-based instruction, the emphasis is on instruction to groups working around a computer. The computer takes on the instructional role of the teacher. Effectiveness of collaborative computer-based instruction has been investigated and results have indicated that grouping does not reduce, but frequently improves, achievement and attitudes when learning from the computer (Rada, Acquah, Baker & Ramsey, 1993). Tomlinson & Henderson (1995) described collaborative small groups as communication between a team of learners, that is each employ their communicative skills towards the successful co-ordination of a joint activity. Simsek and Tsai (1992) concluded that collaborative small groups worked successfully and performed better than those working alone around computers.

Keeler and Anson (1995) claimed that co-operative learning treatment overall appeared to improve learning performance and reduce attrition among students in the computer literacy course. They also observed that students in co-operative learning teams appeared to quickly develop independence from the instructor and have less distress in working through their problems without the instructor's assistance. Webb (cited in Rada, Acquah, Baker & Ramsey, 1993) asserts that learning in small groups is often more effective than learning alone, in both traditional, and computer environments.

Noell and Carnine (cited in Simsek & Tsai, 1992) indicated that learning in collaborative groups may be more efficient with regard to completing tasks than individualistic use in technology. Atkins and Blissett (1989) reported that students in small groups spent much of their time for interacting with each other. Similar results have been reported for computer-based collaborative group learning (Simsek & Tsai, 1992), and research studies report favourable effects of computer-based collaborative group learning on achievement and behaviour (Signer, 1992). Moreover, research reviews show that the benefits of learning in small groups are not limited to achievement effects. There is strong research evidence demonstrating the affective benefits of working in groups (Rysavy & Sales, 1991; Slavin, 1991). A review of the literature on collaborative learning at the computer (Light & Blaye, 1990) points out that pairs or small groups often show better learning outcomes than individuals, and that even when this is not the case, the results obtained by pairs are never inferior.

Human interaction is a primary need and motivation is maintained if this need is satisfied (Rowntree, 1985). However, learning skills must encourage independence of thoughts and the learning process should be non-threatening, and hence reinforce success and increase motivation. This is extremely important for students who experience difficulty with the subject (Lloyd, Taylor & West, 1983). Students also need to develop the study skills necessary to contribute effectively to group work (McEwen, Brannigan, Farmer, 1984). However, to maximise the benefits of group work, staff and students alike need

to believe in the effectiveness of the method used and to have a clear understanding of how the method will be operated (Payne, 1989).

Children in primary schools often use computers in small groups for both pragmatic and well-established educational reasons (Pritchard, 1993); indeed, group use of computers is a tradition that has grown up in contrast to early and popular fears about the likelihood of computers increasing learners' isolation (Wild, & Braid, 1996). There is a general understanding about the value of group work with computers, largely based in social-cognitive theory and focussed on the social construction of knowledge (Bearison, 1982; Vygotsky, 1962; Vygotsky, 1978).

Summary

According to Brewster and Fager (2000) learning involves communicating, questioning and interacting with peers. MacIver and Reuman (1994) add that middle school and high school-age students' level of engagement in school is highly influenced by peer interaction. Their motivation to engage in learning may be influenced by their social group just as much as, if not more than it is by teachers, parents, and other adults. Students who are engaged in their work are usually motivated by success and satisfying relationships with their peers in the classroom (Strong, Silver & Robinson, 1995). When students have a history of failure in school, it is particularly difficult for them to sustain the motivation to keep trying (Anderman and Midgley, 1998).

High motivation and engagement in learning have consistently been linked to reduced dropout rates and increased levels of student success (Blank, 1997; Dev, 1979; Kushman, 2000; Woods, 1995). The interaction patterns (Table 4.4) of giving and receiving task-related help, and solving problems together can help to contribute to success and overcome failure in the computer classroom, which in turn significantly improves students' motivation (Brown et al., 1993; Cohen, 1994). Here learning is linked to peer interaction by the quality of the dialogue, particularly the amount of 'transactive reasoning' described as 'criticisms, explanations, justifications, clarifications and elaboration of ideas'

(Kruger, 1993). The benefits of collaborative computer activity have both theoretical and empirical support from the developmental theories of Piaget and Vygotsky which stress the importance of interaction with others for learning (Lomagnino, NickNicholson & Sulzby, 1999).

The interaction patterns (Table 4.4) of giving and receiving task-related help, and solving problems together also enhance students' relationship with each other, which according to Anderman and Midgley (1998) is a vital part in the motivational theory. This theory describes students as having three categories of needs: needing a sense of competence, of relatedness to others, and of autonomy. Relatedness involves developing satisfactory connections to others in one's social group, when students begin to clarify ideas and concepts through discussion, and develop critical thinking and communication skills. Students want and need work that fosters collaborative and positive peer interactions (Strong, Silver & Robinson, 1995). This drive toward interpersonal involvement is pervasive in all our lives. Further, most of us work hardest on those relationships that are reciprocal - what you have to offer is of value to me, and what I have to offer is of some value to you. In general, unbalanced, non-reciprocal relationships prove transient and fail to generate motivation in the classroom among students (Strong, Silver & Robinson, 1995).

Student motivation naturally has to do with students' desire to participate in the learning process. According to Lumsden (1994) learning is motivated by a child's interest and need to know. It also concerns the reasons or goals that underlie their involvement or non-involvement in academic activities. Although students may be equally motivated to perform a task, the sources of their motivation may differ (see Motivational Behaviours Categories Table 4.6).

The motivational behaviour categories (Table 4.6) of pleasure, persistence and positive self-statements of students working on their computer task show increased levels of student success which according to Blank (1997), Dev (1997) and Kushman (2000) are consistently linked to high motivation and engagement in learning. When students show signs of pleasure at solving a

problem or discovering new information, then it implies an affective reaction to the product of one's work efforts (Nastasi & Clements, 1993). The motivational category of persistence (Table 4.6) refers to students who work continuously to reach their own goals (Brewster & Fager, 2000). These students are more likely to persist with and complete assigned tasks (Dev, 1997). They have a willingness, need, desire and compulsion to participate in, and be successful in, the learning process (Bomia et al., 1997). Slinner and Belmont (1991, p. 3) noted that students who are motivated to engage in school initiate action when given the opportunity, and exert intense effort and concentration in the implementation of learning tasks; they show generally positive emotions during ongoing action, including enthusiasm, optimism, curiosity, and interest like the motivational categories in Table 4.6.

Students' attitudes about their capabilities and their interpretation of success and failure further affect their motivational behaviours and willingness to engage themselves in learning (Anderman & Midgley, 1998). The motivational behaviour categories of negative self-statements, always needing encouragement and failure/difficulty in the classroom (Table 4.6) show that some students were not sufficiently motivated to succeed in school, which appears to carry more negative implications, especially for their self-concept of ability (Lumsden, 1994). Students who feel less confident about their ability to learn new material are said to lack motivation (Dev, 1997). A healthy self-esteem is the foundation for success, which in turn fosters motivation and engagement in school (Brewster & Fager, 2000). Students who are always experiencing failure and difficulty (Table 4.6) are less likely to be motivated to learn (Brewster & Fager, 2000). Students need to feel successful and that they've earned success. Clearly, students who are not motivated to engage in learning are unlikely to succeed (Brewster & Fager, 2000). Less motivated or disengaged students"are passive, do not try hard, and give up easily in the face of challenges" (Slinner and Belmont, 1991, p. 4). They seem to make negative self-statements (Table 4.6) like comments about task performance and

evaluative comments about cognitive competence efforts (Nastasi & Clements, 1993).

Literature on Data Gathering Methods

According to Guba (1981, p. 76), in selecting a methodology one should choose an approach appropriate to the 'phenomenon being investigated'. This notion is supported by Merriam and Simpson (1989, p. 9) who states that "the selection of a methodology depends upon the source of knowledge being accessed and the assumptions underlying the nature of research".

Although Merriam and Simpson (1989) divide educational research into three main styles positivist, interpretivist and critical, there is an assumption that a researcher will choose one or the other (Guba, 1987; Smith 1983a, 1983b; Smith & Heshusius, 1986). This current study can be termed positivistic and the researcher agrees with the 'compatibility thesis' (Howe, 1988), that supports the view that combining quantitative and qualitative methods is a good thing and denies that such a joining of methods is epistemologically incoherent. On the contrary, the compatibility thesis holds that there are important senses in which quantitative and qualitative methods are inseparable (Howe, 1988).

Trochim (1997) has pointed out foundational similarities between qualitative and quantitative methodologies: it is possible that qualitative data can be measured and coded using quantitative methods; and secondly quantitative research can be generated from qualitative enquiries. Patton (1990) discusses that qualitative and quantitative research can be conducted within the same study, thus possibly overcoming weaknesses inherent in each. Using both research approaches, negates the debate polarising the two (Guba, 1981) and is a considered option by such researchers as LeCompte and Preissle (1993), and Patton (1990) who all believe that research method should be appropriate to the cohort group, type of information desired and question asked.

There is a theory that the two approaches (qualitative and quantitative) should be considered complementary rather than competitive (Pope & Mays, 1995).

Salomon, Perkins & Globerson (1991) believe that research should be categorised into analytic or systemic and that the qualitative/quantitative debate is not constructive.

Descriptive Method

This study uses qualitative and quantitative methods within a descriptive research framework. Descriptive research has been shown to be appropriate when facts about people, attitudes and opinions are sought (Kerlinger, 1986). The descriptive method is one of the most commonly used with learners, as this method is able to accurately describe facts and characteristics of a given population (Merriam, 1988, p. 58). Descriptive methodology concerns itself with describing what has happened rather than predicting what will happen, and is appropriate when the central focus of the research is to examine facts about people, their opinions and attitudes (Kerlinger, 1986). Descriptive research often helps to identify the degree to which two events or phenomena are related and is the most common form of research in education (Merriam, 1988). Its strengths are that it is easy to use, and if well conducted, produces data that are accurate and representative. It allows the researcher to study relationships or events as they happen in human life situations, and allows for exploration and identification of new variables.

Quantitative Method

Quantitative methods tend to lead us to regard the world as made up of observable and measurable facts (Glesne & Peshkin, 1992, p. 7). There are many versions of quantitative research, however most share some common features. These include: the belief that theory is universal and that law-like generalisations are not bound to specific contexts or circumstances; the commitment to an objective or dispassionate pursuit of 'scientific truth'; a belief in determinism, or the assumption that events have causes which are distinct and analytically separable from them; the view that variables can be identified and defined and that knowledge can be formalised; and a conviction that relationships between and among variables can be expressed in

mathematically precise ways in the development and testing of theoretical propositions.

From a set of assumptions such as these flows the implementation of the 'scientific method', elements of which include specification of hypotheses at the start of research, the attempt to remain objective and detached from the area of study, the search for invariant causal relationships, and the attempt to reduce findings to quantified forms. Lying behind many of these practices is the notion that theory, conceived as a body of scientific knowledge, can be used to predict and hence to control outcomes (Candy, 1989).

Some quantitative methods were used for this study because the researcher wanted to measure, with the help of the Peer Interaction Categories (Table 4.4) peer interaction among students that occurred when they worked together in groups within a computer-based learning environment. An analysis of peer interaction was sought in an objective, quantifiable form. The means and standard deviations of motivational and collaborative behaviours for different groups was presented, and ANOVA techniques were conducted to indicate a significant or non significant group effect on motivation and collaboration.

Qualitative Method

Interviews were used in this study because the researcher wished to understand the thoughts and feelings of the participants in the study in order to determine how they worked in groups and in what ways the chosen learner effects of immersion, scaffolding and coaching, motivation, reflection, learner control and challenge affected learning, and to identify some of the factors that contributed to group work and these learner effects.

Qualitative research is a term meaning different things to different researchers and represents a variety of methods, rather than a single approach. Qualitative research methods are designed to help researchers understand the people being studied, what they think and feel, and the social and cultural contexts in which they live (Myers, 1997). Qualitative methods are generally supported by a view

which portrays a world in which reality is considered to be socially constructed, complex, and ever changing (Glesne & Peshkin, 1992, p. 7). A researcher using qualitative research methods employs an "insider's perspective" and the style is consequently subjective. The qualitative researcher studies things in their natural settings and attempts to understand the participant's view of the world.

According to Patton (1990), description and interview are the essential ingredients of qualitative enquiry. Sufficient description and direct quotations should be included in data presentation to allow the reader to enter into the situation and thoughts of the people represented in the report. Yet the description must not be so thin as to remove context or meaning. Qualitative analysis is about or requires "thick description" (Patton, 1990). Thick description is described by Denzin (quoted in Patton, 1990, p. 430) as going beyond a mere description, but presents detail and context. The description allows the reader to interpret what has been said or seen, and allows them to decide about the extent of generalisation.

Interviews

In this study interviews of children were conducted. Many qualitative researchers define an interview as a conversation with a purpose. Patton (1990) explains that people are interviewed to find out from them those things that cannot directly be observed. For example how people have organised the world and the meanings they have attached to what goes on in the world cannot be observed. People have to be questioned about those things. The purpose of interviewing is then to enter into the other person's perspective.

A standardised, open-ended interview was used in this research, to ensure that each participant was asked the same questions. The distinction between open-ended and closed-ended questions concerns the degree of freedom accorded the participant in choosing the answer (Baumgarten, 1986). Open-ended questions allow the participants to generate responses in their own words, whereas closed-ended questions restricts them to choosing among alternatives specified by the survey designer (Patton, 1990; Merriam & Simpson, 1989). Flexibility was

built-in with probe questions where necessary. This form of interview also makes data-analysis easier as each participant's answer to a particular question is easy to locate, and similar answers are easy to group together (Patton, 1990).

Observations

Other methodologies such as fieldwork, case-study and participant observation are also commonly associated with the interpretive paradigm (Jennings, 1986). Observation is a useful adjunct to interviews as the observations allow the researcher to put responses into context. It is also a flexible method, allowing the researcher to be "...open, discovery oriented and inductive in approach." (Patton, 1990). Observation also facilitates documentation of events such as on-task, off-task and collaboration, and events which may be unconscious to the participants. Observation also allows the researcher to track movements and see difficulties which participants may be unwilling to articulate in an interview.

Structured observation is used to gather data about the performance and interaction of people. Observation of people's actions often contributes to understanding the context. Observers get to view action in the context first-hand. They do not have to rely on someone else's report of the events. Observation makes it possible to record events as they happen. Merriam (1988 p. 89) suggests that observation is the best technique to use when an activity, event, or situation can be observed first-hand, when a fresh perspective is desired, or when participants are not able or willing to discuss the topic under study. However, observation does have some limitations, namely the amount of activity that can be observed at any one time, and the fact that the events occurring may be unpredictable and difficult to forecast (Merriam, 1988), and also that what you see depends on what you believe.

As with other data gathering methods, according to Selltiz (1959, p.205), observations need to be carefully planned and prepared to fit the particular research problem and the following questions should be asked prior to embarking on the observation:

- What should be observed?;
- How should the observation be recorded?;
- What procedures should be used to ensure accuracy of observations?; and
- What relationship should exist between the observer and observed and how should that relationship be established?

A skilled observer according to Patton (1990, p. 123) is one who knows also how to write descriptively, practices the disciplined recording of field notes, knows how to separate detail from trivia and uses rigorous methods to validate observations. There are a number of observation methods and, as with other research techniques, the chosen method should be appropriate to the data being gathered (Patton, 1990).

After careful consideration the unobtrusive method of observation was adopted for this research. Unobtrusive observation is a form of observation, where the participants are not totally aware that they are being observed. This was achieved by the researcher situating him self behind the students in order to take down field notes which would help in coding the different interaction categories, and any required assistance was given by the classroom teacher. The advantage is that it is more likely to capture what is really happening than when participants are aware they are being observed. For more detail on observations of students can be obtained in the next chapter.

Conclusion on the Literature Review

The literature presented has provided information on peer interaction, gender, attitudes towards computers, motivation, collaboration, and learner effects as primary school children work with technology-based lessons. Both qualitative and quantitative research was conducted within the same study, thus potentially overcoming the weaknesses inherent in each (Patton, 1990). The descriptive method was used in this study because it was appropriate when the central focus of the study was to examine facts about people, their opinions and attitudes.

Triangulation was addressed as it gives multiple perspectives on a given problem; it can provide a richer, contextual basis for interpretation and it can

also provide cross validation of the data. Triangulation was used to validate the data analysis for reliable descriptive recording. Data triangulation (Denzin & Lincoln, 1984; Creswell, 1994, p. 167) in the form of multiple sources of evidence from primary school children was collected for example video and audio taping the participants. In addition, there was triangulation in the methodology (Denzin & Lincoln, 1984) used for analysis and categorisation of classroom interaction, which included both qualitative and a quantitative component. The report included the qualitative analysis of data collected through the interviews and observations, as well as the quantitative analysis (Gay, 1990; Patton, 1990; Van Manen, 1990; Miles & Huberman, 1984) of the different interaction categories (Table 4.4, 4.5 and 4.6).

Chapter Three

THEORETICAL FRAMEWORK

Introduction

The introduction of computers into schools has created new educational problems and new questions for cognitive psychology (Barbieri & Light, 1992). The fact that the educational use of computers in schools has been, of necessity, a group-based experience for most children (Jackson, Fletcher & Messer, 1986) has helped teachers to see the value of computers in terms of their capacity to support collaborative modes of learning. At the same time psychologists have studied the cognitive potential of peer interaction (Azmitia & Perlmutter, 1989). A review of the literature on collaborative learning around a computer (Light & Blaye, 1990) points out that pairs or small groups often show better learning outcomes than individuals, and that even when this is not the case, the results obtained by pairs are usually not inferior.

Socio-cultural Perspective

This study is strongly influenced by the socio-cultural theoretical perspective on teaching and learning in schools. For the study of learning in the classroom, a socio-cultural perspective encourages the recognition of the social and historical context as a powerful shaping influence on children's interpretation and understanding of classroom experience. It focuses attention on the use of language as the medium through which children and teachers are able to develop shared contextualised understandings of that experience (Edwards & Mercer, 1987; Maybin, Mercer & Stierer, 1992; Scrimshaw, 1993).

It also suggests that the educational process that goes on in schools is not so much 'learning' as 'teaching-and-learning'. That is, a communicative process whereby knowledge is constructed, shared, debated, interpreted and misinterpreted as children talk with teachers and each other. Talk is thus seen to have a much more prominent role in learning (Durkin, 1986; MacLure,

Phillips & Wilkinson, 1988; Norman, 1992). One particularly interesting line of research has focused on the significance of reasoned argument (Berril, 1988; Billig, Conder, Edwards, Middleton, & Radley, 1988), focussing on the part played by talk in the process of defining and resolving conflicts and in talk as a social mode of thought, and not merely as the representation or reflection of individual thinking.

Probably the most important consequence of taking a socio-cultural perspective on any computer-based classroom activity is a recognition of the possibility that the activity is defined by wider and more subtle parameters than those set by the software. It highlights the significance of the communicative process whereby computer-based activities are set up and carried out by children and their teachers as joint social action. This kind of contextualised definition of a computer-based activity is broader than that found in most research on computer-assisted learning (CAL) or educationally-applied information technology and it has important implications for research methodology. If it is accepted that any observed learning activity is contextually situated, then the criteria employed – explicitly or implicitly – by researchers (or teachers) in evaluating any such learning need to be sensitive to contextual factors (Crook, 1991). Decontextualised evaluations of any communicative activity are antithetical to the spirit of socio-cultural research.

Vygotsky (1978, p. 89) believed that "human learning presupposes a specific social nature and a process by which children grow into the intellectual life of those around them". Socio-cultural theory emphasises that language plays a vital role in enabling the learner to participate, interact with others and solve problems, and is therefore essential to learning. Language is not just a means of communication it is a cultural tool for making sense of the world. These constructs as they relate to this study are illustrated diagramatically in Figure 3.1.

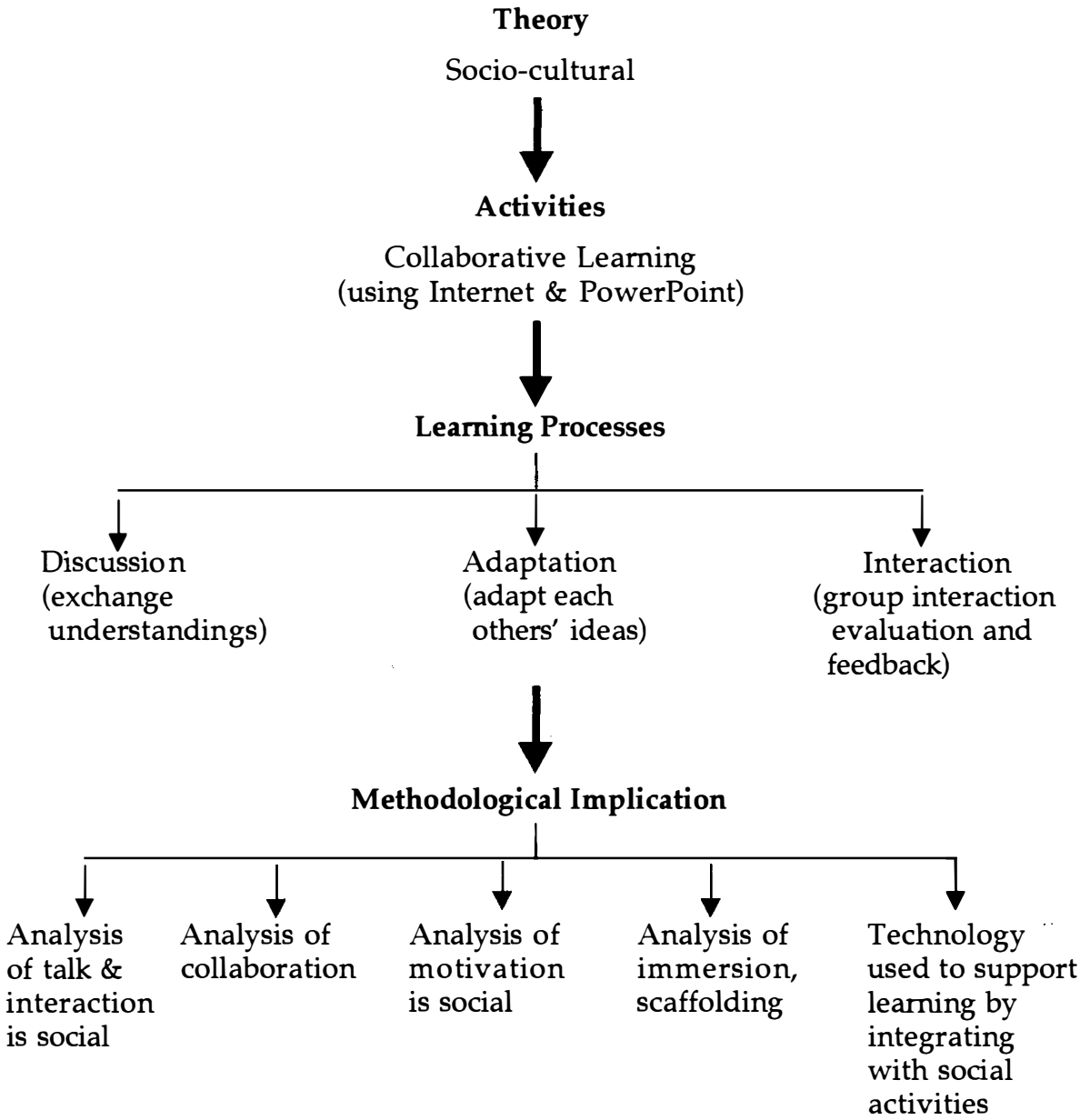

Figure 3.1. Theoretical Framework for Investigating Computer-Based Lessons in Primary Schools

Summary

In summary, socio-cultural theory provides an integrating theoretical perspective for the proposed study as it provides a coherent framework in which cognition is socially grounded; technological and cultural tools mediate and support thinking; learning and teaching are interrelated experiences; learning takes place initially as a form of assisted performance, with the learner assuming full control when competence is attained; and learning and thinking are located within social settings.

