

*AN ACTION RESEARCH STUDY OF COOPERATIVE LEARNING IN A  
PRE-SERVICE NATURAL SCIENCE COURSE*

BY

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## ABSTRACT

*Cooperative learning (CL) research has gone through a series of phases representing different orientations of research. This inquiry uses action-research as a way of implementing cooperative learning in a pre-service science course. Cooperative learning was regarded as an innovation in the context of this inquiry. The evidence of the inquiry was in the form of texts from sources including classroom observation, student reflective notes, the research diary and interviews, among others. The qualitative analysis involved the writing of descriptive-interpretive reports which were used in a process of data reduction to formulate analytic theme reports. Propositions were developed from these reports. Some recommendations emanated from these propositions.*

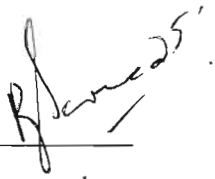
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## DECLARATION

I declare that this dissertation is my own work, and has not been submitted previously for any degree in any university.



\_\_\_\_\_  
Researcher

\_\_\_\_\_  
Supervisor



## DEDICATION

I dedicate this thesis to my friend Rashid Meer who died tragically  
on 29 May 1996

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## CHAPTER 1

### COOPERATIVE LEARNING AS AN APPROACH TO LEARNING SCIENCE

This study is an **action research** inquiry into the nature of **cooperative learning** as an innovative way of learning in a pre-service second-year Natural Science course at Edgewood College of Education.

By **cooperative learning** (subsequently abbreviated to 'CL' in this report), I mean the act of students working together on a learning task to achieve a common goal. This is an operational definition used in the inquiry. Some definitions used by other authors are outlined in Chapter 2.

In brief the **action research** approach that I used incorporates a series of cycles of activities, in which learning about improving my practice and increasing knowledge and understanding of my practice occurred. These types of learning were on-going within and at the end of each cycle and such learning informed subsequent cycles. A more detailed account of action research is in Chapter 3.

Purpose of the Study: The goal of the research was to answer the question "*How can an action-research approach be used to evaluate and develop cooperative learning as the main learning approach in a science course?*" At the same time it inquires into the nature of cooperative learning.

Context of the Study: In **South Africa**, the changed democratic environment needs people who can work together. A focus on CL may be needed, if schools in South Africa are to prepare people for life in a democratic environment. It follows that there is a need to promote cooperation in the classroom. CL is, in fact, an integral aspect of one of the *critical outcomes* of education in current policy debates on curriculum transformation in South Africa, thus featuring as a 'new' way of learning in transformative practice. But teachers may not know how to implement CL or lack confidence to do so as a result of inadequate exposure to processes and ideas in their pre-service years of education. It is my opinion that the place to begin a change of modes of teaching and learning is in teacher education and I

located this study within my practice at an institution preparing pre-service teachers.

The education environment at the institution (**Edgewood College of Education**), and as elsewhere in South Africa, is complicated by a change from a homogeneous 'race' student group to a heterogeneous one. CL has already been seen by many, as an advantage in heterogeneous multiethnic groups (Johnson and Johnson 1981), which means it could be particularly useful in our context.

I regard **all** college students, who have emerged from the past divisive system of education, as disadvantaged, in that they were exposed to the same messages about learning, authority and competition, notwithstanding the maldistribution of educational provision that existed. There are a range of reasons why students have been disadvantaged and these include language relating both to science language and second language usage. Constraints to implementing CL may be exacerbated by the use of a second language (English) in dialogue, along with using the already potentially alienating language of science. In this regard, Lemke (1990) found that the traditional classroom interaction pattern, tends to engage only a few students and he asserted that

*the one change in science teaching that should do more than any other to improve students' ability to use the language of science is to give them more practice actually using it. Students must be given opportunities to speak at great length...(p 168)*

This is reinforced by the social constructivist view that we construct meanings within specific verbal interactions within groups of people; and as we participate in such environments we become full members in such groups. Language, therefore, may be a constraint on the use of CL but also a good reason for CL. Aspects of the language of discussion and instruction were revealed during the inquiry.

An important consideration is that, in its aim of promoting unquestioning submission to authority, the education system bred a student population in which individuals, especially those of the black communities, were made to feel that their personal ideas were of no value. Many of these students were characterised by feelings of low self-esteem. Constraints like these may hamper the introduction and implementation of cooperative learning environments, thus necessitating research into ways of overcoming them. The potential benefit of the

enhancement of self-esteem is good reason for CL, as well.

The Edgewood student population is multicultural, consisting of the historically separated 'race groups' of apartheid; and comes with a varied educational history, being fed by schools of the previous different education departments of the apartheid era. The second-year Natural Science students had experienced some group-work in the Natural Science course and in other subject departments, during their first year studies, thus allowing the introduction of CL at a serious level, but it was still largely an innovation for the students and myself.

Teacher preparation and particularly science teacher preparation, is seen to be significant in the reform of science education. In a guest editorial of the *Journal of Research in Science Teaching*, Adams and Tillotson (1995) argued that it was inappropriate that programmes and practices in science teacher education were not informed by research. It is hoped that this inquiry will help to promote a shift away from the practice of reproduction of current practice by newly qualified teachers and informs the move to transform science teacher preparation.

Research Questions: The specific research questions that this study began with were:

- \* In using action research, what aspects of the nature of cooperative learning allow it to be initiated in a multicultural pre-service education class in South Africa?
- \* What constraints involved in sustaining cooperative learning are revealed and may be overcome by action research?
- \* How do student and lecturer perceptions affect cooperative learning?
- \* How do students and the lecturer engage with cooperative learning for it to be effective?

Choice of Methodology Strategy: Since action research was seen as a useful way for teachers to innovate and the specific situation is one of innovation, action research was chosen as the appropriate methodology. I give a full rationale for my choice of action research methodology in Chapter 3 (section 3.5). The historical context of using action research to inquire into CL is given in Chapter 2. Action research has only recently been used as a means of researching CL.

In fact, research about CL has gone through a series of phases representing different orientations of research. Starting with a focus on the perceived value of CL, it shifted to a focus on the generation of models or techniques of CL, influenced generally by theories of social psychology. Following this there was a prolific phase of experimental research in the form of comparative and correlational work, dominated by statistical analyses and ‘input-intervention-output’ design. The focus of research then shifted to inquiring into interactions that occurred among learners in the small CL group, with some descriptive and interpretive studies, indicating a move away from implementing CL using models. In representing a shift from the psycho-statistical or empirical paradigm of research, action research began featuring in some recent CL studies. This study adds to this approach.

The basic research plan began with a series of discussions with a participant colleague in 1994 and proceeded in 1995. A retrospective analysis was made a year later in 1996. A pictorial display of the inquiry process is included here (Figure 1) to help the reader ‘walk through’ the inquiry. A more detailed version is included in Chapter 3. The terms used in the figure are explained within the report and a brief explanation of labels used in Figure 1 is given.

Assumptions: The assumptions were that

- \* CL is worthwhile in the context of the institution and country;
- \* action research offers the opportunity of examining more closely the process of introducing, maintaining and understanding CL in a heterogeneous science class; and
- \* action research could be used to promote professional development, in a critical engagement.

My assumptions that CL was worthwhile in our context, that action research was an appropriate means of introducing CL and that action research was worthwhile for professional development were ‘tested’ by the inquiry.

Limitations of the Study: My experiential background of practice was a limitation in that I was a comparative novice to CL work. My resolve not to be prescriptive in the constructivist environment I attempted to provide, was challenged. I engaged with the attendant limitations



of qualitative analysis, especially those involving the issue of trustworthiness, in Chapter 3 (section 3.6). The choice of deductive/inductive testing developed during the research and was resolved by using a mix depending on the context of a construct. Detailed discourse on such limitations of the inquiry is provided in Chapter 7 (section 7.2).

Further discourse about the 'worthwhile' aspect of CL and where I place this inquiry within the CL research nexus, follows in Chapter 2; the use of action research and the research methodology in Chapter 3; and the analysis involved in the inquiry in Chapter 4. The major propositions that emerged are discussed in Chapter 5, proposition testing is discussed in Chapter 6 and Chapter 7 includes some implications of the findings. A list of the appendices is provided in Chapter 4 (Table 4).

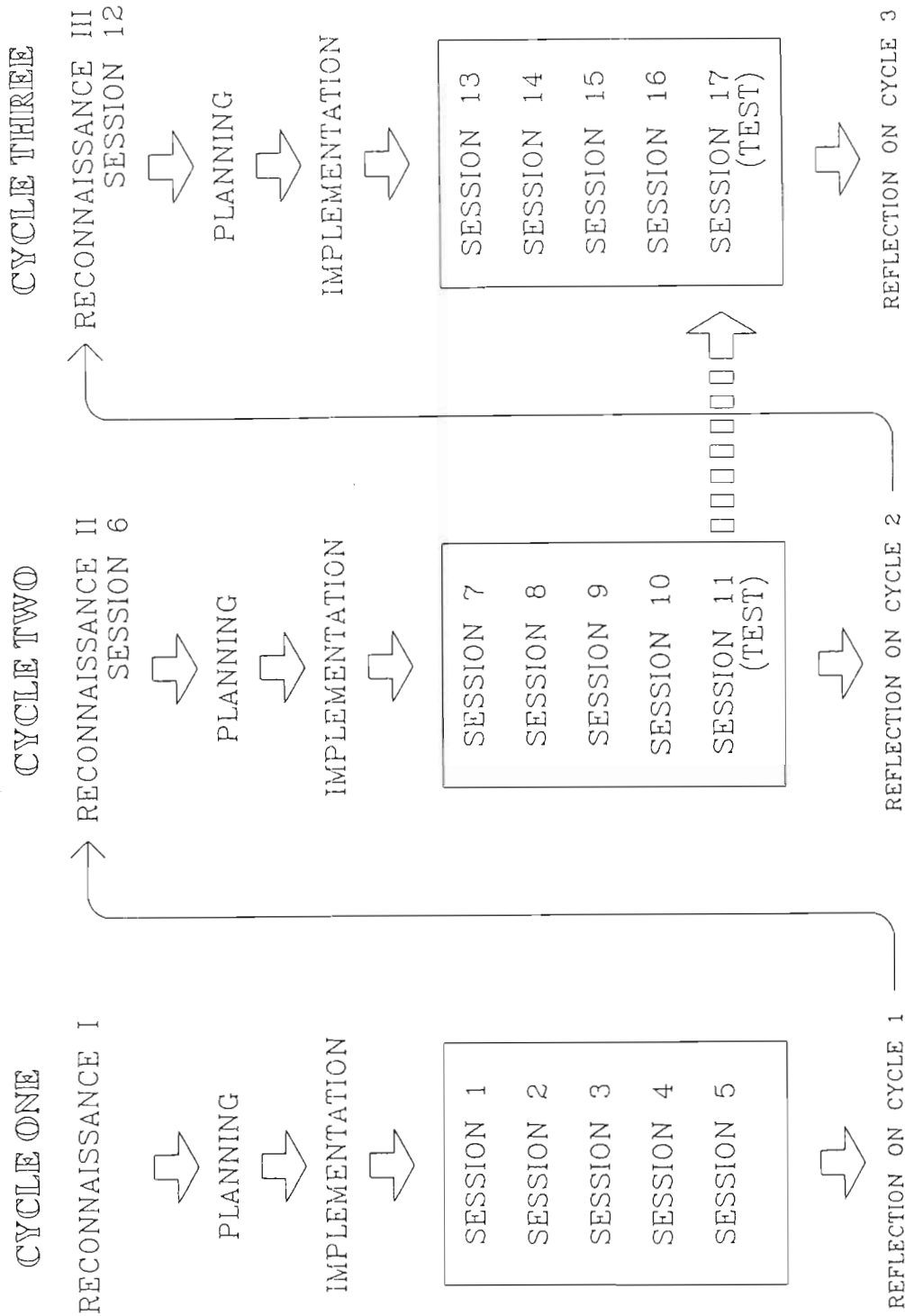


Figure 1 Overview of the Action Research

Cycle: refers to a part of the action-research consisting of moments of planning, observing, reflecting and acting, and focussing on specific areas of enquiry  
Reconnaissance: refers to a stage in the research in which there was convergence of reflections, made by the participants, of preceding processes that had occurred and their use for planning of action for a subsequent cycle  
Planning: involved a meta-reflection of reconnaissance for me in planning the lecture sessions of the subsequent cycle  
Implementation: refers to the action that resulted from the plan and embodied observing, reflecting and planning within and after sessions of the cycle  
Session: refers to a lecture session  
Reflection: refers to reflections within sessions and after sessions of the cycle by participants.

## CHAPTER 2

### COOPERATIVE LEARNING: LITERATURE REVIEW

There is a long history of research on cooperative learning (CL), especially relating to its effects, its potential for academic and personal development and for high achievement. Although there has been a recent renewed interest in small group learning, CL is an idea that has been around for some time. The origins of peer tutoring (a form of CL) have been traced back to Greek and Roman times by western writers like Hooper (1992). It has become an important area of science education research in recent years.

The literature on research in CL may be considered in a chronology of 'waves' or foci, identified as follows:

- \* focus on the assumption that CL was beneficial
- \* focus on generating CL models/techniques
- \* focus on evaluating models/techniques
- \* focus on interactions within the small CL group.

The first three waves will be discussed briefly, while the last will be dealt with in greater detail since this would help in locating my enquiry. Furthermore, some research in the pre-service and in-service education sectors, will be discussed. I will then sketch the implications of this review for the study that I conducted.

#### **2.1 Early Focus: Value of CL**

Walberg (1984), in his extensive review of educational research, asserted that CL had significant effects on learning. According to Sapon-Shevin and Schniedewind (1992), the view that the CL approach was beneficial in classrooms had its roots in social psychological theory. They trace this view to include Morton Deutch's theory on cooperation and competition that emanated from Kurt Lewin's work in the 1940s, work on the effects of goal structure on group cohesiveness in the 1950s, work of the social reform movement of the 1960s, and work on inter-ethnic relationships by the desegregation and integration efforts of the 1970s (ibid).

The idea that CL was of benefit in education developed further with theories, on the role of social interaction in learning, like those of Sullivan in the 1950s, Piaget in the 1960s and Vygotsky in the 1970s (Lumpe and Staver, 1995). Sullivan's assertion was that peers could work together without replicating one another's ideas. His ideas were modified by Damon (Phelps and Damon, 1989), who proposed that ideas were jointly formed during interactions, which involved the sharing of ideas, consensus seeking, compromises and remaining open to new insights. Piaget's idea of the social genesis of knowledge was part of his theory of cognitive development. He emphasised the cognitive conflict aspect of peer interaction, as resulting in 'disequilibrium' and then 'equilibrium'. Vygotsky's 'zone of proximal development', that is, the difference between the ability of a person to solve a problem alone and the ability to do it with the help of a more knowledgeable person, followed his argument that social interaction involved cognitive structuring which is later internalised by a person (Lumpe and Staver, 1995).

The major researchers of CL, like Roger Johnson and David Johnson, Shlomo Sharan and Robert Slavin, argued that cooperative group-work could serve as a motivational tool for learners, thereby increasing achievement.

## **2.2 Focus on Teaching Method Models**

In the 1970s principles of cooperation were made into programmes for use in classrooms. Research into cooperative learning methods in classroom settings in the 1970s, yielded many different models of CL that were initiated by groups in USA and Israel. Slavin (1991) outlined these, as the *Student Team Learning (STL)*, *Jigsaw*, *Learning Together* and *Group Investigation* models. *STL* which included *TGT (Teams-Games-Tournament)* and *STAD (Student Teams Achievement Divisions)*, was developed at the John Hopkins University in USA, with Slavin being a major developer; *Jigsaw* by Aronson and others in USA; *Learning Together* by David and Roger Johnson in USA; and *Group Investigation (GI)* by Shlomo Sharan and others in Israel (Watson, 1992).

Generally, the models proposed how CL may be structured. According to Sharan and Sharan (1990) the *GI* model grew out of their interest in Herbert Thelon's group investigation model

which, according to Joyce and Weil (1980), attempted

*to combine in one teaching strategy the form and dynamics of the democratic process with the process of academic inquiry* (p 230).

The *GI* model represented an attempt to eliminate competition and emphasised the accessing of information by students, the interpretation of information through group discussion and the collation of individual contributions into a group presentation. Inherent in the other models was a reward system as motivation.

The major CL approaches of Slavin (1980) and the Johnsons (1987), may be seen as being influenced by the educational and philosophical teachings of experimental psychology and behaviour analysis of the 1960s and 1970s (Sapon-Shevin and Schniedewind, 1992).

Joyce and Weil (1980) saw the CL models as originating from models of teaching, namely, the *Jurisprudential Model* (developed by Donald Oliver and James Shaver), the *Group Investigation Model* (theorised by Herbert Thelon and John Dewey), the *Social Inquiry Model* (whose major theorists were Byron Massiales and Benjamin Cox) and the *Laboratory Method Model* (developed by the National Training Laboratory in USA). These models had been informed by social inquiry. The major CL techniques were seen by the developers themselves as having emerged from social psychological theory (Slavin, 1980; Johnson and Johnson, 1987).

### **2.3 Focus on Evaluating CL Models**

In response to the models that were proposed, research and practice of CL began focussing on evaluating them. This evaluation was in the mode of the behaviouristic paradigm (eg., on improved academic achievement using quantitative data analysis) by Slavin's group and, on the added goal of developing social skills for working in groups using systematic instruction on social behaviours, by the Johnson group. Techniques were evaluated in numerous laboratory and field experiments in the 1970s and 1980s, although research on the effects of cooperation dates back to the 1920s in the work of J.B. Maller (Slavin, 1991). Most of these studies involved comparing experimental (CL treatment) with control groups. In the Johnsons' research portfolio alone, there were many such investigations. Other studies,

involving CL treatment and control groups, included those of Ryan and Wheeler (1977), O'Donnell et al (1985), Okebukola (1986a, 1986b, 1992), Okebukola and Jegede (1988) and Lazarowitz et al (1988).

Furthermore, major research reviews on CL, like those of Johnson and Johnson (1974), Slavin (1980, 1991), Johnson et al (1981) and F. Newman and J. A. Thompson (Cohen, 1994), concentrated on comparing the effectiveness of CL techniques with traditional forms of instruction. Thus there was a preponderance of research in the ilk of the experimental-control type of enquiry, which typified positivistic research. A further characteristic of this type of research, namely an input-output design, of experimental work using a pre-test, intervention, post-test format, was prevalent in this wave of research on CL.

Claims made by this wave of research were that CL promoted academic achievement, higher levels of cognition, positive peer relationships, social skills and social support, self-esteem, inter-ethnic relations and mainstreaming of students (Slavin, 1991; Sharan, 1980; Johnson et al, 1981). In a review of the use of cooperative learning techniques in science education, Blosser (1993) commented that CL prepared students for society and that it allowed "active learning-students" to learn more than when they were passively listening. She cited various authors who suggested that CL

*motivates, leads to academic gains, fosters respect for diversity, and advances language skills...breaks down stereotypes and leads to an increase in self-esteem (p 4).*

In agreeing with the "noteworthy effects" on cognitive, affective and social variables of the CL methods discussed, Sharan (1980) distinguished between 'peer-tutoring' and 'group investigation' methods. He provided hypotheses, concerning the effects of the various methods on academic achievement, 'affective-social' and 'racial relations'. These hypotheses indicated an emphasis on studies comparing different CL methods, rather than comparing a CL method with traditional classroom instruction. In urging the research community towards such 'comparative' studies he does not do justice to his statement that

*In order to understand the process as well as the products of cooperative learning we must learn about what transpires within the group (p 267).*

A cogent argument in the use of the positive effects of CL, could not be made on findings

from research of the input-output design, especially due to a lack of observational data in linking achievements that were investigated to the CL strategies used.

More recently, research seemed to have shifted from such 'experimental-control' foci, to investing more value in interpretations made from in-depth observational studies of processes involved in group interactions. Studies focussing on interactions began to emerge, mostly in the latter part of the 1980s.

As people began to view CL as an essential element of learning, opposition to the 'models' approach to CL also made itself felt. This was embodied by Kohn's (1992) attack on CL models research when he asserted that

*CL is not simply a set of techniques...it is an entirely different way of approaching the act of learning* (p42).

Kohn was particularly scathing about the use of rewards in motivating learners. He saw Morton Deutsch's idea of 1949, of 'promotive interdependence', in which group members' goals were linked, as being misinterpreted by people like R. E. Slavin, who believed that interdependence was best achieved by the use of rewards. Kohn urged for a critical examination of this supposition (Kohn, 1991).

Bossert (1988), on reviewing the research on cooperative learning, found that the research field suggested that CL was beneficial for all age groups, for all subjects and for a wide range of tasks; but he was critical of the lack of theory, in the research, about ways in which these effects were produced. He criticised the research tradition of comparing a CL method with a non-cooperative one on outcomes alone.

Furthermore, in some of the early studies, like that of DeVries and Slavin (1978), the results of CL were seen to be the same as those of more traditional forms of instruction. In a review of CL in mathematics education by Davidson (1985), significant differences favouring CL over traditional studies were found only in a third of the studies reviewed. F. Newman and J. A. Thompson (Cohen, 1994) found 68% of the studies, that they reviewed, favoured CL over traditional strategies.

## 2.4 Focus on Learner Interaction in CL Groups

Recently cooperative learning began to be viewed more as an "ever-growing philosophy of education", rather than an instructional technique (Sapon-Shevin and Schniedewind, 1992). It must be noted, however, that the approaches advocated by Slavin and other researchers still enjoy favour in research and practice in science education and other fields, as evident in the research of Miller (1996) and other workers.

Generally, in past research, there seemed to be an overemphasis on the different methods or techniques of CL, as represented by the production of models. Furthermore, research seemed to revolve around investigations which were partial to comparing CL effects with those of individualistic and competitive approaches and, later, analyses comparing different CL methods as in Sharan's work (1980). These research approaches, generally, used experimental and control groups in the inquiry design, with little inquiry into the nature of the CL strategies themselves.

In reviewing the research about CL, Tobin, Tippins and Gallard (1994) remarked that they found

*little empirical research on the teacher's mediational role in cooperative-learning environments, the role of negotiation and consensus building in the collaborative process, or how collaborative learning actually develops* (p 79).

More recently, however, there have been studies of interactions within groups, albeit using empirical approaches.

Some studies progressed beyond the 'black-box' approach to include enquiry into features of particular conditions that were seen to facilitate or even constrain cooperation. Much of the research on interaction, however, persisted in using the experimental 'input-output' formats, with as much in the way of correlational studies, as had occurred in the 'evaluation of techniques' studies. Tingle and Good (1990) studied the effect of cooperative group interactions on problem-solving. Although they used a pre-test, intervention and post-test design, they also used qualitative analysis of video-taped interactions and written work. The study led to their proposal that CL might serve as a means of teaching interaction skills.



Basili and Sanford (1991) looked at interactions involved during concept development in groups. They used qualitative analysis of transcript data, which involved coding of verbal interactions and roles that emerged in the small group discussions. They included control groups, however, to answer one of their research questions, which asked if small group CL might result in a lower proportion of "misconceptions" (sic) than those from individualistic learning. Among the results, the study inferred that certain conditions were necessary for conceptual change, dynamics of leadership roles and how interactions might reinforce or clarify science concepts for learners.