Chapter Four

METHODS OF INVESTIGATION

Introduction

The effect of technology-based lessons on primary school students working in mixed and single-gender groupings was the main concern of this study. In order to understand these effects, a review of the relevant methodological literature was undertaken, and now a detailed plan of how the research was conducted is presented. This chapter outlines the specific methodology used to determine particular elements of group work in a computer-based environment. The sample is described, as is the setting of the proposed study followed by a description of students' computer-based activities that were completed in class.

The methodology for data collection and analysis procedures adopted to ensure validity and reliability of the findings is described. The data collection section describes step by step precisely what was done to collect the data, and the data analysis section describes what was done with the data. Finally issues of credibility, reliability, validity and ethical considerations arising from the study are discussed.

Sample and Setting

The sample was chosen from a K-7 school located ten kilometres from the city centre in the metropolitan area of Perth, Western Australia. The students were predominantly from middle class families. Twenty-nine students, sixteen boys and thirteen girls from year 5/6 with an age range of ten and eleven were chosen for the study. The Year 5/6 class was selected for the study because, as a convenience sample, both the class teacher and the students were willing to participate in the study, and the equipment in the class was appropriate for the

study. The classroom had fifteen computers and the students worked in groups of twos and threes. Parental consent was obtained in writing for the twenty-nine students to participate in the study.

The classroom teacher randomly assigned students to three different groups: Male-Gender Groups, Female-Gender Groups and Mixed-Gender Groups. Table 4.1 below shows the different groups.

Table 4.1
Group Composition

Gender of Group	Type of Group
Male Gender Groups	3 pairs of boys 1 group of three boys
Female Gender Groups	2 pairs of girls 1 group of three girls
Mixed Gender Groups	2 pairs of boy and girl 2 groups of three (2 boys and 1 girl) 1 group of three (2 girls and 1 boy)

The activities for the technology-based lessons were based upon the theme of endangered animals because it fitted part of the science curriculum. The task was open-ended and the children were allowed to work at their own pace.

Procedure

The teacher introduced the researcher to the children and they were told in general terms that the researcher was there to learn about how they learn. The class teacher took responsibility for the teaching and management of the class, in order to allow the researcher to collect data and carry out observations. Audio tape recorders were placed on the desk next to the computers, and a video camera set up behind the students, were used to record students' interactions. Prior to the commencement of the study, a video camera was situated on the left-hand side of the computer facing the children. The video camera was put into position and the researcher visited for a period of two weeks prior to the commencement of the study to enable the children to become used to the presence of researcher and video camera, so they would not

become over-excited or distracted. The video camera was set up a week before the observation time in order to allow the children to get used to its presence. The camera was switched on, but left unattended without recording. This time period proved to be sufficient to achieve the desired outcome.

The teacher then introduced the topic Endangered Animals to the class, and using a computer projector, she demonstrated on how to perform an Internet search. After the demonstration, the following web sites were written on the board for the children to investigate:

- schoolworld.asn.au/species/species. html;
- worldkids.net;
- tenan.vuurwerk.nl;
- wcmc.org.uk; and
- zip.com.au/~elanora/projects.html.

The students were then provided with worksheets on endangered animals. Table 4.2, on the following page, shows a typical worksheet on endangered animals. The teacher explained that in order to answer the questions on the worksheet the students had to use the Internet. The students then carried out an Internet research based activity on endangered animals. They referred to the above web sites in order to obtain information about their endangered animal.

Students worked in groups around the computer and were instructed to work together; partners in both mixed and single-gender groups were consistent for the duration of the study. Students were encouraged to work independently of teacher guidance but were provided with assistance upon request. The researcher observed and gathered data while the students worked 45 minutes a day, three days a week for 8 weeks. Data was collected and analysed through a variety of techniques, and these techniques will be discussed in relation to the respective research questions in the next chapters.

Table 4.2
Worksheet on Endangered Animals

Find out the following information on your endangered animals. Use the headings below to collect information and record it in your journal.

SUBJECT
What is the animal's common name? The name the animal is most commonly known by (e.g. lion).
What is the animal's scientific name? Many research areas will supply this name along with the common name (e.g. Leo pantheras).
What is the animal's nickname? (e.g. King of the Jungle).

DESCRIPTION
Provide a description of the animal you have researched. Supply as much information as possible on:
Which category is the animal? (e.g. marsupial, egg laying etc)
What does the animal look like? Describe it in your own words.
(Provide a physical description, size, colour and appearance).
What does the animal eat?
(Provide a description of eating habits and favourite foods).
Describe their breeding. (e.g. Do they lay eggs? What is the gestation period?).

ENVIRONMENT
Describe the environment that the animals live best in.
(e.g. Do they live above ground or underground? Do they hibernate?)

PROBLEMS
Describe why the animals have become endangered. This is a very important part of the report and should be as detailed as possible.
(e.g. has there been a loss or change in the environment? Has there been a loss of food supply? Is the animal hunted or cultivated for food?).

SOLUTIONS
What steps have been taken to protect the animals? In this section you must come up with your own ideas. (e.g. have plans been made to improve the environment of the animals? Are there breeding programs in place to increase population? Do you know of any organisations that have assisted in improving the environment of the animals).

SUMMARY
Describe why you decided to study this particular endangered animal. Add any items that you may have learnt that have not been included in other areas.

REFERENCES
Where did you find the information you have collected? Include the complete Internet address.

After completing their investigation and collecting data on endangered animals, each group word-processed their report on their endangered animal, which they printed out. The children were then told that they would have to present their report on slides using PowerPoint (Microsoft Office, 1998). The teacher gave instructions on how to use PowerPoint (Microsoft Office, 1998). The children were taught to use slides and learned to add animation, transitions, backgrounds and sound effects to their slideshow production. They were also shown how to save pictures from the Internet onto their slides.

The children were instructed to plan out on paper, how many slides they would produce, what information they would include and what pictures they would copy and paste on their slides. They also planned the sequence of each slide. After the planning stage, the children then began their task of making slides on endangered animals using PowerPoint (Microsoft Office, 1998). To conclude the activity, each group presented their slides on a large monitor in front of the class. Table 4.3 shows their activity sheet for the PowerPoint exercise.

Table 4.3
PowerPoint Exercise

Step One Design the Information On paper design a series of at least seven slides to show information obtained from the Internet on the endangered animal of your choice. You must have a title slide, information slides and conclusion slide. Each slide must have text and graphics. Nobody reads a lot of information, so keep it clear and simple. 3 or 4 lines are enough in each slide. Provide just enough information to convey your message.
Step Two Create PowerPoint Slides Use PowerPoint to create text-based slides. Use background colours or template from the format menu. Download pictures from the Internet. Add sounds and transitions.
Step Three Presentation Do not read your slide; instead prepare an effective speech.

Instruments used in the Study

Instrument used in Peer Interaction Categories

All observations of peer interaction were coded and tallied by means of the Peer Interaction Categories (Table 4.4). Although a structured coding system was used to observe peer interaction, an unobtrusive method of observation was adopted, where the participants were not totally aware that they were being observed. The advantage is that it is more likely to capture what is really happening than when participants are aware they are being observed. The Peer Interaction Categories (Table 4.4) was adapted from the Peer Interaction Coding System (Lee, 1993). The adaptation from the original scale is condensed and consists of minimal alterations to the wording, to ensure that each statement is appropriate to this research (see Appendix 30).

The Peer Interaction Coding System was designed as a research tool to measure peer interaction among students when they worked together in a computer-based lesson environment. The instrument provided a systematic framework in terms of which the analysis of peer interaction could be made in an objective, quantifiable form. The coding system was constructed to adopt a pragmatic approach to human communication, in which the interaction categories in the coding system were considered as variables that allowed for the functional classification of verbal behaviours which were externalised and observable (Trujillo, 1986; Weigel & Corazzini, 1978). The coding system was essentially derived from the methods of interaction analysis developed by Webb (1980, 1982b, 1984b) and Lee (1989b).

The Peer Interaction Categories (Table 4.4) consisted of five interaction categories. These task-related interactions included categories concerned with the substantive content of the task and constructed in terms of the sequence of the interaction behaviour among group members, with the focus on help seeking and help giving for solving a set of problems. The area of socio-emotional interaction has three interaction categories related to the manifest affect of the interaction among students. The first is a positive socio-emotional interaction that shows the group enjoying their computer-based activity. For

example a team member may say, "That is neat" or "I like to watch it again" or "Let's try and solve it together". The second is a negative socio-emotional interaction that expresses frustration, for example "What's happening?" The third is a neutral socio-emotional interaction, for example students may say, "Not too bad" or "It's ok."

Table 4.4
Peer Interaction Categories

Task-Related Interactions
Gives task-related help (GH)
Asks a question & receives task-related help (RH)
Positive socio-emotional interaction (PEI)
Solves problems together (SP)
Off-task interaction (OT)

Instrument used in Collaborative and Motivational Behaviour Categories

All observations of collaborative and motivational behaviour interactions were coded and tallied by means of Collaborative Behaviours (Table 4.5) and Motivational Behaviours Categories (Table 4.6) which were adapted from the Descriptions of Motivational and Collaborative Behaviours (Nastasi and Clements, 1993). The Descriptions of Motivational and Collaborative Behaviours were designed as a research tool to capture relevant and significant collaborative and motivational interactions exhibited by students working in groups around the computer. An observational scheme based on the study of Nastasi and Clements (1993) was employed to distinguish all collaborative and motivational behaviour.

The Collaborative Behaviours Categories consisted of six interaction categories:

- Jointly Engaged (JE): behaviour coded in this category if a student initiates or engages in collaboration with a partner on assigned tasks such as jointly engages in computer activity; includes initiation of collaborative work;

- Seek information (SE): student seeks work-related information from partner such as seeks/asks information-seeking questions regarding the task solution;
- Gives Information (GI): student gives work-related information to partner such as gives information in response to such requests;
- Turn Taking (TT): one partner is actively engaged in the task while the other watches and assists, or works on a separate task, then the partners change places;
- Social Negotiation (SN): students have a mutual negotiation on a social basis such as "Let's try my idea first then yours". Also includes reaching successful resolution of conflict, without adult intervention, especially cognitive conflict which includes conflict or disagreement concerning task conceptualisation or solution; and
- Social Dominance (SD): student imposes one's solution and/or partner acquiesces.

Table 4.5
Collaborative Behaviour Categories

Jointly Engaged (JE)
Seek Information (SE)
Receive Information (RI)
Turn Taking (TT)
Social Negotiation (SN)
Social Dominance (SD)

The Motivational Behaviours Categories consisted of seven interaction categories:

- Pleasure (PL): student shows signs of pleasure at solving a problem or discovering new information such as cheers after reaching a problem

solution. This implies an affective reaction to the product of one's work efforts;

- Persistence (PR): student continues to work on a task after difficulty or failure without teacher coaxing or encouragement. This includes both attempts to correct mistakes such as debugging, and restarting with an alternative plan;
- Positive Self-Statements (PS): student makes positive statements about self or work. A positive self-statement referred to evaluative comments about cognitive competence e.g. "I'm smart"; "I'm good at writing", and task performance e.g. "This plan worked well", "this is a great story". These comments reflected a positive cognitive appraisal;
- Negative Self-Statements (NS): student makes negative statements. A negative self-statement referred to evaluative comments about cognitive competence such as "I'm dumb"or "I'm not good at computers", and task performance such as "This plan bombed" or "Our work is terrible". These comments reflected a negative cognitive appraisal;
- Encouragement (EN): student requires coaxing or encouragement from the teacher; and
- Failure/Difficulty (FD): student experiences difficulty or failure in completion of the task or reaching a goal e.g. plan fails. Responses to failure were blaming a partner or quitting.

Table 4.6

Motivational Behaviours Categories

Motivational Behaviours:
Pleasure (PL)
Persistence (PR)
Positive Self-Statements (PS)
Negative Self-Statements (NS)
Encouragement
Failure/Difficulty (FD)

Data Collection

Observation

The current study chose to record and study behaviour as it naturally occurred, rather than compile a list of behaviours expected of the students (Borich, 1990; Gay, 1992). The researcher collected data by video and audio taping the participants and taking field notes. All the observations took place during the children's daily classroom activities. A video camera was situated in front of the computer, where the children sat at approximately 45 degrees facing the lens of the camera. As the computers were situated on small rectangular tables, a tripod was used to position the lens of the camera to capture the faces of the children whilst using the computer. During each lesson four groups at a time were chosen to be videotaped as they worked around their computers. Each group was videotaped for ten minutes during a forty-five minute lesson, three times a week for eight weeks (see Table 4.7).

Table 4.7

Groups that were video taped during 8 weeks

Groups	Monday	Wednesday	Friday
Group 1	G3 & G4	G10, B13, B15	G11, B14
Group 2	G8 & G9	B2, B3, B10	G12, G13, B16
Group 3	B4 & B5	B6, B7	B12 & B17
Group 4	G1, B8, B9	G2, B1	G5, G6, G7

Seven audio tape recorders were placed on the desk next to the computers and seven groups at a time were audio taped during the forty-five minute lesson, which was held three times a week for eight weeks (see Table 4.8).

Table 4.8
Groups that were audio-taped during 8 weeks

Groups	Monday	Wednesday	Friday
Group 1	G10, B13, B15	G5, G6, G7	G10, B13, B15
Group 2	B2, B3, B10	G3 & G4	B2, B3, B10
Group 3	B6, B7	G8 & G9	B6, B7
Group 4	G2, B1	B4 & B5	G2, B1
Group 5	G11, B14	G1, B8, B9	B12 & B17
Group 6	G12, G13, B16	G11, B14	G1, B8, B9
Group 7	B12, B17	G12, G13, B16	G5, G6, G7

The researcher situated himself behind the students in order to take down field notes which would help in coding the different interaction categories, and any required assistance was given by the classroom teacher. To record field notes the researcher spent approximately ten minutes with each group during a forty-five minute lesson. Lessons were held three times a week for eight weeks (see Table 4.9).

Table 4.9
Groups used during field notes to record interaction categories

Groups	Monday	Wednesday	Friday
Group 1	G11, B14	G3 & G4	G10, B13, B15
Group 2	G12, G13, B16	G8 & G9	B2, B3, B10
Group 3	B12 & B17	B4 & B5	B6, B7
Group 4	G5, G6, G7	G1, B8, B9	G2, B1

Although the researcher was in close proximity to the computer, he remained outside the focus range of the video camera. "A non-participant observer stands aloof from the case being investigated and eschews group membership" (Burns, 1997, p. 373). In this situation the naturalistic non-participant observation approach was chosen as it is obviously necessary, when it is

impossible for the researcher to be a member of the study group (Burns, 1997). Furthermore, Lincoln and Guba (1985) refer to naturalistic inquiry as a type of research, whereby the researcher plays a more central role in the elucidation and interpretation of behaviours observed. Patton (1990, p. 40-41) argues that naturalistic inquiry involves "studying real-world situations as they unfold naturally; non manipulative, unobtrusive and non controlling; openness to whatever emerges, which lack of predetermined constraints on outcomes".

The unit of analysis was defined as a single, uninterrupted verbal utterance emitted by a student and separated by a pause or another student's verbalisation. In the forty-five minutes that was used for observation during each session, an average of twenty minutes was spent on talking in each group. Interactions were coded as they occurred during observations, and each interaction was classified into one and only one category. Counts were made of the number of times talk reflected the different categories (Table 4.4 – 4.6). Sometimes their conversations would cut across two or more of the categories, and in these cases the utterances were counted more than once rather than trying to classify them into one particular category. No allowance was made for the length of the conversations; rather the incidences only of each category were counted. The degree of coder inference required tended to be moderate, as supported by Herbert and Attridge (1975) who also used a similar coding system.

Both structured and unstructured observations were used to generate data while the students worked around the computer. Structured observations included the structured instruments used for coding and analysis of data, which were the Peer Interaction Categories, Collaborative Behaviours Categories and Motivational Behaviours Categories. Unstructured Observations used field notes that were recorded for descriptive reporting during the time when the structured instruments were not being recorded. All collaborative and non-collaborative interactions that were observed between the children and their partners were recorded, and field notes were taken, as groups interacted with the software, and interacted with each other. All data

was successfully entered and coded, and no new categories were developed and there were no problems with any of the categories.

All sessions were recorded and all interactions according to the different categories (see Table 4.4 – 4.6). Sessions were recorded on audio and videotape as students worked and interacted with the software, and interacted with each other in their groups. This supported and enhanced the data collected through the student interviews and observations. This method was used to ensure that the students did not display their perception of 'expected' behaviour, and it also enabled the researcher to study the interactions in more depth at a later time, thereby avoiding observer bias (Gay, 1992).

Transcriptions were coded for each participant. Interaction patterns were recorded on individual charts for each child. Each videotape was expanded to include any contextual information recorded from filed notes. All utterances and non-verbal behaviours represented in the transcripts were coded. An adjudicator in the field of primary education reviewed the videotapes and recorded observations to ensure interrater reliability. Initial codes were constructed and compared with new data until each emerging individual code was mutually exclusive. Codes were constructed to represent each new behaviour and verbalisations made by the children within their respective groups.

The researcher completed a database of 'Field Notes/Observation Records' sheets from field notes, video and audio tape recordings. Data was first coded and then scored. Each interaction that was observed and identified among the learners was counted in each of the established interaction categories examples are shown in Table 4.10, 4.11 and 4.12.

Table 4.10
Video Taping Record

Interaction	Category	Code	Group	Observations
Peer Interact.	Solving Problem	SP	Single Gender 2Boys	B12 & B17 could not find their slides. They searched the hard Drive then PowerPoint and other Programs but failed. B17 then tried the different menus. When he was in Edit, B12 pointed to Find. They went into Find and found their slides in Documents.
Collab. Behav.	Turn Taking	TT	Single Gender 3Girls	G7 did one slide then G6 did the other. After that G5 had her chance to do her slide.
Motiv. Behav.	Encourage	EN	Mixed Gender 2Boys 1Girl	The teacher had to encourage G1 to do her work because she was having problems with her partner.

Table 4.11
Audio Taping Record

Interaction	Category	Code	Group	Observations
Peer Interact.	Receives Help	RH	Single Gender 2 Girls	G9: How do you get pictures from the Internet on the slides. G8: Point the arrow. G9: Where? G8: On the picture...now hold the mouse down...Yes now choose download picture...on the desktop.
Collab. Behav.	Jointly Engaged	JE	Single Gender 2 Boys	B4: What do you think of this background should we use it? B5: Not bad, let's have a look at the templates. B4: These are cool...
Motiv. Behav.	Negative Statements	NS	Mixed Gender 1 Girl 1 Boy	B1: It's no use...I just can't do it.

Table 4.12
Field Notes

Interaction	Category	Code	Group	Observations
Peer Interaction	Off-Task	OT	Single Gender 3Boys	When B2's turn came on the keyboard, he saved & closed the group's work and started playing a computer game. B10 and B3 joined in.
Collab. Behaviour	Social Negotiation	SN	Single Gender 2 Girls	G8 saved a picture on a slide. G9 didn't like it. They then viewed other pictures, but could not decide which one to choose. In the end they decided that each would choose a picture, and both pictures would go on the slides.
Motivation Behaviour	Persistence	PS	Single Gender 3 Girls	The 3 girls tried repeatedly to get into PowerPoint but couldn't. Eventually they went into the hard drive and found Microsoft Office.

Totals were then constructed for each category. Descriptions of the nature of the student talk from the audiotapes was transcribed verbatim and coded in a similar way to interviews to record the incidences of various forms of interactions and behaviours. The audiotapes were examined in conjunction with the videotapes so that non-verbal language such as pointing at the screen, silent reading and writing down information could be noted. This was considered to be important, particularly when determining the extent to which the students were immersed, as well as reflective and collaborative time.

Interviews

Informal interviews were conducted after each session, which supported and enhanced the data collected from the student observations. The researcher interviewed each child separately, with the intention to try and obtain genuine answers without the interference or influence of other team members present.

Interviews were conducted for approximately 10 minutes duration. Children were interviewed to discuss the observed collaborative and motivational behaviours, and what contributed to those behaviours while they worked in mixed and single-gender groups around the computer. Initially the children were put at ease with general questioning. Children were encouraged to speak about and reflect upon their experiences with the computer-based lessons and group work. Open ended interview questions were developed in-situ, and children were probed with further questioning as ideas emerged. Participants were encouraged to respond in their own words. The questions were carefully worded to avoid putting words into the participant's mouths and allowed them to express themselves freely (Patton, 1990).

All the interviews were recorded on audio tape and transcribed by the researcher for analysis. The interviews were taped, with the participant's permission, then played back to the participant and discussed, to ensure accuracy of information and to eliminate the possibility of misinterpretation of data. Transcripts were typed verbatim from the interview tapes and themes or patterns of thought that emerged were coded. Responses were grouped into themes. These themes were drawn together to create a description (Patton, 1990) of what occurred and to enable conclusions to be drawn.

Data Analysis

Data Analysis on Peer Interaction

'Field Notes/ Observation Record' sheets from field notes, video and audio tape recordings (examples are shown in Table 4.10, 4.11 and 4.12) were analysed and scores were recorded according to each student's peer interaction categories, which were: gives task related help; receives task related help; positive socio-emotional interaction; solves problems together; and off-task interaction. These are presented in the next chapter (Table 5.1). To analyse the relative amount of peer interaction in each of these categories, the percentage of the total interaction occurring for each interaction category was computed from the descriptive statistics using SPSS 6.1.1 (SPSS, 1995). The results are presented in Table 5.2.

To analyse differences between groups, a one-way ANOVA was conducted (Table 5.3). The independent factor was the different groups, which were single-gender boy groups, single-gender girl groups and mixed-gender groups. The dependent variables were gives task related help, receives task related help, positive socio-emotional interaction, solves problems together and off-task interaction. The level of significance for all analyses was set at .05 in this study.