In his study, Lonning (1993) also used a 'pre-test-intervention-post-test' format, that evaluated the effects of CL strategies on verbal interactions and achievements of learners. One group was given treatment on CL strategies which involved instruction in collaborative skills and group evaluation of assignments, whereas a control section of learners, who also worked in small groups, were given no instruction on collaborative skills and were evaluated individually on group work. Verbal interaction patterns were video-taped and analysed. He found that specific verbal interaction patterns, that were believed to be related to increased learning, had been used by the treatment group who showed greater achievement gains.

What was different about the experimental studies discussed above, was that they were among studies that increasingly inquired about aspects of interaction, by using progressively more in-depth observations of interactions. They did this by using transcripts of audio-taped or video-taped group actions in analysis, indicating that qualitative analysis was beginning to be emphasised. Similarly there was also a move towards interviewing learners, as shown by Stephens et al (1988), who relied on this technique rather than questionnaires and written pre- and post-tests.

Webb's (1982) review of learning in small groups, concentrated on interaction processes occurring within groups, in that it included a focus on the relationship between interaction and achievement and on the, "*cognitive processes and social-emotional mechanisms bridging interaction and achievement*". She concludes that "*an individual's role in group interaction is an important influence on learning*" and that, "*interaction can best be predicted from multiple characteristics of the individual, group, and setting*" (ibid: p 421). More important

was her emphasis that research examined specific categories of student interaction, instead of measurement of aspects like the frequency of utterances. In lamenting the tendency for researchers to quantify verbal interactions, in relating them to learning, she suggests that evidence of aspects like cognitive restructuring processes, might be sought in the analysis of the actual interaction, using video-tapes or audio-tapes and self-reports from group members. She felt that this would clarify **how** interaction in groups might promote learning and clarify operating mechanisms such as rates of participation.

Analysis of video-taped group sessions, had been included in some studies in the 1970s, like those of Cohen and her co-workers (Webb, 1982). But in the main, it seemed that such observational methods were used only after Webb's review.

Peterson and Swing (1985), seemingly in response to Webb's suggestion to investigate students' cognition in small-group learning, looked at how these cognitions mediated the effectiveness of small-group learning. They coded transcripts of video-tapes of the interactions, to develop categories of interactions, such as listening, explaining, receiving an explanation and social interaction, among others.

Ross and Raphael (1990) coded both audio-tapes and video-tapes in their investigation of communication aspects in problem-solving, thereby enabling them to develop categories of interactions in small groups.

Another study that used in-depth observations, gleaned off audio-tapes of discussions in small groups, was that of Kempa and Ayob (1991), who focussed on verbal interaction in problem-solving tasks to explore the effectiveness of small-group learning in science.

Keys (1995) used collaboratively-written laboratory reports and video-taping of interactions during collaboration, to inquire into students' use of scientific reasoning. Her interpretive study made use of qualitative analysis of discourse.

In his survey of CL in Western Australia, Williamson (1990) reported that there were a few studies, including some recent ones, which involved teachers looking at their own

classrooms. He concluded that,

*These studies, unlike those in the US, are descriptive, small-scale and have focussed on mediating processes in co-operative learning groups rather than outcomes (p 75).*

Much of the qualitative mode of analysis came from studies involving conceptual change: from that of Barnes and Todd (1977) who, in arguing for group-generated construction of meaning, used qualitative techniques in analysing group-generated construction of concepts; to that of Lumpe and Staver (1995), who in their focus on cognitive roles taken by members in a group, attempted to describe the thinking processes that occurred during peer interaction.

In her review of productive small groups, Cohen (1994) included a number of "*modest qualitative studies*" which focussed on the nature of group interactions, most of which were written in the 1980s. These included those of D.L. Schwartz, J.B. Black and J. Strange, whose study, written in 1991, took a constructivist view in investigating why dyads (pairs) were effective in learning; G.L. Chang and G. Wells, whose 1987 study suggested group management of problem-solving with explicit talk; and P. Vedder who, in suggesting that effective CL might result from an explicit process, reported in 1985 on how group members might control and evaluate each other.

As a result of their study, B.P Cohen and Arechevala-Vargas proposed in 1987, that action needed to be taken in reducing uncertainty of the task and on status treatment (Cohen, 1994). E. Cohen's subsequent review (ibid) identified aspects that may be used to predict interaction. She proposed the necessity of both resource and goal interdependence which might be required for desired group participation. She also identified factors that might affect participation.

Cohen's review differed from previous ones in that, among other processes, she moved "*beyond the general questions of effectiveness of small group learning*" (Cohen, 1994: p 1), she developed the review inductively and conceptually, thereby generating propositions about conditions for productive small groups and she built an argument to shift the focus of research of CL by researchers, staff developers and practitioners to "*a second generation cooperative learning that is more firmly based on detailed knowledge of what makes groups*

*productive*" (ibid: p 31).

In looking at some of the recent research on interactions within the small group, the methods of observation and analysis may be seen as a trend, concurrent with a change from empiricist epistemology to a constructivist philosophy informing instructional strategy. A significant aspect of current CL research was the conscious embedding of CL in Piagetian and Vygotskyian learning theory, in order to ground peer interaction in a theoretical framework for cognitive growth. The concept of group cognition, informed by socio-cognitive developmental theory, was used to argue that CL facilitates socially constructed understanding among learners.

Thus, studies using qualitative observations and analysis, focussed on the nuances of interaction within the small CL group. Some such studies, like those of Lumpe and Staver (1995) distinguished between the CL methods of researchers. They dubbed the CL techniques of Slavin and others cooperative learning and distinguished them from their approach, which they called peer collaborative learning and from yet others, which they referred to as peer-tutoring. These distinctions, made also by Phelps and Damon (1989), were based on the levels of equality and mutuality in interactions. Equality describes the relative ability levels of the learners while mutuality describes the commonality of goals of the learners. Peer collaboration was seen to be high in equality and mutuality, 'cooperative learning' (as in *TGT* and *STAD*) as high in equality and low in mutuality, and peer tutoring as low in equality and varying in mutuality according to the goals of the 'tutor'.

Some studies, in using case-study methodology over longer periods of time, had moved beyond experimental settings in inquiry. Among those was a case-study of a university course in New Zealand by Jackson (1994). The evaluation involved evidence gleaned off observational data, interviews, 'discussion log books' and other sources, used to canvass student views. Suggestions made during the implementation of the course were considered for planning subsequent phases of the course. It may be seen as a form of action research, although the authors had not labelled it such, perhaps because it did not employ the features of critical action research. It seemed to stand at the technical and practical levels.

The work of Naidoo and Reddy (1994), may be included in the genre of studies that moved towards observations of the interactive contexts of CL. They used action research in their inquiry of the feasibility of CL as an approach for teaching and learning in a large class situation.

Action-research methodology has featured in a few recent CL studies. A study by Roth (1994), a "*participative action research*" inquiry into high-school students' views on concept-mapping, used interpretive methodology in analysing written reflections on concept-mapping, a questionnaire that was 'validated' by some students, and video-taped sessions with transcripts. The study incorporated 'member checks' and was seen, by the author, as an attempt to "*fulfil practical and emancipatory interests of teachers and students alike*" (ibid: p 5). These aspirations may have been satisfied, in that the inquiry developed understandings of the teaching-learning setting as experienced by both the teacher and students, and in that it was concerned with transforming the setting, based on information from constructions that were generated by the research. Du Bois (1994) used an action-research approach in his inquiry into conceptual learning and creative problem solving in CL groups. He collected data from classroom observations, video-tapes, interviews and personal reflections.

## **2.5 CL in Pre-Service and In-Service Education**

Generally, there was little CL research in the pre-service and in-service areas of education. Johnson and Johnson (1985: 23-24) in commenting that they had "*examined over a thousand studies dating back to the late 1800s*" regretted that CL as, "*a major instructional tool... (is) not found in most teacher education programs.*" Cannon and Scharmann (1996) noted its

*lack of use or notoriety with preservice elementary science teachers in early field experiences, methods courses, or practicum experiences* (p 421).

Jones and Steinbrink (1989) reported on a series of CL learning seminars that took place during the 1986-1988 school years in USA. It involved 50 in-service science teachers who had participated in CL learning seminars and the aim had been to develop a *Two level Small Group* model of CL.

In a report of a year's implementation of CL in their classroom, after a one-day workshop

given by the Johnsons, Edwards and Stout (1990) reflected on the obstacles that they had encountered. They provided "practical suggestions" to teachers who might wish to implement CL in their classrooms and emphasised the help of collegial support groups to facilitate implementation.

Sharan and Sharan (1987) suggested a five-stage experiential learning model, for an INSET workshop to 'train' teachers for cooperative learning. They proposed that the 'training' of teachers for CL might allow those teachers to develop skills for organising CL and for analysing and evaluating lessons, as well as incorporating the effects in both cooperative behaviour and academic learning.

The experiential model proposed by Sharan and Sharan (1987), involved teachers experiencing a CL session, observing and reflecting on it, formulating generalisations, planning implementation and implementing. They listed cooperative skills like communication, interaction, cooperative planning, sharing ideas, decision making, listening, taking turns, exchanging and synthesising ideas and accepting diversity, as outcomes of a CL experience, for teachers in a workshop using this model. If their ideas had included reporting the experiences by the teachers and, if the cycle had extended into their classroom practice, it would have developed into an action-research inquiry for practising teachers.

Lord (1994) reported on a study undertaken to see if biology teachers would find CL beneficial in their teaching. Fifteen teachers participated in two workshops. Positive attitudinal changes towards CL, by the teachers, were gleaned off questionnaires administered at both workshops. The teachers reported that achievements of their students, as well as students' understandings and attitudes to life science classes, had improved.

Sapon-Shevin and Schniederwind (1992), however, cautioned against approaching the implementation of CL by using workshops. They said that,

*While the principles of cooperative learning can certainly be absorbed in a two-hour session or a one-day workshop, it is unlikely that teachers can truly become comfortable and innovative practitioners of a new teaching approach in a short period of time... (It) may encourage teachers and other implementers to adopt a cookbook approach to cooperative learning (p 16).*

Hart (n.d.) reported on a small-scale research project in 1988, that inquired into how experienced teachers developed collaborative methods of working. The interpretive study through observations of teachers in practice, and in recognising that collaboration might be "promoted by *indirect* means" and by "individual activities", recommended that INSET courses might present issues that encouraged a range of strategies to promote collaboration in the classroom, instead of emphasising 'group work' only.

In researching the efficacy of two instructional models in bringing about conceptual change in elementary education major pre-service students, Stephens, Dyche and Beisweiger (1988) found that the learning cycle approach, which incorporated small group learning, yielded higher gains. The research, however, did not attempt to inform classroom practice. An attempt to link CL strategies and teaching practice was inherent in the research of Cannon and Scharmann (1996). They inferred that

*cooperative early field experiences appear to have a crucial, positive influence on elementary preservice teachers' self-efficacy* (p 431).

In South Africa, the work of Naidoo and Reddy (1994) exemplified inquiry into CL practice in the pre-service domain. Although the research was not extended into student teaching practice, it was felt that these experiences of students, in their pre-service years of education, might help in empowering the teacher in his or her practice.

Classroom action research was perceived by Wood (1988) to provide pre-service and in-service teachers with a valuable form of teacher-centred professional development. She used action research in a case study on student cooperation in an elementary classroom.

Not only may teachers and students of education require such learning, but also lecturers who run education courses. Although the pre-service student may need to experience CL both in learning situations and classroom teaching practice to inform CL praxis, the lecturer may need to inform his/her own praxis by researching CL implementation in his/her practice. The beginnings of such a tradition was seen in the study undertaken by Naidoo and Reddy (1994).

In inviting teachers to join their CL research effort, Johnson and Johnson (1986) proposed

that teachers do action research in CL: but they suggested that teachers could "*replicate the classic studies, comparing cooperative learning with competitive or individualistic learning*" (p 32), as one type of study. This type of study may not allow for critical action research. There is greater potential for such research in the "*refinement research*" or the "*research designed to extend the theory*" (ibid: p32), that they suggested, as well.

Generally, it is felt that teachers do not incorporate CL in their classrooms, even though it has been recommended by research findings. Schools in South Africa are perceived to use traditional forms of instruction and a history of CL research is almost non-existent in South Africa, although some inquiry into CL has now been emerging. The National Education Coordinating Committee's (1986) exhortation that education must "*instil democratic values such as cooperative work*", may be seen in the light of placing CL on the agenda of education in South Africa. This was echoed in subsequent policy documents in South Africa, like that of the ANC (1994) and the government's White Paper on Education and Training (Department of Education, 1995) and culminated in the form of one of the *critical outcomes*, as part of the transformed curriculum for education in South Africa.

Perhaps the Johnsons' (1985) idea that, the place to begin change in modes of teaching and learning might be in teacher education and in-service programs, has begun to filter through to South Africa. In proposing that cooperation be "*modeled by instructors in education classes*" the Johnsons have made a case for structuring CL in pre-service education lectures. This practice, however, may be new for the lecturer.

Subsequent to my data collection and analysis a search revealed a report of a study that employed interpretive research methods (Watson, 1995). She used the study to describe "*a preservice teacher education class whose modus operandi is (sic) cooperative learning*" in the hope of encouraging teacher educators to become 'facilitators of learning'. As a result of her study Watson (ibid) encouraged the idea that students be exposed to the practice of cooperative learning in saying that

*Instructors should model cooperation in education classes* (p 210).

She backs this up with an assertion by J. Van Voorhis that

*Modeling gives students a deeper understanding of the strategies and enables the*



*leap from theory to practice often missing in education classes (p 210).*

A study, by a general science teacher, was reported in Davidorff and van den Berg (1990) in South Africa. It was concerned with the use of action research in transforming the type of student involvement in the teacher's traditional 'chalk-and-talk' instruction to one of active participation in a student-centred approach. Naidoo and Reddy (1994) also employed action research to implement CL in response to their perceived problem of instructing a large class. Although they had started out addressing the problem by structuring instruction in grouping students, the failure of such an intervention was perceived by them, as linked to their "*naive understanding of the learning context and groupwork*" (p 7). Their subsequent action-research strategy, based on a recognition of the innovative context of CL, revealed understandings about the potential of using action-research methodology to introduce an innovative practice, like CL.

CL has been seen as having the potential to improve learning. Action research has been recommended by many as a useful way of informing innovative practice, in generating understandings of new and changed praxis. Since the context of my CL practice at Edgewood college was one of innovation, action-research was chosen as the appropriate methodology of the inquiry. The implication for implementing CL, as innovative practice, for a pre-service lecturer using an action-research approach, is that it is potentially empowering and it represents a way of minimising practitioner and student resistance.

Furthermore, there has been a call for the preparation of teachers who are reflective practitioners, both internationally by people like Schon (1983) and in South Africa, by the document released by a government-appointed committee (Committee on Teacher Education Policy, 1995) involved in reforming teacher education. The reflective practice that was built into and modelled by this action-research inquiry exposed pre-service students to varying levels of reflection. Along these lines of modelling reflective practice, Steussy and Naizer (1996) developed a course that represented a prototype of the *Teachers as Reflective Problem Solvers (TARPS)* model for the preparation of elementary mathematics and science teachers.

## 2.6 Conclusion

Research in the area of CL has been discussed chronologically and comment made using a historical perspective. The main research trend may be summarised as going through various phases representing different orientations of research, as shown in Figure 2.

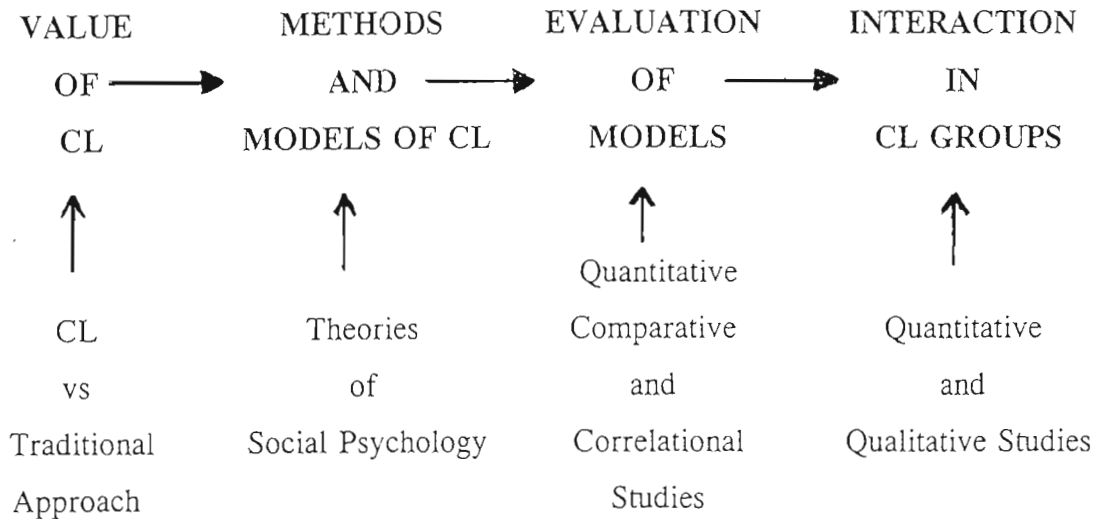


Figure 2 *CL Research Trends*

There was an early focus, oriented towards enunciating a body of theory on the value of CL, as opposed to learning in the traditional instruction of the day, that is, of individualistic learning in individualistic or competitive environments.

This was followed by a focus on 'teaching method' issues, which generated many methods and models or techniques, in structuring and managing cooperative activities, influenced generally by theories of social psychology.

A prolific phase of CL research followed, involving evaluating and re-assessing the models of CL instruction. Such research was dominated by experimental research, in the form of comparative and correlational work, with a preponderance of statistical analysis in its bias towards the quantitative research tradition of positivism and 'input-intervention-output' design. The production of lists of evidence attempting to show worthwhile

outcomes of CL marked this phase.

The focus then shifted to inquiring into the interactions that occurred among learners in the small CL group. Such inquiry is included in the current prolific phase of research on CL. Achievement, or other outcomes, were still being highlighted. Some descriptive and interpretive studies, using qualitative analysis, however, emerged. Concomitant with this phase, was one of debate on some emerging controversies, including a focus on the teacher's influence which generated commentary on aspects of authority, power and control. Other controversial areas were the conflicting ideologies of cooperation and competition informing many CL models and the debate between extrinsic (rewards) and intrinsic motivation. Besides these, there are many studies of CL in computer instruction and the use of computer software like *Groupware* to facilitate CL.

Concurrent with the phase of evaluation of models and subsequent phases, there was an outcry by some against the 'cookbook approach' of implementing CL. This may be seen as emanating from a feeling that teachers had been '*diluting*' (to use Kohn's word) the potential of CL by adopting pre-packaged techniques or that they had been abandoning the approach. Such abandonment was seen to be a result of flawed implementation processes or of resistance to 'expert developed approaches' rather than teacher-driven development. Such commentary presaged a phase in which teachers began researching their CL practice.

In looking at my own CL practice and not as an 'outside researcher', my inquiry is located within this last mode of research. Action research of the study meant that I had chosen to allow an evolution of process rather than using prescriptive processes or techniques embodied in implementing a model. In using an action-research approach into inquiring into interactions in CL groups, I have chosen not to use a traditional 'input-intervention-output' approach or a 'black box' approach used by many past researchers. The action research aspect of the study is described in Chapter 3.

I have been informed by many findings about CL that have emerged from research done in the various traditions, for example, findings relating to conceptual change, like those of

Lumpe and Staver (1995) and others, informed some aspects related to concept development. I engaged with ideas about the role of status in CL, emerging from Cohen's (1994) work and about participative research from Roth (1994). Some discussion of the use of past research findings is given in Chapter 7 under implications (section 7.1).

Locating the research within my own lecture practice, is compatible with the advice of people like Johnson and Johnson (1985) and Watson (1995) on modelling of CL by instructors of education.

## CHAPTER 3

### RESEARCH METHODOLOGY

The methodology employed by this inquiry is that of action research. A brief description of the following aspects is given in this chapter:

- \* action-research methodology and the way I employed it;
- \* the data type and instruments used to collect them;
- \* the rationale behind the choices I made; and
- \* trustworthiness.

#### **3.1 Action Research**

Action research is a research tradition that arose, as a shift from the psycho-statistical or empirical tradition of research. It has strong links to social science research (Hopkins, 1993). In educational research, action research grew as a response to growing rejection of a positivistic view of knowledge, with its emphasis on pre-specified measurable outcomes and its denigration of the teacher's role to knowledge-user or servicer (Elliot, 1991). It celebrates the teacher's role as that of a self-directed professional and it requires that research activity be an integral part of professional work (Hopkins, 1993). Thus it subscribes to the idea of research in practice.

Since each teaching and learning situation is contextual and changing, conclusions are tentative and subject to revision in an action research enquiry. According to Elliott (1991:1) conclusions or 'theories' were "...*not validated independently and then applied to practice. They were validated through practice*" in action-research. A basic tenet of the action-research procedure, therefore, is that it is disciplined by enquiry, being an attempt at understanding while engaged in the process of improvement of practice.

Generally, the use of action research is thought to have originated from the ideas of Kurt Lewin in the 1940s. Lewin saw it as consisting of:

*analysis, fact-finding, conceptualisation, planning execution, more fact-finding or evaluation; and then a repetition of this whole circle of activities; indeed a*

*spiral of such circles* (Hopkins, 1993:45).

During the 1980s and 1990s, Lewin's ideas were used by educational research and action research became defined by people like Carr and Kemmis, Dave Ebbutt and Elliot, variously as:

*...a form of self-reflective enquiry undertaken by participants in social (including educational) situations in order to improve the rationality and justice of (a) their own social or educational practices, (b) their understanding of these practices, and (c) the situations in which the practices are carried out* (Carr and Kemmis, 1986:162)

*...the systematic study of attempts to improve educational practice by groups of participants by means of their own practical actions and by means of their own reflection upon the effects of those actions* (Ebbutt, cited in Hopkins, 1985:45)

*...the study of a social situation with a view to improving the quality of action within it* (Elliott, 1991:69).

Proponents of action research, as a methodology for teachers doing research, include Lawrence Stenhouse in the UK, who saw in it a way of realizing his notion of the "teacher as researcher", Elliott in the UK, who saw it as a method for teachers doing research in their own classrooms and Kemmis in Australia, who refined and formalised the concept of action research as it applies to education.

There are two concerns of action research, namely, to improve practice and to increase knowledge and understanding. These concerns are linked into in a spiral or a series of cycles of activities, in which each cycle learns from the preceding one (retrospectively, but also simultaneously) and shapes the next one (prospectively).

S.Kemmis, J.Elliott and D.Ebbutt produced schematic models to represent the way each conceived the process of action research (Hopkins, 1985). Basically, each of these models embodied a spiral (as in the ideas of Kemmis and Elliott) or a series of cycles (as in Ebbutt's idea), consisting of successive stages of planning, acting and reflecting. These models and other ones that were developed subsequently, built on Lewin's idea and Kemmis' theorising about it. Although the models shared differences, there remained consensus among researchers about the overall method and purpose of action research.

### 3.2 Action Research in This Study

The locus of the research was in the second year Natural Science course. The 1995 class was made up of twelve students (Table 3.1). The entire class thus represented a purposive sample of a case of the Natural Science course. Other participants in the study included two lecturers (a colleague and myself), taking the first semester second-year Natural Science course in 1995 at Edgewood College of Education. Six other lecturers were involved as respondents to a questionnaire during the first reconnaissance.

**Table 3.1** The Student Sample

PARTICIPANT	GENDER	FIRST LANGUAGE	SCHOOLING
S1	F	Zulu	PROMAT
S2	F	English	ex-HOD
S3	M	Zulu	PRIVATE
S4	M	Zulu	ex-KZDEC
S5	F	Zulu	ex-KZDEC
S6	F	Zulu	ex-KZDEC
S7	M	Zulu	ex-KZDEC
S8	M	English	ex-HOD
S9	F	Zulu	PROMAT
S10	F	English	ex-HOA
S11	M	Zulu	ex-KZDEC
S12	M	Zulu	ex-KZDEC

In this inquiry into cooperative learning (CL), the process of action research followed a spiral of 3 cycles, each consisting of reconnaissance, planning, observing and reflecting in action and reflecting on action, followed by a new reconnaissance ushering in the next cycle. It ended at the fourth 'reconnaissance' stage. I presented three topics over most of the semester. Figure 3.1 gives an outline of the process.

The reconnaissance stage may be regarded as a focal point of each cycle. By nature it was both retrospective and prospective, since it integrated reflecting and planning. Reflecting on reflections made during a cycle made the reconnaissance a meta-reflective act.

*Reconnaissance I* involved contextualising student CL experiences. Although it involved reflections made by student participants and six lecturers, it was primarily for my understanding to inform planning, whereas the two subsequent reconnaissance stages were

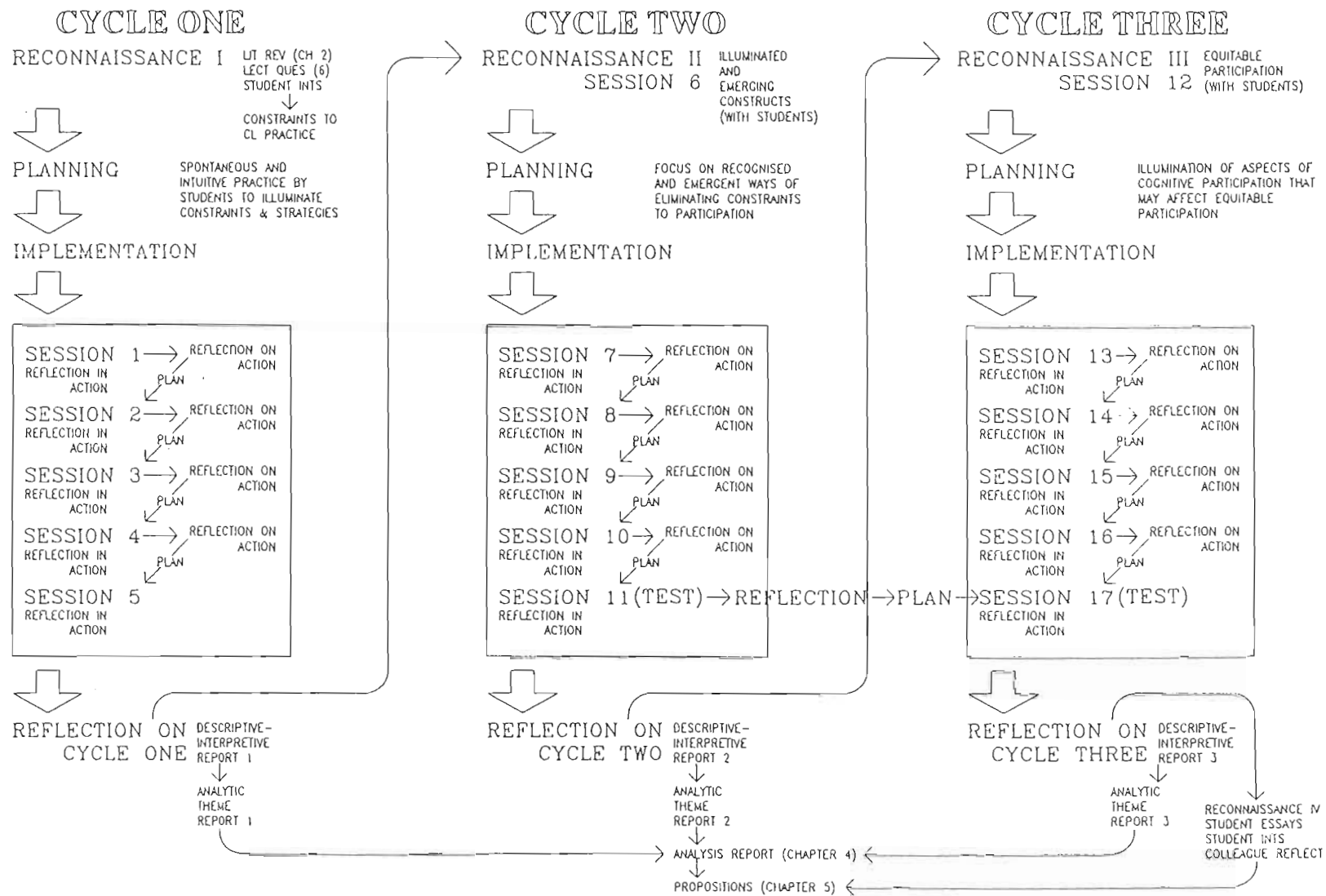
seen as more collaborative in that all students, the colleague and myself participated in both reflection and planning aspects. *Reconnaissance IV*, however, involved only me, since students moved on to a series of lectures with the colleague.

The method evolved responsively during the study, not as a prescriptive model shaping the phases of the research, but more in response to the contextual issues of topics and time. The research progressed in the spirit of contextualising action advocated by action-research proponents. The tight specification of process steps and cycles of past action-research models, was seen as potentially constraining and counter to the central emphasis on individual autonomy, action and ‘emancipation’, the very emphasis of the prescriptive research mode of positivism, that action research inherently works against.

A fourth cycle involving the conducting of the last 6 sessions of the semester by the colleague, as had originally been planned, was not included in the study. The college timetable had been interrupted by boycott action staged by the student body at Edgewood college. Adjustments made by the colleague to the learning programme for students resulted in a change of plan concerning the last 6 sessions. This plan could not accommodate a last cycle that would have been informed by *Reconnaissance IV*, of the research.



Figure 3.1 The Action-Research Cycles



### 3.3 Data Types and Collection Instruments

The study engendered data consisting of evidence collected from interviews, summaries and transcripts of audio-tapes, a research diary, reflective notes made by students, classroom observation notes made by the colleague, student products, student group member observations and questionnaires. Data obtained were in the form of texts. The variety of data allowed for triangulation, by 'data source, by method, by persons and by type', as advocated by Miles and Huberman (1994). Data source types were variously allocated according to the table shown in Appendix XIII (page xiii1). Another source of data was a retrospective interview with the colleague a year after the action research (Appendix XV). Table 3.2 displays the data sources used at different stages of the research and an explanation of each type of data source follows. A more detailed table of data collection is in Appendix XIII (page xiii1)

**Table 3.2** Data Sources

CYCLE 1: Reconnaissance I Sessions 1-5	* Student Interview 1; Lecturer Questionnaire; RD * Colleague's Notes 1-2; Students' Reflections; Student Products - posters, reports, presentations; Taped group-talk; Descriptive-Interpretive Report I; Analytic-Theme Report I; RD
CYCLE 2: Reconnaissance II Sessions 7-11	* Session 6 Posters; Taped Group-Talk; Colleague's Note 3; RD; Student Reflections; Cycle 1 Data * Colleague's Notes 4-5; Students' Reflective Notes; Member Observations; Student Products - posters, test, presentations, lists of ideas, reports; Taped Group-Talk; Student Interview II; Descriptive-Interpretive Report II; Analytic-Theme Report II; RD
CYCLE 3: Reconnaissance III Sessions 13-15	* Session 12 Worksheets; Taped Group-Talk; Cycle 2 Data; RD * Colleague's Notes 6-9; Students' Reflective Notes; Member Observations; Student Products - posters, worksheets, reports, test; Taped Group-Talk; Student Interview III; Descriptive-Interpretive Report III; Analytic-Theme Report III; RD
END: Reconnaissance IV Proposition Testing	* RD; Cycle 3 Data * Retrospective Interview; Reflective Essays and Questionnaire Responses; Colleague's Note 10; RD

The research diary (RD, Appendix XIV) consisted of a record of memos. These included descriptive sequences, interpretive sequences, ideas, plans, and other reflections. Entries were made after each lecture session and at other times, such as when reflections were being made on rereading entries and on conversing with the colleague and students. It was used as a record of what happened during the research, to reconstruct it later (in reports and analyses) to develop a more profound understanding of a situation, in corroboration with other data and analytic sources. Thus it constituted important items for triangulation of observations and interpretations. Detailed description was aimed for, since there often was iteration between description and interpretation during the research. Being a novice at this type of diarising, this aim was not always satisfied, especially during the initial stages, but the writing style became progressively honed with practice. Provisional analysis of diary entries, in the form of coding entries was undertaken from time to time, partly to see if existing data could inform the research and partly to construct reports at the end of each cycle. The diary constituted the data source of myself as a research instrument. An example of an entry in the Research Diary (Appendix XIV, p 16: DOM) is the statement:

**DOM** Tape - articulate students tend to dominate talk-time in each group - distribute these students in different groups as well as men and women;

Note that DOM is a code used to indicate the dominance aspect that emerged in the inquiry.

Lecturer questionnaires (Appendix IV) were administered to 6 lecturers, one in each of the departments of English, Mathematics, History, Geography, Natural Science and Education. Information from these were used for *Reconnaissance I*, during which information was gathered about the experiential background of students in their first year courses. All six lecturers completed the questionnaire at their convenience. An example of a question in the questionnaire is:

4. Do you see any problems in using a cooperative learning strategy? Note these, if any.

Three sets of student interviews (SI/INT, Appendix V) were done and audio-taped. The first set was conducted before the course semester. It was used as part of the initial reconnaissance, to garner an authentic idea of students' CL history. A checklist was used

to target their reflections on previous experiences of CL/group-work. Although some corroboration was given to information of the interviews by the lecturer questionnaire, the information of the interviews was used largely as 'stand alone data'. A second set involving five students, was conducted during non-lecture time in cycle two. This occupied a supplementary status, in that they were administered in order to elicit student ideas about the processes of CL, in which they had been observed to engage. This was included as part of reflections for planning. A third set was administered, with a checklist, to all students after the CL course semester experience. This helped in building the propositions. An example of the kind of data obtained in this way is the following extract from the second set of interviews (SIT II: S6):

DOM [Dominance]...there was; not now - rule session helped - work on dominance.

Audio-taping (TAPE) of interviews (Appendix V) and parts of CL sessions (Appendix XII) were done. These were generally summarised, except in some cases when complete or short transcripts were made, eg., transcripts of previous excerpts for use in an activity during session 3. They provided authentic evidence, were used in reflecting on past action and planning future action, and were used in triangulating sources, observations and interpretations. An example of data obtained in an audio-taped CL session is (Sess 3: [A]):

DOM Input: S1 - "each person must listen to other...", "[rotate leader] so no one dominant";

Student reflective notes (SRN, Appendix VII) were made optionally during cycles 2 and 3. These were used in triangulating perspectives, reflecting and planning. Reflective essays (SRE, Appendix IX) were written by all students at the end of the semester. They were used in developing the reflective questionnaire. An example of an entry (S10, 15.03.95) is:

DOM I personally must try to slow down, because I like things done in a hurry.

Colleague's observation notes (CN, Appendix VI) were made as session observations during some sessions, at the colleague's convenience. These mostly contained procedural notes. Some observations were made of student interaction and these were used in triangulating observations and interpretations and, in reflecting and planning. The reflective note made at the end of the semester was used in corroborating propositions.

An example of an entry (Note 3) is the statement:

**DOM** Dominance - Students were outright — spoke what they felt — spoke about efforts of the most dominant person — what needs to be done to sort this out - needs to delegate more - (good strategising) - everyone gains;

Student member observations (MO, Appendix VIII) were made in prescribed formats for some sessions during cycles 2 and 3. These were used in triangulating perspectives and interpretations and in reflecting and planning. An example of a question to which the observer responded to is:

**DOM** Is there one person talking most of the time?

Student products (SP, Appendix XI) included student work-sheets, tests, assessment, group products like posters, work-sheets and other presentations. These were used in reflecting, planning future action and interpreting various aspects during analysis. An example of such data is one of the group rules (Sess 3: Group rules - [B]):

**DOM** 3. No one's view should be left unattended.

A reflective questionnaire (RQ, Appendix X) constructed from student reflective essays (Appendix IX) were used in corroborating some propositions and to plot changed perspectives. An example of a statement made in a reflective essay (S10) is:

**I learnt that people have to cooperate in a group and not be dominant.**

and an item (4c) in the questionnaire is:

**We learnt how not to dominate/withdraw.**

A retrospective interview (RCI, Appendix III) with the colleague was administered a year later after the action-research study. It represented a case for testing propositions that were made by the study. The analysis is in Chapter 6.

### 3.4 Analysis

Data were analysed qualitatively proceeding in the way shown in Figure 3.2.

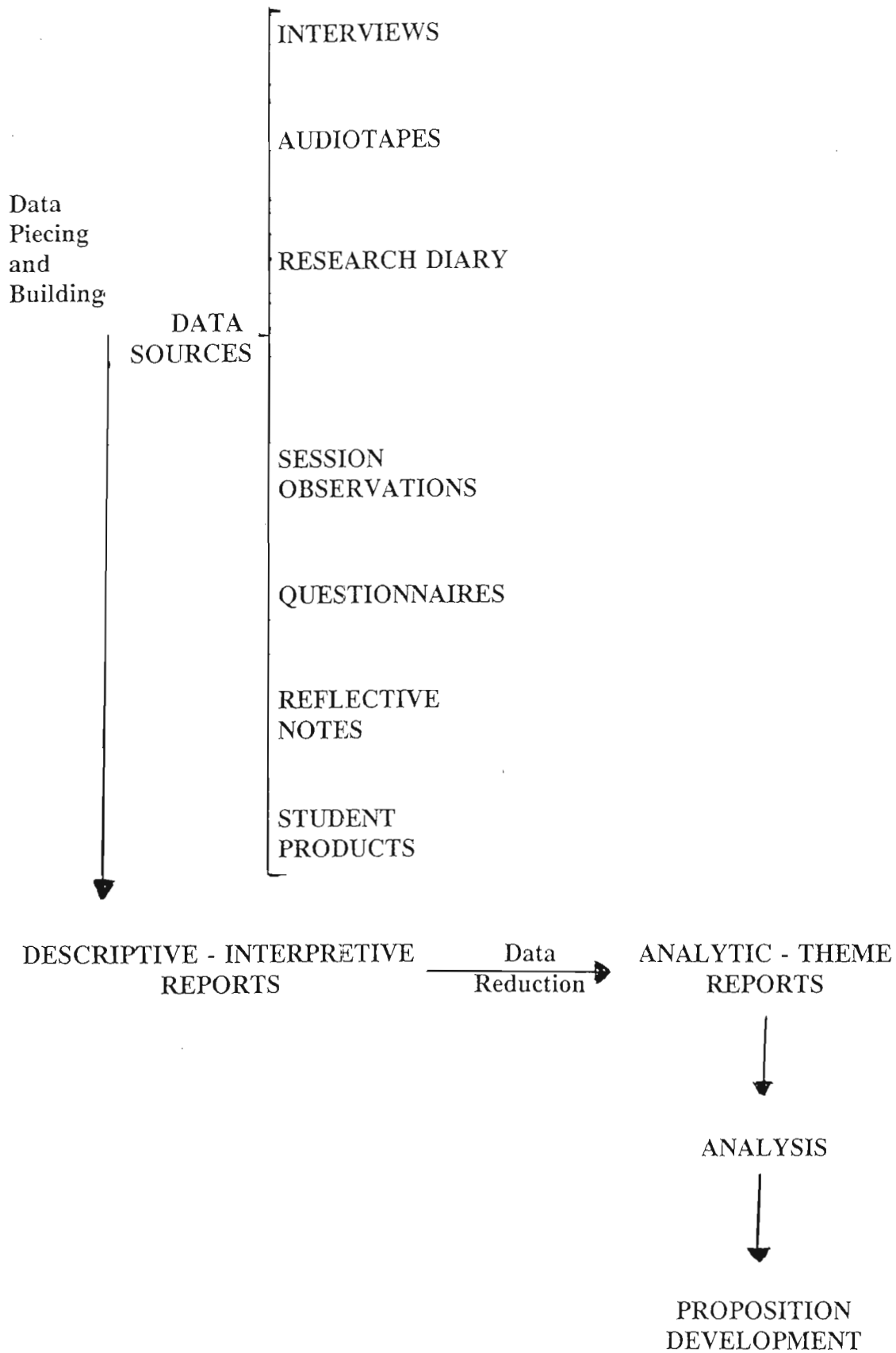


Figure 3.2 *Data Processing and Analysis Technique*

The data sources produced data that were pieced together and built using qualitative analyses to formulate the descriptive-interpretive reports (Appendix I) that were made at the end of each cycle. These served as "interim reports" and represented "interim analysis" (Miles and Huberman, 1994). Furthermore, although they were analytic tools, they became the secondary data sources used in building the analytic-theme reports (Appendix II) of the cycles. Themes were built according to "pattern coding" (ibid.).

The descriptive-interpretive reports generated many tentative constructs about CL, which were further collated, with iteration with original data, within the analytic-theme reports, towards generating stronger claims. These were further analysed and clustered to generate the analytic report in Chapter 4 and major propositions that emanated from the study were developed in Chapter 5. Audit trails as suggested in Miles and Huberman (1994) for an evidential warrant were made for each proposition. An example is displayed in Table 3.3 and an explanation of how this was constructed is given in Chapter 5. Other audit trail tables are in Appendix XIII.

Constructs emerged in all cycles. These were tested in an inductive manner, not as a plan to test in subsequent stages. Some constructs did not feature in formulating propositions. This did not mean, however, that they were not significant. It is more likely the case, that they were suppressed by the inductive mode of inquiry and the conscious choice of selecting those constructs that were adequately illuminated during the subsequent process of inquiry. As a result, there was an inductive-deductive interplay in the construction of theory. Categories had emerged inductively and constructs were made, some of which were deductively illuminated during subsequent stage(s). The final propositions were deductively corroborated, using a retrospective interview (Appendix XV) with the colleague. A discussion about corroboration is in Chapter 6. The generation of concepts was the goal of the inquiry, rather than law-like generalisations. There was much complexity and interrelatedness of constructs, eg., between those of 'language' and 'dominance' or 'monitoring' and 'action research'.

Categorising Data: On reading through texts, like those of the research diary or reflective

notes, 'interesting' or 'important' parts were highlighted using marginal codes. This process of reading and selecting was the beginning of analysis. Categories were built of some codes.

During the process of sorting and thinking about the data, some material that was initially not selected, assumed significance. Thus new categories were created or initial ones were modified. The categories and concepts were used as the language of the analysis. This process could be seen in the light of what Miles and Huberman say about coding schemes:

*The initial coding scheme ... develops and iterates steadily as further coding is carried out.* (Miles and Huberman, 1994:307)

The way data were categorised and propositions were developed are inherent processes of the action research approach.

Engagement with literature was part of this process of categorisation as well, providing a resource of concepts, eg. the terminology of 'cognitive roles' in Lumpe and Staver (1995).

Categories and their data were pieces of analyses which were used to generate some writing in the form of the descriptive-interpretive reports. Categories and concepts were grouped together as an emerging structure for the writing. Feedback was given at this stage from supervisors and the colleague. Sets of categories were coalesced in the analytic-theme reports.

### **3.5 The Rationale Behind the Methodology of the Research**

I opted for the incorporation of the following aspects of methodology: action research embodying the ideas of reflective practice and a developmental research approach, case study using a purposive sample, and the use of a constructivist approach.

Action research was chosen, because, in helping with the introduction of cooperative learning as an innovation in the lecture room, it fulfilled the function of supporting a



teacher in carrying through an innovation. At the same time, action-research methodology was seen as helping broaden my understanding and professional competency.

The method that evolved was informed by theory underlying reflective practice as embodied in Schön's (1983) account. Accordingly, significance was given to:

- \* 'tacit knowing in action' whereby the assumption made was that "*actions could not have resulted without knowledge*" in the form of "*a knowledge base which is 'tacit'..*" (like 'routines') and that could not be excluded from the research;
- \* 'reflection in action' which took place in the course of the actions (in transforming thinking and action during practice); and
- \* 'reflection on action' which occurred after the actions and thus, distanced the students and myself from the action. 'Reflection on action' culminated in the reconnaissance phases of the cycles.

The underlying assumption for the incorporation of reflections, as proposed in Altrichter et al (1993), was that it helped in coping with new situations, in that it allowed the surfacing of different strategies that could be compared and scrutinised, it improved our ability to analyse and reorganise our understandings and practice, in allowing us to plan changes, and it offered a way of communicating these understandings, an action needed in helping us cope with the new and, to take responsibility for our learning and induction as novices.

The research focus, on the introduction and implementation of cooperative learning, into an environment that lacked a culture of cooperative learning, thus making it an innovation for a lecturer who was a novice in the field of cooperative learning, determined a developmental action-research approach to the study. I saw action-research methodology as appropriate to the research since the research was an attempt to change practice. Such change of practice could occur more easily because I was involved in researching my own practice.

Furthermore, the methodology of action research allowed for the modification of

procedures, and allowed the risk of failure in implementing the innovative practice, to be overcome. This stands in contrast to practice that rejects innovations in the belief that barriers to and problems of implementation of new procedures, represent ‘proof’ of the innovations not being viable.

Thus action research seemed compatible with the study, in that it matched the characteristics of action-research methodology like those proposed by Altrichter et al (1993). In this respect, it was carried out by the practitioner; it began with questions arising from practice; it was compatible with an institutional need, in that the department wanted to implement the innovative practice in topics already proposed for the course; it was cost effective, since it inquired into my own practice; and reflection opened up new options for actions which were realised in action.

Merriam’s (1988) idea of a case study was particularly apt for the type of case study I used.

*The qualitative case study is a particularly suitable methodology for dealing with critical problems of practice and extending the knowledge base of various aspects of education* (p xiii).

Since action research was contextualised and realised in my own practice with a particular class group, I deemed it a purposive sample of a case-study. The study was embedded in practice and thus engendered grounded theory.

The research was designed to develop grounded theory in practice, using an interpretive approach grounded in constructivism. Constructivism informed the planning and action, for both student and lecturer interests, in understanding the teaching-learning practice and the transformation of these, as suggested by Carr and Kemmis (1986). Furthermore, constructivism was used to inform the introduction of CL, starting with students’ and my past experiences of small group work and our perceived reasons for the use of this way of learning. In other words the initial reconnaissance was used to **plan** the CL introduction and implementation in the course.

In this way the research design placed the research in the tradition of participative action

research. Similarities between the method of this study and those proposed by Kemmis and others were apparent, for example 'reconnaissance' as incorporating surveying the 'illuminations' and analysis and, as somewhat in keeping with Elliott's ideas on 'reconnaissance'. Perhaps those proposed models should be regarded as having evolved in the practice of the proponents and, as ways by which research may be undertaken and not as prescriptions of method, as suggested in Hopkins' (1993) critique and others.

### 3.6 Trustworthiness

The issues of validity and reliability were regarded within a framework, alternative to general statistical notions of these. Since validity and reliability were positivistic constructs, the criteria for these concepts were reconstructed in the fashion of some qualitative researchers.