Data was further analysed, by using the Scheffé post-hoc comparisons, to compare all groups with all other groups to determine where significant differences existed between single and mixed-gender groups with regard to peer interaction around the computer. This is presented in the next chapter (Table 5.4).

Data Analysis on Collaborative Behaviour

'Field Notes/ Observation Record' sheets from field notes, video and audio tape recordings (examples are shown in Table 4.10, 4.11 and 4.12) were analysed and scores were recorded according to each student's collaborative behaviour categories, which were jointly engaged, seek information, give information, turn taking, social negotiation and social dominance. These are presented in Chapter Six (Table 6.1). To analyse the relative amount of collaboration in each of these categories, the percentage of the total collaboration occurring for each collaborative category was computed from the descriptive statistics using SPSS 6.1.1 (SPSS, 1995). The results are presented in Table 6.2.

To analyse differences between groups a one-way ANOVA was conducted (Table 6.3). The independent factor was the different groups, which were single-gender boy groups, single-gender girl groups and mixed-gender groups. The dependent variables were jointly engaged, seek information, give information, turn taking, social negotiation and social dominance. The level of significance for all analyses was set at .05 in this study.

Data was further analysed, by using the Scheffé post-hoc comparisons, to compare all groups with all other groups to determine where significant

differences existed between single and mixed-gender groups with regard to collaboration around the computer. This is presented in Chapter Six (Table 6.4).

Data Analysis on Motivational Behaviour

'Field Notes/ Observation Record' sheets from field notes, video and audio tape recordings (examples are shown in Table 4.10, 4.11 and 4.12) were analysed and scores were recorded according to each student's motivational behaviour categories, which were pleasure, persistence, positive self-statement, negative self-statement, encouragement required and failure/difficulty. These are presented in chapter seven (Table 7.1). To analyse the relative amount of motivation in each of these categories, the percentage of the total motivation occurring for each motivation category was computed from the descriptive statistics using SPSS 6.1.1 (SPSS, 1995). The results are presented in Table 7.2.

To analyse differences between groups a one-way ANOVA was conducted (Table 7.3). The independent factor was the different groups, which were single-gender boy groups, single-gender girl groups and mixed-gender groups. The dependent variables were pleasure, persistence, positive self-statement, negative self-statement, encouragement required and failure/difficulty. The level of significance for all analyses was set at .05 in this study.

Data was further analysed, by using the Scheffé post-hoc comparisons, to compare all groups with all other groups to determine where significant differences existed between single and mixed-gender groups with regard to motivation around the computer. This is presented in Chapter Seven (Table 7.4).

Data Analysis on Interviews

Interviews were coded initially according to the themes derived from the grouping of the constructs established by the researcher. The printed texts of the interviews were sorted manually, with specific construct group labels used in the margin to highlight areas related to a theme. For example the construct group label Peer Interaction was used to note areas in a text that appeared to

illustrate the theme. The sorted texts were then identified, printed and filed in the appropriate folder for each category. The sorted data were also stored on computer, referred to by page numbers, and then cut and pasted into the written text when needed. The three major themes were broken down into sub-themes as the coding was fined tuned. For example, one of the major themes derived from the grouping of the constructs was Peer Interaction. This theme was divided into sub themes such as gives task-related help, asks a question and receives help, positive socio-emotional interaction, solves problems together and off-task interaction.

Although computer analysis programs could have been used the researcher decided to use this manual method of filing because the number of interviews were manageable. The researcher found this method time consuming but rewarding since it also allowed for familiarity with the data and allowed for identification of each group and student. For example, the researcher became so familiar with the data that particular text or page or quotes to illustrate a theme could be identified of individual students.

Validity and Reliability of the Study

Reliability in research is concerned with the replicability of findings (Hansen, 1979). Issues of reliability, in this study, were addressed by following the suggestions of Le Compte and Goetz (1982). Le Compte and Goetz (1982) argued that investigations have been criticised because they fail to adhere to positivistic canons of reliability and validity. To ensure that research is considered valid, credible and trustworthy, they argued that reliability and validity should be addressed in the design, collection and analysis of a study. McMillan and Schumacher (1989) agreed and noted that qualitative research was considered valid, credible and trustworthy to the extent that the canons of reliability and validity were addressed in qualitative terms when the inquiry was designed, conducted and the findings interpreted.

Credibility in research often refers to the use of appropriate definitions of research criteria – reliability, internal and external validity in the inquiry

(McMillan & Schumacher, 1989). They further argued that definitions of validity and reliability in research assume that the meaningfulness of human actions depends on the contexts or situations in which these actions, feelings and perceptions occur. In this study the research was discovery oriented, assisting the researcher in understanding primary school children working together in groups around the computer.

Reliability of the Study

Reliability often refers to the extent to which studies can be replicated. It has been argued that the criteria regarding reliability for qualitative research differ from that of quantitative research. While reliability in quantitative research refers to the consistency of the observations, the criteria in this present study for qualitative research ensure conditions of reliability and validity are established.

McMillan and Schumacher (1989) explained their criteria for reliability in qualitative research by referring to the consistency of a researcher's interactive style, the data recording and data analysis process, as well as the interpretation of the participant meaning in the data. They noted that to obtain consistency in the description of naturalistic events and its meanings for the participants, the reliability issues must be handled by the researcher during all phases of the research, design planning, data collection and formal data analysis. McMillan and Schumacher (1989) also argued that in qualitative research because of the individualistic and personalistic nature of the qualitative process, as well as the uniqueness or complexity of the phenomena, reliability is a difficult task. They maintain that human behaviour is never static and no study can be replicated exactly (McMillan & Schumacher, 1989).

To ensure reliability in this study, the researcher used strategies that ensured consistency throughout the research in terms of the description of the naturalistic events and its meanings for the participants. Descriptions of the researcher's interactive style, data recording, data analysis and the range of techniques used in the study to supplement and collate the findings have been

described in this study. Interpretations of the participant meanings in the data are presented in the Chapters Five to Eight.

Within this study a description is given of the role of the researcher and the interaction that took place between the researcher and the students, which ensured consistency in interactive style. All efforts were made to ensure that the researcher made no judgement, personal views and opinions and that a cordial but friendly relationship developed between the researcher and each of the students. The students were allowed the time and freedom to share their views uninterrupted and they were then asked questions about working with their groups.

Consistency in data recording was maintained through the use of the same procedure and recording devices with each student. All data were analysed with the same computer program and the themes gathered from the similarities in the elicited constructs were used in the sorting of the depth interviews. The interpretation of the participants' meaning was maintained through the use of recording information collected and returning the same to the students for further feedback, clarification, confirmation or member check.

Data collected from all the interview sessions were used to establish an understanding of group interactions and gender while groups worked around the computer. All relevant information was later synchronised to fit the data collected from the field observations. Data collected from the naturalistic non-participant observations were analysed according to two sources Lee (1993), and Nastasi and Clements (1993). To ensure reliability, data collection was applied consistently in all cases and in each session during this study.

Guba (1978) identifies three types of problems which a researcher may encounter in the acquisition of information using naturalistic method of inquiry, and which may be a threat to reliability. These are boundary problems, focussing problems and problems of authenticity. Boundary problems occur when no clear criteria for the selection of the sample are identified. In this

study boundary problems were solved by choosing a primary school, with year five and six students randomly assigned to their different gender groups.

Focussing problems occur when the researcher is not sure of the willingness of the respondents to participate in the study, and therefore does not know definite times and places in which the data will be collected. The problem of focussing was controlled by contacting the parents and students, enabling them to confirm their willingness to be involved in the study as well as the arrangement of times for the interviews that were suitable for the respondents. The students were still given the freedom to withdraw from the study at any stage. For all purposes, interviews occurred during school hours.

Authenticity relates to the reliability of source of the information, whether the individual is genuine and worthy of trust. It is difficult to determine if an individual is authentic. The assurance of confidentiality and anonymity and the students' interest in their work and interviews, their spontaneous and thoughtful responses, their enthusiasm and willingness to share anecdotes and reflect on group interactions, their explanations of conflicting information and eagerness to suggest ways of reforming their groups, did suggest that they were engaging in genuine dialogue. The researcher discussed the students' transcribed interviews and asked them to confirm and clarify their views. Taped data that was obtained from groups working around the computer was generally in agreement with student interviews.

External Reliability

External reliability addresses the issue of whether independent researchers would discover the same phenomena or generate the same construct in the same or similar settings (LeCompe & Goetz, 1982; McMillan & Schumacher, 1989). McMillan & Schumacher (1989, p. 189) noted that some researchers claim that no qualitative study can be reliable in the positivistic sense since "the development, refinement, and validation of qualitative findings may not require replication of events". They suggested that making explicit five aspects of the design can enhance external reliability, these include the researcher's role

and status position, informant selection, social context, data collection and analysis strategies, and analytical constructs and premises. These are considered in the following sections.

LeCompe & Goetz (1982) argued that the researcher's role and status within the group should be identified. Patton (1990) explained that the researcher is an instrument in research and determines to a large extent, the trustworthiness of the data. Experience in the methods to be used was therefore considered to be crucial in the data collection process. For this study the researcher was experienced in the data collection process because he had used similar data gathering methods for group work around the computer during his university studies. The researcher had gained experience in the development and implementation of checklists and questionnaires, and depth interviewing through previous research. Patton (1990) also explained that the relationship established between the participants and the researcher is important for rapport, trust and reciprocal relations. As a primary school teacher for twelve years and still involved in the education system, the researcher was able to empathise, and established a good rapport, with the students. Given this background and experience, and having worked in similar primary school settings, the researcher was able to act as a facilitator in the data collection process.

As one of the instruments in the study, the researcher took to the field his prejudices and assumptions about primary school children working in groups. Since any views voiced could have some bearing on the research, all efforts were made to ensure that the researcher did not make any evaluative comments or express personal views. In this study the researcher was a non-participant observer who developed no special relationships with members of the group.

McMillan & Schumacher (1989) noted that informant selection as a threat to reliability can be avoided through careful description of the informants and the decision process used in their selection (Le Compte & Goetz, 1982). They

explained that for replicability, this process allows another researcher to contact individuals similar to those who were informants in the study. Earlier in this chapter a description of the students was explained. Students were randomly assigned to their different gender groups, because interactions of mixed and single-gender groups were studied. Twenty-nine students who participated fully in the study were chosen through the process of "reputational case selection" (McMillan & Schumacher, 1989, p. 184) a strategy involving a knowledgeable person making recommendations to the researcher. In this study a senior lecturer from Edith Cowan University recommended the school, class and teacher to the researcher. The students together with their parents made final decisions as to their willingness to participate in the study. The school was a co-educational school, which suited the research on gender and group work.

It is accepted that the social context in which data are gathered may influence the nature of the data. McMillan and Schumacher (1989) noted that to enhance external reliability, the contexts should be fully described physically, socially, interpersonally and functionally. The thesis started with a description of the overall contexts. In the next chapter the researcher gives a description of each context, based on what was seen when the school was visited for the study. The chapters that follow give an account of students working in mixed and single-gender groups, their interactions and collaboration around a computer.
Le Compte and Goetz (1982) and McMillan and Schumacher (1989) note that replication is impossible without precise identification and thorough description of the strategies used to collect data. The techniques used in this study are described in detail as were the strategies for analysing data. In the present study data was gathered in the naturalistic setting of the school and included classroom observations. Direct information from participants was collected in interview situations, outside the classroom and away from the presence of teachers or peers who may have influenced the responses provided by participants. Replication requires that the assumptions that underlie the choice of terminology and methods of analysis be clearly delineated.

McMillan and Schumacher (1989) noted that the primary safeguard against unreliability is making explicit the theoretical framework which informs the study and from which findings can be integrated or contrasted. A full description of the underlying assumptions, theories and the theoretical framework that informed the study are given mostly in proceeding chapters and throughout this study. The theoretical premises and defining constructs that inform the present research have been derived from established theory and are described in Chapter Three.

Internal Reliability

Internal reliability was enhanced in this study by using field notes from regular non-participant observations, a checklist of peer interaction, informal interviews and video recordings. Audio tape recordings were used to obtain verbatim accounts of respondents' conversation and interviews to facilitate accurate transcriptions. The present study used low inference descriptors of students' behaviour in the classroom and school as part of the field notes. Field notes were composed of verbatim accounts of what were said and narrative descriptions of the events that occurred.

The in-depth nature of the interviews combined with interview schedules ensured that attention was focused on the topics for discussion. This ensured maximisation of the richness of data. Contrast questions were used, probing where answers were ambiguous, or the respondent seemed unclear about the meaning of questions. Immediately following the interview, notes were made recording contextual factors associated with the interview ensuring that important details were noted and accounting for any interpretations of the transcript. Interviews were transcribed verbatim and high inference interpretative comments were added. Audio tape recording allowed continual and repeated access to the original conversations, and provided a permanent reference to the data analysis. Reliability of the present study was established through the documentation of all procedures to allow for the same procedures to be repeated with similar results (Yin, 1989).

Lincoln and Guba (1985) stress the importance of detecting and taking into account distortion such as misinformation, which may be introduced by the researcher or respondent. This may be caused by problems associated with lack of trust, nervousness and differences in language. The longitudinal nature of this study avoided these problems, and a period of familiarisation, extended classroom observations, and multiple interviews allowed the development of familiarity and rapport between the researcher and subjects.

Repeated reference was made to the relevant literature during coding and the presentation of summaries to informants allowed for verification of interpretation. The inclusion of information from the participants allowed for checking that the researcher's observations were viewed consistently by both subject and researcher. The class teacher was used as an informant to clarify and confirm the findings of this study. Internal reliability refers to the degree to which other researchers, given a set of previously generated constructs, would match them in the same ways as did the original researcher. Internal reliability issues focus on the extent to which multiple observers of the same phenomenon will agree.

A second coder reviewed the videotapes and recorded observations to ensure inter-rater reliability. Initially, the researcher decided that agreement between coders could be checked by looking at totals of categories across each dimension in the interaction patterns. However, this was not considered sufficiently rigorous since a measure of agreement across totals would not necessarily mean a close agreement in the coding, making the validity of any claims made from the results suspect.

The inter-rater reliability proceeded as follows:

- The coding was completed by the researcher, with some checking for consistency included at this stage.

- The coding rules and procedures were given to the second coder along with a sample of tapes so that the identification of the patterns could be checked

for reliability. It was found that there was 50% agreement on the identification of relevant patterns, although only 8% were in disagreement. The discrepancy arose because the second coder tended to define the social behaviours exhibited by the participants, without using the Peer Interaction Categories (Table 5.1), which was adapted from the Peer Interaction Coding System (Lee, 1993), thus merging the first coder's patterns into a smaller number.

- The researcher and the second coder then agreed on the definition of a pattern and the second coder returned to the previous point. There was a high degree of agreement 91%.

- The second coder tested the reliability of the categories by coding the conversation according to the agreed definition of a pattern. There was a high level of agreement on the categories of collaborative interactions 93% and motivational categories 90%. The goal of the analysis was to distinguish all collaborative and motivational behaviour. Frequency of occurrence of identified interactions were analysed in the form of descriptive statistics.

Validity of the Study

Validity addresses the issue of whether what the researcher says is being measured, is in fact being measured (Rymarchyk, 1996). Validity ensures that the propositions generated, refined or tested match the causal conditions, which prevail in human life (Le Compte & Goetz 1982). Interval validity was described as the major strength of qualitative research and is defined in terms of internal and external validity.

Internal Validity

Internal validity refers to whether the researcher observes or measures what is being observed and measured. The confirmation of the degree to which the conceptual categories such as an informal and formal approaches held mutual meanings between the participants and the researcher, was examined. Some of

the threats to internal validity of this study in terms of the history and maturation, observer effects, selection, mortality and alternative explanations, as noted by McMillan and Schumacher (1989), are explained in the following section.

History and maturation affect the nature of the data collected especially since events rarely remain constant. History affects the general social scene (McMillan & Schumacher, 1989), so the researcher described and documented the students' interactions at that given time. Maturation as a normative process, affects progressive development in well-defined stages of the individual, both mentally and physically. Given the relatively short data (eight weeks) collection time, this was not a problem.

Observer effect relates to the impact the researcher may have on the respondents and their practical, personal knowledge. In this study the data collected from the students represented their particular views on working together, and all efforts were made not to influence these. To minimise this source of invalidity, the researcher spent a total of three months in the field. The time spent in the data collection process also allowed the students to become accustomed to the presence of the researcher. The promise of confidentiality and anonymity also allowed the students to be freer and more confident in their self-expression. Mortality, that is the loss of respondents in the study, was treated as a normal event. One student left the school and was not replaced because, as McMillan and Schumacher (1989) explained, human participants are not interchangeable.

The claim to high internal validity is derived from the data collection and analysis techniques used in the study (Le Compte & Goetz, 1982; McMillan & Schumacher, 1989). The following strategies, noted as those that increase internal validity, were used in the study.

A lengthy data collection period provided the opportunity for continual data analysis, interpretation and corroboration to refine constructs and to ensure

that there was a match between the categories used in the research base and the students' realities in terms of their group interactions. The students' language was used throughout the study since this was less abstract and provided vivid descriptions of the students' thinking. The field research took place in the 'natural' settings in which the students worked and which reflected the reality of their group work. In addition the researcher used "disciplined subjectivity" or self monitoring (McMillan & Schumacher, 1989, p. 192) which entailed submitting all phases of the research process to continuous and rigorous questioning and revaluation.

Providing richness of the data in the presentation of data, and describing the research context also ensured the internal validity of the study. As a result, the data collected may be problematic only if there are claims for its representation beyond the contexts from which it was gathered. The time spent in the data collection process also allowed the researcher to corroborate the data, and gain the students' reactions and confirmation of their interactions with each other. In addition, in the selection process attention was paid and explanations given to how purposeful sampling was used to identify the students in the study.

External Validity

External validity deals with the generalisation of the results or whether the findings are applicable across groups. Twenty-nine students, sixteen boys and thirteen girls from year 5/6 were interviewed in this study. This study did not seek findings that would be generalisable to the wider population, but an extension of the understanding and detailed descriptions of students' interaction in mixed and single-gender groups around a computer in this particular setting. Rich description allows the reader to make decisions in terms of the generalisability of the findings. The findings are specific to the context of the study. It has been suggested that naturalistic inquiry can "establish at least the limiting cases" relevant a given situation...each possible generalisation should be only as a working hypothesis, to be tested again in subsequent encounters" (Guba, 1981, p.70). Rich description and adequate

conceptual density aid the establishment of meaning and relevance to other settings.

Descriptions of the phenomena, which are likely to be useful for comparability and translatability, are given. To ensure comparability to research, components including the sites, the participants, the documents used, the analysis process and the concepts generated are well described and defined. To ensure translatability, the researcher's use of theoretical frameworks and research strategies is explained so that those in the same or similar field can replicate the study. Detailed descriptions of the distinct characteristics of the students, as well as the historical settings and the possible effects of these settings on the students' thinking are discussed in this study. In addition, attention is paid to the attributes of the students as groups, the time period and the settings, so as to alert other researchers in the use of the findings, and to furnish rich description.

Validity in research is concerned with the accuracy of scientific findings (Le Compte & Goetz, 1982). Validity is established when the extent to which the conclusions effectively represent empirical reality is established and the constructs devised by researchers represent or measure the categories of human experience that occur (Hansen, 1979). The most commonly cited method is the triangulation of data, which involves the collection of data from a number of different sources using a variety of methods. According to Lincoln & Guba (1985) in naturalistic paradigms researchers seek credibility, transferability, dependability and confirmability. One technique for establishing credibility is triangulation, and transferability of the findings rests on "thick" description (Patton, 1990). In this study data triangulation, in the form of multiple sources of evidence, were collected. In addition, there was triangulation in the methodology used for analysis and categorisation of classroom interaction, which included both a qualitative and a quantitative component. This study used qualitative and quantitative methods within a descriptive research framework to accurately describe facts and characteristics of a given population.

By combining qualitative and quantitative research, observations, interviews and checklists, multiple perspectives on the program became possible and cross checking of findings added to the validity of the data gathering and analysis. As outlined above, each method has its own strengths and weaknesses and combining methods allow the strengths to be utilised while minimising the weaknesses (Patton, 1990).

Ethical Considerations

This study was conducted using the ethical guidelines implemented by Edith Cowan University, and efforts were made to protect the rights of the participants. The participants were all volunteers, there was no coercion to participate and no reward for participation. Closely related to the notion of voluntary participation is informed consent. A requirement of ethics clearance was implemented and parental authorisation was sought for children participating in the study. This involved a letter of disclosure and a consent form. Parents were informed that their child's participation was not compulsory and they were alerted to the fact that they could withdraw their child at any time without penalty.

Standards were applied in order to help protect the privacy of research participants. To guarantee confidentiality and anonymity, the school was not named and the students were referred to by pseudonyms throughout the research in order that they would remain anonymous. Methods of data collection were as unobtrusive as possible and complemented the students' programme where possible for minimal disruption to their daily routine. Assessment was not affected and no student was disadvantaged by the assessment. The ethical issue of right to service was addressed by designing the study to eliminate the use of a no-treatment control group, so that no participant would feel their rights to equal access would be curtailed.

Summary

This chapter describes the location and the settings where the study was conducted, the participants, the methodology used to collect and analyse the

data, as well as measures that were taken to ensure the validity and reliability of data. The ethical issues were also considered. The results obtained from the collection of these data are presented and discussed in the next Chapters.

Chapter Five

Results on Peer Interaction

Introduction

This chapter provides the results of analysis of the patterns of peer interaction that took place when children worked in small groups within a computer-based learning environment. First the research question will be stated, followed by the results of the data analysis. Quantitative and qualitative data were gathered as children worked in mixed and single-gender groups and this chapter answers Research Question 1: What patterns of peer interaction take place when children work in mixed and single-gender groups within a computer-based learning environment? The researcher examined the occurrence of task-related interaction processes, which were: gives task-related help; asks a question and receives task-related help; positive socio-emotional interaction; solves problems together; and off-task interaction around a computer. Behaviours indicating peer interaction were recorded. Evidence related to peer interactive behaviours was derived from analysis of interview responses, field notes, videotapes of students working in groups and audio tapes of student talk.

Results on Peer Interaction

The results obtained from each student's peer interaction scores from field notes, videotape transcriptions, audio recordings (examples shown in Tables 4.10, 4.11, 4.12) and interviews were totalled and recorded in Table 5.1, following a procedure adapted from Lee's (1993) table of Means, Standard Deviations, and Percentages of Interaction Categories for All Students. The means of each of the five interaction categories were also recorded according to each of the three groups, single-gender boys, single-gender girls and mixed-gender groups. Lastly, the percentage of the total interaction occurring for each interaction category was computed to show the relative amount of interaction in each category. For example in the Gives Help interaction category, the students made a total number of 82 interactions based on the means. About

34% of the total means of Gives Help interactions involved single-gender boy groups, 39% were single-gender girl groups and 27% were mixed-gender groups.