**Internal validity**, the extent to which findings 'ring true' or are congruent with reality, was addressed, in this inquiry, by using triangulation, confirming interpretations with participants (eg., by reviewing perceptions with student participants and discussions with the colleague participant),

staying 'in the field' over a semester, encouraging comment from the colleague on emerging findings, involving participants in the observing, reflecting and planning stages of the cycles, and clarifying my assumptions and biases during the acts of the research, eg., in selecting and interpreting data.

The aspect of **reliability**, i.e. the extent to which findings have consistency, was addressed by my explanation of the underlying theory and assumptions of the inquiry, by triangulating data and by providing a commentary of how the study was conducted, how findings were derived and presenting a set of audit trail tables as an evidential warrant.

There has been much debate and controversy surrounding the issue of **external validity**: the extent to which the processes and findings of a case-study, might be generalised to

other situations. I found some ideas given by Erickson (1986) and those of L.J.Cronbach, R.F Stake and S. Wilson outlined in Merriam (1988), helpful in enhancing the potential worth of the study for other practitioners. Erickson's notion that the search in an inquiry, was not for '*abstract universals*' but for *concrete universals*, embodied the idea that, although each classroom situation was unique, some generic aspects of the teaching and learning experience might be realised in **practice** and thus manifested in the **concrete**. My concurrence with this view of generalisability was reinforced, eg., by instances of the inquiry, when features of the CL process were recognised as those discussed by other researchers of CL.

If we regard the findings as belonging to the class of Cronbach's *working hypotheses* relevant to conditions, they may provide guidance and perspective for other practitioners in making choices. Similarly, Stake puts forward the notion of *naturalistic generalisations* which draw on the tacit knowledge, intuition and personal experience of another practitioner in recognising patterns in a particular inquiry to explain his or her own practice, and this notion may be used to explain the generalisability of the study. Other practitioners may abstract similarities in the inquiry, in and out of its context.

A view that is particularly apt to my inquiry is, to my mind, that of Wilson's *user and reader generalisability*. The reader will have to decide to what extent the findings of my inquiry might apply to other situations. To this end, the reader is provided with details of the process, such as how data were collected, how and which data were selected, how they were analysed and so on.

Table 3.3 'Dominance' Audit Trail

ITEM	LOCATION
<p><b>DATA SOURCE:</b>            Research Diary</p> <p>Colleague's Notes</p> <p>Student/Group Product</p> <p>Student Reflections</p> <p>Interviews</p> <p>Lecturer Questionnaire</p>	<p>P 16: DOM            P 21: DOM            P 24: DOM<sub>1</sub>, DOM<sub>2</sub>, RN            P 32: DOM, RNDATA            P 34: DOM<sub>1</sub>, DOM<sub>2</sub>            P 35: DOM            P 41: DOM            P 54: DOM            P 55: DOM            P 61: DOM</p> <p>Note 3</p> <p>Sess 3: Group rules-[A],[B],[C]            Sess 6: Poster-[A],[B],[C]</p> <p>Sess 2: 'Least liked' lists-S6, S3            Sess 7: MO:[A]-S3,[B]-S8,[C]-S10            Sess 8: MO:[A]-S2,[B]-S5,[C]-S11            SRN: S10, 13.03.95            SRN: S10, 15.03.95            SRE: S10</p> <p>SIT I: S1,S3,S5,S8            SIT II: S1,S3,S6,S9,S11</p> <p>Item 4: History, Mathematics</p>
<p><b>ANALYSIS:</b>            Audiotape CL</p> <p>Descriptive-Interpretive Report</p> <p>Analytic-Theme Report</p> <p>Corroboration</p>	<p>Sess 1: [A],[B],[C]            Sess 2: [A],[B]            Sess 3: Act.2-[A],[B]; Act.3-[A]            Sess 4: [B],[C]            Sess 6: [A],[B],[C]            Sess 7: [A],[B],[C]            Sess 8: [A],[B]            Sess 12: [A],[B],[C]</p> <p>I: p 10, 14, 22-23, 26, 27            II: p 3-5, 9-11, 17-18, 24-26            III: p 9</p> <p>I: p 6-8            II: p 1-5</p> <p>RQ: 4c            Colleague Note 10            SIT III 5,6            RCI</p>

Key:

[I]	Report 1	Sess	Session
[II]	Report 2	Act	Activity
[III]	Report 3	MO	Member Observation
SI	Student Interview	RQ	Reflective Questionnaire
SIT	Student Interview Tape	SRN/E	Student Reflective Note/Essay
RCI	Retrospective Colleague Interview		

## CHAPTER 4

### ANALYSIS

In this chapter I will analyse the themes which emerged in each cycle of the action research. Each of the three cycles of action research began with a reconnaissance. A final reconnaissance and reflections made by the participating students, the colleague and myself marked the end of the data collection process of the inquiry.

What emerged from cycle one were constructs on the perceived constraints to the cooperative learning (CL) process and implementation that came out of *Reconnaissance I*. These constraints included those of dominance, shyness, noise, 'off-task' behaviour, withholding of ideas, conflict, group composition, time and topic. Other issues emerged during cycle one and included student induction to CL, management of alternative concepts, management of cognitive outcomes, management of assessment, lecturer constraints and utilitarian issues of CL.

Issues that emerged in cycle two were the 8 aspects of the reconnaissance focus, viz., dominance, language dilemma, time constraint, alternative concepts, group size, changing groups, group rules and topic. Other emerging themes of cycle two included assessment, monitoring, self-esteem, motivation, learning environment and the action-research methodology of the study.

The reconnaissance ushering in cycle three focussed on the cognitive aspects of participation that emerged. Cycle three focussed on equity in participation. The last reconnaissance commented on the relationship between status and participation.

At this stage the descriptive-interpretive and analytic-theme reports that were made during the action research, were used to compose the final report.

Table 18 (Appendix XIII, pxiii1-2) indicates the data sources used in the analysis. This analytic report is arranged around the significant constructions that emerged during each cycle. Some evidenciary data are discussed as exemplary/illustrative evidence. The bulk

of the evidence, however is contained in the descriptive-interpretive reports (*Report 1, 2 and 3* in Appendix I), that were made at the end of each cycle and the analytic-theme reports (*Analytic-Theme Reports 1, 2 and 3* in Appendix II), that emerged from the descriptive-interpretive reports. Table 4 indicates the appendices from which evidence was sourced.

Note that in this report [A] denotes group A, [B] denotes group B and [C] denotes group C. This analysis is written in the format of the cycles, in that it reflects and contextualises the progressive movement of reflecting, planning, acting and observing of the study, in a chronological way. Thus the report consists of descriptions and interpretations of these processes and the theoretical constructs made, within each cycle. The sections entitled ‘plan’ give a rationale for subsequent actions.

**Table 4:** List of Appendices

APPENDIX NO.	ITEM
I	Descriptive-Interpretive Reports
II	Analytic-Theme Reports
III	Retrospective Colleague Interview
IV	Lecturer Questionnaires
V	Interview Summaries and Checklists
VI	Colleague’s Observation Notes
VII	Student Reflective Notes
VIII	Member Observations
IX	Student Reflective Essays
X	Student Reflective Questionnaire
XI	CL Products
XII	Audiotape Summaries and Transcripts
XIII	Audit Trail Tables
XIV	Research Diary

## 4.1 Cycle One

Cycle one began with *Reconnaissance I* and included 5 lecture sessions of 80 minutes each, about classification.

The reconnaissance involved gathering information about the **CL history of students**, their **perceived reasons for CL**, what they and lecturers perceived as **constraints to CL**, and the **preferred learning environments** of students and lecturers (using *Student Interview I* for the 12 students and *Lecturer Questionnaire* for 6 lecturers).

A major construction that emerged from the reconnaissance was that all students **had been exposed to some type of group work including some CL**, that there was some match between lecturers' and students' **perceived reasons for doing CL** and that most students **preferred the CL approach to learning**.

**Plan:** The setting seemed to be conducive to **a serious study of the implementation of CL in the course**.

The information base from *Reconnaissance I*, informed the planning of the CL sessions. To introduce CL into the Natural Science II course, I decided to allow the **strategies used by students to develop intuitively and spontaneously, with a view to illuminate perceptions of experiences in their practice**. Observations of the cycle were planned such that the existing student perceptions about constraints of CL might be illuminated and from these to generate constructs about emerging themes.

### The Sessions

The interview and questionnaire analysis (Appendix II : ii4-ii5) revealed that students and lecturers had perceived that the main factors that constrain CL are those of dominance, shyness, noise, 'off-task' behaviour, withholding of ideas, conflict, group composition, time and topic. The major constructions related to these aspects are discussed below.



#### 4.1.1 Dominance

Based on my interpretation of my reflections of the first session (Appendix I, p i 4:

*Dominance: I perceived that S2 and S10 in Group A, S8 in Group B and S12 in Group C as talking the most ; in directing activity, both S2 and S8 were perceived as being 'managers', bringing members 'on-task' (session 1 tape); Appendix XIV, p xiv 6: Tape - articulate students tend to dominate talk-time in each group - distribute these students in different groups as well as men and women), that some individuals may dominate some processes in CL, which was reinforced by reflections made by at least three students and myself during session 2 (Appendix VII, p vii1: S1 - The changing of groups made me feel uncomfortable, because the guys were dominant; S3 - What I dislike is when one person dominates the group and does not want to accept other peoples viewspots; S6 - Others views may not be considered), I felt that this should be made overt; but finding some way for students to monitor and reveal dominating processes was problematised by me, in that I did not want to impose my interpretation or prescriptions of action on students.*

**Plan:** To avoid such imposition I planned to include a rule generating activity in the third session based on the idea that the activity might lead to some group processing of what had occurred in the first two sessions. The rules that were generated by the three groups (eg. *Each day - leader should change - prevents domination [A] ; Each member of the group should listen attentively to others view [B]; Each should have a turn [to] work [C]*), indicated that students had perceived some processes as dominating and had decided to act by formulating rules that indicated an intention of monitoring dominating patterns. Thus constructs were made that

- 1 *A rule generation activity may be regarded as a reflective activity and, is an important component of CL in that it may reveal to students the constraints of effective CL.*
- 2 *Group members, given the opportunity to reflect on the constraints of dominance, may perceive patterns, and make decisions on future monitoring of such patterns of dominance.*

and

3 *Group rules may help to monitor dominance in a group.*

It seemed that some control of dominating patterns ensued, but it may have been other factors that constrained a previously dominant member, eg., member S8 of [B] was heard on tape (Appendix XII, p xii4) to say, "...I think - I'm not sure..."; "Do all plants have roots, stem, leaves?"; "It's asexual, right?". This type of evidence led to the construct that

4 *Dominance patterns may be related to cognitive demands of tasks, cognitive ability and cognitive security of certain individual members who are perceived to be potentially dominating by nature.*

Roles (at least those of scribe and reporter) were rotated in subsequent sessions and the following construct was tentatively made:

5 *Groups may take it upon themselves to rotate roles to minimise dominating patterns*

**Plan:** Based on the above reflections and interpretations, I felt that a focus on the generation of rules, was potentially worthwhile for problematising and acting on the factor of dominance and might help in equitable participation in group tasks. As a result I planned to include a focus on 'domination' at the next reconnaissance (*Reconnaissance II*, the first session of cycle 2) by students.

#### 4.1.2 Shyness

Analysis of the interviews revealed that four students regarded shyness as a constraint and three others had a different perspective of it, in that they found the small group environment as one in which it could be overcome. Furthermore, S8, after 2 sessions, reflected that CL had an advantage in that members were not "*shy or embarrassed*" by

their ideas (Appendix VII, p vii1). Neither the group rules nor student reflections, nor the class observations illuminated shyness as a constraint. Thus I assumed that shyness did not feature as a constraint in the first cycle. The construct I made in this regard was:

6 *The small group situation of CL may pose less risks for participation of those students who see themselves as non-participants in a whole class situation, than a whole class one does.*

#### 4.1.3 Noise

This potential constraint, as perceived by two students at the interviews, was not illuminated by the first cycle, perhaps because of the **relatively small size of the class**.

#### 4.1.4 'Off-Task' Behaviour

This potential constraint had been perceived by at least two lecturers and one student. At least one sequence of taped group talk during the sessions was interpreted by me as involving group strategies for bringing members 'on-task' when they were perceived to be 'off-task'. Furthermore, I interpreted some rules (Appendix XI, p xi1: *Group leader ensures that the topic is discussed ...[A]; If we are given work, we must do it [B]; Take work seriously [C]*) that were generated to embody moves towards the promotion of 'on-task' behaviour. A construct made in this regard was that

7 *Pre-service students may be capable of ensuring on-task behaviour of members in a CL group,*

or they may be motivated to do so.

#### 4.1.5 Withholding of Ideas

Although a student (S3) (Appendix II, p ii7: *"keep ideas to themselves and not share them"*) had felt that this was a possible constraint when he was interviewed, this idea was

supplanted by one that was contradictory to it. This was shown by illumination of the cycle in which both the colleague and I observed that students were generally contributing ideas; and giving and sharing of ideas featured in most of the students 'best liked' lists. Furthermore S3, himself, noted "*One can evaluate...his ideas with reference to other...*" (Appendix VII, pvii1), as what he liked most about CL, and S12, who had reiterated his perceived problem of being "*compelled to consider views of others*" in his 'least liked' list (Appendix VII, pvii2), however, contradicted himself by noting "*I like sharing of ideas most*". Based on these interpretations, the construct generated was that

8        *CL may provide opportunities for students to give their own ideas and to share ideas.*

#### 4.1.6 Conflict

Although some students (at least three) variously indicated (Appendix II, pii8: *some students noted 'conflict' positively as their 'most liked' aspect of CL: S5 - "share ideas and have conflicts but at the end we come up with a conclusion"; S2 - "debates"; and S11 - "even if there was no agreement but there was a settlement"*), in their interviews, that conflict situations that may arise in a CL group, are potentially constraining; and three of these students reiterated this view in their 'least liked' lists, other students (at least three) viewed 'conflict' positively in their 'most liked' lists.

**Plan:** I asserted that since 'conflict' may be an inherent aspect of CL, it should be problematised for discussion and potential management. I had planned for the possible revealing of this aspect by the rules generation activity. [A] and [C] each made a rule which were interpreted as embodying potential management of conflict. Furthermore, I planned that the aspect would be incorporated within the aspects of 'domination' and 'group rules' planned for *Reconnaissance II*.

**Note:** By 'problematisation' I mean the reflection and analysis of an aspect so as to uncover its subtleties which may include its problem areas and people's perceptions of the aspect, so as to pose and reflect on possible action (eg., possible strategies of minimising

constraints to effective CL) with regard to what is revealed.

#### 4.1.7 Group Composition

A lecturer had posed the criteria for composing groups as a problem and cited "*racial and academic disparities*" as "*real problems*" and differing abilities as an aspect to be considered in composing groups. In her interview, a student (S9) spoke about "slow thinkers" being constrained by "fast thinkers" in a group (Appendix V, pv4: *fast thinkers can discuss particular topic and slow thinkers does not participate - one of problems*). This posed a dilemma for action. On the one hand, the literature suggests that heterogeneous grouping has many advantages and, on the other hand, a lecturer and a student perceived the criteria of group composition as problem areas. Perhaps they did so to indicate the perspective of composing homogeneous groups for effective CL, as backed by some literature (especially of that on 'tracking').

Based on the overriding plan for cycle one, students chose their own groups for session 1. Since we ended up with a group of all women ([A] of session 1), I modified the plan, in the interests of heterogeneous groupings. I did this modification using gender and language proficiency as criteria for new groups for subsequent sessions.

The potential dominance of first language speakers had also been noted as a possible constraint by the Mathematics lecturer. Observations of session 1 yielded a perception that English first language speakers (S10 and S2 in [A], S8 in [B], with only English second language speakers in [C]) had dominated talk time (Appendix XII, p xii1). The subsequent action taken, whereby groups were rearranged primarily on the grounds of gender balance (two men and two women per group), resulted in a distribution of 1 English first language speaker per group. The criterion of abilities was not considered since perusal of past performance did not reveal differences adequately. Differing educational backgrounds were catered for by the language criterion. Varying language proficiency levels of the English second language speakers were observed by listening to the taped playback of parts of session 1 and 2, and serendipitously, each group had a range of levels of proficiency.

The 'race' problem referred to by a lecturer was tackled in a potentially constructive way to increase intercultural communication.

The following constructs were made on interpreting session 3 processes:

9 *Language idiosyncrasies that reinforce alternative concepts may be revealed in a group heterogeneously composed on the basis of language and culture.*

This construct emerged from the illumination given by a student (S7), at my request, on why a member of his group said that plants were 'fed with water'. He said that it was a transliteration of the Zulu phrase referring to watering plants.

10 *An English speaking student may tend to initiate, clarify, and explain ideas in a group heterogeneously composed on the basis of language.*

This was illuminated by interpreting the taped part of session 3 where S2 in [A] was observed to dominate the processes of initiating, clarifying and explaining ideas of members in her group (Appendix I, p 11: *Dominance: Although all members participated in groups A and B, on reviewing the playback one member of group B (S8) was perceived to dominate talk-time and direction of talk, even resisting attempts of bringing him 'on-task' (as perceived by group members) by members. Some rules, however, were generated cooperatively by the group. In group A, S2, an English speaker, was perceived to take on the roles of explainer, initiator and scribe, but all inputs were discussed in the agreement of rules*); S10's reflective note (Appendix VII, pvii2: *The members of our group do work well together but they rely on me to say if what they have said is correct or incorrect. I see this as a type of dominance in the group which I don't want and I try and ask their question with a question but sometimes because of the time constraint I don't do this*); taped summary in session 1 (Appendix XII, p xii1: *\* S1 - stone is living - S6 supports using concept that metals expand; clarified by S2 and S10; S1 agreed... S10 initiates idea that it is important for biologists to classify "We will take everything as one"; S2 extends this to include that it is important for people as well; S1 and S6 agree and do not extend*); my diary notes (Appendix XIV, p xiv11: *I walked around to each group reminding them*

*about their 'rules', especially about 'dominance' - my perception (which I did not share with students) was that S2 in group A, S8 in group B and S10 in group C tended to dominate talk - these students are English first language speakers - could this be the reason for their dominance - or is it dominance? - S10's may be just articulating and summarising and the same may apply to S2; but in S8's case it seems that it's his nature to dominate - this was brought to his notice by other group members during the rule generation activity!).* The idea in construct 10 could be perceived as disadvantageous in the sense of being a dominating process, but also advantageous for group comprehension of ideas.

**Plan:** The language issue was planned for by putting 'language' on the agenda, among the problematic aspects for the reconnaissance session.

The question of effective **group size** emerged in session 5, when a group, [B], presented the idea of having 5 pupils per group for a CL activity they had planned for a standard 5 class of 35-40 pupils. This idea was not identified by the students for discussion in the session, but I decided to include it for problematisation during the reconnaissance session planned.

#### **4.1.8 Time**

Two lecturers raised the issue of the justification of the longer time that they perceived as required for CL. During the first report-back process, the last group to report had insufficient time to do so because equitable distribution of report back time was poorly planned and managed by me.

**Plan:** As a result, I decided to address this in subsequent sessions, wherein I managed the issue by stipulating time limits for report back and other sessions.

Although students had not mentioned time as a constraint in the interviews, the time factor surfaced during their practice of CL, in the guise of a reflection made as a 'least liked' aspect of CL by a student (S11 in [C], Appendix VII, p vii1: *But what I liked the*

*least was that time seemed to be against us as there seemed to be much to learn from others).*

Only one group, [A], however, incorporated the idea of managing time in their group rules poster (Appendix XI, px11) as, "*Those expressing views should be aware of the time*", perhaps because of my practice of specifying and cuing for time during sessions.

I therefore posed that the time for study of a topic using CL may be more than that employed in traditional lecture practices; and that students were unused to managing time for themselves. These ideas had management and curriculum implications. The dilemma existed whereby on the one hand, I specified time limits for activities as a way of managing time, and on the other hand students saw the need for more time to be given for certain activities. The **nature of the CL activity** was seen to influence time planning, in that in session 5, I had allocated a larger proportion of time for the task. This led to the construct, backed by literature, that

11 *The more open-ended the task, the more time may need to be allocated for the task.*

I saw open-ended tasks as those that generated many ideas and discussion.

**Plan:** 'Time' was included as an aspect for the reconnaissance session.

#### **4.1.9 Topic Clarification and Format**

During his interview a student had located the problem, of poorly managed CL, in inadequate teacher guidance and topic clarification.

In session 1, two groups had asked me for clarification of the task that was given. I interpreted this as a problem of an inadequately stated topic.

**Plan:** I decided that verbal clarification and guidance by a lecturer may be needed, at



times, to reinforce written instructions related to CL tasks (eg., on time limits, mechanisms of reporting and feedback and task topic) and this was considered for future CL sessions.

Inadequate handling of the classification scheme used by students in session 3, reinforced the promotion of such a consideration. Furthermore, although students had perceived that the covert aim of the first session was to elicit and share ideas and to reach consensus, it was decided that such goals for group products could be made transparent, when the clarification of goals did not subvert the aim of the activity. It was also decided that criteria and the strategies, decided by each group for presentation in report back sessions, should be made overt. These ideas presented themselves in the form of a construct that

- 12 *Strategies and criteria should be made overt in a CL environment and goals may be made overt in cases in which stated goals were perceived as not subverting the learning process.*

I reflected that the first activity of session 2 (on the tentative nature of classification systems) effectively involved a combination of group, class and lecturer interaction. Thus I interpreted the sessions as involving two ways by which CL may proceed: from group interaction to whole class interaction in the form of report back, and as iterative group-class-lecturer interactions in a session. Thus a construct made was:

- 13 *CL may occur in contexts other than small groups in the classroom.*

Session 2 involved much critical thought, which was ascribed to the nature of the task involving the sounding out and subsequent presentation of ideas during the class discussion.

**Plan:** The appropriateness of a topic was problematised for the reconnaissance session planned.

It was also observed that the report back sessions may have been insufficient for inter-

group sharing and construction of ideas and, that changing groups could help by enabling students to experience a range of ideas.

**Plan:** A focus on this issue was also planned for in the reconnaissance session.

#### 4.1.10 Other Constructs

Constructs were made on other themes that emerged, viz., **student induction to CL, management of alternative concepts, management of cognitive outcomes, management of assessment, lecturer constraints and utilitarian issues of CL.**

##### a. Student Induction to CL

The question arose of why students did not resist CL implementation. The cycle was analysed to illuminate this.

The initial interviews yielded only one case, S12 that was regarded and identified as not preferring CL (Appendix V, p5: [S12] - **Prefer: to learn alone even about new things - group revision ; [S1] - Prefers: CL for new learning, but not for 'studying'; [S2] - Prefers CL for learning 'new' things, but not for studying - prefers to do this alone; [S3] -Prefers both - some lessons require individual; more group work, marks should be individual; but in terms of discussion should be group; [S4] -Prefers group work; enable more information than alone; [S5] - Prefer learning new things in group; study/revise on own because "I am a talkative person"; [S6] - Prefers group work - other times need individual work; [S7] - Prefer group work; study - learn by yourself and then group. Democracy starts in group work - agreement even if stated differently; [S8] - Prefer to learn in group for new work, but studying for exam alone; [S9] - Prefer to learn in group; revise - in a group first and study alone ; [S10] - Prefers - CL is preferred style of studying. Most learning should be in groups - problems can be overcome; [S11] - Prefer group learning - skills can be mastered - because of help from group-mates; revision - study in area where able, alone. Prefer to learn in group in some subjects, and where I am weak).** Based on this outcome, it seemed and therefore was assumed, that motivation for learning in groups

existed. Furthermore, it had been established that students had some experience of CL in their first year of study, in the Natural Science course, at least, and it was seen that their preferences were based on the experiences they had.