Table 5.1
Scores of Each Student's Interaction Categories

Groups	GH	RH	PEI	SP	OT
Single-Gender Boy Group					
B4	36	24	32	34	5
B5	34	36	28	34	4
B6	28	22	18	23	7
B7	30	18	14	21	4
B12	40	36	26	34	6
B17	44	28	32	36	4
B2	18	6	24	18	25
B3	8	24	18	15	15
B10	14	10	26	18	20
Means of each Inter.Categ.	28	23	24	26	10
Percent of TotalMean	34	33	35	38	34
Single-Gender Girl Group					
G3	24	28	20	30	5
G4	36	22	30	30	7
G8	36	40	10	40	6
G9	50	30	20	40	4
G5	24	22	18	20	6
G6	36	32	34	24	4
G7	20	26	18	16	8
Means of each Inter.Categ.	32	29	21	29	6
Percent of TotalMean	39	41	30	42	21
Mixed-Gender Group					
B1	26	10	26	18	18
G2	28	20	14	18	8
B14	30	40	30	38	6
G11	44	30	20	38	5
B8	16	2	40	12	10
B9	3	10	28	8	22
G1	4	8	18	10	14
B13	12	10	12	4	22
B15	18	30	16	4	26
G10	20	10	30	4	5
G12	34	5	28	12	15
G13	36	16	32	12	8
B16	20	40	20	6	16
Means of each Inter.Categ.	22	18	24	14	13
Percent of TotalMean	27	26	35	20	45
Total Means of Inter.Categ.	82	70	69	69	29
Total Percent	100	100	100	100	100

To describe patterns of peer interaction descriptive statistics - means, standard deviations and percentages using SPSS 6.1.1 (SPSS, 1995) were computed for each of the five interaction categories. The percentage of the total interaction occurring for each interaction category was computed to show the relative amount of interaction in each category (Table 5.2).

Table 5.2

Descriptive Statistics of Interaction Categories for All Students

Interaction Category	Mean	S.D.	Percent
Gives task related help (GH)	26.5	12.1	25.6
Receives task related help (RH)	21.9	11.4	21.1
Positive socio-emotional interaction (PEI)	23.5	7.5	22.7
Solves problems together (SP)	21.3	11.6	20.5
Off-task interaction (OT)	10.5	7.1	10.1
Total Interaction	103.7	49.7	100.0

Results from the descriptive statistics of interaction categories for all students (Table 5.2) showed that the students, based on means, made a total of 103 interactions when they were working around a computer. However, the frequencies of interactions were not equally distributed among the categories under study. Of the five interaction categories examined, giving task related help was on average the interaction occurring most frequently for all students 25.6 percent, next was socio-emotional interaction 22.7 percent, then receives task related help 21.1, followed by solves problems together 20.5 percent. The off-task interaction category took place infrequently 10.1 percent compared to the other interaction categories.

In the categories of gives task related help and receives task related help, scores were different because students were giving task related help but sometimes their partners were not taking the help, for example:

"Here this Internet site will give you the information you need for the Giant Panda". (G1 talk).
"I don't need it, I will try another". (B9 talk).

"She was trying to get a picture of the Snow Leopard from the Internet to her slides, but she couldn't. I tried to show her by explaining to her to press the control key and the mouse. Instead, she grabbed the mouse from my hand and began doing something else...typing information". (B15 interview).

A one-way ANOVA was conducted (Table 5.3) to determine in which interaction categories significant differences might occur. The level of significance for all analyses was set at .05 in this study.

Table 5.3
Summary of ANOVA Results for Interaction Categories by Group Composition

Var	D.F.	F Ratio	Significance of F
GH	2, 26	1.7	.20
RH	2, 26	2.2	.13
PEI	2, 26	0.3	.71
SP	2, 26	6.2	.01
OT	2, 26	3.2	.06

The results of the analyses of variance (Table 5.3) showed that there was a significant difference only in scores in the Solved Problems Together category between the groups $F(2, 26) = 6.2$, $p = .01$. Other interaction categories of giving task related help, asks questions and receives help, positive socio-emotional interaction and off-task interaction had no significant difference between groups.

In the Solved Problems Together category, the single-gender girl groups scored an average of 29, the single-gender boy groups scored an average of 26 and the mixed-gender groups scored an average of 14. With regard to Solved Problems Together category, points were awarded to groups that solved problems

together around the computer that were related to their computer task. These problems they solved together were part of the learning task as well as technical problems that students found while working around computers. Their principal learning task was to be able to use the Internet to get information on endangered animals and then create a slide show presentation using PowerPoint. Observations revealed that although Internet addresses were provided, some students had problems accessing the web sites. Eventually most of the groups solved the problem together when they discovered that they had left out a letter or symbol from the Internet address. To obtain information from the web to answer questions about their endangered animal also caused problems with some of the groups. The problem was eventually solved when they decided to use different search engines.

A few groups had problems with printing their word-processed documents. For example:
"It's refusing to print." (B7)
"Well let's try again." (B6)
"No, still not printing." (B7)
"Err...highlight it, what we want printed...do it, it will work." (B6)
"No...no it can't be the printer others are printing." (B7)
"Oh! It's the computer. Let's try switching off and putting it on again. [Then] the computer becomes alright." (B6)
"No...it is printing, computer says printing...still nothing from printer." (B7)
"Try another printer [icon]...if it's printing, it's printing somewhere else." (B6)
"...Yes!" (B6).

The children solved problems together when working on their slides using PowerPoint (Microsoft Office, 1998). The problems some groups encountered were animation, transitions, backgrounds, sound effects and downloading pictures from the Internet to their slides.

Data was further analysed, by using the Scheffé post-hoc comparisons, to compare all groups with all other groups within the Solved Problems Together

category to determine where significant differences existed between single and mixed-gender groups (Table 5.4).

Table 5.4

Groups Significantly Different (Scheffé post hoc tests)

Variable	Groups	Mean	P Value
Solves Problems Together	Single-Gender Boys	25.9	.01
	Mixed-Gender	14.1	
	Single-Gender Girls	28.6	.01
	Mixed-Gender	14.1	

Results of the Scheffé post hoc tests (Table 5.4) indicated that there was a significant difference between single-gender boys and mixed-gender groups, and single-gender girls and mixed-gender groups with regard to solving problems around a computer.

Single-Gender Girl Groups and Solving Problems Together

The single-gender girl groups showed a higher level of solving problems together (X = 29) compared to single-gender boy groups and mixed gender groups. This was 42 percent of 69, which was the total mean of interactions coded in this category of all groups (see Table 5.1). Results from observations, interviews and tape recordings of single-gender girl groups provided examples of how they solved problems together around the computer. For example the audio tapes indicated that single-gender girl group G3 and G4 worked together to solve the problem of getting colours and backgrounds for their slides:

"No I don't think it is the edit menu, because we want colours for our backgrounds...(G3 talk).
"In that case it will be format, format menu. Now, which one should we choose?" (G4 talk).
"...no it will be background because that is what we need." (G3 talk).
"From here, let's try slide colour scheme for our background." (G4 talk).
"Cool...now we just choose the colour we like." (G3 talk).

G5's interview indicated that in the beginning the single-gender girl group had difficulty importing pictures from the Internet onto their slides. Eventually they worked together and solved the problem:
"[G6] and myself had problems getting pictures from the Internet into our slides. We eventually solved it together after trying different things – cutting, saving, highlighting and clicking." (G5 interview).

The videotape provided another example of a single-gender girl group G8 and G9 having problems changing the order of their slides. They tried 'select all' from the edit menu then 'cut' but it did not work. They then tried outline view and other options but were unsuccessful. G8 then pointed to the sort icon at the bottom of the slide and then by cutting and pasting they solved their problem and were able to place their slides in the correct order.

The above examples indicated how single-gender girl groups co-operated and solved problems together. They were generally persistent when it came to solving problems around the computer. When one girl was experiencing difficulty, then the other would most of the times collaborate to find a solution. There were times when single-gender girl groups were not solving problems together around the computer, for example:

"How do we swap the slides around?" (G5 talk).
"...No that does not work." (G6 talk).
"We are in the wrong view... (G7 talk).
"What are you talking about?" (G5 talk).
"You can't do it in slide view, try... (G7 talk).
"Don't listen to her, she's 'dumb', just delete the slide." (G5 talk).

Single-Gender Boy Groups and Solving Problems Together

Single-gender boy groups, with regard to solving problems together, had the second highest mean (X = 26). This was 38 percent of 69, which was the total mean of interactions coded in this category of all groups (see Table 5.1). Results from observations, interviews and tape recordings of single-gender boy groups

indicated that they could solve problems together around the computer. For example the audio tapes indicated that single-gender boy group B4 and B5 worked together to solve the problem of retrieving their work they had lost:

"The computer has deleted our work and I can't find it." (B4 talk).
"Did you save our work?" (B5 talk).
"I saved it and it deleted the whole thing." (B4 talk).
"Let us see if it is on the desk top." (B5 talk).
"No it's not there." (B4 talk).
"What name did you save it as?" (B5 talk).
"B4 and B5...let us try the hard drive...no it's gone." (B4 talk).
"Wait try find...where is find?" (B5 talk).
"There in the file menu...yea, type B4 and B5." (B4 talk).
"That's it... it is in PowerPoint!" (B5 talk).

B7's interview indicated that his group was having a problem printing their information on endangered animals. Eventually they worked together and solved the problem:
"Printing was a problem. We just could not print our information. It took us a while, but we solved the problem, we were sending our work to the wrong printer – the library's printer." (B7 interview).

The videotape showed a single-gender boy group B12 and B17 solving the problem of saving Internet pictures on their slides. They first highlighted the picture, then chose edit and clicked on save, but it did not work. They tried to cut and paste then drag the picture to the desktop. In the end they worked out that by holding the mouse down on the picture they could then save the picture and later transfer it onto their slides. The above examples indicated how single-gender boy groups could work together and assist each other to obtain answers. Occasionally single-gender boy groups were not solving problems together around the computer, for example:

"We got to put animation in our slides." (B3 talk).

"Leave it, it's too hard." (B2 talk).
"How do you do animation?" (B10 talk).
"I think it's the format menu...no...hey stop it!" (B3 talk).
"Come on, let's play that game." (B2 talk).
"Yea, we can come back to animations later...cool it's my turn to start, I had the highest score." (B10 talk).

"When ever it came to something difficult to solve, B2 made an excuse and wanted to play games on the computer or would playfully start pushing and shoving." (B3 interview).

Mixed-Gender Groups and Solving Problems together

Compared to the other two groups, mixed-gender groups had the lowest mean ($X = 14$). This was 20 percent of 69, which was the total mean of interactions coded in this category of all groups (see Table 5.1). Results from interviews, observations and tape recordings of mixed-gender groups indicated that most of the times they could not solve problems together around the computer because they were often arguing, for example:

"How do we change the order of our slides?" (G1 talk).
"Give me the mouse." (B9 talk).
"No...stop pushing...just tell me." (G1 talk).
"Then do it yourself..." (B9 talk).

"We hardly solved problems together because we were always arguing. We wanted to do different things, and when I was on the computer, [B15 and B13] were playing games on the other computer. How could we solve problems together?" (G10 interview).

In the following mixed-gender groups the girls did not want to solve problems with the boys and just wanted to do their own work, for example:
The videotape showed B1 either sitting passively at the computer or wandering around. During an interview with his partner G2 said, "I did not want to solve

problems with him because he knew nothing. I knew more than him about computers."

"Let's work this out together [G12 and G13], and leave [B16] out..." (G13 talk).

The students in one of the mixed-gender groups did not successfully solve problems together because the girl was very assertive, and wanted to do all the work herself for example:
"I was taking over, making slides and I knew how to do all." (G10 interview).
"She (G10) didn't want my help. So I let her 'hog' the computer." (B13 interview).

The above examples indicated how some mixed-gender groups were not co-operating and solving problems together. There were times when mixed-gender groups were able to solve problems together, especially mixed-gender group B14 and G11 were most of the times collaborating together to find a solution, for example:

"Let's use other sounds, not the ones from PowerPoint." (B14 talk).
"You mean from the Internet, like animal sounds." (G11 talk).
"...I'm trying to think how, or what's the best way..." (B14 talk).
"...Why not save them like how we saved the Internet pictures..." (G11 talk).
"No...it doesn't work." (B14 talk).
"I know, let me have a go, I'll save it on the desk top." (G11 talk).
"Yea, now it has to play on our first slide...view...format menu...no." (B14 talk).
"May be we can do it like how we got the other sounds...slideshow menu." (G11 talk)
"...Try custom animation...sound...no these are the usual sounds...camera, chime etc...." (B14 talk).
"There, try 'other sound'...from desktop...yes! Yes!" (G11 talk).

"I don't mind solving problems with a boy, because boys ideas are different, sometimes better." (G11 interview).

Conclusion on Patterns of Peer Interaction

The observations and data reported here have established, in quantitative and qualitative terms, that single and mixed-gender groups tend to interact quite frequently overall with their group members. The results of the analyses of variance showed that there was no significant difference between mixed and single-gender groups with regard to the interaction categories of giving and receiving help, positive emotional interactions and off-tasks. There was only a significant difference in the interaction category of solving problems together. Scheffé post hoc tests indicated a significant difference between single-gender boys and mixed-gender groups, and single-gender girls and mixed-gender groups. Observations and interviews of students implied that single-gender boys and girls collaborated and solved problems together around the computer, better than mixed-gender groups, which generally did not co-operate when they had to solve problems. The average amount of times single-gender boys and girls solved problems together around the computer was much higher than mixed-gender groups.

Chapter Six

Results on Collaborative Behaviours

Introduction

This chapter provides the results of analysis of children's collaborative behaviours while they worked in mixed and single-gender groups. Quantitative and qualitative data were gathered as children worked in mixed and single-gender groups and this chapter also answers Research Question 2: How did the technology based learning environment impact on children's collaborative behaviours while they worked in mixed and single-gender groups?

The researcher examined the occurrence of interaction processes, which were jointly engaged, seeking and giving information, turn taking, social negotiation, social conflict and social dominance during collaborative problem solving within a computer-based learning environment. Behaviours indicating collaborative problem solving were recorded. Evidence related to children's collaborative behaviours was derived from analysis of interview responses, field notes, videotapes of students working in groups and audio tapes of student talk.

Results on Collaborative Behaviours

The results obtained from each student's collaborative behaviour scores from field notes, videotape transcriptions, audio recordings (examples shown in Tables 4.10, 4.11, 4.12) and interviews were totalled and recorded in Table 6.1, which was adapted from Nastasi and Clements (1993) table of Descriptions of Motivational and Collaborative Behaviours. The means of each of the six collaborative categories were also recorded according to each of the three groups, single-gender boys, single-gender girls and mixed-gender groups. Lastly, the percentage of the total interaction occurring for each collaborative category was computed to show the relative amount of collaboration in each category. For example in the joined engaged collaborative category the students based just on the means, made a total means of 74 interactions in this category. About 38 percent of the total means of jointly engaged collaborative category involved

single-gender boy groups, 42 percent were single-gender girl groups and 20 percent were mixed-gender groups.

Table 6.1
Scores of Each Student's Collaborative Behavioural Categories

Groups	JE	SI	GI	TT	SN	SD
Single-Gender Boy Group						
B4	38	30	30	36	36	3
B5	45	33	33	45	36	3
B6	21	27	21	21	24	6
B7	22	27	24	18	24	0
B12	45	39	39	45	39	2
B17	45	39	39	45	39	0
B2	15	6	6	15	19	5
B3	10	6	6	15	18	0
B10	10	9	6	15	18	5
Means of each Collab.Categ.	28	24	23	28	28	2
Percent of TotalMean	38	35	36	39	37	15
Single-Gender Girl Group						
G3	30	30	21	45	42	3
G4	33	33	21	45	36	0
G8	45	36	36	45	36	3
G9	45	36	39	45	32	0
G5	19	21	12	12	28	10
G6	24	21	22	18	16	0
G7	20	21	20	15	28	2
Means of each Collab.Categ.	31	28	24	32	31	3
Percent of TotalMean	42	41	37	44	41	23
Mixed-GenderGroup						
B1	20	24	24	9	25	0
G2	15	21	21	12	20	20
B14	30	39	39	36	40	0
G11	35	39	39	36	40	3
B8	10	3	9	9	10	0
B9	9	18	9	3	6	27
G1	10	3	3	3	3	10
B13	5	3	9	9	6	0
B15	9	9	3	3	9	0
G10	5	3	3	3	6	35
G12	15	18	24	12	15	10
G13	15	18	21	12	15	10
B16	12	9	15	12	12	0
Means of each Collab.Categ.	15	16	17	12	16	8
Percent of TotalMean	20	24	27	17	22	62
TotalMeans of Collab.Categ	74	68	64	72	75	13
Total Percent	100	100	100	100	100	100

To describe patterns of group collaboration around the computer descriptive statistics - means, standard deviations and percentages using SPSS 6.1.1 (SPSS, 1995) were computed for each of the six collaborative categories. The percentage of the total collaboration occurring for each collaborative category was computed to show the relative amount of collaboration in each category (Table 6.2).

Table 6.2

Descriptive Statistics of Collaborative Behavioural Categories for All Students

Collaborative Categories	Mean	S.D.	Percent
Jointly Engaged (JE)	22.6	13.4	19.6
Seek Information (SI)	21.4	12.6	18.6
Give Information (GI)	20.5	12.4	17.8
Turn Taking (TT)	22.0	15.8	19.1
Social Negotiation (SN)	23.6	12.0	20.5
Social Dominance (SD)	5.1	8.5	4.4
Total Collaboration	115.2	74.8	100.0

Results from the descriptive statistics of collaborative behavioural categories for all students (Table 6.2) indicated that students, based on means, made a total of 115 interactions when they were working around a computer three times a week during the eight-week activities. Interactions included both verbal and an action taken around the computer. However, the frequencies of collaboration were not equally distributed among the categories under study. Of the six collaborative categories examined, social negotiation was the interaction occurring most frequently for all students 20.5 percent, next was jointly engaged 19.6 percent, then turn taking 19.1, followed by seek information 18.6 and give information 17.8 percent. The social dominance collaborative behaviour category took place infrequently 4.4 percent compared to the other collaborative categories.

In the categories of seek information and give information, scores were different because students were seeking for information, but sometimes information was not given to them by their partners, for example:

"How did you do this background?" (B1 talk).
"Don't worry about it, just do the poem on the Mountain Gorilla". (G2 talk).

"How do you make the sentences come in from the left? (G1 talk).
"Move." (B9 talk).
"No...don't push, I don't want you to do it. I want you to show me." (G1 talk).
"Well do it yourself." (B9 talk).

A one-way ANOVA was conducted (Table 6.3) to show which collaborative categories may have had significant differences between groups. The level of significance for all analyses was set at .05 in this study.

Table 6.3
ANOVA Results for Collaborative Categories by Group Composition

Var	D.F.	F Ratio	Significance of F
JE	2, 26	5.8	.01
SI	2, 26	2.7	.08
GI	2, 26	1.1	.36
TT	2, 26	6.5	.00
SN	2, 26	5.8	.01
SD	2, 26	1.8	.18

The results of the analyses of variance (Table 6.3) indicated that there was a significant difference between groups in jointly engaged $F(2, 26) = 5.8$, $p = .01$, taking turns $F(2, 26) = 6.5$, $p = .00$ and social negotiation $F(2, 26) = 5.8$, $p = .01$. Other collaborative categories of seek information, give information and social dominance had no significant difference between groups.

Data was further analysed, by using the Scheffé post-hoc comparisons, to compare all groups with all other groups to determine where significant differences existed between single and mixed-gender groups while collaborating around a computer (Table 6.4).

Table 6.4
Groups Significantly Different during Collaboration (Scheffé post hoc tests)

Variable	Groups	Mean	P Value
Jointly Engaged	Single-Gender Boys	27.9	.02
	Mixed-Gender	14.6	
	Single-Gender Girls	30.9	.00
	Mixed-Gender	14.6	
Turn Taking	Single-Gender Boys	28.3	.01
	Mixed-Gender	12.2	
	Single-Gender Girls	32.1	.00
	Mixed-Gender	12.2	
Social Negotiation	Single-Gender Boys	28.1	.02
	Mixed-Gender	16.4	
	Single-Gender Girls	31.1	.01
	Mixed-Gender	16.5	

Results of the Scheffé post hoc tests (Table 6.4) indicated that there was a significant difference between single-gender boys and mixed-gender groups, and single-gender girls and mixed-gender groups with regard to jointly engaged, turn taking and social negotiation.

Single-Gender Girl Groups and Jointly Engaged

The single-gender girl groups showed a higher level of jointly engaged category (X = 31) compared to single-gender boy groups and mixed gender groups. This was 42 percent of 74, which was the total mean of collaborations coded in this category of all groups (see Table 6.1). Results from observations, interviews and tape recordings of single-gender girl groups provided examples of how they were jointly engaged around the computer. For example the audio tapes provided an example of single-gender girl group G8 and G9 were jointly engaged when choosing background templates for their slides:

"Do you like this background?" (G9 talk).
"Let's try 'Whirlpool' before we make up our minds." (G8 talk)
"...this one is not too bad." (G9 talk).

"Yes, but I preferred the one you first showed me." (G8 talk).
"You mean this one 'Fireball', OK." (G9 talk).
"Are you sure, because..." (G8 talk).
"Yes, I also like it." (G9 talk).

G4's interview provided an example of her group jointly engaged together while working on the Internet and developing slides for their class presentation:

"Our main task was to choose endangered species from the Internet. This was a joint effort. [G3] chose and I looked if it was any good. When we finally agreed on our animal, we then planned together and placed it on our slides to present it to the class. " (G4 interview).

The videotape provided another example of a single-gender girl group G5, G6 and G7 jointly engaged together in presenting their PowerPoint slides at the school assembly. They jointly agreed that G6 would start by giving the introduction and talk on the first five slides, G7 would then talk on the last 5 slides and conclude, while G5 would change each slide on the computer.

The above examples showed examples how single-gender girl groups initiated or engaged in collaboration with their partners on assigned tasks around the computer. They generally helped each other by searching the Internet for information on endangered animals. They worked jointly together to develop their slides and present them in class and the assembly. There were times when single-gender girl groups were not jointly engaged around the computer, for example:

"At times we were not working together because G5 and G7 could not get along. Since last year they have always been arguing with each other. Some times when G7 was on the computer, G5 would look away or do something else." (G6 interview).

Single-Gender Boy Groups and Jointly Engaged

Single-gender boy groups, with regard to the behaviour category of jointly engaged together, had the second highest mean (X = 28) compared to single-gender girl groups and mixed gender groups. This was 38 percent of 74, which was the total mean of collaborations coded in this category of all groups (see Table 6.1). Results from observations, interviews and tape recordings of single-gender boy groups indicated that on many occasions they were jointly engaged around the computer. For example the audio tapes provided an example of single-gender boy group B4 and B5 were jointly engaged when deciding what to print on endangered species.