During the first cycle of research it was observed that students 'took to' CL quite easily in that motivation was high, so I generated the construct that

14 *Cooperative learning may be seen as a preferred learning mode, over traditional individualistic modes, for most second year Natural Science students who have been exposed to CL in their first year of studies.*

The construct was strengthened by interpretations of observations of CL sessions, discussions, and reflections, indicating high motivation, during the cycle:

\* In session 1 observations made, by myself and the colleague observer, were to the effect that students enjoyed interacting and learning during the CL activities.

\* On analysis of students' reflections, in their 'most liked' and 'least liked' lists, the number of 'most liked' reflections outweighed those that were 'least liked'; 'least liked' being interpreted as referring to constraints (dominant members, time, handling of alternative concepts and ignoring a member's contribution) that could be problematised in group processing, rather than to indicators of resistance to CL. Only one comment, S12's, the negative case identified earlier (Appendix VII, p vii2: *S12 - In groupwork - I like the sharing of ideas most. Liked least? Compelled to consider views of other people even if such views lack sense;* contrasted with Appendix V, pv5: *Prefer to learn alone even about new things - group revision*) was interpreted as not reinforcing motivation but as reinforcing the student's perceived resistance to CL. In the total picture, these negative comments, on being juxtaposed with the positive ones made, created an understanding that the strength of students' positive comments outweighed their negative ones.

\* Students were motivated to formulate group rules, incorporating self-generated foci on constraints. I interpreted this firstly as a constructive activity, whereby

students used the constraints (acknowledged by them in the interviews and in their reflections) to generate pertinent rules that aimed to minimise these constraints and secondly as confirmation that the implementation of CL was to be continued with the constraints being problematised and thus minimised.

\* Interactions were interpreted to be high both from classroom observations and from playback of taped parts of all sessions in the cycle: indicating that motivation was maintained in the cycle.

By the end of session 5, the stage was set for a reconnaissance session, reflecting on the cycle and involving a focus on areas that may be problematised, rather than an abandonment of the CL approach (a reinforcement of the feelings proposed by students in their interviews).

Thus the initial rationale, of illumination of constraints during the first cycle, was implemented to plan future action, to expedite CL in the semester and to reinforce the preference for learning cooperatively. The first cycle may also be seen as critical to the introduction and implementation of CL in the course, in that CL could have been rejected by students at this stage, if their initial perceptions of its worth had shifted.

## **b. Managing Alternative Concepts**

Although not mentioned *per se* during the initial interviews with students, alternative concepts had surfaced during CL, when students were made aware of them by other members in a group and when I, the lecturer, observed these ideas and made students aware of them (Appendix I: p i4: *Misconceptions/Alternative Concepts: Certain alternative concepts were revealed on the poster and clarified during class discussion (diary, p13 AC; colleague's note 1, AC); during the presentation (diary, p13 AC; colleague's note 1, AC); and in the audiotape playback (session 1 tape, AC). Some alternative concepts, revealed by the playback, were in addition to those revealed by the poster and presentation; pi6: Alternative Concepts: These were about day and night gaseous exchange patterns in plants (session 2 tape, AC). Posters revealed such*

alternative concepts also (diary p19, AC; colleague's note 2, AC). Undetected alternative concepts occurred as revealed on the tape playback, eg., Group B - 'plants are....lazy'; Group C - 'plants will use carbon dioxide....for respiration' (transcripts 2 & 3). More information on alternative concepts was revealed on playback. Alternative concepts on poster could be clarified by the lecturer (diary, p18 AC).

Interpretations made on analysis of taped group talk, revealed that members may detect some alternative concepts. Some examples of these observations were: in session 1, [A] members (S2 and S10) responded to S1's alternative concept; in session 2, S8's idea that was clarified by S5 in [B]; and in session 3, S12's concept about how a plant gets its food which was followed by a discussion leading to a shift in [C] (Appendix III, piii3: Group

A: S2 ... endoskeleton will be human - but we don't actually study them -

S10 - they'd be vertebra -

S6 - ya - we don't have an endoskeleton, I don't have an endoskeleton - (laughs)

S2 No! - but it's regarded that your skeleton is inside -

S10 - no we've got a vertebra, we've got a spinal cord

S6 - ya - not -

S2 - okay, I know what you mean - ya ...

Group B: S6 - plants cannot also help themselves by - maybe - moving in order to get the things to - eat - they just remain there - they wait for something to happen. In other words they are lazy -

S5 (laughs)

S6 - they wait for the sun to reach themselves - and they wait for the rain or an animal to feed them with water - and in that way they do their - work S5 - you were going to say (transportation..inaudible)

S6 -ya - they are not active -

S5 - (reads what is being written) - Alright in other words, X ( asks another student), only plants have cell walls?

Group C: S10 ...plants give off - also plants give off O whereas take in CO , whereas the animal takes in O and gives off CO

*S12 that's my point - (laughs) - I think that plants only during the day - during the day plants will use CO<sub>2</sub> -*

*S10 - um -*

*S12 - for respiration -*

*S10 - ya -*

*S12 - while during the night they use O<sub>2</sub>*

*S10 - ya - They still use a little bit of CO<sub>2</sub> at night - they photosynthesise 24 hours... ).*

Thus a construct that was made at the onset after session 1 and reinforced by subsequent observations, was that

15 *Alternative concepts may be shifted by group member interactions in a CL group.*

In the very first session during the class report back, it was seen that the group posters (Appendix XI, pxi4) revealed some alternative concepts, and a construct was made that:

16 *A poster presentation may be used as a strategy to reveal learning, consensus agreements and alternative concepts.*

These alternative concepts were discussed in the class discussion following the poster presentations, with the aim of clarifying certain concepts and, perhaps, shifting certain concepts towards those acceptable to the scientific community.

On analysis of the taped playback, it was revealed that although some alternative ideas surfaced during CL discussions and were discussed by students in their groups, not all alternative concepts were necessarily revealed by posters and presentations, and this led to the constructs that

17 *Some alternative ideas may surface and be discussed by students in a group during CL.*

18 *Some alternative concepts may not be detected by the group and may not be revealed by posters and presentations; and ways of revealing these during CL implementation should be problematised.*

These constructs were reinforced during session 2, when once again, it was observed that posters revealed some alternative concepts and that monitoring the clarification and explanation of these concepts was problematic. A tentative construct made was that

19 *Group members may not be sophisticated enough to detect certain alternative concepts and monitoring the clarification and explanation of these concepts is problematic.*

**Plan:** I decided to test students' ability to detect alternative concepts by using selected transcripts of what they said in their groups.

Action taken in this regard was that a short transcript extracted from the previous CL sessions was given to each group for critique in session 3. Two groups detected that they had ignored a potential alternative concept in their group, but this remained undetected in one group. The last group further illuminated the idea embodied by the above assertion, that members of a group may not be critical enough to detect and discuss alternative concepts generated within their groups. Thus the construct was modified to include

20 *Group members may not have the necessary schema for the detection of certain alternative concepts and this may reinforce these alternative concepts.*

I reflected that the very nature of CL, whereby there is a co-construction of concepts, may embody tacit approval of certain alternative ideas, thereby reinforcing them and preventing shifts towards concepts acceptable to the scientific community.

Thus I was posed with a dilemma: on the one hand, CL activities have the potential of clarifying personal and idiosyncratic concepts to more socially accepted ones and, on the other hand, those alternative concepts that go undetected and unresolved may be

reinforced with tacit social approbation.

Furthermore, as was referred to earlier in the discussion of the language constraints, some of the CL talk of session 3 was interpreted to mean that everyday language, at times, may promote the keeping of alternative concepts.

One student (S10) had reflected that, what she liked least about CL was that, "*we have not had explanations and so there were misconception (sic) in the group*" (Appendix VII, pviii1). Her group had made a rule to this effect: *Talk about misconceptions and make [making] mistakes* (Appendix XI, pxi4). I reflected (Appendix XIV): that the discussion of some identified alternative concepts during the report back sessions, may not have been sufficient; that there were instances when groups asked me for clarification of certain ideas during a CL activity; and that I saw this intervention as a way of clarifying certain concepts. But, I felt that such intervention may be taken only on request from the group and, only after ascertaining if members had tried to construct the concept themselves.

**Plan:** I proposed that for the purposes of clarification of concepts and ways of revealing alternative ones, the processes of presentations, of class discussions during report back, of reflecting on what was learned (eg., as the critiquing activity in session 3) and of groups requesting lecturer clarification be kept. The aspect of 'alternative concepts' was planned as one of the foci of the forthcoming reconnaissance session.

### **c. Managing Cognitive Outcomes**

Although I felt that there was a need to focus on the cognitive processes involved in CL by students, students themselves had not revealed this need. Cognitive processes (like the selection of meaningful ideas, and making social constructs) were considered in the design of activities by me. They may be seen as being problematised: by students in the guise of working with alternative concepts by members and consensus-making processes; and by me in the search for ways of revealing, monitoring and clarifying alternative concepts.

As far as the design of CL sessions was concerned, I reflected that tasks involving the sounding out of ideas (eg., 'What is a plant'), and the post-CL class report back, wherein



the sharing of ideas occurred, may have promoted critical thought and learning. My interpretation was that the nature of the CL topic might determine the type of learning outcomes.

I reflected that the group product (poster, work sheet, etc.) and report back were important for consolidation of ideas, for self-monitoring of learning and to reveal learning, consensual constructs and alternative concepts. Thus I made a construct pertaining to managing cognitive outcomes that

21 *Group products, presentations and subsequent class discussion may help with promoting, revealing and monitoring learning outcomes.*

#### **d. Managing Assessment**

At the initial interviews, 9 students intimated that they liked 'topping the class', while the remaining 3 had not felt this way. All, however, said that they accepted a group mark, although two students preferred individual marks. Ten students said that they preferred to work cooperatively rather than competitively, although, there seemed to be contradiction in their thinking, in that they felt, for varying reasons, that intergroup competition was important. Only one student (S10) was definitely against any type of competition.

I was posed with a dilemma: on the one hand, students had been socialised by a dominant ideology that promoted and celebrated competition and individual achievement; on the other hand, they valued group cooperation in producing group achievement.

**Plan:** I planned to implement a combination of individual and group assessment, but without encouraging competition, even between groups.

The first assessment negotiated with students, in session 2, took the form of peer group assessment of posters (50%), a self evaluation mark for cooperation (25%), and a lecturer evaluation mark for a paragraph written individually on 'what I learnt' (25%). Students had been guided on the criteria for assessing.

On revealing the summary of marks awarded and the criteria used in awarding the marks to students, they indicated that they were amenable to such a system of awarding marks. One student (S7) had noted, "*I'm satisfied [with] the way marks are allocated [allocated], it is fair to everybody*" (Appendix VII, pvii1), in his reflection of what he liked in CL. A construct was made that

22 *A combination of intergroup peer assessment, self-evaluation and lecturer evaluation, based on overt criteria, may be regarded as a satisfactory way of assessing CL work.*

The perceived satisfaction with mark allocation illuminated their initial perceptions and assessment was not problematised for the reconnaissance session.

#### **e. Lecturer Constraints**

The CL study had been undertaken in practice partly because of my view that the externally imposed *RDDA* (Research Development and Dissemination Approach) model of dissemination of innovations would 'deskill' me somewhat.

During the process, being a relative novice at implementing the CL approach, I was tempted to succumb to old habits of an authoritarian mode: at times, I was tempted to intervene, uninvited, in the CL discussions, feeling that my ideas may have been more valid in certain cases. I consciously resisted the temptation, however, and a decision was taken that intervention would occur at the request of a group, and that clarification and explanations that were perceived to be needed, were to occur only after students had worked with their ideas. Students themselves were learning this in the practice of CL.

**Plan:** Thus this type of guidance was given, especially during the class discussions that followed the small group work. I made a construct in this regard that

23.1 *A novice CL facilitator may need consciously to act to promote processes conducive to the idea that students are in charge of constructing their own ideas*

*about science and science concepts in a CL environment, during CL practice.*

Furthermore, there were times during the CL activities of the first cycle, when I felt at a 'loose end', since, in the past, I habitually occupied myself with teacher talk, even during 'group work'.

**Plan:** I decided to occupy the time during which students were involved in their groups, in moving around the groups, observing 'snippets' of processes that occurred. I consciously aimed at being unobtrusive, so as not to pose a threat to the perceived secure and non-authoritative learning environment, that had been created in the groups. I reflected that, with continued practice, the increasing familiarity between students and myself meant that students may not have regarded me as a threat in this way. Thus, a construct made was that

23.2 *Ways of releasing control in the classroom during CL may be learned in situ, during practice and may be problematised as needing continual reflection, by a lecturer, who is a novice at CL practice.*

It must be noted, however, that I still maintained the role of planning CL sessions, thereby making judgements as to what were worthwhile topics to pursue. This was not problematised, and on reflection, it is my opinion that, it needed to be problematised, especially for the current need to transform education in the emerging democracy in South Africa. Perhaps at college level, students may want to choose what to learn in their pre-service science education. On the other hand, they may value the idea of including topics that are responsive to present school science curricula, the development of which involved neither the lecturer nor the students. My colleague and I had considered the prevailing school curricula in developing the course.

#### **f. Using CL at Pre-service Level**

Apart from the cognitive and affective learning of CL, the CL approach was reflected on as facilitating induction into teaching practice. During session 5 students collaborated in

groups to design a CL activity on classification for a standard 5 (grade 7) class. When their ideas were presented to the class, it was reflected that such pre-service experiences may help make them competent in planning such activities at the school level. Furthermore, I reflected that the collaborative exercise may be perceived as enabling future collegial collaboration in the field. A construct made in the light of such reflections was that

24 *Students may perceive pre-service experience in the practice of CL as helping prepare them for a CL ethos in the classroom and in the education community.*

**Plan:** The themes that were identified and discussed were those that impinged on the next cycle of learning and research. It has been indicated that a reconnaissance session (*Reconnaissance II*) had been planned to initiate the cycle, partly because students needed to be inducted into conscious reflection in action, on action and for action.

Thus the second cycle was planned in a somewhat technical manner, in the sense: of providing opportunities and strategies for students to reflect on their learning; and partly as a conscious intention for students to focus on the problematised areas identified and acted on, to varying extent, during the first cycle.

### **Reflective Note**

I regarded the process of producing the descriptive-interpretive report of cycle 1 and generating the themes, themselves, not only as part of the methodological processes in **analysing** evidence presented during the cycle, but also as a reflexive process informing **action** and **planning** in the CL practice. In this vein, it may be noted that some difficulty in separating research issues, theoretical issues and praxis was perceived by me.

I had noted diary that other aspects about CL were being revealed (Appendix XIV, p xiv13; Appendix I, p i10; Appendix II, p ii15). Although I had planned to illuminate constraints to CL in the first cycle, my analysis yielded other aspects (as 'other

constructs') that were being revealed by the cycle. This I ascribed to the action-research approach of the study, as opposed to other approaches by which one or a few aspects may be studied at a time. In this respect I made a construct that

25 *A cycle of action research reveals aspects other than what was planned to be illuminated.*

## 4.2 Cycle Two

Cycle two began with *Reconnaissance II* in session 6 and comprised 5 more lecture sessions around *Topic 2 (Anthophyte Morphology and Modifications)*.

Analysis included coding and categorising data, and developing the *Descriptive-Interpretive Report II* and the *Analytic-Theme Report II* (Appendices I and II).

The following three themes that were identified will be discussed:

1. reconnaissance foci
2. other emerging constructions and
3. cognitive participation.

### 4.2.1 Reconnaissance Foci

The focus during reconnaissance was on the eight aspects of dominance, language, time, alternative concepts, group size, changing groups, group rules and topic, selected on the basis of analysis of cycle one.

#### a. Dominance

The following constructs were made, based on analyses of data abstracted from taped group talk of parts of all the sessions, the reconnaissance group posters, class observations, student reflective notes, member observation for CL activities of sessions 7

and 8 and interviews of 5 students (*Student Interview II* - S1 and S3 in [A], S6 in [B], S9 and S11 in [C]):

26 *Certain members' ideas may be valued above others and such dominance may not be regarded as constraining or as dominating by students.*

27 *Students may perceive some dominating processes as necessary for progress in CL; these perceptions may differ from those of the lecturer.*

28 *Students may covertly reflect on dominance during group activity (eg., as in formulating group rules) and find, on overt reflection during reconnaissance, that the strategies they used helped minimise dominance.*

29 *Dominance during CL may be minimised by action based on deliberate reflections by members and on reconnaissance of such reflections by the CL group.*

30 *A group may resolve a conflict in its own peculiar way, which may be unconventional.*

Construct 26 was based on the analysis of data as exemplified by those of [A]: taped sessions 6 and 7 (Appendix XII), student interviews (Appendix V, pv6: S3 - *one may give instructions sometimes ... helping*; S9 - *there was [S10] was - for group progress in giving ideas*), but also on analysis of data of other groups. I interpreted that [A] valued ideas of S2 and to a lesser extent of S3, ignoring S4's 'valid' ideas. Students, however, did not identify a dominating pattern.

Construct 27 was based on [C]'s idea, revealed by group talk (Appendix XII, pxii12-13) and their poster presentation (Appendix XI, pxi4), during which they said that they managed dominance for the "*good of the group*" and on S3's idea who saw, what I perceived as dominance, as "*helping*".

Construct 28 emanated from S10's reflection of her 'withdrawing' and her 'cuing'

strategies to limit her dominance (Appendix VII, pvii2: *The members of our group do work well together but they rely on me to say if what they have said is correct or incorrect. I see this as a type of dominance in the group which I don't want and I try and ask their question with a question but sometimes because of the time constraint I don't do this; I believe I participate well but I'm trying to move out because I don't want to be the person the group relies on, instead we must all rely on each other*) and the action strategies on dominance, formulated by groups during reconnaissance.

Construct 29 was based on interpretations about dominance of the first cycle, student interview comments (Appendix V, pv6, eg., S6 - *there was; not now - rule session helped - work on dominance*) and the overt reflections on dominance during the reconnaissance session (Appendix XII, pxii10).

Construct 30 was based on [B], in which a conflict situation that had arisen revealed a dominating pattern initiated by the men of the group over S5's idea (Appendix XII, pxii10: S8 - *It's bad for a person to be dominant all the time - right?* S5 - *I don't think it's bad - what about when other people don't know what to say - if they - have got ideas - they have to be dominant. If other people are quiet - if you got all the ideas - just say them out*). This was subverted, however, by a decision to use S5's idea (Appendix XI, p xi4 : [B] - idea 4), contrary to my perception of the dominating pattern and to the view of consensual agreement based on majority views.

Clustering of the constructs made on dominance in cycle one and cycle two, yielded a tentative major construct, since I perceived saturation of observations on dominance:

31 *Dominating processes may surface during CL practice; and conscious and overt reflections on aspects of dominance, made both by students and the lecturer, incorporating group and class reconnaissance, may be needed, if the implementation of effective CL is to be successful.*

**Plan:** It seemed that students had focussed on the **managerial roles** regarding dominance, like monitoring talk time, rotating roles of scribe, leader, reporter and organiser of work

and not on **dominating processes related to cognitive participation**, like those concerning participation, in, eg., generating ideas, explaining and clarifying ideas, questioning and critiquing ideas, judging and accepting ideas. Based on this interpretation, a reconnaissance session (*Reconnaissance III*), focussing on equity in participation was planned for session 12 (session 11 being a test session).

## b. Language

The following constructs were made, based on data of taped group talk during the reconnaissance session, mainly of [A] (Appendix XII, pxii8), in which it was revealed that the English speaker (S2) of the group tended to clarify instructions and S4's ideas, whereas S3 tended to rephrase S4's ideas for clarification:

- 32 *Instructions may need to be clarified not only by the lecturer, but also by peers at the beginning of a CL session; members who are proficient in the language of discussion may be included in a group to expedite this.*
- 33 *Small group CL may provide the opportunity for help in the expression of ideas, for less proficient speakers of the language of discussion.*

A dilemma on the issue of language was posed, based on analysis of group talk and interpretations thereof, of poor input by some group members (S1, S6 and S9). On the one hand, poor language proficiency coupled with low self-esteem, which may be generated by poor language proficiency or may perpetuate it, may constrain CL interactions. On the other hand, CL may provide the secure environment required for development of language and self-esteem.

A paucity of input by members, like S1, may be seen as stemming from their insecurity in expressing themselves in a second language, or by being unsure of concepts, exacerbated by members ignoring their ideas, at times. [B]'s input in the report back poster confirmed the idea that a second language speaker may lack **confidence** in his/her ideas.



In [B] all members were perceived to be proficient in the language, although 3 members were English second language speakers. In [C], S10 (first language) and S11 (second language) were proficient in the language, whereas S9 and S12 (both second language) were reasonably proficient, although S12 took time when speaking. S9's poor general input (although relatively better in session 7), may be seen, not as being constrained by language. By her own admission, during her interview, S9 saw herself as not being very proficient and this she saw as "*one of the reasons for not participating*" (Appendix V, pv6).

In the class discussion during the report back, it was agreed that language proficiency may be enhanced by talking. How this could be encouraged, was posed as problematic.

Group talk analysis of session 7 (Appendix XII, pxii14), revealed a pattern similar to previous ones, whereby the more proficient English speakers tended to clarify and rephrase contributions, probably following strategies the groups had decided on in relation to the promotion of language development; and indicating, that groups were involved in encouraging language development. Based on the idea that this may have been inspired by the reconnaissance session's focus on the language dilemma it was asserted that

34     *Reflections on language issues involved in CL may promote the monitoring and development of language.*

Furthermore, member observations, in each group, indicated that members had expressed themselves, so that all understood and that members were given opportunities to rephrase inputs so that all understood. This was further corroborated by statements, made during the interviews at the end of the cycle, that all members understood the language used in their groups (Appendix V, pv6: S1 - *improving-because talking; group sometimes impatient because of time; science language-1st language person understands better; S3 - practice increases proficiency; all understand; should not use mother tongue; science language-1st language speaker not advantaged; S6 - language-no problem even in science language- group works through it; S9 - practice increases proficiency; S11 - language-slight problem because of time limit; science language - both 1st and 2nd language*

*speakers have problems*). At least one group [A] had consciously decided not to use 'mother tongue' (meaning siZulu), in their CL interactions. It was also noted, by the observer in [C], that the idiosyncratic usage of a term had been clarified by the group. This gave strength to the construct made in cycle one, that it may represent a way of working through potential alternative concepts, by a heterogeneous group.

Members who were perceived to give less input in their group discussion, seemed to increase their input, in the sessions subsequent to reconnaissance. A construct based in this regard was made that

35     *Second language speakers may improve their language proficiency in the small group environment of CL.*

Students, who were interviewed, reflected that practice in using the language of instruction improved their proficiency in the language.

S4's Case: Analysis of [A]'s talk often revealed S4 verbally rehearsing ideas generated by others, in sounding them off on others. I reflected that, although both S4 and S1, in [A], seemed to have problems in expressing their ideas, I perceived that S4 was undeterred by this, in that his input was relatively frequent in the group. S4 was regarded, at least by me, as an 'above average' student and group CL seemed to improve his language proficiency. This idea was reinforced by [C]'s report that CL helped the development of language in a group.