"I don't think we should print all this information." (B5 talk).
"Yes, it's far too much, let's highlight and print what we need." (B4 talk).
"No it does not work that way, just jot down points on a piece of paper." (B5 talk).
"...This is taking ages." (B4 talk).
"Copy and paste on a word document, that will be quick." (B5 talk).

B6's interview indicated that his group jointly engaged together while working on their slides:

"[B7] would give me the information and I would put it in the slides." (B6 interview).

The videotape provided another example of a single-gender boy group B12 and B17 jointly engaged in choosing pictures for their slides from the Internet. They pointed on the screen to pictures they liked. Then they scrolled down and looked at other pictures. Eventually they choose five pictures and saved them on their disk.

The above examples are of single-gender boy groups collaborating with their partners on assigned tasks around the computer. They generally jointly agreed on information to be printed and pictures to be chosen for their slideshow

presentation. There were times when single-gender boy groups were not jointly engaged around the computer, for example:

The audio tape some times provided examples of single-gender boy groups B7 and B6 working separately on two different computers. "There were times when I wanted to try things out myself – new things, which B6 was not interested to do so I went over to a spare computer and worked."

Mixed-Gender Groups and Jointly Engaged

Compared to the other two groups, mixed-gender groups had the lowest mean (X = 15). This was 20 percent of 74, which was the total mean of collaborations coded in this category of all groups (see Table 6.1). According to the audio tapes the mixed-gender groups that had a low mean were often not jointly engaged in their tasks because group members disagreed on different issues for example:

"No don't put that in the slides, put this information." (B9 talk).
"This is important, and should be used." (G1 talk).
"This has nothing to do with our animal." (B9 talk).
"It does, it tells us how many are left in the wild." (G1 talk).
"Delete it...I will if you don't." (B9 talk).

An example from the videotape showed a mixed-gender group with only G13 using the computer. With her right hand she controlled the mouse and pressed the keys, and her left shoulder and hand was used as a barrier so that B16 and G12 could not use the computer.

The interviews indicated that girls in mixed-gender groups were generally prejudiced towards working with boys:

"No, not much [joint activity] because girls don't get along with boys." (G13 interview).

"B16 always wanted to joke around. I would have preferred it if we had another girl instead." (G12 interview).

"Jointly engaged, not much because there were two boys and I was the only girl. I wanted to do girlie things and they wanted boy's stuff. So we did not get along." (G10 interview).

Observations and interviews on the jointly engaged collaborative category generally indicated disunity among mixed-gender groups. There was often conflict and disharmony between boys and girls as they worked around the computer. The other mixed-gender group (B14 and G11) that had a high mean often collaborated and observations and interviews indicated that both B14 and G11 were generally jointly engaged around the computer, for example:

"I will read out our notes and you type." (G11 talk).
"Cool 'cause I don't like reading aloud." (B14 talk).
"That's fine because I can't type fast." (G11 talk).

Conclusion on Jointly Engaged Collaborative Behaviour

The mean scores of jointly engaged collaborative behaviour indicated that during the computer activity single-gender groups were generally jointly engaged around the computer compared to most of the mixed-gender groups. Scheffé post hoc tests indicated that there was a significant difference between single-gender boys and mixed-gender groups, and single-gender girls and mixed-gender groups with regard to jointly engaged collaborative behaviour. According to the interviews and tape recordings, single-gender groups initiated or engaged in collaboration with their partners on assigned tasks more than mixed-gender groups, who were often not jointly engaged in their tasks.

Single-Gender Girl Groups and Turn Taking

The single-gender girl groups showed a higher level of turn taking around the computer ($X = 31$) compared to single-gender boy groups and mixed gender groups. This was 44 percent of 72, which was the total mean of collaborations coded in this category of all groups (see Table 6.1). Results from observations, interviews and tape recordings of single-gender girl groups provided examples of how they generally took turns around the computer. An example from the

audio tapes indicated that single-gender girl group G8 and G9 took turns when working on the Internet to get information on endangered species:

"I've jotted down as much information I could get from this site. Now it's your turn." (G9 talk).
"OK, I'll look up, this one schoolworld.asn.au site, while you sort out your bits of information." (G8 talk).

G3's interview showed how her group took turns while working on the Internet and developing slides for their class presentation:
"We worked very well because we took turns looking for information on the Internet, and then typing our information out. After that we took turns putting the information in our slides." (G3 interview).

The videotape showed an example of a single-gender girl group G4 and G3 taking turns using PowerPoint in class. G4 did the first slide, with G3 watching and helping when required. Then G3 did the next slide, followed by G4 doing the third slide. They continued working this way until they each completed six slides.

Occasionally the audio tape provided examples of single-gender girl groups, who did not taking turns around the computer, for example:

"When am I going to have my turn?" (G7 talk).
"Wait, we are trying out different effects." (G5 talk).
"First it was backgrounds, now its effects." (G7 talk).
"Don't bother [G6], let her go on." (G5 talk).

Single-Gender Boy Groups and Turn Taking

Single-gender boy groups, with regard to the behaviour category of turn taking, had the second highest mean (X = 28) compared to single-gender girl groups and mixed gender groups. This was 39 percent of 72, which was the total mean of collaborations coded in this category of all groups (see Table 6.1). Results from observations, interviews and tape recordings of single-gender boy groups

provided examples of how they generally took turns around the computer. For example the audio tapes provided an example of single-gender boy group B2 and B3 and B10 taking turns using the keyboard:
"That's it I've finished now, whose turn is it?" (B3 talk).
"It's B10's turn on the keyboard." (B2 talk).
"Yes my turn because [B2] had his turn before you." (B10 talk).

B17's interview indicated that his group took turns when choosing endangered animals for their slides:
"We decided to do four different animals for our project. So I chose the two that I liked and [B12] chose the ones he was interested in." (B17 interview).

From the videotape an example showed single-gender boy group B4 and B5 taking turns choosing pictures from the Internet about endangered species. They then took turns saving the pictures onto their slides.

From the interviews and observations of single-gender boy groups, it can be concluded, that in this study single-gender boy groups generally collaborated by taking turns working around the computer. They often took turns while using the keyboard and selecting endangered animals for their PowerPoint presentation. Occasionally single-gender boy groups did not taking turns around the computer, for example:

"There were times when I was getting 'cheesed off' because B6 was on the keyboard for hours looking for pictures on the Internet. I even told him, but he kept saying one sec." (B7 interview).

Mixed-Gender Groups and Turn Taking
Compared to the other two groups, mixed-gender groups had the lowest mean (X = 12). This was 17 percent of 72, which was the total mean of collaborations coded in this category of all groups (see Table 6.1). According to the audio tapes the mixed-gender groups that had a low mean were often not taking turns during their computer activities because generally a group member took over the keyboard for example:

"Here let me do it." (G12 talk).
"No, I have not finished." (B16 talk).
"You're too slow, the work will never be done." (G12 talk).
"Alright then you do it." (B16 talk).

Some members of the mixed-gender groups seldom allowed their partners the opportunity to use the computer, for example:
"Only sometimes I got a chance on the computer. [G2] did most of the work because she said she knew more than I did. I had to learn by watching but would have liked to use the computer." (B1 interview).

The videotape provided an example of a mixed-gender group around a computer where taking turns was rare. If G1 was working on the computer, [B9] would snatch the mouse from her, or attempt to push her off her chair.

Occasionally mixed-gender groups did take turns around the computer, especially mixed-gender group B14 and G11. Observations and interviews generally provided examples that both B14 and G11 collaborated and took turns during their activity:
"Now it's your turn to do the next slide." (B14 talk).

Conclusion on Turn Taking Collaborative Behaviour

The mean scores in the turn taking collaborative behaviour indicated that during the computer activity single-gender groups were generally taking turns around the computer compared to mixed-gender groups. Scheffé post-hoc tests indicated that there was a significant difference in turn taking between single-gender boys and mixed-gender groups, and single-gender girls and mixed-gender groups. According to the interviews and tape recordings single-gender groups took turns mostly getting information on their endangered species and constructing slides. Mixed-gender groups compared to single-gender groups rarely took turns around the computer.

Single-Gender Girl Groups and Social Negotiation

The single-gender girl groups showed a higher level of social negotiation around the computer (X = 31) compared to single-gender boy groups and mixed gender groups. This was 41 percent of 75, which was the total mean of collaborations coded in this category of all groups (see Table 6.1). According to examples from interviews and tape and video recordings single-gender girl groups generally under took mutual negotiations on a social basis. Most members of these groups considered the quality or content of the ideas or proposed solutions; that is resolution followed discussion of the quality of ideas. Most of these resolutions involved a process of negotiation, with resolution through compromise or synthesis of ideas, in contrast to discussion followed by imposition of or acquiescence to one partner's idea.

"Let's make different backgrounds for each slide." (G3 talk).
"I don't think that will look pretty." (G4 talk).
"You mean use only one template from the format menu for all the slides?" (G3 talk).
"Why not make some slides with different backgrounds and some with the same and see which looks better or have both types." (G4 talk).
"...Well what do you think of the different backgrounds?" (G3 talk).
"I think it looks gaudy, too much, far too much colours." (G4 talk).
"Let's view the other slides, the ones with the same backgrounds." (G3 talk).
"...Well what do you think?" (G4 talk).
"You want my opinion, I think you were right. The slides look better with the same background, not so much colour." (G3 talk).
"Yes they are more uniform and pleasing to the eyes..." (G4 talk).

An example from an interview indicated that single-gender girl group G8 and G9 negotiated while working on their slides:
"[G8] did a slide then I redid the same slide. We disagreed, so we talked then decided to combine our ideas, sort of mixed them together." (G9 interview).

The videotape provided another example of how a single-gender girl group G4 and G3 generally negotiated as they worked on their project. G3 wanted her information that she found from the Internet to be used in the slides. G4 also wanted her information included. Both agreed that all the information could not be used because it was too long. In the end they began to negotiate what information to be included and what was to be deleted.

There were times when single-gender girl groups did not negotiate around the computer, for example:
"Let's change this background." (G5 talk).
"Why?" (G6 talk).
"I know why because I did it." (G7 talk).
"No, because it does not look too good." (G5 talk).
"Well I think it's OK and there's nothing wrong with it." (G7 talk).
"[G6] also agrees with me, to change it." (G5 talk).
"She has not said anything, ask her." (G7 talk).
The argument continued until G5 forcibly deleted the slide.

Single-Gender Boy Groups and Social Negotiation

Single-gender boy groups, with regard to the behaviour category of social negotiation, had the second highest mean (X = 28) compared to single-gender girl groups and mixed gender groups. This was 37 percent of 75, which was the total mean of collaborations coded in this category of all groups (see Table 6.1). Results from observations, interviews and tape recordings of single-gender boy groups indicated that these groups often showed a mutual negotiation on a social basis among group members during their computer activities. For example the audio tapes generally provided examples of how single-gender boy group B6 and B7 negotiated while working on their slides:

"Why not put the picture in the middle and wrap the text around." (B6 talk).
"No that may not look good, leave the picture out." (B7 interview).
"What's wrong with the picture?" (B6 talk).
"OK use the picture but not in the middle." (B7 talk).

"Why? Let me show you...see it looks good." (B6 talk).
"It does, but the writing is broken up and that's more important." (B7 talk).
"Well we could put the picture on top." (B6 talk).
"Yes, I think that's better." (B7 talk).

B4's interview indicated that his group negotiated the choosing of an endangered animal for their slides:
"(B5) did not want to choose the whale, but the cheetah as the animal for our project. We discussed it, and I explained to him that two other teams had chosen the cheetah. In the end we negotiated and chose the numbat." (B4 interview).

There were times when single-gender boy groups were not socially negotiating around the computer. For example the audio tape some times provided examples of generally no negotiation between single-gender boy groups.
"...it's stupid, choose another animal." (B10 talk).
"No, I have chosen it and it stays." (B3 talk).

Mixed-Gender Groups and Social Negotiation

Compared to the other two groups, mixed-gender groups had the lowest mean (X = 16). This was 22 percent of 75, which was the total mean of collaborations coded in this category of all groups (see Table 6.1). According to examples from interviews and tape recordings mixed-gender groups compared to the other groups exhibited more social dominance of individuals than social negotiation. They would generally impose one person's solution with the partner acquiescing. They were generally more engaged in verbal or physical conflict with partners. Instead of social negotiation, there were often conflicts concerning negotiation of turn taking, control of the keyboard, or other conflicts of a social nature such as those reflected in name calling or hitting:

"There was no such thing [social negotiation] in our group. Because [G12] would always give reasons why she should do it or it should be done this way, and [G13] would run out of reasons why not and give in." (B16 interview).

"We tried to compromise with the keyboard but it did not work because [G12] always wanted to type. "She would 'hog' the computer and not allow us to use the keyboard." (G13 interview).

"There was no negotiation but fighting over who goes next. [B9] would push us out of our chairs so he could control the keyboard and mouse." (G1 interview).
"There was pushing and shoving. We tried to get [B9] off the computer, but he would not budge." (B8 interview).
"Although they disagreed with what I did, I always got my way. I called them stupid when they tried to interfere with the slides." (G10 interview).

When social negotiations failed during group work around the computer, partners sometimes left the group and engaged in off-task activity:

"When they did not want to do what I suggested, I left and played games on the other computer." (B9 interview).
"[G10] never wanted to listen to my ideas. I told her not to fill the slides with pictures and patterns but she just continued. So I left the group, sat at my desk and read a book instead." (B15 interview).
"The animal that I wanted was not chosen, and also I tried to do things on the slides, but she would not allow me. She would always do her own thing on the computer. I gave up and joined B9 for a while, who was playing games on the computer." (B3 interview).

There were also conflicts including conflict or disagreement concerning task conceptualisation or solution:

"Both the boys did not want some of the things I put on the slides. But, I believed that they were all relevant to our project. They deleted it. I put it back and had my way." (G10 interview).
"Sometimes the slides were not that good. They were not appropriate to the theme. I then put the right sound, colours and graphics. [G10] would say no and always change what ever I had done." (B15 interview).

Conclusion on Social Negotiation

The results of the analyses of variance showed that there was a significant difference in scores in the social negotiation collaborative behaviour between the groups. Single-gender girl groups had the highest mean score, and according to the interviews and tape recordings single-gender girl groups often under took mutual negotiations on a social basis. Members of these groups considered the quality or content of the ideas or proposed solutions; that is resolution followed discussion of the quality of ideas. Most of these resolutions involved a process of negotiation, with resolution through compromise or synthesis of ideas. The single-gender boy group had the second highest mean in social negotiation collaborative category. Observations and interviews that were conducted with these groups generally provided examples of a mutual negotiation on a social basis among members of this group, during their computer activities. Mixed-gender groups' mean was the lowest in the social negotiation collaborative behaviour category. Examples provided from interviews and tape recordings showed that mixed-gender groups compared to the other groups exhibited more social dominance than social negotiation. They would impose one's solution and/or partner acquiesces. They were more engaged in verbal or physical conflict with their partner. Instead of social negotiation, there were conflicts concerning negotiation of turn taking, control of the keyboard, or other conflicts of a social nature. There were also cognitive conflicts including conflict or disagreement concerning task conceptualisation or solution.

Conclusion on Collaborative Behaviours

The results of the analyses of variance showed that there was a significant difference between single-gender groups and mixed-gender groups in collaborative behaviours of jointly engaged, turn taking and social negotiation. Scheffé post hoc tests indicated a significant difference between single-gender boys and mixed-gender groups, and single-gender girls and mixed-gender groups in these collaborative behaviours.

The observations and data reported here have established in quantitative and qualitative terms that single-gender groups initiated or engaged in collaboration

with their partners on assigned tasks more than mixed-gender groups. They generally co-operated with each other by jointly engaging in their computer activities, and took turns around the computer. According to the interviews and tape recordings single-gender groups often undertook mutual negotiations on a social basis. Members of these groups tended to consider the quality or content of the ideas or proposed solutions; resolution followed discussion of the quality of ideas.

Mixed-gender groups were generally not jointly engaged in their tasks because group members often disagreed on different issues and there was much conflict and disharmony between the boys and girls. According to the interviews and tape recordings, mixed-gender groups rarely took turns at the computer. Instead, they fought to get control of the mouse. Mixed-gender groups exhibited more social dominance than social negotiation. They would impose one's solution and/or partner acquiesces. They were more engaged in verbal or physical conflict with partner. Instead of social negotiation, there were conflicts concerning negotiation of turn taking, control of the keyboard, or other conflicts of a social nature.

Chapter Seven

Results on Motivational Behaviours

Introduction

This chapter provides the results of analysis of children's motivational behaviours while they worked in mixed and single-gender groups around the computer. Quantitative and qualitative data were gathered as children worked in mixed and single-gender groups and this chapter also answers Research Question 3: How did the technology based learning environment impact on children's motivational behaviours while they worked in mixed and single-gender groups? The researcher examined the occurrence of motivational interaction processes, which were the effects of pleasure, persistence, positive-self statements, negative self-statements, encouragement and failure/difficulty. Behaviours indicating motivational behaviours were recorded. Evidence related to children's motivational behaviours was derived from analysis of interview responses, the videotapes of students working in groups and audio tapes of student talk.

Results on Motivational Behaviours

The results obtained from each student's motivational behaviours scores from field notes, videotape transcriptions, audio recordings (examples shown in Tables 4.10, 4.11, 4.12) and interviews were totalled and recorded in Table 7.1, which was adapted from Nastasi and Clements (1993) table of Descriptions of Motivational and Collaborative Behaviours. The means of each of the six motivational categories were also recorded according to each of the three groups, single-gender boys, single-gender girls and mixed-gender groups. Lastly, the percentage of the total interaction occurring for each motivational category was computed to show the relative amount of motivation in each category. For example in the pleasure motivational category the students based just on the means, made a total means of 87 interactions in this category. About 36 percent of the total means of pleasure motivational category involved

single-gender boy groups, 34 percent were single-gender girl groups and 30 percent were mixed-gender groups.

Table 7.1
Scores of Each Student's Motivational Behavioural Categories

Groups	PL	PR	PS	NS	ER	FD
Single-Gender Boys						
B4	32	30	30	14	10	10
B5	32	28	32	10	8	8
B6	32	23	28	14	10	12
B7	32	24	28	10	10	13
B12	36	32	32	10	8	8
B17	36	30	32	10	9	9
B2	28	24	20	14	10	12
B3	24	22	24	14	10	12
B10	28	22	22	14	10	14
Means of each Motiv.Categ.	31	26	28	12	9	11
Percent of TotalMean	36	36	37	26	26	29
Single-Gender Girls						
G3	32	26	28	10	10	12
G4	32	24	26	18	10	14
G8	32	30	32	18	10	12
G9	32	25	28	14	10	14
G5	28	22	24	18	11	20
G6	28	20	22	18	11	16
G7	28	20	20	18	11	18
Means of eachMotiv.Categ.	30	24	26	16	10	15
Percent of TotalMean	34	33	34	34	28	39
Mixed-Gender Group						
B1	25	20	20	26	20	25
G2	35	28	32	18	10	8
B14	30	22	25	18	16	8
G11	32	24	28	10	10	12
B8	25	24	22	22	15	8
B9	25	20	20	22	26	12
G1	25	20	18	22	20	16
B13	10	4	4	20	26	8
B15	24	14	18	18	20	8
G10	25	26	20	22	10	20
G12	28	28	30	18	10	8
G13	32	30	32	18	10	8
B16	27	23	20	20	10	16
Means of eachMotiv.Categ.	26	22	22	19	16	12
Percent ofTotalMean	30	31	29	40	46	32
Total Means of Motiv.Categ.	87	68	76	47	35	38
Total Percent	100	100	100	100	100	100

To describe the patterns of group motivation around the computer descriptive statistics - means, standard deviations and percentages, using SPSS 6.1.1 (SPSS, 1995) were computed for each of the six motivation behaviour categories. The percentage of the total motivation occurring for each motivation category was computed to show the relative amount of motivation in each category (Table 7.2).

Table 7.2
Descriptive Statistics of Motivational Behavioural Categories for All Students

Motivational Categories	Mean	S.D.	Percent
Pleasure (PL)	28.8	5.1	24.4
Persistence (PR)	23.6	5.5	20.1
Positive Self-Statement (PS)	24.7	6.3	20.9
Negative Self-Statement (NS)	16.0	4.9	13.6
Encouragement Required (ER)	12.5	5.0	10.5
Failure/Difficulty (FD)	12.5	4.4	10.5
Total Motivation	118.1	31.2	100.0

Results from the descriptive statistics of motivation behavioural categories for all students (Table 7.2) indicated that students, based on means, made a total of 118 interactions when they were working around a computer. However, the frequencies of motivation were not equally distributed among the categories under study. Of the six motivation categories examined, pleasure was the interaction occurring most frequently for all students 24.4 percent, next was positive self-statement 20.9 percent, then persistence 20.1, followed by negative self statement 13.6. Encouragement required and failure/difficulty motivation behaviour categories took place infrequently, both 10.5 percent each, compared to the other motivational categories.

Some of the examples in the category of pleasure were recorded when students were able to solve answers from their worksheets or work out how to add sounds to their slides:

"I hit Jackpot, the animal's scientific name, at last." (B12 talk).

"Yes! Yes! Sounds, now we have sounds in our slides." (B5 talk).

Some of the examples in the category of persistence were recorded while students were trying to solve the problem of including links into their contents slide or record animal sounds from the Internet onto their slides:

"No it didn't work because you clicked on custom animation, OK go to effects...no nothing on linking." (B6 talk).
"I know effects are for animation, only animation...what about timing because timing will have to do with linking, timing...wrong, now why? Why?" (B7 talk).
"Because timing maybe timing, how much time, time it takes...let me have a go from the beginning...first point..." (B6 talk).
"...See even play settings doesn't work...I know, why don't you try highlighting the points." (B7 talk).
"Yes I did...I'll show you, let's go back to the first slide...see." (B6 talk).
"...No not custom animation again...see it has play settings only left, that's, that's animation...here let's have the mouse...chart effects does not do." (B7 talk).
"Go to something else instead of custom animation then...what's action settings? There, there hyperlink..." (B6 talk).

"No it did not save on our slides." (G9 talk).
"Let's give it another go...didn't do." (G8 talk).
"Why not first save it on our disk and then we save it on our slides, that will work...no, it says I don't have enough space." (G9 talk).
"Desktop, put it on the desktop...OK, OK." (G8 talk).
"So we've got sound on the desktop, now what...just drag like that...no...drag...it's not working...how? You have a go." (G9 talk).
"...How do we put sounds on the slide, you know the easy way." (G8 talk).
"Was it format...no slideshow...record, record narration..." (G9 talk).