My interpretation of S4's case, was that high self-esteem may have counteracted poor language proficiency, in promoting participation in CL.

S4's language constraint, however, was noted as constraining him in defending his sometimes valid ideas. S4, himself had mentioned that it was **difficult** for a second language speaker **to express** ideas. S4's case engendered a proposal that

36     *A motivated second language person, undeterred by language constraints in*

*participating, may enhance his/her performance by interacting with ideas in a CL environment.*

S10's dilemma: S10's reflective notes (Appendix VII, pvii2) on sessions 8 and 9 indicated a dilemma that could be faced by an English speaker in a heterogeneous group, when she said "*the group battles with time because.. [S12]...and..[S11]...try to make each fact they know known...*" and in the next note, "*took a long time because.. [S12]...and...[S11]...did quite a bit of talking*" and then, as she concludes, "*... the problem of language does affect our group because ...[S11]...and ...[S12]... don't put sentences short and sweet because of the barrier of the language*". She resolved her dilemma by saying, "*I personally must try to slow down, because I like things done in a hurry*". This type of practice may be one way of managing CL in a multilingual environment for first language English speakers, who had been disadvantaged by apartheid, in being deprived of interacting with members of other groups in the community.

The second language speakers, themselves, may have been aware of the problem mentioned by S10, as indicated by some comments in their interviews (Appendix V, pv6): S1 said that her group members, at times, had become impatient with the time she took to say something; the time taken by English second language speakers in expressing ideas was also referred to by S11 who saw a "*slight problem*" because of time limits, in that it took more time for such members for "*thinking and formulating ideas*" and that "*the ability is there, but time is a constraint*". A construct based on this was that

37     *Language proficiency, per se, may not be a constraint to effective CL and participation, but the longer time required for second language speakers in expressing ideas may be seen as problematic.*

The following construct emanated from data abstracted from group talk during reconnaissance and student interviews:

38     *Both first and second language students may find science language difficult to*

*understand.*

**Plan:** Based on ideas negotiated with students: that rehearsal promoted the development of language and the CL environment provided the stage for such practice; that reflection and reconnaissance helped in personal language development and in promoting group monitoring of development; and that language proficiency may be seen as affecting equitable participation, the major construct that **CL groups, composed heterogeneously on the basis of language proficiency, facilitated language development,** was reinforced. The implication that a longer time is needed for CL, stemming not only from the nature of CL, but also from the perception that more time was required in such groups, was noted and taken into consideration as a planning criterion for future sessions.

### **c. Time**

The idea that the time, for the study of a topic using CL, may be more than that employed in traditional lecture practices and that this had **management and curriculum implications** had been posed. This idea was based on my perceptions and, on those of two lecturers, who had raised the issue of the justification of the longer time they perceived as required by CL. This was problematised for reconnaissance discussion in session 6. All groups reported that the time given was insufficient for CL work. The curriculum implications, however, were not discussed although the management issue was alluded to by students. Thus a construct made was that

39 *Students may not be experienced enough in CL practice, or in curricular policy issues, to reflect on the curricular implications of the relationship between time for CL and a curriculum favouring CL.*

It was noted, also, that although students who were interviewed saw group reflections as improving their CL practice, they had not alluded to the curricular implication of time being devoted to such activity. Furthermore, I felt that the longer time envisioned, when using CL for groups composed heterogeneously for language proficiency, may have curricular implications.

During cycle one, I had reflected that students were unaccustomed to **managing time** for themselves and I saw this as having management implications. A construct that was negotiated with students at the end of the reconnaissance period was, that time may always present a constraint in CL since a topic may engender many different ideas, but, how to control this was problematised. This was indicated in the diary (Appendix XIV, pxiv16: *time may be a constraint almost in all cases - a topic may engender many ideas - how do we manage this?*), in the colleague's note 5 (Appendix VI, pvi5) and in the group posters (Appendix XI, pxi6). During sessions 7 and 8, it was noted that the time allocations were adhered to (Appendix XIV, pxiv17: diary page 35 TIME, page 36 TIME), and that this had been promoted by external prompts given by the lecturer and by those of the activity hand-out. Furthermore, member observation during sessions 7 and 8 revealed that groups had not managed time, except for [B] in session 7. Based on these observations it was asserted that

40 *Groups may habitually rely on external prompts to manage time.*

Furthermore, in cycle one, the dilemma existed where, on the one hand, the lecturer specified time limits to activities as a way of managing time and, on the other hand, students saw the need for more time given for certain activities. A construct made in the first cycle had indicated that the nature of the task determined the time given. This was reinforced by [C] which reported that "*time should be determined by the way it is used*". My reflection, on session 6, was that the report back period had taken up much of the time allocated for the class discussion. Thus I decided that time should be planned more carefully to include effective class discussion. To implement this, the discussion emanating from questions during report back, was time managed, in that only one question per group was to be tendered. A construct made in this regard was that

41 *All aspects of a session, including class discussion, may be catered for during the planning stage, by anticipated time allocations and, time allocations may be adhered to, in a flexible way, by both lecturer and group management of time.*

**Plan:** I decided that there should be a careful allocation of time in planning sessions, with

due consideration given to the nature of the CL tasks; that this be accompanied by flexible management of time during the sessions by the lecturer; and that group management of time be encouraged. Taking time into consideration the remaining sections that the colleague had planned for the semester were modified in consultation with her.

#### **d. Alternative Concepts**

Saturation had been reached on the ideas that had surfaced in the first cycle: that group products revealed some alternative concepts; that group members may detect some alternative concepts; and that report back class discussions helped clarify some alternative concepts.

It was significant, however that no mention was made of teacher observation as a way of revealing alternative concepts, although mention had been made of teacher guidance in shifting alternative concepts. Thus a construct made was that

42 *Students do not find it significant that alternative concepts may go undetected and thus reinforced by social approval in peer interactions; lecturer intervention in the form of guidance, supported by literature information, in such a case may be required to focus students on looking at ways to improve the detection of alternative concepts.*

On comparing the occurrence of alternative concepts noted on analysis of taped group talk with those revealed by group products, the idea emerged that **a task product may be designed to reveal more alternative concepts.**

**Plan:** Groups were asked to include lists of ideas that were used and those that were not used, with their group products, partly as a way of revealing undetected alternative concepts.

This was initiated in session 8 (although only one group made this for session 8). Some alternative concepts were revealed by such lists, eg., "*grass plants has [have] no midrib*"

by [C], and a construct made was that:

43 *The design of a task product may be used for revealing alternative concepts more effectively.*

The following construct was made, on reflection of the kind of guidance I needed to give during sessions, to shift some alternative concepts, eg., the guidance needed to shift [B]'s concept of 'modification' (Appendix XII, pxii16: *S6 - adventitious roots... metaphor [pneumatophore]...how many types of roots ... complex roots; S7 - sinker; S8 - primary root*

\* *Alternative ideas: S6 - 'types of roots' as topic 'modifications' - questioned by S8, "is that a modification...?" - ignored, with initiation of idea by S7; S6 - 'complex root' and 'adventitious roots' as modifications - accepted; S8 - 'primary root' as modification - accepted):*

44 *Lecturer guidance may be needed to promote shifts in alternative concepts that may have been revealed to the lecturer, when these alternative concepts remained undetected by group interactions.*

**Plan:** It was acknowledged that peer help in shifting alternative concepts was a desirable component of CL and that there were limitations in peer recognition of alternative concepts. It was decided that a group product may be designed to reveal more alternative ideas and that there should be lecturer guidance on revealed alternative ideas, in the absence of peer guidance.

#### **e. Group Rules**

Group processing of the effect of group rules, yielded that all groups found the rules necessary: for discipline by [A], to avoid chaos by [B] and that it should be monitored by [C] (Appendix XI, pxi6). Thus a construct made was that

45 *Students may see the need for group rules to implement effective CL.*

Analysis of member observations included my interpretation that, although groups were not requested to observe, evaluate and modify their rules, they had done so to some extent. A construct generated to this effect was

46 *Students may see the need for group rules to be monitored by the group, for possible modification and evaluation of observance of rules and the provision for such activity is recommended.*

#### **f. Group Size**

Although [A] proposed a flexible approach dependent on the size of a class and the groups generally felt that a group may have 6-8 students (Appendix XI, pxi6; Appendix XIV, pxiv 15: GR SIZE), it was agreed that groups remained as they were, indicating a preference for the 4-member group. The relative effective participation of members of different group sizes was problematised and posed by me. Thus a construct made was that

47 *Students may not problematise the effect of group size on participation for effective CL, in interpreting the issue as it relates to the management of different class sizes.*

#### **g. Changing Groups**

[A] and [B] reported that they had felt that changing groups was a good idea since it "develops skills of working with different types of people" according to [A], to fulfil the "need to socialise/familiarise" themselves with others, according to [B]. [C] reported that they did not think it was a good idea since people "bond" in a group (Appendix XI, pxi6). S10, however, had reflected, "I personally don't know all the people and I think it would be an experience for us all to change groups, to get new ideas and get to know the people in the class" (Appendix VII, pvii2). All groups, however, decided against changing their groups. A construct made in this regard was

48 *Although the changing of groups may be desirable, the timing of the change may*



*be problematised.*

I reflected that the option of changing groups would augur well for integration ideals, in the context of the transforming educational environment and social order in South Africa.

#### **h. Topic**

During reconnaissance, [A] reported that problem-solving, and [B] that teacher introduction of the CL activity followed by a discussion, were appropriate formats for CL; and [C] felt that the format used by the course was appropriate for CL (Appendix XIV, xivp15/16; Appendix XI, pxi6).

The format that had been used in this cycle was varied: mostly informed by constructivism, whereby ideas were first generated in groups followed by group construction of concepts (sessions 6 and 7 in this cycle); a session in this cycle (session 8), wherein students had to individually prepare beforehand, by reading information, pooling and selecting information for a report; and two sessions in this cycle (sessions 9 and 10) in which groups prepared and presented a 'teach session' to the class.

During the cycle, analyses of class observations, taped group talk, group member observations, student reflective notes and interviews, yielded information that indicated that students were on-task for all sessions. The participation level, however, varied and was judged as being lowest in session 8 (relatively lower in [B] and [C]) (Appendix XIV, pxiv22 PART). It was rated by some students as one in which participation was unsatisfactory. They ascribed this to not doing the required preparation (Appendix VII, pvii4: *Well, I did participate most of the time but not to my satisfaction because I had not worked or prepared my work beforehand*; Appendix XIV, pxiv20: *Although they were free to visit the library, nobody did this; they consulted the books I had made available, some students were chatting (not on-task), some spoke with the colleague about a field trip that was scheduled, some asked about the planned test*).

Perhaps, if the required preparation for session 8 had been done as a group activity,

participation levels might have been better. This, however, had implications for course design, since the class had met as a class unit only for the Natural Science course. Thus such group preparation may need to be done during lecture time. On the other hand, it may not have been the format of the task, but the nature of the task, that promoted less participation. The task entailed the generation and selection of 4 examples which may have engendered discussion, limited mostly to justifications for examples suggested by members. Such justifications may not be necessary if everyone did the required preparation, unless a member had not understood the information presented. Furthermore, the task was considered to be restrictive, in that it was not completely open-ended.

Member participation in [A]'s discussion during this session, however, was perceived to be the highest of all groups (Appendix XIV, pxiv22: *made assessment reports for each group (chart[10] + notes[10] + lesson[20], max 40: A:  $6 + 6 + 11 = 23$ ; B:  $6 + 5 + 10 = 21$ ; C:  $4 + 7 + 13 = 26$ . The overall ranking seems to reflect the participation in each group; Appendix I, p17: Playback also revealed that ideas were generated in all groups although the discussion of each idea was seen to be high in group A)*). Members of the group had prepared for the session. There was much rehearsing and 'sounding-off' of ideas and all members generated ideas; whereas [B]'s strategy had been to generate the minimum number of examples, with very little discussion amounting to brief unchallenged clarifications given by the proposers. Only two examples of the 4 that were proposed by [B] were valid, and it was perceived that members had not internalised the concept 'modifications'. My interpretation of this was that participation, learning, productivity, and group interactions, as indicators of effective CL, had not been hampered by the nature of the task in [A], whereas the required preparation (format of task) had hampered [B]'s effective CL. Participation may be affected by the way the task was perceived. Thus a construct was made that

49     *The nature and the format of tasks may be determinants of the effectiveness of CL.*

The students who were interviewed rated the reconnaissance session as best, followed by the 'teach session' preparation. Classroom observations and group talk analysis indicated

that participation levels were high during the reconnaissance session. I reflected that, perhaps, students were personally motivated to contribute in the CL activities in this session, which involved looking at personal reflections in coming to a construction on each aspect. The group constructing aspect may have given the CL sessions high motivation for interaction, since it presumed high mutuality. Furthermore, it was considered open-ended, in that all constructions were potentially valid.

In the same vein, mutuality was considered to be high in tasks involving the preparation of the teach session, since each group was required to teach a section to the class and it was perceived, that effective teaching by a group was aimed for. I noted high levels of participation during the preparation session. Reflective notes also provided corroborating insight in this respect. The varying presentations indicated the open-endedness of the task. A construct made on 'task nature' was that

50 *Open-ended CL tasks may engender high participation levels for effective CL.*

Lecturer and member observations of CL activity in session 7, indicated high participation. The CL activities of session 7 were planned such that high mutuality could be engendered.

This view was corroborated by that which emerged during the interview with S3 (Appendix V, pv6: *some topics allow for more participation; some no participation- don't know what to say, just sit; the way topic is structured helps-allow people to participate*). He was of the opinion that, at times, the nature of the topic was inappropriate for participation, and at other times the format of CL tasks was inappropriate. He felt that some areas, eg. reading 'theory', should be individualistic activities, which may be enhanced by subsequent group discussions.

Based on S11's opinion that the 'plant classification' activity of the first cycle was one in which the group had "*difficulty for participation*" (Appendix V, pv6), I reflected that this activity had required a certain degree of familiarity with some biological terms. Some students were perceived to have lacked such familiarity. For me, the implication here was

that, the lecturer needed to consider the varying cognitive background of members within a CL group in planning a CL task.

**Plan:** I decided that, to encourage optimal participation in the next cycle, future tasks be planned with due consideration of: the format and nature of the task, the varying cognitive background of members of CL groups and the incorporation of some individual work within CL. *Reconnaissance III* was planned to focus on ways of increasing participation.

#### 4.2.2 Other Emerging Themes

Other emerging themes of cycle two included ‘assessment’, ‘monitoring’, the ‘action-research methodology’ used in the study, ‘self-esteem’, ‘motivation’ and ‘learning environment’.

##### a. Assessment

On comparing the poster presentation and playback analyses of session 7, it became apparent that some valid ideas (like those of S4 in [A], Appendix XII, pxii14; Appendix I, pi14: *In group A, S2 presented; S3 observed and had decided not to participate in discussions. Playback of the second activity revealed that most inputs were made by S2 and S4, who ‘sounded out’ ideas with each other. Fewer ideas of S4’s contribution were taken, most being valid ideas*) that students had expressed, were not revealed by the product. This had implications for group assessment and a dilemma was posed that a group chose what was to be represented on a poster, but that very selection affected the assessment of what was on the poster. This was problematised with students during the next session and a suggestion was made that the task product be designed to reveal more, to include the generation of ideas that were both accepted and rejected by the group.

Furthermore, a picture of the general nature of interactions and participation of members and how the ideas were generated and discussed, was not apparent on a poster and could not be assessed in a product like the types of posters groups had made.

It was also reflected that the group which was perceived to be most productive, assessed as [A] - 7/10, on analysis of the taped playback (Appendix XIV, piv18: *My tentative assessment: appearance(5) + content(5) + presentation,response(5) + productivity(10) (25 max): A: 2 + 2,5 + 3 + 7 = 14,5; B: 4 + 2,5 + 3 + 4 = 13,5; C: 4 + 2,5 + 4 + 5 = 15,5; Appendix I, pi16: I pointed out that playback had resulted in the perception that group A had been the most productive and yet the poster did not represent that*), had not succeeded in producing a product, assessed as the best by peer groups; and that the presentation by a group may obscure the quality of social and cognitive interactions that had occurred in the group.

Based on the idea that the most productive group may not produce the best product, a construct made was that

51 *The assessment of a group's CL may need to include a consideration of the group interaction processes and the production of ideas, but finding ways of implementing such assessment needs to be problematised.*

**Plan:** In the search for ways of assessing such components, it was reflected that these may include finding ways of assessing: the amount of input as an indication of participation; the acceptance and rejection of inputs on substantiated grounds (how input was critiqued) or critiquing the group's judgement of ideas; the validity or quality of ideas; the giving of help (including support in listening, agreeing and clarifying); formulating products; and group mutuality.

Group assessment for session 8 included evaluation of the participation and generation of ideas, in addition to the product. Students had been satisfied by this mode of assessment. Since this involved analyses of taped playback, the implication for such assessment was that

52 *Each group's CL may need to be carefully observed for assessment purposes, as well as for planning purposes.*

In the absence of taped observations, this type of assessment remained problematic in classroom practice. I reflected that to enhance assessment, a product or member observations, could be designed to include lists generated by the group, indicating what was accepted and discarded, what was consensually arrived at and what was not and other aspects indicating the way in which ideas may have been generated.

**Plan:** To address this suggestion the idea of lists of 'used' and 'unused' ideas had been implemented for sessions 8 and 9. Lists that were made by groups included valid and invalid ideas in both lists of 'used' and 'unused' ideas. Thus a new construct was made that

53 *Assessment of group CL may include the evaluation of the participation and generation of ideas, in addition to the product.*

'Participation' could be interpreted to include aspects like initiating, clarifying, accepting, rejecting with substantiation, judging and collating of ideas and, the resolution of conflicts. 'Generation of ideas' may involve the overall cognitive productivity of the group.

The colleague observer and students had indicated that the discussion following a CL activity (in which reports were presented and in which clarification and questioning by students and lecturer and guidance by the lecturer occurred) had helped group and self-evaluation. Lecturer guidance during CL periods, as had occurred when a group requested help, was also perceived as helping assessment. Thus a construct made was that

54 *Lecturer guidance and interactions with students, in negotiating concepts, may help students in their self and peer group assessment.*

Criteria used by groups to assess the posters in session 7 were not overt, as had been indicated by the surprise expressed, by the colleague and myself on the marks awarded (Appendix XIV, pxiv19: *Peer group assessments of the posters of session 7 were made (appearance[5]+content[5]): A was given 2 + 3 = 5; B 3 + 2 = 5; C 3 + 2 = 5, by*

the two other groups in each case. [Colleague] commented on this - she suggested to students that they need to substantiate their assessment since she could not understand why group A had 3 for content whereas others had 2! I suggested that I expected students to be careful in awarding marks especially since I had guided them at assessing the content of a poster during our first experience). It was observed, by the colleague, that peer assessment practices should be justified by them (Appendix XIV, pxiv19 ASSESS) and a construct made in this regard was that

55 *Initial guidance in peer-assessment given to students may need to be reinforced during subsequent assessments and criteria used may need to be substantiated by them.*

The idea that criteria negotiated by students may differ from those of the lecturer, for reasons that may be difficult to uncover, however, was reflected upon against the broader debate of the validity of any assessment, and whether assessment was a worthwhile activity for evaluating learning.

Lecturer assessment of the 'teach presentations' by groups to the class, revealed that presentations were not of a standard that had been anticipated by the criteria that lecturers held. It was reflected that teacher use of CL in the classroom may require reflective practice, implying a gradual progression towards effective classroom CL. Thus it was interpreted by the lecturers that

56 *Pre-service students may require practice in classroom CL for it to be effective.*

Although group assessment had been given for CL activities, the test at the end of the cycle (Appendix III: session 11) was designed to assess mostly individual learning. Approximately 19% of the test required pair work and approximately 30% included peer group-generated questions. The latter had been included, partly on the basis that groups had been involved in generating information, especially on morphology and modification of anthophyte plant parts. The quality of these questions, however, was perceived by the colleague and myself and, by some students, as poor.

I reflected that within the formal testing context, the induction of group assessment had been executed with some difficulty, since such an experience had not been in the students' repertoire. Thus a construct made was that

57 *Students may need to be inducted into a test format which included items reflective of CL aspects.*

The management of tests which incorporate CL aspects may be different from those in the lecturer's and students' experience and may require reflective practice.

A further reflection was that the college environment would limit such assessment during an examination, and a construct here was

58 *Group assessment may need to be limited to continuous assessment practice, as in a college record mark; formative assessment of this type may be regarded as a 'fair' type of assessment.*

**Plan:** This had implications for the respective weighting of college record marks and examination marks. This was problematised with students and the colleague lecturer who was responsible for the final assessment for the semester. The colleague had decided to continue with the department's plan of using a college record representing 50%, and a semester examination representing 50% of the semester mark.

## **b. Monitoring**

During the first cycle no formal monitoring of CL by students had been planned, although reflection was inherent in the rule generation activity, the class discussion periods, the discussion around the transcripts and the 'least liked' and 'best liked' student lists. My reviews of previous sessions, based on my reflections, were presented to students for reflection, confirmation of their perceptions and problematisation, at times, with the idea of revealing bases of action to students. This 'modelling' may have helped students in their induction into reflective practice. After the reconnaissance session, which had been



planned as conscious reflection by students in their groups, I posed the idea of monitoring their CL in the form of member observations and personal reflective notes. Some guidance on such monitoring had been given to students, supplemented by a hand-out outlining some types of monitoring (Appendix III, piii7).

The reconnaissance session was seen by students as reflecting on their CL practice, and as embodying some planning of future action. Analysis of the posters presented during the session, yielded that reflections on an aspect produced **reflective statements** about an aspect, **planning action**, and **revealed dilemmas**. Thus a construct made was that

59 *Students may perceive the practice of monitoring their CL practice, as affecting effective CL.*

From the students' and lecturers' comments on the reconnaissance activities, a construct was made that

60 *Students may find reflective activity motivating.*

Member-observation of CL work (Appendix VIII, pviii1) was implemented for sessions 6 and 7 of the cycle, on a rotating basis, but students had mixed feelings about this type of monitoring. The idea of feedback to a group by a member, was not implemented by groups, probably based on views like "but observer telling group - not sure about its effect because it is from one person and not group" (Appendix V, pv6 - S11). A perception given by a student (S11) during his interview (Appendix V, pv6), that member observation "helps because members know someone is observing", was different from that of mine, that of feedback of member observations helping promote effective CL. I regarded it as subverting the process, in that it may have been seen as 'policing' rather than 'monitoring' their work. A construct I made was that

61 *Members of a group may regard the practice of observing their group's CL in a way different to those underlying the practice of reflective practice.*

Mention had also been made by interviewees that a group may be more amenable to

reflective inputs made by all members of a group. The option of writing reflective notes was taken up by only four students during the cycle for sessions 8 and 9 (Appendix VII, pvii2/3), although two, of five students interviewed, had indicated that they had been writing reflective notes, but had not handed them in (Appendix V, pv6). These reflections had not been fed into the groups by their members. A construct, based on these observations, was that:

62 *Time for all members to reflect personally and, in their groups may need to be incorporated in classroom CL practice for CL to be effective and reflexive.*

**Plan:** Based on the ideas that the reconnaissance activities, the CL rules activity and the practice of writing reflective notes were beneficial for effective CL and that member observation was negatively viewed by some, it was decided that, generally, students perceived **certain reflective practices as worthwhile for effective CL, but the structure of some activities (like member observation) as problematic.** The idea given by students that member observation was regarded as effective for personal participation, but not affecting group participation was taken. Reconnaissance was planned for the beginning of the next cycle, the option of writing reflective notes was retained, lecturer feedback was retained and class discussions were retained, for the purposes of reflexive practice.