"No, nothing here, it's not a narration...not doing." (G8 talk).
"Try animation...not pre set..." (G9 talk).
"Custom? Custom?...Timing no...effects, there sound." (G8 talk).
"It says no sound..." (G9 talk).
"There, play settings...while playing? No, stop playing?" (G8 talk).
"You can't choose any, no it does not give you a choice...try another menu, from on top." (G9 talk).
"No it has to be slideshow, I'll try again...and custom animation...then effects...see we are clicking on sound and it does nothing...nothing works see...oh! No effects arrow works. But sound doesn't." (G8 talk).
"First choose an effect, then sound works..." (G9 talk).
"OK, fly from left...Yes! We can choose sound..." (G8 talk).
"No not these. These are other sounds, sounds already done...we want the sound from the desktop." (G9 talk).
"Well, we tried. Use one of these sounds?...they are so silly...you said before to try from the top. Where? You want to have a go? I'll watch." (G8 talk).
"It's not font or table menu...could be tools...customise...no nothing here." (G9 talk).
"Insert, click on insert...that should work...no, no...there movies and sound." (G8 talk).
"Sound from gallery...no sound from file..." (G9 talk).
"We've got it...desktop, desktop...that's the one...double click...no double click." (G8 talk).

A one-way ANOVA was conducted (Table 7.3) to show in which motivation categories there may have been significant differences.

Table 7.3

ANOVA Results for Motivational Categories by Group Composition

Var	D.F.	F Ratio	Significance of F
PL	2, 26	3.1	.06
PR	2, 26	1.7	.20
PS	2, 26	2.2	.13
NS	2, 26	11.0	.00
ER	2, 26	6.6	.01
FD	2, 26	2.1	.15

The results of the analyses of variance (Table 7.3) indicated that there was a significant difference between groups in negative self-statements $F(2, 26) = 11.0$, $p = .00$, and encouragement required $F(2, 26) = 6.6$, $p = .01$. Other motivation behaviours pleasure, persistence, positive self-statements and failure/difficulty had no significant difference between groups, although pleasure (PL) was close.

Data was further analysed, by using the Scheffé post-hoc comparisons, to compare all groups with all other groups to determine where significant differences existed between single and mixed-gender groups with regard to negative self-statements and encouragement required around a computer (Table 7.4).

Table 7.4

Groups Significantly Different during Motivation (Scheffé post hoc tests)

Variable	Groups	Mean	P Value
Negative Self-Statements	Single-Gender Boys	12.2	.00
	Mixed-Gender	19.5	
	Single-Gender Girls	14.4	.02
	Mixed-Gender	19.5	
Encouragement	Single-Gender Boys	9.4	.01
	Mixed-Gender	15.6	
	Single-Gender Girls	10.4	.04
	Mixed-Gender	15.6	

Results of the Scheffé post hoc tests (Table 7.4) indicated that there was a significant difference between single-gender boys and mixed-gender groups, and single-gender girls and mixed-gender groups with regard to both negative statements and encouragement.

Mixed-Gender Groups and Negative Self-Statements

Mixed-gender groups showed a higher level of negative statements (X = 19) compared to single-gender boy groups and single-gender girl groups. This was 40 percent of 47, which was the total means of motivational behaviours coded in this category of all groups (see Table 7.1). Examples of Tape recordings and interviews that were conducted with mixed-gender groups showed that the students made negative self-statements mostly about self or work around the computer. Their negative statements referred to comments about task performance:

"What's going wrong, nothing seems to be working?" (G11 talk).
"That's it, I don't want to work anymore because we will never get this done." (B14 talk).

"Why did you quit from 'explorer'?" (B16 talk).
"I can't get anything from the Internet. No point of carrying on I can't find anything." (G12 talk).

"There were times when I wanted to give up because I thought I had lost all our work...I just could not find it anywhere on the computer." (B1 interview).

The students' negative statements also referred to evaluative comments about cognitive competence:

"This is never going to work out because I don't know anything about Power Point." (G1 talk).

"When things did not work out as they should on the computer, I thought how dumb I was." (B1 interview).

"I just can't seem to get these pictures. Here you better have a go, because I am not good at computers." (G10 talk).

Observations and interviews about mixed-gender groups' negative statements indicated that students were frustrated and were not achieving their goals as they worked around the computer. Occasionally mixed-gender groups made positive statements around the computer, for example:

"We've done it! Beautiful." (B14 talk)
"Yes this background we have done looks much better than the templates we were shown." (G11 talk).

Conclusion of Mixed Gender Groups and Negative Self-Statements
In the negative self-statement category, there was a significant difference between mixed-gender groups and single-gender boy and single-gender girl groups (Table 7.4). Students in mixed-gender groups quite often made negative self-statements about self or work around the computer. Their negative statements referred to comments about task performance and evaluative comments about cognitive competence. Out of the six motivational categories examined negative self-statements occurred less frequently than the motivational categories of pleasure, positive self-statements and persistence, and more frequently than the motivational categories of encouragement required and failure/difficulty.

Single-Gender Groups and Negative Self-Statements
Single-gender boy groups showed the lowest level of negative self-statements (X = 12) compared to single-gender girl groups and mixed gender groups. This was 26 percent of 47, which was the total means of motivations coded in this category of all groups (see Table 7.1). The single-gender girl group had the second lowest level of negative self-statements (X = 16) compared to single-gender boy groups and mixed gender groups. This was 34 percent of 47, which was the total means of motivational behaviours coded in this category of all groups (see Table 7.1). According to examples of interviews and tape recordings, single-gender groups generally made more positive than negative self-

statements about self or work around the computer. Their evaluation of work statements referred often to positive than negative comments about task performance:

"Wow these slides we have done are incredible. We will get the most points for our work and be chosen to present it at the assembly." (B12 talk).

"Yes! These pictures we got are good and it has made our slides look very attractive." (B4 interview).

"This plan worked well. It's amazing that we got so far." (G3 talk).

"We worked very well and did all our work. I would say, "Yes that's great", when what we did worked." (G8 interview).

The students' positive statements also referred to evaluative comments about cognitive competence:

"Our group was smart, that is why we worked very well, did all our work and were in front of schedule. We were ahead of all the others in the class." (B17 interview).

"I'm crash hot at computers. I was able to move the slides around and place them in the right order." (B5 interview).

"These slides are perfect and we have achieved a lot. Our backgrounds and pictures are cool." (G5 talk).

"We made a wonderful report, a very nice background and good pictures for our slides." (G7 interview).

Occasionally single-gender groups made self-negative statements around the computer, for example:

"It's no use, we cannot do our work. This computer keeps crashing." (G5 talk).

"I don't think we can do a presentation. Nothing works, I can't get PowerPoint started." (G7 talk).

Conclusion on Negative Statements

The mean scores of negative statements indicated that during the computer activity mixed-gender groups generally made more negative statements about self or work around the computer than single-gender groups. Their negative statements often referred to comments about task performance and evaluative comments about cognitive competence.

Mixed-Gender Groups and Encouragement

Mixed-gender groups showed a higher level of requiring encouragement (X = 16) compared to single-gender boy groups and single-gender girl groups. This was 46 percent of 35, which was the total means of motivational behaviours coded in this category of all groups (see Table 7.1). Examples of Tape recordings and interviews that were conducted with mixed-gender groups showed that the students generally sought approval or feedback from the teacher, for example:

"Do we need more information before we start on the slides?" (G10 talk).
"That's great, you have enough information...yes, now you can get on with your slides." (Teacher talk).

"When we did a slide we would put our hands up and call the teacher to find out if our slide was alright." (G13 interview).

The teacher sometimes recognised that students were experiencing difficulty and went to encourage them:

"What is the problem?" (Teacher talk).
"There's nothing on the Internet, so we decided to quit." (B16 talk).
"Well let's see, have you tried all four Internet sites that were given to you in class?" (Teacher talk).

"Yes we have, but we could not find anything on endangered species." (G13 talk).
"Alright, now [G12] you type out the first Internet site that was given and I will watch..." (Teacher talk).

"What's wrong?" (Teacher talk).
"We give up, we can't put good pictures in our slides." (B8 talk)
"It's no use the computer is dumb, it keeps saying no memory." (G1 talk).
"Let me have a look...It's your disk, there is no more space in your disk. Try and delete some of the slides from your disk and then you can save your pictures." (Teacher talk).

Occasionally mixed-gender groups required no approval or feedback from the teacher, for example:
"We got help from each other. Invariably if I did not know the answer, B14 would solve it, or if he didn't know things then I would solve it...Often, if we were stuck we worked it out together." (G11 talk).

Single-Gender Groups and Encouragement

Single-gender boy groups showed the lowest level of requiring encouragement (X = 9) compared to single-gender girl groups and mixed gender groups. This was 26 percent of 35, which was the total means of motivations coded in this category of all groups (see Table 7.1). The single-gender girl group had the second lowest level of negative self-statements (X = 10) compared to single-gender boy groups and mixed gender groups. This was 28 percent of 35, which was the total number of motivational behaviours coded in this category of all groups (see Table 7.1). According to examples of interviews and tape recordings, single-gender groups generally did not need as much encouragement as other groups while working around the computer. They continued to work on a task after difficulty or failure without teacher coaxing or encouragement, for example:

"I thing we have lost our slides. That means we have to do the whole thing again or should I call the teacher." (B4 talk).

"No, wait, it must be somewhere in the computer. Let's see...give me the mouse." (B5 talk).
"Search the hard drive, hard drive..." (B4 talk).
"No, let me have a go I'll try opening some other files..." (B5 talk).
"No, I think the computer has deleted our work." (B4 talk).
"Wait let's try 'find'." (B5 talk).
"Er go to edit and then there, there is find...type Slide2B1." (B4 talk).
"Yes! Got it! It's in document." (B5 talk).

"After we finished the first slide, we had problems to do the next one. We just could not get a new slide. We tried different things but nothing seemed to work. [G4] said that we should have another go before calling the teacher. We then began going through all the icons on the menu bar. We then found the icon 'new slide' and that did it." (G3 interview).

The single-gender groups did not require as much encouragement because they attempted to correct mistakes and restart with an alternative plan:

"A background came up on our slides and we could not stop it. It would always appear when we wanted a different background. In the end after trying to correct the problem in different ways, [G8] saved another one and we used it." (G9 interview).

"What's wrong with our slides?" [B6 talk].
"I don't know the letters seem to be going on the pictures and nothing is clear." [B7 talk].
"Well just delete this one and we will redo it." (B6 talk).
"...It's happened again. Do you think it is a computer problem?" (B7 talk).
"No it could be the colours. Try another background...No let's change the colour of the lettering...No take the sound out." (B6 talk).
"Let's try from the beginning again...No it's still doing it." (B7 talk).
"It keeps happening when we import a picture...see." (B6 talk).
"Well we won't put a picture..." (B7 talk).

"Wait it could be out of memory. Yes, that's it, increase PowerPoint's memory and it should be fine...see." (B6 talk).

"We were late in starting compared to others because we could not get an Internet site. We were going to call the teacher, but decided to give it another go. We then tried and tried again. At last we discovered we were leaving out a letter or a sign." (B10 interview).

Occasionally single-gender groups needed encouragement around the computer, for example:
"There were times when we needed encouragement from the teacher to continue with our work, especially in the beginning when we could not get information from the Internet." (G6 talk).
"Yes we were encouraged by our teacher to start over again, when we lost all our work." (B7 talk).

Conclusion on Motivational Behaviours

The results of the analyses of variance showed that there was a significant difference between single-gender groups and mixed-gender groups in motivational behaviours of negative statements and encouragement. Scheffé post hoc tests indicated a significant difference between single-gender boys and mixed-gender groups, and single-gender girls and mixed-gender groups in these motivational behaviours.

In both these two categories, the mean scores indicated that during the computer activity single-gender boys and girls had lower mean scores compared to mixed-gender groups who had higher mean scores. Mixed-gender groups made more negative statements about self or work around the computer than single-gender groups. Their negative statements referred to comments about task performance and evaluative comments about cognitive competence. Mixed-gender groups also needed encouragement from the teacher by seeking approval or feedback. Single-gender groups did not need much encouragement while working around the computer. Although

experiencing difficulty or failure, they continued to work on a task with little teacher coaxing or encouragement.

Chapter Eight

Answering the Research Questions and Discussion

Introduction

This chapter provides an overview of the research conducted and the findings. The study was conducted in a mixed methods fashion, which allowed the specific problem of whether technology-based lessons motivated and helped students of different gender collaborate. The various forms of data that were obtained allowed multiple perspectives on the issues, as well as giving a holistic overview and increasing the validity.

This chapter also provides a discussion on patterns of peer interaction, children's collaborative and motivational behaviours and five motivational learner effects: immersion; scaffolding and coaching; reflection; learner control; and challenge. In this chapter, the results obtained from this study are discussed through comparison with relevant findings on peer interaction, collaborative and motivational behaviours and learner effects in similar settings.

Overview of the Study

Computers have the potential to facilitate and motivate co-operative learning activities (Perzylo & Oliver, 1992), because the medium can provide a context for student conversations as they negotiate meaning and construct their knowledge about a given topic (Adams, 1996). By introducing computers for instructional uses, research leaves open the possibility that during computer-based small group work female and male students may experience interaction patterns that are different from those found in non-computer settings. A number of studies have examined the specific patterns of peer interaction among students, and have suggested that individual and group characteristics are important factors that influence how students interact verbally with each

other during small group learning. Of particular interest in this study was gender of the student and gender composition of the group.

The literature review in this study showed a strong and consistent research finding that children's social interactions increased as they co-operated in certain computer environments. A study from the literature review (Lee, 1993, p. 550), conducted on the social impact of the use of the computer, showed that students tended to interact a great deal and did so in a collaborative way when they were working with the computer than when they were using other classroom resources. In discussing computer usage, McLoughlin and Oliver (1998) emphasised that learning around computers is a social activity where learners share resources, talk, discuss ideas and collaborate. McLoughlin and Oliver (1998) further the argument by stating that:

> The quality of learning around computers is not entirely dependent upon the interface between learners and the technology. Instead, it is related to the whole social climate of the classroom and the opportunities created for interaction and 'exploratory talk' between participants in the learning process. (p. 134)

According to Hodgson and McConnell (1995, p. 212) students interacted with each other by helping each other to clarify ideas and concepts through discussion. This developed critical thinking and provided opportunities for learners to share information and ideas. Communication skills were developed which provided the opportunity for learners to take control of their own learning in a social context and provided validation of individual's ideas and ways of thinking through conversation, presentation of multiple perspectives and argument (McConnell, 1994).

Research has consistently shown that collaborative problem solving within learning environments can enhance motivation for learning and children's self-concepts as learners (Nastasi & Clements, 1993, p. 21). Thus, an environment that is likely to strengthen motivation and perceived competence is likely to be one that fosters collaboration, social feedback about the quality of performance, comparison of one's own abilities with those of peers, and/or modelling of motivational orientation and sense of competence. Furthermore,

co-operative problem-solving environments that encourage cognitive conflict and its resolution may provide optimal contexts for enhancing motivation and perceived competence.

There were three research questions, and a summary of the results relating to these three questions is set out below:

Findings of the Study

Research Question 1

What patterns of peer interaction take place when children work in mixed and single-gender groups within a computer-based learning environment?

The observations and data reported here have established in quantitative (Table 5.1 and Table 5.2) and qualitative terms (Table 4.10, category: solving problems, Table 4.11 category: receives help and Appendix 31, peer interaction) that mixed and single-gender groups tend to interact frequently overall within their groups. The results concerning the patterns of peer interaction indicated that the students' interactions were primarily positive task-related interactions (Appendix 31, category: gives task related help). The study has provided evidence that the children were generally involved in the frequent exchange of, and elaboration on, task-related information, explanations and suggestions (Chapter 5 pages 71 to 73, and 75, Table 4.10 and 11).

The results of the ANOVA (Table 5.3, variable GH, RH, PEI and OT) showed that there was no significant difference between mixed and single-gender groups with regard to the interaction categories of giving and receiving help, positive emotional interactions and off-task behaviour. There was only a significant difference in the interaction category of solving problems together (Table 5.3, variable SP). During problem solving, boys in mixed-gender groups generally did not seem to collaborate because in these groups boys were often socially dominant (Chapter 5 pages 69), and if they were unsuccessful they left their groups and joined other single-gender boy groups (Chapter 5 page 74). Dalton (1990) reported that same-gender pairs around a computer performed

significantly more efficiently in their work than mixed-gender pairs. It can be concluded, that in mixed-gender groups the female and male students had considerably different experiences in regard to specific categories of interaction. Hence, gender of the student and gender composition of the group tend to exert differential effects on the interaction that students have with each other while working together in small groups around the computer.

According to this research, girls were on-task more than boys, and solved problems together more than boys (Chapter 5 page 71). In one of the mixed-gender groups a girl dominated the group because she had extensive computer skills (Chapter 5 page 74). This suggests that in this group gender was not an issue, but skills were more important than gender. The findings suggested that the nature of the computer task coupled with co-operative small group learning generally provided a peer-interactive, collaborative, and task-oriented learning environment for the single-gender groups (Chapter 5 pages 71 to 73; Appendix 31 categories: gives task related help & solving problem).

Research Question 2

How did the technology based learning environment impact on children's collaborative behaviours while they worked in single and mixed-gender groups?

The results of the one-way ANOVA (Table 6.3) indicated that there was a significant difference between single and mixed-gender groups with regard to the different collaborative behavioural categories. According to observations, interviews and tape recordings, the examples showed that generally mixed-gender groups were not jointly engaged in their work, did not take turns around the computer, and had little social negotiation compared to single-gender groups (Chapter 6 pages 80, 84 and 85). Whereas, single-gender groups often worked together to solve problems by jointly engaging in their task. They often helped clarify each other's ideas and concepts through discussion, and provided opportunities for group members to share information and ideas (Chapter 6 pages 81 to 83).

The only single-gender group that generally had negative collaborative behaviours was the group with three boys (Table 4.12, peer interaction). In this study, members of the three-boy group felt that it took longer to get a chance at the computer, and therefore individual students felt that they had less time at the keyboard. The frustrating experience of being at the computer and getting only a short turn at the keyboard appears to have been a powerful influence on the thinking of this all boy group. This appeared to lessen motivation of members of this team, and sometimes resulted in off-task behaviours (Appendix 31, category: off task).

The findings in this study indicated that generally mixed-gender groups displayed negative collaborative behaviours (Chapter 6 pages 80, 84 and 85). Group members did not often provide support and encouragement working on their tasks (Chapter 6 page 80). Generally one person dominated inter-group communication (Appendix 31 category: social dominance 1). This one person believed that only his or her ideas were good and other members' ideas were often rejected (Chapter 6 pages 84). This sometimes caused children to withdraw from their groups or to engage in disruptive behaviour (Appendix 31 category: social dominance 3).

The investigation found fewer gender differences than were found in previous studies probably because girls were as capable or at times out performed the boys in computer skill performance (Appendix 31 category: social dominance 2 and 4). The problems that arose in one of the mixed-gender groups related to ability than gender. The girl took over a leadership role in her computer group because of her high level of knowledge about computers (Appendix 31 category: social dominance 2). She had high general ability and prior knowledge with regard to the use of computers.

All single-gender girls working in pairs had the most positive collaborative behaviours compared to the other two groups (Chapter 6 pages 81 and 82). Single-gender girl pairs generally shared their skills and worked together

around the computer (Table 4.11, peer interaction). They had the highest means for most of the collaborative categories (Table 6.1) and the lowest mean for social conflict (Table 6.1) which showed that there were few problems for turn taking (Appendix 31, category: turn taking), control of keyboard and other conflicts of a social nature in these groups (Appendix 31, category: social negotiation).

The educational reasons for asking children to work as a part of a group, or a pair, were based on the idea that discussion is a way of coming to understand what is being done, by questioning, explaining, describing and listening. This study has demonstrated that the computer station is one place where this occurs. But, this study concludes that gender and ability influenced effects of computer-based collaborative learning.

Research Question 3

How did the technology based learning environment impact on children's motivational behaviours while they worked in mixed and single-gender groups?

The results of the one-way ANOVA (Table 7.3) indicated that there was a significant difference between single and mixed-gender groups with regard to negative statements and encouragement behavioural categories. According to examples from observations, interviews and tape recordings two mixed-gender groups often made negative statements around the computer (Table 4.11), and required coaxing or encouragement from the teacher (Table 4.10). The main reason for this was that one person always tried to dominate the group (Appendix 31 category: social dominance).

Findings from examples in this study indicated that all students were generally engaged and on task around the computer (Chapter 7 pages 97 to 99, 105 and 106), hence it can be inferred that they were motivated by their computer-based lessons. Examples from interviews generally indicated that the students were not bored with the computer-based task (Appendix 31 category: pleasure 2), and

it gave them satisfaction and confidence. The computer task was not too difficult, so they experienced feelings of achievement and success, which are related to confidence and satisfaction (Appendix 31 category: positive self-statements).

The students were generally noted to correctly solve problems such as demonstrating competence at the activity, which in turn produced feelings of satisfaction thereby promoting intrinsic motivation (Chapter 5 page 70 to 73 and Chapter 7 pages 97 and 98). Often the students were motivated possibly because the lessons held their attention and were relevant. The lessons generally aroused their interest and gave direction and purpose towards their goal (Appendix 31 category: pleasure 5). The children often expressed pleasure as they transferred graphics from the Internet into their slides, or used animation in their slide presentation (Appendix 31 category: pleasure 3 and 4).

This study found that the majority of single-gender groups were motivated around the computer (Chapter 7 pages 98 and 99), and mixed-gender groups made more negative statements about self or work around the computer (Chapter 7 page 101). Mixed-gender groups also needed encouragement from the teacher usually by approval or feedback (Chapter 7 page 104). Single-gender groups did not need much encouragement while working around the computer (Chapter 7 pages 105 and 106).

Discussion on Patterns of Peer Interaction

The results concerning the patterns of peer interaction (Table 5.1) indicated that generally students in single-gender groups were actively involved in the interaction processes, and that their interactions were often primarily positive task-related interactions. For example most of the times: they gave and received help; they had positive emotional interactions and were on task; and both single-gender groups solved problems together. These findings are consistent with those of Fisher (1992); Howe, Tolmie, Anderson & Mackenzie (1992); Whitelock et al. (1993); Azmitia & Montgomery (1993) and Wegerif

(1996) who claimed that peer interaction and exploratory talk supports learning and collaborative work.

The results of this study indicate that students in single-gender groups tend to interact quite frequently overall with their group members and, furthermore, their interactions were primarily task-related, collaborative and positive, support the findings from previous studies of Light (1993); Nicholson, Gelpi, Young, & Sulzby, (1998); and Lee (1993). In general, the findings of the present study corroborate current knowledge of peer interaction among students working in small groups within a computer-based learning environment from readings of Simsek & Tsai (1992); Nastasi & Clements (1992, 1993); Pritchard (1993).