**Reflective Note:** I regarded the interviews, themselves, as being reflective for those members who were interviewed, since they focussed on certain issues regarding CL. Furthermore, ways of monitoring CL practice like the interviews, reflective notes, reconnaissance, member observations and lecturer feedback were all forms of student reflexive practice, which they perceived to be effective for their CL practice. They were, simultaneously, the research tools required by my action-research inquiry, involving my own reflexive practice.

### c. Action-Research Methodology

A major inquiry, for me, was to evaluate the process of action-research as a suitable way of introducing myself and my students to CL practice. In the process I had found that action research revealed much about CL, giving an in-depth understanding about the nature of CL. Since students seemed to appreciate the reflective activities, generally, my response to this evidential corpus was that it was suitable. This was reinforced by my reflections on my own practice, as represented by reflections in the research diary at this stage, for example, p 56: *I find that this way of teaching reveals much that would have eluded me before - how did I ever cope with evaluating my lectures before!* and comments in cycle one (Appendix XIV, p 13, p 20). A construct I made in this regard, a reaffirmation of my initial feelings and assumptions, was that

63 *Action research may be a suitable way of introducing and implementing CL for both students and lecturer and of revealing many aspects about the nature of CL.*

Furthermore, a research effect, to my mind, was that of the extra care taken in planning sessions. The use of action-research seemed to increase the quality of planning and preparation and the delivery of sessions.

### d. Self-Esteem

According to a construct made in cycle one, the small group situation of CL provided fertile ground for 'confidence building' for those who perceived themselves as 'shy' in a whole class situation. The confidence and self-esteem of those interviewed at the end of cycle 2, they perceived to have increased. This, they ascribed to CL experiences in the course (Appendix V, pv6.3: *S1-increased this year ...sharing ideas increases confidence; S3-sometimes if know stuff - then confident ...CL promotes confidence very much ...by sharing ideas one evaluates oneself when in a group; S6-confidence increased more than last year - because small group - therefore everyone has a chance to speak; S9-still a little shy - not shy in group - because of group work - may make more input in class - better than last year; S11-confidence increased by CL*). They found that these types of

experiences, had helped in promoting their participation. They had also hinted at the idea that reflecting on such experiences in 'confidence building' may help them in being more confident in a whole class situation (Appendix V, pv6.3) and commented on how their group had been involved in 'confidence building'. Thus the construct was reinforced and modified to

64 *CL and reflective sessions may help individuals to overcome personal inhibitions, constraining classroom interactions and, consequently, practising CL may help in building self- confidence and self-esteem in a cumulative way.*

#### **e. Motivation**

All students interviewed still thought CL to be worthwhile. Saturation of observations was seen to have been achieved and it was asserted that

65 *Students may be motivated to learn cooperatively in small groups.*

#### **f. Learning Environment**

The last construct made on 'self-esteem', hints at the non-threatening environment of the small group, perceived by students; and it may be reformulated to

66 *A CL ethos may provide a secure environment for learning for all students.*

Furthermore, students who had been interviewed were noted as being more open in vouching information than at the first series of interviews (Appendix XIV, pviv23: *Interviewed S1, S6, S9 and S11. All seemed more comfortable than the last set of interviews, good rapport, not self-conscious*). This could have been ascribed to familiarity with the lecturer, or to an increase in confidence on their part, or it may be seen as the development of a rapport desirable for a CL and participative environment. Based on the perception that, in using an action-research format for CL implementation, student ideas had been illuminated and a more collective reflective interpretation of individual ideas and

events had been possible, a construct was that

67 *A CL ethos may promote lecturer-student interactive relationships, desirable for effective learning.*

A dilemma that arose was that students may have worked well because of aspects of the research perspective, like audio-taping of their talk. On the other hand, a positive effect may have been that students worked better in perceiving that I, as their lecturer, was interested in and cared about their knowledge construction, in that I was not just a provider of the 'learning environment', but an active participant or collaborator in the process of students' knowledge construction.

#### 4.2.3 Cognitive Participation

Analysis of participation yielded the idea that there were different perspectives of what was meant by participation (Appendix I, pi18: *The interviews were also motivated by the perception that equitable participation had been a problematic issue [made from observations of sessions, eg. session 8 CL and tape analysis of that, observations made by the colleague lecturer, eg., as in the diary (p 45 I PART), and in the colleagues note (3 PART) and reflections made by students as observers, eg., 'Evaluation of Group-work', S10, 6/3, and as in their reflective notes, eg., "enhance the process ... more participation", S3, 15/3]*).

The analysis of dominance in the reconnaissance, revealed that group members seemed to have valued certain members' ideas without regarding them as dominant (Appendix XI, pxi7). A reference had been made, also, to intentional and unintentional dominance, an indication that the group had worked through it. A construct, based on this idea, was that

68 *Members of a group may become aware of practices, like poor language proficiency, that may limit participation of members and may act on them.*

This refers to the idea that members, who were proficient in English, provided

clarification of the topic and ideas to promote participation of all members in the group.

Interviews (Appendix VII, p vii6) revealed that students had perceived that dominating patterns had changed and, that it had been reduced with their practice. My perception, however, was that some members, who had expressed feelings that participation of members in their groups and their personal participation had improved, were looking at aspects relating to the **management of participation** (like group rules and rotation of roles) and not at the **cognitive participation of members** (Appendix I, pi 22: *The traditional managerial roles, like those of presenter and scribe were seen to be undertaken on a rotating basis, within a group. The cognitive role of generating ideas was seen to be problematic*). A construct made here was that

69 *Dominating practices, whether intentional or unintentional and, whether accepted by the group as desirable or undesirable, may create unequal cognitive participation.*

As had been noted; my perception, during the analysis of productivity of groups for assessment purposes, was that cognitive participation was a significant component of participation.

Constructs made on the nature and the format of the task, as important considerations of the effectiveness of CL activity, may be reasserted, especially in the light of the idea that the productivity of the group may be affected by such considerations, and that the productivity may be determined by the type of cognitive participation of members of the group, as:

70 *The nature and the format of tasks may be significant determinants of the type of cognitive interactions that may occur to effect CL.*

**Plan:** Unequal preparation by students for the CL activity in session 8 was seen to have produced unequal cognitive participation. Similarly, I reflected, that other constraints, which groups may or may not have managed, for engendering participation, may have

been looked at from a management point of view, i.e. in managing CL as a type of learning that was 'new' and in the process of being implemented. In focussing on these management aspects of CL implementation, however, it seemed that the cognitive aspects of participation had been ignored to an extent. Thus a focus on the cognitive aspects of participation had been suggested by such observations and, the reconnaissance session of the next cycle was planned to this effect. To enhance such reconnaissance, student interviews which were planned to take place at the end of the second cycle, were structured to reconnoitre some of these cognitive aspects, by focussing on participation of individuals.

On reflection of comments made at the interviews (Appendix V, pv6, eg., S7 - *the longer time taken for second language speaker to express*; S4 - *[Pre-lesson preparation] - important - determines the level of contribution and participation*), I perceived that, for at least some members: **language proficiency** and **cognitive background** in a group may constrain participation; that participation may have been possible in an **environment of 'freedom'** of expression of ideas; that **'sounding-out'** of ideas may have promoted participation; and that a self-perceived poor **cognitive background** may limit participation.

Generally, it seemed as though cognitive background was seen as limiting participation, but the environment of the small group promoted the expressing of ideas. A construct made was that

71 *The cognitive background of individuals may affect the individual participation of members in a CL group.*

and that

72 *The small group environment of CL may promote participation.*

**Plan:** These ideas were planned to be included in the reconnaissance, marking the beginning of cycle 3. Further items that needed to be reconnoitred were included in the

interview checklist (Appendix V, pv1), as questions designed to illuminate patterns of the cognitive processes of generating, clarifying, critiquing, and selecting ideas in a group. Looking into patterns of the process of help, as related to cognitive participation, was included in this inquiry.

**Generating Ideas:** From analysis of the interview question on generation of ideas (Appendix V, pv6.2) and [A]'s group talk, I interpreted that all members had been involved in generating ideas, but that this role **fluctuated** for different CL sessions, depending on the cognitive background of the members; in [B], that the group seemed to have worked on eliminating **past dominance in the role of generating ideas** by one person (Appendix XII, 14/16; Appendix I, pi23: *It had been revealed that students may need to learn not only managerial/social skills but also how to generate ideas, how to explain ideas so that their peers understand them, how to critique ideas and how to judge and select them for equitable participation to occur*; Appendix II, pii34). A construct made in this regard was that

73 *The role of generator of ideas in a group may fluctuate, according to the cognitive background of members for a CL session.*

**Explaining Ideas:** The process of explaining ideas that had been generated had been undertaken by the **whole group** in groups [A] and [C], according to comments made by S3 and S11 in the interviews (Appendix V, pv6.2) and, I perceived that it was the habit of the groups to give the role of explaining ideas that were generated by a member to all members of the group (Appendix II, pii35: *on the evidence of at least 3 of the 4 who were questioned on this, it seemed that it was the habit of the groups to give the role of explaining ideas that were generated by a member to all members of the group*). The following construct was made:

74 *The role of explaining ideas that were generated in a CL group may be given to all or any member of the group.*

**Critiquing Ideas:** On being questioned about how an idea was critiqued: S1 said that



ideas were often not questioned, except when there had been a **conflict**, in which case the group had taken both opposing ideas, keeping them on hold, to be resolved by an 'outside' source; S3 felt that the group had been aware of their "*impatience with the development of an idea*"; S6 saw her role, partly, as to question ideas and said that the group had been happy with "*one member resolving conflicts*", although all had tried to help in this regard; S11 felt that there had been little questioning of ideas since, generally, they had accepted ideas; and S9 saw the "*questioning*" in her group as being done by "*one person mostly*", although she found that this had helped her and others, in the clarification of an idea, in that they may have had a need to question an idea but had not consciously expressed such a need (Appendix V, pv6.2).

Based on these and my interpretations, on analysis of group talk (Appendix II, pii35: *Based on these observations and those that I had made [eg., in group B's conflict between the idea of interrupting or not interrupting someone with an 'invalid' idea; during session 7 in group A, when it was observed that S1 had questioned S4's idea that the stem 'stores' and [S12] questioning S11's idea that parts of leaves may be modified as spines during session 8], it seemed that critiquing of ideas, as represented by questioning and conflict situations, had occurred and had been done by different people at different times*), it seemed that critiquing of ideas, as represented by questioning and conflict situations, had occurred and had been done by different people at different times. Thus a construct emerged that

75     *The role of critic or sceptic may fluctuate depending on the cognitive background of the person who questions.*

Furthermore, not all ideas had been critiqued, probably since some ideas were understood by members to be valid, according to their experience and cognition. Thus a further construct was that

76     *Some ideas may be critiqued and some may not be critiqued, or some to a lesser extent, depending on the cognitive and experiential schema of members of a group.*

**Group Selection of Ideas:** Based on students' indications that all members of a group had been involved in the selection of ideas by the group, and that in some cases, there seemed to be implicit acceptance by all members of certain dominant ideas (Appendix II, pii36; Appendix V, pv6.2), a construct made was that

77 *Members of a group may agree to accept ideas, judged as valid or with the condition of suspending judgement of an idea, as those of the group.*

**Help Processes:** Interview comments revealed that students perceived that 'asking for help' increased the participation of the receiver of help; that the person who had given help had also benefitted, in that the person 'rehearses' and reformulates ideas (Appendix V, pv6.3). Based on the ideas given by students on giving and receiving help, a construct made was

78 *The process of asking for help may increase the cognitive participation of the receiver of help and, of other members in a CL group and the process of giving help may be beneficial for the giver of help as a form of cognitive rehearsal.*

**Plan:** What had emerged in the cycle was that the students and I, in looking at interactions within groups during CL, had been focussing on the management issues of participation to increase participation, whereas, a focus on the cognitive processes of participation, may have been required to promote equitable participation. It was decided that, if equity in CL needed to be critically looked at, then the planned reconnaissance session should focus on the **cognitive aspects underlying equitable participation** of members in the CL groups.

This decision was promoted by the suspicion that what the practice in the two cycles revealed, were the constraints to CL implementation and ways of working through such constraints (Appendix II, pii36).

This limiting approach of the research, and of the lecturer implementing CL, was

acknowledged at this stage, and a more critical stance of the research had ensued, perhaps rather late in the semester with only 5 sessions remaining, of those allocated to the lecturer. On the other hand, it may be that such revelations may only occur on prolonged exposure to CL practice.

### 4.3 Cycle Three

Cycle 3 began with *Reconnaissance III* (Appendix III, piii10-session 12) and comprised 5 more sessions about anthophyte reproduction, ending with a session in which students completed a questionnaire (Appendix X) developed out of their reflective essays (Appendix IX).

As mentioned in the analysis of cycle 2, I found that I had planned to illuminate certain aspects in cycle 2 (i.e. the reconnaissance foci), but other aspects, for example, 'monitoring' and 'self-esteem', emerged. This reinforced the idea that the action-research approach revealed more than what was planned in a cycle. My reflections on the action-research methodology of implementing CL (Appendix XIV, eg., p 70: [The colleague]...*commented that there was much planning...the session was good...*), reinforced my construct made in this respect, during cycle one, and the construct was modified as

79     *Action research is seen as a suitable way of revealing the nature of CL and of introducing and implementing CL for both students and lecturer and this is reinforced during practice.*

This section reports on an analysis of the themes underlying the **cognitive aspects** that were seen to be involved in participation, towards a vision of **equitable participation**.

*Reconnaissance III*, focussed on the cognitive aspects of participation. In attempting to enhance the participation of individual members of a group, implementation had been viewed from a managerial perspective. We had tended to focus on the frequency of individual input, not on the quality of such input. Thus action had entailed ways of

increasing input rather than on ways of promoting equity. It was realised that cognitive participation was significant in such equity. Thus a construct was that

80 *The cognitive processes of CL may embody significant aspects of equitable participation.*

### The Cognitive Processes

During the reconnaissance session (session12), groups had been asked to note their observations of the cognitive processes in a short problem-solving exercise: this together with the taped reflections of their participation were analysed. The taped CL sessions of sessions 13, 14 and 15 (Appendix XII, pxii21-34) were analysed to plot the progress of cognitive participation. Member observation of some cognitive processes involved in CL was also done in session 15.

In [A], the group analysis of the exercise in session 12, noted that each member had generated 2 ideas (Appendix XI, pxi5). On analysing how one of these ideas was cognitively processed by the group, they noted that the idea that had been generated by S1, was justified by her, that all members helped in clarifying the idea, that a question relating to the idea asked by S2, had been answered by S1 and that all members helped in critiquing the idea in that its validity had been assessed by the group as relevant (Appendix XI, pxi5). Thus it would seem that all members had been participating cognitively.

The analysis of group talk in [A], revealed that, although S2 perceived S4's initial lack of verbalisation as an instance of non-participation, his response indicated that he had been involved in the process of **listening critically** (Appendix XII, pxii17-18; Appendix II, pii37). A construct in this case was that

81 *Critical listening may be a process of cognitive participation.*

S1 had perceived her participation to have been hindered by an interruption by S3

(Appendix XII, pxii18: S1: -'ehe'-seventy percent-little percent I was disturbed-with this; S3: - disturbed by what?; S1: -by you- [laughs] - we were given a turns to speak-while I was speaking-okay-I was the first to speak-and you said-please give [S4] a chance-while I was speaking). Thus in her case, interruptions may be seen to have curtailed some cognitive participation, and a construct in this case was

82 *Injudicious interventions by group members may curtail the cognitive participation of a member.*

From analysis of group talk and member observations in subsequent sessions (Appendix II, pii37-38), I interpreted that there was an increase in cognitive participation by members of [A] and, a general distribution of cognitive processes among members. This may have arisen out of the focus on cognitive processing during the reconnaissance session. The group's report in the reconnaissance session had intimated certain strategies that they were to use. Thus a construct in the case of [A] may be

83 *Reflections on the cognitive participation of individual members in a group, in revealing different perceptions of cognitive participation among members and subsequent monitoring, may promote the cognitive participation in CL.*

Cognitive roles seemed to have fluctuated in this group, although S3 was perceived to be the 'sceptic' in the CL in which he participated (Appendix II, pii38). Previous constructs about cognitive roles made in cycle two were modified as follows:

84 *Cognitive roles may fluctuate for different CL sessions.*

[B]: I interpreted [B]'s note on how an idea generated by a member, was processed during session 12, as involving a 'dialogue' between 2 members, although the idea had been accepted by the group (Appendix XI, pxi5). The taped reflections of session 12 (Appendix XII, pxii18), however, revealed that the group had perceived all members to have been "equally" active in their participation, and although they had felt that a member "had contributed more than others", they had not perceived this as dominating, but, as

being helpful in shifting alternative concepts.

Analysis of their group talk and member observations (Appendix II, pii38-39), yielded the interpretation that cognitive roles fluctuated and cognitive processes were distributed among members of [B], as had been noted for [A]. This reinforced the construct above. The cognitive processes involved in [B]'s CL may also be seen as resulting from the "Future Strategies" proposed by them during reconnaissance (poster - Appendix XI, pxi4), thereby reinforcing the construct made in this regard.

S5, however, had consistently been a 'sceptic' in the sessions of the cycle, just as S3 had been seen to be the 'sceptic' in [A] (Appendix II, pii39). A construct emanating was that

85      *Some members may tend to take on stereotypic roles.*

[C]: In looking at S10's idea during the exercise in session 12 (Appendix XI, pxi5), [C] noted that it had been clarified by S10 and S12, with a question to aid the clarification being asked by S11 and, that the group had accepted the idea as valid based on the clarification. Their taped reflections revealed S10's confession, with S9's agreement, of her dominance in generating ideas; S12's feeling that he had "*contributed optimally*"; S11 saying that he had agreed on an idea only after he had satisfied himself of its validity; and S9 expressing her opinion that, because she found that she personally agreed with the ideas, it contributed to creating the perception, among the members, that her participation had been low. Thus it may be seen that both S11 and S9 concurred with the view that verbalisation of an idea may not necessarily be an indication of cognitive participation. S10, however, had suggested that ideas that members had "*in ... minds*" should be verbalised, and proposed the strategy, which was accepted by the group, of a "*round and have a turn to say the ideas*".

Thus unequal cognitive participation in the group had been acknowledged, on reflection and a strategy for future action proposed, reinforcing the construct made in this regard, once again. Furthermore, the idea that verbalisation may not be an indication of cognitive participation, had been hinted to by S4's actions in [A]'s reflections, and a construct

made in this regard was that

86 *Some cognitive processes, like listening critically or judging an idea, may remain unrevealed to a group during CL.*

Analysis of group talk and member observations of subsequent sessions saw me interpreting roles, like those of 'judge,' 'educator', 'collator' and 'sceptic' as fluctuating (Appendix II, pii39-40). S9's cognitive participation was seen to be improved in the taped part of this session in that she had generated an idea. The analysis of [C]'s cognitive processing during the cycle gave strength to the 4 previous constructs (Appendix II, pii40).

#### **4.4 Reconnaissance IV**

A reconnaissance of what was learnt about equitable participation had been made by me. Students were not involved in this reconnaissance: the sessions that had been allocated to me had passed. I reflected that aspects related to equity and participation needed inquiry. Although there seemed to be an overall increase in participation of members within a group, participation patterns persisted: there was a least participative person in each group, based, not only on the frequency of input, but also, on the quality of cognitive input (they tended not to generate, but question ideas for clarification).

One aspect that may be identified, in responding to why such patterns persisted, is the relationship between status and participation. An inquiry into the perceived status of participants in the small group may yield critical insight into the participation patterns observed. The status of an individual may be seen in the light of academic status, language status, gender status and popular status.

I perceived that the least participatory members of each group (S1 in [A], S6 in [B] and S9 in [C]), may have enjoyed a similar status within their group: low academic, language and gender status ('popularity' was obscured). The other women members were seen to enjoy at least one other higher status category: S2 in [A] - high language (and perhaps

high academic), S5 in [B] - high language (and perhaps high popularity), S10 in [C] - high language (and perhaps high academic). There may be other complexities involved, eg., S7 in [B] may be seen as having low academic status from my perspective, yet his ideas were perceived to be valid by members of his group. Perhaps his popularity status had more weighting, or perhaps his language status was regarded as high by himself or by his peers.

Thus, the next cycle would have focussed on the relationship between status and participation. The colleague lecturer, however, saw the need to reconnoitre other aspects on embarking on her series of lecture sessions, perhaps arising out of a need for her to appraise the situation, as in an introductory process at the beginning of a course.

#### **4.5 Coming out of the Experience**

To obtain insight into the overall experiences of participants of the course, the following had occurred to garner such information:

- \* all students wrote reflective essays (Appendix IX)
- \* statements were abstracted from these essays to formulate a questionnaire relating to general experiences of students (Appendix X)
- \* the authenticity of these statements were corroborated by 25% of the student population
- \* all students responded to the corroborated reflective questionnaire
- \* all students were interviewed (audio-taped)
- \* the colleague produced a reflective note (Appendix VI, pvi9-10).

Analysis of the reflective questionnaire, apart from providing corroborations to propositions, embodied a commentary on the use of action-research as a way of introducing and implementing CL. This really extended my previous reflections on the action-research aspect, as seen in construct 63.

The student interviews, the reflective questionnaire and the colleague's reflective note, were used as corroborative tools for the propositions developed, in the next chapter. The



reflective questionnaire and the colleague's reflective notes were used together with a retrospective interview with the colleague (Appendix III) in testing the propositions developed in Chapter 6.

## CHAPTER 5

### DEVELOPMENT OF PROPOSITIONS

The themes that emerged mark out the main outcomes of using cooperative learning (CL) in this action-research study. It was found appropriate to cluster the constructs around each theme and to analyse them to develop a set of propositions linked to these themes. The propositions produced could contribute to a fuller understanding of how CL works in the kind of teaching-learning situation studied.

The constructs had emanated from the analysis of the interpretive and analytic reports of each cycle and of the analysis in Chapter 4. Engagement with these constructs involved inductive testing during analysis and an audit trail had been constructed for each cluster of constructs/theme. Each audit trail comprised a list of data and analytic sources with relevant indicators of the location of the raw data and/or analytic data representing the evidence for the constructs of the particular theme.