Giving task-related help had the highest mean frequency compared to the other interaction categories (Table 5.1). This implies that generally students were not only attentive to the shared group activity of the computer task but also engaged in the problem-solving processes related to the substantive content of the task. For instance during this study, children were often involved in the exchange of, and elaboration on, task-related information, explanations and suggestions. Examples of children helping each other to understand how to solve problems of lost work, not enough memory on the disk and importing pictures form the Internet into their slides were some of the incidences obtained from interviews and tape recordings. These findings are consistent with those of Light (1991, 1993), who explained that peer interaction seemed to facilitate problem solving and promote understanding.

Generally the students also participated in verbal collaboration with the focus on help seeking and help giving for solving a set of problems. They asked questions and received help from their group members at most times. During the problem-solving processes, the students more often made positive rather than negative socio-emotional interactions. These results may be accounted for by the nature of the study sample, the characteristics of co-operative small group learning, and the computer as the instructional medium itself. The

computer activity facilitated talk by encouraging students to deliberate about what information to extract and include in their project from the Internet, and discuss how they should present this information on slides.

Thus, the present results corroborate and lend further support to the view that computer-based small group learning provides a social, interactive environment which promotes task-oriented peer interaction as well as co-operative interdependence among students in the learning process (Tomlinson & Henderson, 1995; Blaye, Light, Joiner & Sheldon).

Studies (McConnell, 1994; Hodgson & McConnell, 1995; Keeler & Anson, 1995) have pointed out the importance of peer interaction in the learning process and have suggested that the influences resulting from peer interaction have powerful effects on intellectual and social development of students. At the same time, these findings negate the concern that the influx of computers into the classroom will result in less interaction of students with their peers and increase the isolation and alienation of students (Au and Bruce, 1990; King & Alloway, 1992; Crook, 1992).

There was no significant difference between single and mixed-gender groups with regard to: giving and receiving help from each other; positive emotional interaction; and off-task interaction. Examples from observations and interviews in this study indicated that two mixed-gender groups generally had no problems with helping each other and were on-task. The reason given by these mixed-gender groups was that the lessons were interesting, so they wanted to complete their task. These results are inconsistent with the findings of those found in previous research. For example Underwood, McCaffrey and Underwood (1990) found that children of the same gender while working in pairs collaborated more in their work compared to children working in mixed-gender pairs. Dalton (1990) reported that same-gender pairs performed significantly more efficiently around the computer than mixed-gender pairs.

There was a significant difference between mixed-gender groups and single-gender groups with regard to solving problems together. Mixed-gender groups had the lowest mean in this interaction category indicating that they generally had difficulty in solving problems together. Examples from observations and interviews also indicated that often during problem solving, boys in mixed-gender groups sometimes tried to be dominant and if they were unsuccessful they left their group and joined other boys.

These findings, in general, corroborate and extend current knowledge of peer interaction among students working in small groups around a computer. According to the literature review, children in single-gender groups collaborated, but those in mixed-gender pairs did not seem to collaborate as often because in these pairs boys were often socially dominant, causing females to be at a disadvantage in learning (Underwood, McCaffrey and Underwood, 1990; Dalton, 1990; Nicholson, Gelpi, Young & Sulzby, 1998). Boys are more likely to take the lead in computer activities and to crowd girls out (Siann, Macleod, Glissov & Durndell, 1990).

Nicholson, Gelpi, Young, & Sulzby, (1998) noted that access to computers may be jeopardised for girls in their classrooms by boys. For example, boys have been observed to take over the computer, refusing to let girls have access (Kiesler, Sproull & Eccles, 1985). Similar results were reported by King and Alloway (1992) who observed that girls often found it difficult to secure a turn at the computer when they had to work with the boys. Girls reported being easily discouraged when working with boys (Nicholson, Gelpi, Young & Sulzby, 1998, p. 5). But, these findings were inconsistent with two mixed-gender groups found in this present research, as in one mixed-gender group it was observed that the girl dominated the keyboard and verbal activity. Examples from interviews with B1 and G2 revealed that the girl often dominated the computer, because she had additional computer knowledge and experience compared to her partner. B1 acknowledged this and withdrew allowing G2 to do most of the work.

Examples from these mixed-gender groups showed that if a girl has extensive computer skills then she can dominate a mixed-gender group. This indicated that in this group computer skills were more important than gender in determining group interactions. These findings were consistent with those of Ayersman & Reed (1996), who believed that the trend that computer performance has historically been a male-dominated area, in which the males have consistently outperformed the females, is however not held true. In fact, according to Ayersman & Reed (1996), the trend has reversed and females significantly outperformed the males. According to this research, generally girls were on-task more than the boys, and even solved problems together more than the boy groups. Perhaps this is an indication of breaking away from previously established stereotypes involving computers due to their increased abundance in our educational, home, and work environments (Ayersman & Reed, 1996).

According to Nicholson, Gelpi, Young & Sulzby (1998) gender differences quite often occur when investigating gender and computer use in primary and high schools. Gender differences point towards quite consistently favouring males over females in technical competence and computer usage, although there were some exceptions from the above studies. It can be concluded, like Webb (cited in Lee, 1993, p. 550), that in mixed-gender groups the female and male students had considerably different experiences in regard to specific categories of interaction, especially in this study with regard to problem solving.

Conclusion on Peer Interaction

Previous studies have suggested that gender of the student and gender composition of the group tend to exert differential effects on the interaction that students have with each other while working together in small groups around the computer. Generally single-gender groups interacted in a more positive behaviour compared to mixed-gender groups. Regarding the results for the different categories of interactions, it appears that the overall levels of verbal activity of the boys and girls were modified by the presence or non-presence of their peers of the opposite gender.

However, overall the results of the present study have suggested that the nature of the computer task coupled with co-operative small group learning generally provided a peer-interactive, collaborative, and task-oriented learning environment.

Discussion on Collaborative Behaviours

Use of the group learning process is based on the belief that individuals learn better when they learn together (Nastasi & Clements, 1993, p.35). For example extensive research on collaborative small group learning has shown positive effects on a wide range of students' cognitive and social-affective outcomes (Hodgson & McConnell, 1995; Johnson & Johnson, 1987b). These previous research findings corroborate those found in this study of single-gender groups, who generally worked together to solve problems by jointly engaging in their task. For example single-gender groups generally worked and planned well together to get information from the Internet and answer focus questions.

According to McConnell (1994) the practice of small group work, and research into the processes and outcomes of collaborative learning, suggest that children working in small groups help clarify each others' ideas and concepts through discussion, develop critical thinking, provide opportunities for learners to share information and ideas and develop communication skills. These research findings are consistent with those found in this study about single-gender groups, who provided validation of individuals ideas and ways of thinking through conversation (verbalising), multiple perspectives (cognitive restructuring), and argument (conceptual conflict resolution).

According to Boyd-Barrett and Scanlon (1991) and Kealer and Anson (1995), group members can provide support and encouragement in learning basic computer skills and completing assignments. A collaborative learning environment is where children not only learn from computers, but also learn from each other while using computers (King & Alloway, 1992). These research findings were confirmed in this study of groups which demonstrates

sharing of skills and generally working together around the computer.

McConnell (1994) and Keeler & Anson (1995) noted that students in collaborative learning groups appear to quickly develop independence from the teacher and have less stress in working through their problems. Thus the teacher is able to provide more time to students in greater need. The results of this study add to these research findings that group work generally provides the opportunity for learners to take control of their own learning in a social context around a computer. Students were often checking their partners for understanding and at various times exchanged knowledge and ideas with their partners. Single-gender girl groups provided examples of how they assisted each other through their work, by helping one another to understand what to do next and how. The audio recordings revealed students sharing their views of their learning with their partners and helping them to understand their difficulties and understand the meaning of the material.

Social interaction in the form of co operative dialogues between children and more knowledgeable members of society is necessary for children to acquire the ways of thinking and behaving that make up a community's culture (Van der Veer and Valsiner, 1991). Rather than just learning co-operatively, the children had long discussions questioning and clarifying, each helping the other to understand the information, all of which are redolent of collaboration. The findings of this research have suggested that generally even with minimal or no adult assistance, students exhibited many constructive patterns of interaction around the computer.

Results indicated that there was a significant difference between single and mixed-gender groups with regard to jointly engaged, taking turns and social negotiation collaborative behavioural categories. According to examples from observations, interviews and tape recordings, mixed-gender groups generally were not jointly engaged in their work, did not take turns around the computer, and had little social negotiation while working in groups.

These findings corroborate and extend current knowledge of group work around a computer. According to the literature review on mixed-gender groups males tend to dominate the group (Lee, 1993), causing females to be at a disadvantage in learning (Siann, Durndell, Macleod & Glissov, 1988), which results in mixed-gender groups not being jointly engaged in their work. Boys have been observed to take over the computer, refusing to let girls have access (Kiesler, Sproull & Eccles, 1985), and King and Alloway (1992) observed that girls often found it difficult to secure a turn at the computer when they had to work with boys. There is not much social negotiation in mixed-gender groups because boys tend to dominate the verbal activity (Lee, 1993), discourage girls and use assertion (Nicholson, Gelpi, Young & Sulzby, 1998, p. 5).

Mixed-gender groups of three in this study generally had negative collaborative behaviours. In each of these groups participating in the collaborative effort, one person tended to dominate inter-group communication. These spokes-persons emerged spontaneously rather than assuming the task by consensus. Extracting information from the Internet and using PowerPoint to construct slides works better when ideas are tried, amended and used or rejected. Some group members in the mixed-gender groups of three did not allow this to happen, believing only their idea would do. The problems that arose in one of the mixed-gender groups related more to ability than gender.

A wide range of students' characteristics have been identified as being significant in classroom environment studies, these include: general ability, prior subject knowledge and self-esteem (Levine & Donitas-Schmidt, 1995; Fraser, McRobbie and Giddings, 1995). G12 took over a leadership role in her computer group because of her high level of knowledge about computers. Her perception of computers was shaped not only by the strategies used for teaching and learning, but also by individual characteristics, prior experience and attitudes.

The problems in both the mixed-gender groups of two boys and one girl were linked to personality factors. In these groups children were prone to withdraw

from their group or to engage in disruptive, emotional behaviour that threatened its effectiveness, if not also its survival.

According to Nicholson, Gelpi, Young and Sulzby (1998) boys have been observed to take over the computer, refusing to let girls have access. Girls often found it difficult to secure a turn at the computer and quietly conceded and chose to select other play activities instead (Volman & Eck, 2001; Butler, 2002). These findings as evidenced in previous researches are in general not consistent with the findings of those found in two mixed-gender groups in this study. In both these mixed-gender groups, the girls dominated the group.

Concerning the results of this study that single-gender groups tend to have quite frequent collaboration in their group, their collaborations were primarily jointly engaged, turn taken and social negotiation, add to the findings from previous studies of Underwood, McCaffrey and Underwood (1990), Dalton (1990) and Carrier and Sales (1987). They reported that children of the same gender while working in pairs collaborated more in their work, performed significantly more efficiently and engaged in the most on-task verbalisations compared to children working in mixed-gender groups.

All single-gender girls working in pairs had the most positive collaborative behaviours. They had the highest means for most of the collaborative categories and the lowest mean for social conflict which showed that there were no problems for turn taking, control of keyboard and other conflicts of a social nature. These findings corroborate and extend current knowledge of girls working in pairs, such as during co-operative computer-assisted instruction female pairs engaged in the most on-task verbalisations compared to other groups, and the girl pair was not only more accurate but worked more collaboratively than either the boy or boy/girl pairs (Yelland, 1994, p.31; Nicholson, Gelpi, Young and Sulzby (1998); Barbieri and Light (1992, p. 201); Cordon (1992); Signer (1992); Dalton (1990); Clariana (1990).

The only single-gender group that had generally negative collaborative behaviours was the group with three boys. This finding corroborates and extends current knowledge of boys working in groups within a computer-based learning environment, Signer (1992, p. 141) and Dalton (1990) found that male teams were less willing to take turns at the keyboard and experienced more problems co-operating. In this study, members of the three-boy group felt that it took longer to get a chance at the computer and therefore in effect gave each child less time at the computer. Individual students felt that they had less time at the keyboard during any one turn.

The frustrating experience of being at the computer and getting only a short turn at the keyboard appears to have been a more powerful influence on the thinking of this particular group. This lessened the motivation of members of this team, which sometimes resulted in off-task behaviours.

Conclusion on Collaborative Behaviours

This study presented a computer-based collaborative learning task with inter-group work. The educational reasons for asking children to work as a part of a group, or a pair, were based on the idea that discussion is a way of coming to understand what is being done, by questioning, explaining, describing and listening (Pritchard, 1993, p. 213). This study has demonstrated that the computer station is one place where this might be encouraged. The investigation of this study resulted in fewer gender differences than were found in previous studies, because girls were generally as capable or at times out performed the boys in computer skill performance. This is an indication of breaking away from previously established stereotypes involving computers (see Francis, 1994) due to their increased abundance in our educational, home and work environments.

This study concludes that gender and ability influenced effects of computer-based collaborative learning. The problems that were found during this collaborative study will make teachers aware of individual students in order to find a solution to get groups to work effectively together.

Discussions on Motivational Behaviour

Research has shown that co-operative, compared to individualistic, learning environments enhance motivation and goal orientation (Johnson & Stanne, 1985, Nastasi and Clements, 1991). These previous research findings corroborate those found in this study of students working in co-operative learning environments, which enhanced motivation for learning and the children's self-concepts as learners.

Results indicated that there was a significant difference between single and mixed-gender groups with regard to negative statements and encouragement motivation behavioural categories. According to examples from observations, interviews and tape recordings the two mixed-gender groups often made negative statements around the computer, and required coaxing or encouragement from the teacher.

Research has shown that structured controversy, compared to concurrence-seeking, during collaboration is more likely to increase motivation, task-involvement, and self-efficacy (Johnson, Johnson, Pierson & Lyons, 1985; Johnson, Brooker, Stutzman, Hultman & Johnson, 1985).

Situational interest, such as novelty, is a major motivational factor, as is topic interest that varies widely (Duchastel, 1996). Gaining and sustaining attention can also be facilitated through the inclusion of interesting elements such as graphics, animations, sounds and colour as well as the exploratory nature of the environment. In this study the motivational category of pleasure was abundant. The children expressed emotional appeal as they transferred graphics from the Internet into their slides, "Oh! Such a cute polar bear." (G9 interview), or used animation in their slide presentation "I would enjoy doing and watching animation on our slides." (B6 interview). The students had the opportunity of exploring the Internet and the "exciting new functions of PowerPoint" (B7 interview).

Relevance of the content can lead to intrinsic motivation. In this study the students discovered generally relevant material from the Internet to transfer into their slides, and learning PowerPoint helped them to present their work successfully during the school assembly. Confidence and satisfaction are part of competence, which is often a motive for exploration and play (Kinzie, 1990). The students experienced feelings of achievement and success during their computer activity which is also related to confidence and satisfaction (Duchastel, 1996).

The Year 5/6 computer activities were personally satisfying to most of the groups and they were able to achieve success. According to Keller (1983) if students expect to succeed then their personal motivation increases. This researcher observed that there was very little decrease in the students' motivation inferring that they were not bored. This indicates that the computer task was not easy, and it was not very difficult because that would make them anxious and frustrated.

During the study the learning materials were modified to increase the student's expectation of success, the goals and expectations were more realistic, the tasks were graded in difficulty and a review of the reasons for groups encountering difficulties was due to lack of abilities rather than luck or chance. This all meant that the students were motivated. The Year 5/6 students were also motivated because of curiosity in their work. Curiosity is the most direct intrinsic motivation for learning (Malone & Lepper, 1987).

The students while working around the computer were generally noted to correctly solve problems (target goals), which later led to higher order goals such as demonstrating competence at an activity. This class of goals is known as competence purpose goals and are useful for inducing feelings of competence and accomplishment which in turn produce feelings of satisfaction thereby promoting intrinsic motivation (Harackiewicz & Sansone, 1991).

Conclusion on Motivational Behaviours

The children in this study were observed as generally being engaged and on task around the computer, hence it can be inferred that they were motivated by their computer-based lessons. Enhanced motivation is assumed when learners spend long periods of time engaged in an activity (Ames, 1987). The students were motivated because the lessons aroused their interests and gave direction and purpose towards their goal.

This study has shown that working in a group around a computer can be interesting. The investigation of this study resulted in the majority of single-gender groups being motivated around the computer, while mixed-gender groups made more negative statements about self or work around the computer. Their negative statements referred to comments about task performance and evaluative comments about cognitive competence. Mixed-gender groups also needed encouragement from the teacher by seeking approval or feedback. Single-gender groups did not need much encouragement while working around the computer. Although experiencing difficulty or failure, they continued to work on a task with little teacher coaxing or encouragement. In conclusion this study implies that the Internet and PowerPoint were major contributors that influenced effects of computer-based motivational learning. The findings of this study will make teachers aware of the value of these elements to motivation in a computer-based classroom environment.

Summary

This chapter has examined the findings in relation to the three research questions, which guided the study. The discussion has served to highlight in particular the patterns of peer interaction that took place when students worked co-operatively in mixed and single-gender groups engaged in an educational computer environment. Factors that may facilitate or inhibit these interaction patterns were also discussed. The findings indicate that in accordance with a socio-cognitival theoretical perspective, when children use computers collaboratively, development will occur when partners have

different levels of competence and interact positively in dialogue that includes questioning, providing elaborated responses and instructing.

Chapter Nine

Conclusion to the Study

Recommendations for Further Research

This study provides very promising results supporting technology-based lessons on primary school children working in mixed and single-gender groupings. However, many questions arise from the study and further research is possible in a number of areas. While important and interesting findings have been revealed, the study, still exploratory in nature, needs to be extended. In addition, there are several points, which may be worth further investigation. Therefore, it is not possible to generalise the study's findings to all centres everywhere. It would be useful to replicate the study with a more diverse sample (for example, children from low socio-economic status (SES), and children from diverse cultural backgrounds) in order to determine whether or not the findings of this study are representative of larger populations of children.

- The subjects of the study were relatively homogeneous in terms of the ethnic and socio-economic backgrounds. The analysis of data from a nation-wide probability sample across various student populations might yield different and more generalisable results, like upper socio-economic status.

- Of possible interest might be a comparative study which could analyse inter-action processes among female and male students in non-computer based settings to determine whether and to what extent these interaction patterns are unique to computer settings.

- In this study, the computer task that students were working on in small groups was a social studies problem-solving task based on the Internet and PowerPoint. Future research using other types of tasks, along with other learning areas, might show different results in regard to gender influences

in peer interaction as well as to patterns of peer interaction. Studies on children from various computer competencies and social skills may also provide significant outcomes.

- Also, it is recommended that the research be conducted with children from different cultural backgrounds in order to establish what they perceive as being culturally appropriate in terms of group work and software packages.

This study has highlighted the value and importance of single-gender groups working around a computer. Although this study was undertaken in a fixed context and its explorations were limited to a discrete subject area, it is evident that group work, which was observed among the learners could be replicated in other subjects and settings. The outcomes from this study strongly support the need for continued research and development to ensure that the full potential of technology-based group lessons can be exploited in different learning environments.

In conclusion, the interaction patterns identified in this study are likely to be representative of primary student's social interactions in a range of educational computer environments and primary settings. By integrating computer technology through appropriate strategies, and promoting and modelling pro social behaviours, teachers can help students develop positive interaction patterns during collaborative activities around a computer.

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Appendix 1

B4 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	11	7	10	8
ReceivesHelp	7	5	7	5
Posit.Emot.Inter.	10	6	9	7
SolvesProblems	11	5	9	9
Off-taskInter.	2	1	1	1

B4 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	11	8	10	9
SeekInformation	9	6	9	6
GiveInformation	10	6	9	5
TurnTaking	11	7	10	8
SocialNegotiation	10	7	11	8
SocialDominance	2	0	1	0

B4 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	10	6	9	7
Persistence	9	6	9	6
Pos.SelfStatement	10	5	10	5
Neg.SelfStatement	4	3	4	3
Encourage.Required	4	2	2	2
Failure/Difficulty	4	2	2	2

Appendix 2

B5 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	10	6	10	8
ReceivesHelp	10	7	11	8
Posit.Emot.Inter.	9	5	8	6
SolvesProblems	11	5	10	8
Off-taskInter.	1	1	1	1

B5 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	12	9	12	12
SeekInformation	11	5	9	8
GiveInformation	10	6	9	8
TurnTaking	13	9	11	11
SocialNegotiation	11	7	10	8
SocialDominance	2	0	1	0

B5 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	12	5	9	6
Persistence	9	5	8	6
Pos.SelfStatement	10	6	9	7
Neg.SelfStatement	3	2	3	2
Encourage.Required	2	2	2	2
Failure/Difficulty	4	1	2	1

Appendix 3

B6 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	9	5	8	6
ReceivesHelp	7	4	6	5
Posit.Emot.Inter.	6	3	5	4
SolvesProblems	7	4	7	5
Off-taskInter.	3	1	2	1

B6 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	7	4	7	5
SeekInformation	9	5	7	6
GiveInformation	6	4	6	5
TurnTaking	7	4	5	5
SocialNegotiation	8	4	6	6
SocialDominance	3	1	2	0

B6 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	10	6	9	7
Persistence	8	4	6	5
Pos.SelfStatement	9	5	7	7
Neg.SelfStatement	4	3	4	3
Encourage.Required	3	2	2	3
Failure/Difficulty	4	2	3	3

Appendix 4

B7 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	10	5	9	6
ReceivesHelp	6	4	5	3
Posit.Emot.Inter.	4	3	4	3
SolvesProblems	7	4	5	5
Off-taskInter.	1	1	1	1

B7 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	7	4	6	5
SeekInformation	9	5	7	6
GiveInformation	9	4	6	5
TurnTaking	6	3	5	4
SocialNegotiation	9	4	6	5
SocialDominance	0	0	0	0

B7 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	10	6	8	8
Persistence	8	4	6	6
Pos.SelfStatement	9	5	7	7
Neg.SelfStatement	3	1	3	3
Encourage.Required	4	2	2	2
Failure/Difficulty	4	3	3	3

Appendix 5

B12 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	12	8	11	9
ReceivesHelp	11	6	10	9
Posit.Emot.Inter.	8	5	7	6
SolvesProblems	11	6	10	7
Off-taskInter.	2	1	2	1

B12 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	13	9	12	11
SeekInformation	11	8	11	9
GiveInformation	11	8	10	10
TurnTaking	12	9	12	12
SocialNegotiation	12	7	11	9
SocialDominance	1	0	1	0

B12 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	11	6	11	8
Persistence	10	6	9	7
Pos.SelfStatement	11	5	10	6
Neg.SelfStatement	3	2	3	2
Encourage.Required	2	2	2	2
Failure/Difficulty	3	1	2	2

Appendix 6

B17 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	12	9	12	11
ReceivesHelp	9	5	7	7
Posit.Emot.Inter.	11	6	9	6
SolvesProblems	12	5	11	8
Off-taskInter.	1	1	2	0

B17 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	13	10	11	11
SeekInformation	11	8	10	10
GiveInformation	12	7	11	9
TurnTaking	12	10	11	12
SocialNegotiation	12	8	11	8
SocialDominance	0	0	0	0

B17 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	11	7	10	8
Persistence	10	5	9	6
Pos.SelfStatement	12	5	9	6
Neg.SelfStatement	3	2	3	2
Encourage.Required	4	1	2	2
Failure/Difficulty	3	2	2	2

Appendix 7

B2 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	6	3	5	4
ReceivesHelp	2	1	2	1
Posit.Emot.Inter.	8	4	6	6
SolvesProblems	6	4	5	3
Off-taskInter.	7	5	7	6

B2 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	5	3	4	3
SeekInformation	2	1	2	1
GiveInformation	2	1	1	2
TurnTaking	5	3	4	3
SocialNegotiation	7	3	5	4
SocialDominance	2	1	1	1

B2 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	9	5	8	6
Persistence	8	4	7	5
Pos.SelfStatement	7	3	6	4
Neg.SelfStatement	4	3	4	3
Encourage.Required	3	2	2	3
Failure/Difficulty	4	2	3	3

Appendix 8

B3 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	3	1	2	2
ReceivesHelp	9	4	6	5
Posit.Emot.Inter.	6	3	5	4
SolvesProblems	4	3	4	4
Off-taskInter.	5	3	4	3

B3 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	3	1	3	3
SeekInformation	2	1	2	1
GiveInformation	2	1	1	2
TurnTaking	5	3	4	3
SocialNegotiation	6	3	5	4
SocialDominance	0	0	0	0

B3 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	8	4	7	5
Persistence	7	4	6	5
Pos.SelfStatement	8	4	6	6
Neg.SelfStatement	4	3	4	3
Encourage.Required	3	2	3	2
Failure/Difficulty	4	2	3	3

Appendix 9

B10 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	4	3	4	3
ReceivesHelp	3	2	3	2
Posit.Emot.Inter.	8	5	7	6
SolvesProblems	6	3	5	4
Off-taskInter.	7	3	6	4

B10 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	3	1	3	3
SeekInformation	3	1	2	3
GiveInformation	2	1	1	2
TurnTaking	5	3	4	3
SocialNegotiation	6	4	5	3
SocialDominance	2	1	1	1

B10 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	10	4	8	6
Persistence	8	4	5	5
Pos.SelfStatement	6	4	6	6
Neg.SelfStatement	4	3	4	3
Encourage.Required	3	1	3	3
Failure/Difficulty	4	3	4	3

Appendix 10

G3 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	8	4	7	5
ReceivesHelp	9	6	8	5
Posit.Emot.Inter.	7	3	5	5
SolvesProblems	11	5	8	6
Off-taskInter.	2	1	1	1

G3 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	10	5	9	6
SeekInformation	9	6	9	6
GiveInformation	7	4	5	5
TurnTaking	13	9	12	11
SocialNegotiation	12	8	12	10
SocialDominance	1	1	1	0

G3 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	10	6	8	8
Persistence	8	5	7	6
Pos.SelfStatement	10	4	8	6
Neg.SelfStatement	4	2	2	2
Encourage.Required	3	1	3	3
Failure/Difficulty	4	2	3	3

Appendix 11

G4 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	11	6	11	8
ReceivesHelp	6	4	6	6
Posit.Emot.Inter.	9	6	10	5
SolvesProblems	10	5	10	5
Off-taskInter.	3	1	2	1

G4 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	11	5	9	8
SeekInformation	10	6	10	7
GiveInformation	7	4	6	4
TurnTaking	12	10	12	11
SocialNegotiation	10	7	11	8
SocialDominance	0	0	0	0

G4 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	10	6	9	7
Persistence	7	5	7	5
Pos.SelfStatement	9	5	6	6
Neg.SelfStatement	6	4	5	3
Encourage.Required	4	2	2	2
Failure/Difficulty	5	3	3	3

Appendix 12

G8 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	12	7	10	7
ReceivesHelp	11	8	12	9
Posit.Emot.Inter.	3	2	3	2
SolvesProblems	12	7	11	10
Off-taskInter.	2	1	1	2

G8 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	12	10	12	11
SeekInformation	11	7	10	8
GiveInformation	12	7	10	7
TurnTaking	13	9	12	11
SocialNegotiation	12	6	11	7
SocialDominance	1	1	1	0

G8 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	12	5	8	7
Persistence	11	5	8	6
Pos.SelfStatement	10	6	9	7
Neg.SelfStatement	6	3	5	4
Encourage.Required	3	2	2	3
Failure/Difficulty	4	2	3	3

Appendix 13

G9 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	14	10	13	13
ReceivesHelp	9	6	10	5
Posit.Emot.Inter.	7	3	5	5
SolvesProblems	12	7	11	10
Off-taskInter.	1	1	2	0

G9 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	12	9	12	12
SeekInformation	11	6	10	9
GiveInformation	11	8	10	10
TurnTaking	12	9	12	12
SocialNegotiation	10	6	9	7
SocialDominance	0	0	0	0

G9 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	11	5	9	7
Persistence	8	4	6	7
Pos.SelfStatement	10	4	8	6
Neg.SelfStatement	4	3	4	3
Encourage.Required	3	2	3	2
Failure/Difficulty	5	2	3	4

Appendix 14

G5 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	8	4	6	6
ReceivesHelp	8	4	5	5
Posit.Emot.Inter.	6	4	5	3
SolvesProblems	7	3	6	4
Off-taskInter.	2	1	2	1

G5 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	6	3	5	5
SeekInformation	6	4	6	5
GiveInformation	5	2	3	2
TurnTaking	4	2	3	3
SocialNegotiation	9	5	8	6
SocialDominance	3	2	3	2

G5 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	9	5	7	7
Persistence	7	4	6	5
Pos.SelfStatement	9	4	6	5
Neg.SelfStatement	6	4	5	3
Encourage.Required	4	2	2	3
Failure/Difficulty	6	4	5	5

Appendix 15

G6 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	13	5	12	6
ReceivesHelp	10	6	9	7
Posit.Emot.Inter.	11	5	10	8
SolvesProblems	8	4	7	5
Off-taskInter.	1	1	1	1

G6 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	7	5	7	5
SeekInformation	7	4	5	5
GiveInformation	7	4	6	5
TurnTaking	6	3	5	4
SocialNegotiation	5	4	4	3
SocialDominance	0	0	0	0

G6 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	9	5	8	6
Persistence	7	3	6	4
Pos.SelfStatement	7	4	6	5
Neg.SelfStatement	6	4	5	3
Encourage.Required	4	2	3	2
Failure/Difficulty	5	3	5	3

Appendix 16

G7 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	7	3	6	4
ReceivesHelp	9	5	6	6
Posit.Emot.Inter.	6	4	5	3
SolvesProblems	5	4	4	3
Off-taskInter.	3	2	2	1

G7 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	7	3	6	4
SeekInformation	7	4	5	5
GiveInformation	7	3	5	5
TurnTaking	5	3	4	3
SocialNegotiation	9	5	8	6
SocialDominance	1	0	1	0

G7 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	10	4	8	6
Persistence	7	3	6	4
Pos.SelfStatement	7	3	5	5
Neg.SelfStatement	6	4	5	3
Encourage.Required	4	2	3	2
Failure/Difficulty	6	4	5	3

Appendix 17

B1 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	8	5	7	6
ReceivesHelp	3	2	3	2
Posit.Emot.Inter.	9	5	6	6
SolvesProblems	6	4	5	3
Off-taskInter.	6	3	5	4

B1 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	7	3	5	5
SeekInformation	7	5	7	5
GiveInformation	9	4	6	5
TurnTaking	3	2	2	2
SocialNegotiation	8	4	8	5
SocialDominance	0	0	0	0

B1 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	9	4	7	5
Persistence	7	3	6	4
Pos.SelfStatement	7	3	5	5
Neg.SelfStatement	8	5	7	6
Encourage.Required	7	3	5	5
Failure/Difficulty	9	4	6	6

Appendix 18

G2 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	10	4	8	6
ReceivesHelp	6	4	5	5
Posit.Emot.Inter.	4	3	4	3
SolvesProblems	6	3	5	4
Off-taskInter.	3	2	2	1

G2 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	5	4	3	3
SeekInformation	7	3	6	5
GiveInformation	8	3	6	4
TurnTaking	4	2	3	3
SocialNegotiation	7	3	6	4
SocialDominance	7	3	5	5

G2 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	11	7	9	8
Persistence	9	5	8	6
Pos.SelfStatement	10	6	9	7
Neg.SelfStatement	6	3	5	4
Encourage.Required	3	1	3	3
Failure/Difficulty	3	1	2	2

Appendix 19

B14 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	11	5	8	6
ReceivesHelp	12	7	11	10
Posit.Emot.Inter.	9	6	10	5
SolvesProblems	12	7	11	8
Off-taskInter.	2	1	2	1

B14 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	10	5	9	6
SeekInformation	11	8	11	9
GiveInformation	11	7	12	9
TurnTaking	11	6	11	8
SocialNegotiation	12	8	11	9
SocialDominance	0	0	0	0

B14 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	11	5	8	6
Persistence	7	4	6	5
Pos.SelfStatement	10	4	6	5
Neg.SelfStatement	6	4	5	3
Encourage.Required	5	4	4	3
Failure/Difficulty	3	1	2	2

Appendix 20

G11 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	12	10	11	11
ReceivesHelp	10	5	10	5
Posit.Emot.Inter.	7	3	5	5
SolvesProblems	13	7	11	7
Off-taskInter.	2	2	1	1

G11 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	11	6	10	8
SeekInformation	11	8	11	9
GiveInformation	12	7	10	10
TurnTaking	11	6	10	9
SocialNegotiation	12	8	11	9
SocialDeminance	1	1	1	0

G11 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	10	6	9	7
Persistence	9	4	6	5
Pos.SelfStatement	9	5	7	7
Neg.SelfStatement	3	2	3	2
Encourage.Required	4	2	2	2
Failure/Difficulty	4	2	3	3

Appendix 21

B8 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	5	4	4	3
ReceivesHelp	0	0	1	1
Posit.Emot.Inter.	11	9	10	10
SolvesProblems	4	2	3	3
Off-taskInter.	3	1	3	3

B8 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	3	2	3	2
SeekInformation	1	0	1	1
GiveInformation	3	2	2	2
TurnTaking	3	1	2	3
SocialNegotiation	4	2	2	2
SocialDominance	0	0	0	0

B8 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	9	4	7	5
Persistence	8	4	7	5
Pos.SelfStatement	7	4	6	5
Neg.SelfStatement	8	3	5	6
Encourage.Required	5	4	3	3
Failure/Difficulty	3	1	2	2

Appendix 22

B9 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	1	0	1	1
ReceivesHelp	4	2	2	2
Posit.Emot.Inter.	9	5	8	6
SolvesProblems	3	1	2	2
Off-taskInter.	7	4	6	5

B9 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	3	2	2	2
SeekInformation	6	3	5	4
GiveInformation	4	1	2	2
TurnTaking	1	1	1	0
SocialNegotiation	2	1	1	2
SocialDominance	8	5	8	6

B9 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	9	4	7	5
Persistence	7	3	6	4
Pos.SelfStatement	7	3	5	5
Neg.SelfStatement	7	4	6	5
Encourage.Required	9	5	6	6
Failure/Difficulty	4	2	3	3

Appendix 23

G1 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	1	1	1	1
ReceivesHelp	3	1	2	2
Posit.Emot.Inter.	6	3	5	4
SolvesProblems	4	2	2	2
Off-taskInter.	5	2	4	3

G1 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	3	1	3	3
SeekInformation	1	1	1	0
GiveInformation	1	0	1	1
TurnTaking	1	1	1	0
SocialNegotiation	1	0	1	1
SocialDominance	4	2	3	1

G1 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	10	4	6	5
Persistence	6	4	5	5
Pos.SelfStatement	6	3	5	4
Neg.SelfStatement	7	4	6	5
Encourage.Required	7	3	6	4
Failure/Difficulty	5	4	4	3

Appendix 24

B13 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	4	2	3	3
ReceivesHelp	3	2	2	3
Posit.Emot.Inter.	4	2	3	3
SolvesProblems	1	1	1	1
Off-taskInter.	7	4	6	5

B13 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	2	1	1	1
SeekInformation	1	0	1	1
GiveInformation	4	1	2	2
TurnTaking	3	2	2	2
SocialNegotiation	2	1	2	1
SocialDominance	0	0	0	0

B13 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	3	2	3	2
Persistence	1	1	1	1
Pos.SelfStatement	1	0	1	1
Neg.SelfStatement	7	3	5	5
Encourage.Required	8	5	7	6
Failure/Difficulty	3	1	2	2

Appendix 25

B15 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	6	4	5	3
ReceivesHelp	9	6	9	6
Posit.Emot.Inter.	5	3	5	3
SolvesProblems	1	1	1	1
Off-taskInter.	8	5	7	6

B15 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	4	1	2	2
SeekInformation	3	2	2	2
GiveInformation	1	0	1	1
TurnTaking	1	0	1	1
SocialNegotiation	3	1	2	3
SocialDominance	0	0	0	0

B15 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	7	5	7	5
Persistence	4	3	4	3
Pos.SelfStatement	6	3	5	4
Neg.SelfStatement	6	4	5	3
Encourage.Required	7	3	6	4
Failure/Difficulty	3	1	2	2

Appendix 26

G10 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	7	3	5	5
ReceivesHelp	3	1	3	3
Posit.Emot.Inter.	10	5	9	6
SolvesProblems	1	1	1	1
Off-taskInter.	2	1	1	1

G10 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	2	0	1	2
SeekInformation	1	0	1	1
GiveInformation	1	1	0	1
TurnTaking	1	1	1	0
SocialNegotiation	2	1	1	2
SocialDominance	12	5	10	8

G10 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	9	4	6	6
Persistence	9	5	7	5
Pos.SelfStatement	6	4	5	5
Neg.SelfStatement	6	4	6	6
Encourage.Required	3	2	3	2
Failure/Difficulty	7	3	5	5

Appendix 27

G12 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	11	5	10	8
ReceivesHelp	1	1	1	2
Posit.Emot.Inter.	10	4	8	6
SolvesProblems	4	2	3	3
Off-taskInter.	5	3	4	3

G12 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	4	4	4	3
SeekInformation	6	4	5	3
GiveInformation	8	4	7	5
TurnTaking	4	2	3	3
SocialNegotiation	5	3	4	3
SocialDominance	3	2	3	2

G12 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	9	5	8	6
Persistence	10	4	8	6
Pos.SelfStatement	9	6	9	6
Neg.SelfStatement	6	3	5	4
Encourage.Required	3	1	3	3
Failure/Difficulty	3	1	2	2

Appendix 28

G13 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	12	6	11	7
ReceivesHelp	5	3	5	3
Posit.Emot.Inter.	10	6	9	7
SolvesProblems	4	2	3	3
Off-taskInter.	3	1	2	2

G13 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	5	3	4	3
SeekInformation	6	3	5	4
GiveInformation	6	4	6	5
TurnTaking	4	2	3	3
SocialNegotiation	5	3	4	3
SocialDominance	4	2	2	2

G13 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	10	6	9	7
Persistence	9	6	10	5
Pos.SelfStatement	11	5	7	9
Neg.SelfStatement	6	3	5	4
Encourage.Required	4	2	2	2
Failure/Difficulty	3	1	2	2

Appendix 29

B16 Peer Interaction Categories

	Audio	Video	Field Notes	Interviews
GivesHelp	7	3	6	4
ReceivesHelp	11	8	11	10
Posit.Emot.Inter.	6	4	5	5
SolvesProblems	2	1	2	1
Off-taskInter.	5	3	5	3

B16 Collaborative Categories

	Audio	Video	Field Notes	Interviews
JointlyEngaged	4	2	3	3
SeekInformation	3	2	2	2
GiveInformation	5	3	4	3
TurnTaking	4	2	3	3
SocialNegotiation	4	2	2	3
SocialDominance	0	0	0	0

B16 Motivation Categories

	Audio	Video	Field Notes	Interviews
Pleasure	9	5	7	6
Persistence	8	4	6	5
Pos.SelfStatement	7	3	6	4
Neg.SelfStatement	6	4	5	5
Encourage.Required	4	2	2	2
Failure/Difficulty	5	4	4	3

Appendix 30

Peer Interaction Categories

Task-Related Interaction

A. Gives task-related help (GT)
B. Gives inadequate task-related help (GIT)
C. Asks question and receives task-related help (AT)
D. Asks question and receives inadequate task-related help (AIT)

Socio-Emotional Interaction

1. Positive socio-emotional interaction (POS)
2. Negative socio-emotional interaction (NEG)
3. Neutral socio-emotional interaction (NEU)

Miscellaneous Off-Task Interaction

1. Miscellaneous off-task interaction

Appendix 31

Examples of all Interaction Categories Observed

Examples of all Interaction Categories during Peer Interactions

Interaction	Category	Code	Group	Observations
Peer Interact.	Gives task related help	GH	Single Gender 2 Boys	B4 helped B5 in his work by showing him how to make a home button because he had missed last weeks work.
Peer Interact.	Receives Help	NH	Single Gender 2 Girls	Note: scores were different to 'gives task related help' because sometimes partners were not taking help e.g. "She was trying to get a picture of the Snow Leopard from the Internet to her slides, but she couldn't. I tried to show her by explaining to her to press the control key and the mouse. Instead she grabbed the mouse from my hand and began doing something else...typing information". (B15 interview).
Peer Interact.	Posit. Socio-emotional Interaction	PEI	Single Gender 3 Girls	Both G5 and G7 asked G6 to show their slides again and again to watch the transitions and animations.
Peer Interact.	Negative Socio-emotional Interaction	NEI	Single Gender 2 Boys	B12 and B5 expressed frustration because they had tried everything (deleted slides and graphics) and still their work was not being saved on their disk.
Peer Interact.	Neutral Socio-emotional	NUI	Mixed Gender 2 Boys 1 Girl	When B13 was asked how he liked working in groups he casually answered that it was ok.

Contd.

Interaction	Category	Code	Group	Observations
Peer Interact.	Solving Problem	SP	Single Gender 2 Boys	B12 & B17 could not find their slides. They searched the hard Drive then PowerPoint and other Programs but failed. B17 then tried the different menus. When he was in Edit, B12 pointed to Find. They went into Find and found their slides in Documents.
Peer Interact	Off-Task	OT	Single Gender 3Boys	B2, B3 & B10 felt that they had to wait too long for their turns at the keyboard. Generally this resulted with one team member at the computer while the other two went to a spare computer to play games.

Examples of all Interaction Categories during Collaborative Behaviours

Interaction	Category	Code	Group	Observations
Collab. Behav.	Jointly Engaged	JE	Single Gender 2 Boys	B4: What do you think of this background should we use it? B5: Not bad, let's have a look at the templates. B4: These are cool...
Collab. Behav.	Seek Information	SE	Single Gender 2 Boys	B6 wanted to get sounds for his slide so he asked his partner how to do it. B7 told him to go into slideshow then animation and showed him the different sounds he could use.
Collab. Behav.	Receive Information	RI	Mixed Gender 1 Boy 1 Girl	Note: scores were different to 'Seek Information' because some-times partners were not receiving help e.g. "How did you do this background?" (B1 talk). "Don't worry about it, just do the poem on the Mountain Gorilla". (G2 talk).

Contd.

Interaction	Category	Code	Group	Observations
Collab. Behav.	Turn Taking	TT	Single Gender 3Girls	G7 did one slide then G6 did the other. After that G5 had her chance to do her slide.
Collab. Behav.	Social Negotiation	SN	Single Gender 2 Girls	G3 wanted her information that she found from the Internet to be used in the slides. But G4 wanted her information included. All the information could not be used because it was too long. In the end they began to negotiate what information to be included and what was to be deleted.
Collab. Behav.	Social Dominance (1)	SD	Mixed Gender 2 Girls 1 Boy	"We tried to compromise with the keyboard but it did not work because [G12] always wanted to type. "She would 'hog' the computer and not allow us to use the keyboard." (G13).
	Social Dominance (2)	SD	Mixed Gender 2 Girls 1 Boy	"Yes I did take over the computer in my group more than the others did because [B16] knows nothing about computers and [G13] knows just a little. I am always using computers at home." (G12).
	Social Dominance (3)	SD	Mixed Gender 2 Boys 1 Girl	B13 was sometimes seen reading a book at his desk or in another group. During the interviews he explained that G10 was always wanting her own way and did not listen to any of his suggestions or ideas.
	Social Dominance (4)	SD	Mixed Gender 1Girl 1 Boy	G2 did most of the computer work in class. During the interviews she said that B1 was "hopeless" with computers he didn't know much and was "slowing things down".

Examples of all Interaction Categories during Motivational Behaviours

Interaction	Category	Code	Group	Observations
Motiv. Behav.	Pleasure 1	PL	Single Gender 2 Boys	"I hit Jackpot, the animal's scientific name, at last." (B12).
Motiv. Behav.	Pleasure 2	PL	Single Gender 2 Boys	"It was great! Not like other lessons boring. Here there were lots to do and we enjoyed it." (B5).
Motiv. Behav.	Pleasure 3	PL	Single Gender 3 Girls	"Do it again and again... I want to see the letters move... (G6).
Motiv. Behav.	Pleasure 4	PL	Single Gender 2 Boys	"It worked, at last. This is the picture I wanted not from clip art like the others, but from the net." (B17).
Motiv. Behav.	Pleasure 5	PL	Single Gender 3 Girls	"I like it. Now let's carry on the same way. Follow the next part that is background colours, then we can finish our slides for presentation. (G7).
Motiv. Behav.	Persistence	PS	Single Gender 3 Girls	The 3 girls tried repeatedly to get into PowerPoint but couldn't. Eventually they went into the hard drive and found Microsoft Office.
Motiv. Behav.	Positive Self Statements	PS	Mixed Gender 1 Boy 1 Girl	"Yes this background we have done looks much better than the templates we were shown." (G11).
			Single Gender 2 Boys	"No sweat! We did our slides... beaut...no difficulty...easy, easy..." (B12).
Motiv. Behav.	Negative Statements	NS	Mixed Gender 1 Boy 1 Girl	B1: "It's no use...I just can't do it."
Motiv. Behav.	Encourage	EN	Mixed Gender 2 Boys 1 Girl	The teacher had to encourage G1 to do her work because she was having problems with her partner.

Motiv. Behav.	Failure/ Difficulty	FD	Mixed Gender 2 Girls 1 Boy	This group had problems finding information about the Red Kite from the Internet. Eventually G12 said she would get the information from home.