Each audit trail may be used to find the evidential route for propositions about a particular theme. Consider the first proposition which states:

**Dominance patterns surface, whereby some members dominate CL, for various reasons, like cognitive ability or language proficiency, during CL practice.**

The proposition was developed from a cluster of constructs, viz., constructs 2, 3, 4, 5 and 30. It is useful, for example, to look at the items listed in the audit trail for one construct, construct number 2, which states:

**Group members, given the opportunity to reflect on the constraints of dominance, may perceive patterns and make decisions on the future monitoring of such patterns of dominance.**

Locating items related to this construct: in the Research Diary (Appendix XIV), 'p 16: DOM' yields the statement:

DOM Tape - articulate students tend to dominate talk-time in each group - distribute these students in different groups as well as men and women;

in the Colleague's Notes (Appendix VI), 'Note 3' yields the statement:

DOM Dominance - Students were outright — spoke what they felt — spoke about efforts of the most dominant person — what needs to be done to sort this out - needs to delegate more - (good strategising) - everyone gains;

in the 'Student/Group Product' (Appendix XI), 'Sess 3: Group rules - [B]' yields the statement:

DOM 3. No one's view should be left unattended;

in the 'Student Reflective Essays' (Appendix IX), 'S10' yields the statement:

DOM I think the reconnaissance sessions were beneficial because it made you look how you were working in the group and it gave opportunities to change the way things happened in the group eg get rid of the dominant person in the group;

in the 'Interviews' (Appendix V), 'SIT II: S6' yields:

DOM [Dominance]...there was; not now - rule session helped - work on dominance;

in the 'Audiotape CL' (Appendix XII), 'Sess 1: [C]' yields the following:

DOM Input: S3 gives examples (at least 6), by S12 (at least 2), one by S9, none by S11;

and 'Sess 3: [A]' yields

DOM Input: S1 - "each person must listen to other..."; " [rotate leader] so no one dominant";

in the 'Descriptive-Interpretive Report' (Appendix I), 'I: p 8' yields:

I claimed that:

- a. A member may be dominant by nature.
- b. Group members may perceive dominating processes.

in the 'Analytic-Theme Report' (Appendix II), 'I: p 5' yields:

The students' reflective activity of listing what was 'most liked' and 'least liked', undertaken at the end of session 2, revealed that dominance was seen as a problem by at least 3 students (S1 - a student that initially perceived this as a constraint, and as male dominance now; S4 and S3, both males). This led to the claim that

8.2 *A reflective activity is an important component of CL in that it may reveal to students the constraints*

*to effective CL;*

and 'II: p 16' yields:

It had been revealed during the first cycle, however, that some dominating self-imposed roles occurred in group A (eg., S2 as 'manager') and in other groups, giving rise to claims 7 - 12, which indicated progressive constructions starting with the acknowledgement of dominating processes that may arise naturally in a group and student awareness of such processes, to that of the need to monitor such processes (as perceived by both students and myself), culminating in an action decision to reflect on dominating processes during reconnaissance. Thus a new construction was made that

35 *Students may covertly reflect on dominance during group activity (eg., as in formulating group rules) and find, on overt reflections during reconnaissance, that the strategies they used, minimised dominance;*

and in the 'Corroboration' (Appendix X), 'RQ: 4c' yields the item:

c. We learnt how not to dominate/withdraw.....

These are some of the items that gave rise to construct 2. In the same way items that gave rise to other constructs may be located.

Some propositions developed from constructs emanating from themes that traversed more than one cycle of the action research. These major themes of the inquiry were dominance, language, time, alternative concepts, topic, assessment, monitoring, participation, group rules, student induction and action-research methodology. Other propositions were developed from constructs generated from themes that did not straddle cycles or were saturated or quenched in one cycle. These minor themes were lecturer constraints, utilitarian issues, group size, changing groups, self-esteem and learning environment.

Tables 5.1 - 5.12 represent this process. Each cluster of propositions is followed by postulates addressing the contexts and processes involved in CL. This close relationship between context and processes further strengthens the case for action research as a way of implementing CL.

## Propositional Development from Major Themes

Propositions were developed for each constraint.

On dominance four propositions were developed, on language three and on time two.

### 5.1 Propositions about Dominance

Table 5.1 displays the clustering of constructs in developing the propositions.

**Table 5.1.** Constraint: Dominance

CONSTRUCT	TIME	PROPOSITION
2 Group members, given the opportunity to reflect on the constraints of dominance, may perceive patterns and make decisions on the future monitoring of such patterns of dominance.	Cycle 1	Dominance patterns surface, whereby some members dominate CL, for various reasons, like cognitive ability or language proficiency, during CL practice.
5 Groups may take it upon themselves to rotate roles to minimise dominating patterns	Cycle 1	
4 Dominance patterns may be related to cognitive demands of tasks, cognitive ability and cognitive security of certain individual members who are perceived to be potentially dominating by nature.	Cycle 1	
3 Group rules may help to monitor dominance in a group.	Cycle 2	
30 A group may resolve a conflict in its own peculiar way, which may be unconventional.	Cycle 2	
28 Students may covertly reflect on dominance during group activity (eg., as in formulating group rules) and find, on overt reflection during reconnaissance, that the strategies they used helped minimise dominance.	Cycle 2	Conscious and overt reflections by students and lecturer, on aspects of dominance incorporating group and class reconnaissance, is needed if the implementation of effective CL is to be successful.
29 Dominance during CL may be minimised by action based on deliberate reflections by members and on reconnaissance of such reflections by the CL group.	Cycle 2	
26 Certain members' ideas may be valued above others and such dominance may not be regarded as constraining or as dominating by students.	Cycle 2	Certain ideas and processes that are perceived as dominating are retained by groups as necessary for progress in CL.
27 Students may perceive some dominating processes as necessary for progress in CL; these perceptions may differ from those of the lecturer.	Cycle 2	
69 Dominating practices, whether intentional or unintentional and, whether accepted by the group as desirable or undesirable, may create unequal cognitive participation.	Cycle 2	Dominating practices create unequal cognitive participation.

Constructs that emerged related to the idea that members may detect dominance in a group and that group members employ strategies like rotating roles that allow for the monitoring of such dominance and that dominance patterns may be related to factors like cognitive security. The first proposition on dominance addresses these sorts of issues.

The second proposition is formulated out of the clustering of the constructs related to reflections on dominance, the monitoring of dominance and action taken on such aspects of dominance.

The third proposition on dominance relates to the idea that at times dominating processes are not regarded as ineffective and are thus overlooked by groups and the fourth proposition addresses the idea that the cognitive participation of individual members could suffer when there is dominance in a group.

Since the contextual aspects are that various types of dominance were detected and existed, that unequal cognitive participation was detected and that there were differing perceptions of dominance, the processes of reflections about dominance and monitoring dominance could generate strategies that promote change and equity in participation in a CL group.

Information abstracted from the completed student reflective questionnaires (item 4c) indicated that individuals accomplished some learning in this respect: 8 of 10 students that responded strongly agreed that they had learned 'how not to dominate or withdraw'. Only one item on dominance was developed on the questionnaire, indicating that this constraint was not regarded as significant at the end of the study. Perhaps students no longer found this constraint relevant at the end in that they may have felt that they had developed to a point where they had overcome the problem of dominance.

The audit trail table for 'dominance' is in Appendix XIII, page 3.

## 5.2 Propositions about Language

Table 5.2 displays clustering of the constructs in developing propositions about language.

**Table 5.2.** Constraint: Language

CONSTRUCTS	TIME	PROPOSITION
9 Language idiosyncrasies that reinforce alternative concepts may be revealed in a group heterogeneously composed on the basis of language and culture.	Cycle 1	Heterogeneous grouping based on language proficiency levels, helps CL and language development.
10 An English speaking student may tend to initiate, clarify and explain ideas in a group heterogeneously composed on the basis of language.	Cycle 1	
32 Instructions may need to be clarified not only by the lecturer, but also by peers at the beginning of a CL session; members who are proficient in the language of discussion may be included in a group to expedite this.	Cycle 2	
33 Small group CL may provide the opportunity for help in the expression of ideas, for less proficient speakers of the language of discussion.	Cycle 2	
35 Second language speakers may improve their language proficiency in the small group environment of CL.	Cycle 2	
36 A motivated second language person, undeterred by language constraints in participating, may enhance his/her performance by interacting with ideas in a CL environment.	Cycle 2	
38 Both first and second language students may find science language difficult to understand.	Cycle 2	
34 Reflections on language issues involved in CL may promote the monitoring and development of language.	Cycle 2	Monitoring language aspects helps the promotion of interaction by developing strategies to improve language.
68 Members of a group may become aware of practices like poor language proficiency that may limit participation of members and may act on them.	Cycle 2	
37 Language proficiency, <i>per se</i> , may not be a constraint to effective CL and participation, but the longer time required for second language speakers in expressing ideas may be seen as problematic.	Cycle 2	Time constraints are especially relevant when members are not speakers of the language of discussion.

Everyday language may promote the holding of alternative concepts in science for both first and second language English speakers. That students generally find the language of science difficult is well documented. Propositions on language, however, were formulated from constructs that were based on the ideas:

- \* that a heterogeneous grouping that included a fluent English language speaker helped in clarifying written and verbal tasks and in negotiating tasks and ideas;
- \* that language development occurred progressively with the implementation of CL, especially for members who were motivated to verbalise and rehearse ideas;
- \* that language development was enhanced by reflective action; \* and that second language English speakers required more time to express ideas.

Thus it could be said that the contextual aspects were:

- \* that language development was required; that the heterogenous language grouping promoted such development;
- \* and that the language constraint was accentuated by time constraints (or language and time constraints were mutually reinforced).

The evolving relevant process of monitoring language development by reflective action is conducive to language development. This implies that more time be incorporated into CL in the interests of language development by this way.

Reflection on language was evidenced by at least 3 items (items 1d, 1j, 1i) on the reflective questionnaire. From the student interviews, students were of the opinion, generally, that groups should be heterogeneously composed according to language proficiency levels in the interests of language development. One student (S12), however, saw advantages in composing the groups homogeneously.

The audit trail table for 'language' is in Appendix XIII, page 4.



### 5.3 Propositions about Time

Table 5.3 displays clustering of the constructs in developing propositions about time.

**Table 5.3.** Constraint: Time

CONSTRUCT	TIME	PROPOSITION
39 Students may not be experienced enough in CL practice, or in curricular policy issues, to reflect on the curricular implications of the relationship between time for CL and a curriculum favouring CL. 40 Groups may habitually rely on external prompts to manage time.	Cycle 2  Cycle 2	Groups do not manage time for themselves, during CL.
11 The more open-ended the task, the more time may need to be allocated for the task. 37 Language proficiency, <i>per se</i> , may not be a constraint to effective CL and participation, but the longer time required for second language speakers in expressing ideas may be seen as problematic. 41 All aspects of a session, including class discussion, may be catered for during the planning stage, by anticipated time allocations and, time allocations may be adhered to, in a flexible way, by both lecturer and group management of time. 62 Time for all members to reflect personally and, in their groups may need to be incorporated in classroom CL practice for CL to be effective and reflexive.	Cycle 1  Cycle 2  Cycle 2  Cycle 2	Time is to be considered in the curriculum, since more time is needed for construction of ideas and for monitoring (group processing).

In CL time is a real constraint. More time than is traditionally devoted to concept learning needs to be allocated. This is further compounded by the perception that students manage time poorly, perhaps because they are not accustomed to such a responsibility.

The contextual issues about time are that students are not accustomed to managing time and that the time factor needs to be addressed in developing programmes. The processes embodied by reflective action involved re-planning the programme and monitoring time management of groups.

6 items on time were generated in the questionnaire (items 6a-f) showing a concern by students for this aspect. Students were of varied opinion on the amount of time that they had for CL (interviews). On the one hand, some felt that it was adequate and that they should manage time and some felt that it was inadequate but that they should manage time with practice. On the other hand, some students were aware of the curricular implications for time, in that at least two students (S8, S11) felt that the curriculum should accommodate the time aspect of CL and 3 others (S2, S6, S12) felt that the sessions should be adjusted according to the curriculum.

The audit trail table for 'time' is in Appendix XIII, page 5.

An overarching proposition on the perceived constraints of dominance, language and time, to CL implementation was developed

*To overcome the constraints that were perceived, illuminated and had become evident during the implementation, students need to identify and negotiate ways of surmounting constraints of dominance, language and time. Furthermore, they need to implement and monitor these ways, in their pursuit to overcome the constraints.*

Propositions were also developed on other major themes.

## 5.4 Propositions about Alternative Concepts

Three propositions were developed on alternative concepts as displayed by Table 5.4.

**Table 5.4.** Alternative Concepts

CONSTRUCTS	TIME	PROPOSITION
17 Some alternative ideas may surface and be discussed by students in a group during CL.	Cycle 1	Science concepts and alternative concepts are constructed in CL practice.  CL interactions and products reveal, reinforce or shift only some alternative concepts; careful observation, planning and guidance by the lecturer is required to detect and shift alternative concepts when group members do not have the schema necessary for this.
9 Language idiosyncrasies that reinforce alternative concepts may be revealed in a group heterogeneously composed on the basis of language and culture.	Cycle 1	
15 Alternative concepts may be shifted by interactions in a CL group.	Cycle 1	
16 A poster presentation may be used as a strategy to reveal learning, consensus agreements and alternative concepts.	Cycle 1	
18 Some alternative concepts may not be detected by the group and may not be revealed by posters and presentations; and ways of revealing these during CL implementation should be problematised.	Cycle 1	
20 Group members may not have the necessary schema for the detection of certain alternative concepts and this may reinforce these alternative concepts.	Cycle 1	
19 Group members may not be sophisticated enough to detect certain alternative concepts and monitoring the clarification and explanation of alternative concepts is problematic.	Cycle 1	
44 Lecturer guidance may be needed to promote shifts in alternative concepts that may have been revealed to the lecturer, when these alternative concepts remained undetected by group interactions.	Cycle 2	
21 Group products, presentations and subsequent class discussion may help with promoting, revealing and monitoring learning outcomes.	Cycle 1	
42 Students do not find it significant that alternative concepts may go undetected and thus reinforced by social approval in peer interactions; lecturer intervention in the form of guidance, supported by literature information, in such a case may be required to focus students on looking at ways to improve the detection of alternative concepts.	Cycle 2	
43 The design of a task product may be used to reveal alternative concepts more effectively.	Cycle 2	Planning for the detection and shifting of alternative concepts could entail considering the design of a group product.

In the co-construction of concepts during CL, alternative concepts are revealed during the verbalisation of personal ideas. The dilemma for us is that although at times alternative concepts may be shifted by peers, there may be social approval and thus reinforcement of such concepts by peers, who may not have detected the alternative concept or who may also hold such an alternative concept. Strategies to reveal alternative concepts included verbal and poster presentations and class discussion was used to help shift the ideas. The third proposition related to alternative concepts indicates that such strategies by themselves may not reveal all alternative concepts and that other strategies need to be considered.

Thus the context was that although concepts are constructed within the CL environment

some alternative ideas remain undetected. The process (action) involved is engagement with strategies developed by the facilitator.

11 items (3b, 3e-i, 3k, 3m-o, 3r-s) about concepts, of which 2 (items 3e, 3f) were concerning alternative concepts, were generated on the reflective questionnaire, one on the potential of CL in revealing alternative concepts and the other on shifting these in the CL context. Reflections made by the colleague (on how "Misconceptions can be addressed" by taping and, on student development in working through "misconceptions that they had on their own, in their groups and also in the large [class] group"), go towards reinforcing the propositions.

The audit trail table for 'alternative concepts' is in Appendix XIII, page 6.

## 5.5 Propositions about Topic

On topic two propositions were developed as displayed in Table 5.5.

**Table 5.5.** Topic

CONSTRUCTS	TIME	PROPOSITION
11 The more open-ended the task, the more time may need to be allocated for the task. 50 Open-ended CL tasks may engender high participation levels for effective CL. 49 The nature and the format of tasks may be determinants of the effectiveness of CL. 70 The nature and the format of tasks may be significant determinants of the type of cognitive interactions that may occur to effect CL.	Cycle 1 Cycle 2 Cycle 2 Cycle 2	The nature and format of a CL task are significant determinants, of the kinds of cognitive participation by members in and the effectiveness of CL.
12 Strategies and criteria should be made overt in a CL environment and goals may be made overt in cases in which stated goals were perceived as not subverting the learning process. 32 Instructions may need to be clarified not only by the lecturer, but also by peers at the beginning of a CL session; members who are proficient in the language of discussion may be included in a group to expedite this.	Cycle 1 Cycle 2	The clarification of the topic may be done by written guidance and by peers and criteria and sometimes goals should be overt.

The nature and format of a task determine the amount of time required and the type of participation. Careful planning is required to enhance participation. Students should understand the task and the strategies and criteria required for concept development. Various means could be used to this effect. Often the goal of the CL activity may need to be understood by students. In many cases, however, this may preempt the learning and the lecturer should employ discrimination where this is concerned.

The need for clarification of topic and the nature and format of the task are significant contextual aspects. The process that addressed these aspects was a search for and reflective implementation of strategies to promote clarification of topic and format design.

11 items (items 7a-k) were developed by the reflective questionnaire, showing that this was a significant concern for students. 4 items (items 7a, 7d, 7h, 7j) related to the first proposition. Most students felt that all topics were suitable for CL work. As far as format is concerned, most felt that preparation preceding a CL topic may be required for certain topics. Most students saw advantages both in a format, whereby all groups are involved

in the same topic so that a range of ideas emanate, and in a format, wherein the topic is subdivided and distributed among groups so that lecture time may be effectively used. Most students agreed that instances of class discussions involving the lecturer were preferred over formal lecturer delivery. Students, however, did not problematise the relationship between the nature or format of the CL topic and kinds of participation.

The audit trail table for 'topic' is in Appendix XIII, page 7.

## 5.6 Propositions about Assessment

On assessment three propositions were developed as displayed in Table 5.6.

**Table 5.6** Assessment

CONSTRUCTS	TIME	PROPOSITION
21 Group products, presentations and subsequent class discussion may help with promoting, revealing and monitoring learning outcomes. 22 A combination of intergroup peer assessment, self-evaluation and lecturer evaluation, based on overt criteria, may be regarded as a satisfactory way of assessing CL work. 54 Lecturer guidance and interactions with students, in negotiating concepts, may help students in their self and peer group assessment. 55 Initial guidance in peer-assessment given to students may need to be reinforced during subsequent assessments and criteria used may need to be substantiated by them.	Cycle 1  Cycle 1  Cycle 2  Cycle 2	A combination of lecturer, self and peer assessment is suitable for CL assessment. A presentation of group ideas may be assessed by both lecturer and peer groups. Peer assessment may be gradually implemented with negotiated criteria.
51 The assessment of a group's CL may need to include a consideration of the group interaction processes and the production of ideas, but finding ways of implementing such assessment needs to be problematised. 52 Each group's CL may need to be carefully observed for assessment purposes, as well as for planning purposes. 53 Assessment of group CL may include the evaluation of the participation and generation of ideas, in addition to the product.	Cycle 2  Cycle 2  Cycle 2	The assessment of a group's CL needs to include the group interaction processes and the production of ideas; assessment may include the evaluation of the participation and generation of ideas, in addition to the product.
56 Pre-service students may require practice in classroom CL for it to be effective. 57 Students may need to be inducted into a test format which included items reflective of CL aspects. 58 Group assessment may need to be limited to continuous assessment practice, as in a college record mark; formative assessment of this type may be regarded as a 'fair' type of assessment.	Cycle 2  Cycle 2  Cycle 2	Pre-service students, in requiring practice in CL for it to be effective, need to be inducted into a test format, which includes items reflective of CL aspects; group assessment, may initially need to be limited to continuous assessment practice.

Peer and self assessment, inherent in the nature of CL, are innovative in our context. Students need to be inducted into the processes. In addition to assessing learning outcomes represented by products of CL, assessment of CL should include that of the learning of the interaction processes including social and cognitive participation in the process of the generation and processing of ideas and the quality of such ideas. This requires that assessment be a continuous process.

The context of 'new' assessment procedures requires a process wherein students are inducted by the facilitator and a search for reflective implementation of innovative ways of assessing is practised.

6 items of the questionnaire (items 9a-d, 9f-g) were related to the 'induction',

'negotiation', 'production of ideas' and to 'participation' inherent in these propositions. They provide corroborating evidence for the propositions. The type of continuous assessment, involving lecturer and peer assessment was favourably received by students. Although the propositions relate to assessment of CL work, most students felt that overall assessment of the course should be 50% group assessment and 50% individual assignments. All students felt, however, that a group mark should be given for CL work.

The audit trail table for 'assessment' is in Appendix XIII, page 8.



## 5.7 Propositions about Monitoring

On monitoring four propositions were developed as displayed in Table 5.7.

**Table 5.7** Monitoring

CONSTRUCTS	TIME	PROPOSITION
1 A rule generation activity may be regarded as a reflective activity and, is an important component of CL, in that it may reveal, to students, constraints of effective CL. 3 Group rules may help to monitor dominance in a group. 7 Pre-service students may be capable of ensuring on-task behaviour of members in a CL group.	Cycle 1  Cycle 1 Cycle 1	Rule generation and group rules help in group processing, such as ensuring on-task behaviour, and monitoring CL.
Proposition: Conscious and overt reflections by students and lecturer, on aspects of dominance incorporating group and class reconnaissance, may be needed if the implementation of effective CL is to be successful. 34 Reflections on language issues involved in CL may promote the monitoring and development of language.	Table 5.1  Cycle 2	Conscious and overt reflections by students and lecturer, on constraining aspects, like dominance and language proficiency incorporating group and class reconnaissance, help in the implementation of effective CL.
59 Students may perceive the practice of monitoring their CL practice, as affecting effective CL. 60 Students may find reflective activity motivating.	Cycle 2  Cycle 2	Students perceive the practice of monitoring their CL practice, as affecting effective CL, and find reflective activity motivating.
61 Members of a group may regard the practice of observing their group's CL in a way different to those underlying the practice of reflective practice. 62 Time for all members to reflect personally and in their groups may need to be incorporated in classroom CL practice for CL to be effective and reflexive.	Cycle 2  Cycle 2	Since some students regard the practice of individual member observation of a group's CL in a way different to those underlying the practice of reflective practice, time for all members to reflect personally, and in their groups, needs to be incorporated in classroom CL practice for CL to be effective and reflexive.

Self and group monitoring of various aspects are seen to be inherent aspects of CL and are favourably adopted by students as motivating. Aspects that could be monitored include 'on-task' behaviour, constraints, language development and group dynamics. Ways of monitoring include self and group reflection in a structured way for which time is allotted and in an unstructured fashion in the form of individual reflections and group processing. Group reflections would be public while individual ones could be private or public. Other types of monitoring like member observation could be negotiated.

Since the context was that members of a CL group tended to develop *ad hoc* strategies to bring members 'on task', a deliberate focus on the generation and reflective monitoring of the implementation of rules, constituted the process involved in enhancing effective CL.

Many items (items 5.1a-j; 5.2a, 5.2e; 5.3d, 5.3f; 10c; 11c-d) of the reflective

questionnaire provide corroborating evidence for these propositions. The colleague's final reflections on "reconnaissance" and on "taping", further reinforce these propositions.

The audit trail table for 'monitoring' is in Appendix XIII, page 9.

## 5.8 Propositions about Participation

On participation seven propositions were developed as displayed in Table 5.8.

**Table 5.8** Participation

CONSTRUCTS	TIME	PROPOSITION
69 Dominating practices whether intentional or unintentional and whether accepted by the group as desirable or undesirable may create unequal cognitive participation. 70 The nature and the format of tasks may be significant determinants of the type of cognitive interactions that may occur to effect CL.	Cycle 2 Cycle 2	Factors that determine the distribution of cognitive participation, include the nature and format of tasks, and dominance in a group.
71 The cognitive background of individuals may affect the individual participation of members in a CL group. 76 Some ideas may be critiqued and some may not be critiqued, or some to a lesser extent, depending on the cognitive and experiential schema of members of a group.	Cycle 2 Cycle 2	The cognitive and experiential background of a participant determines his or her cognitive participation.
73 The role of generator of ideas in a group may fluctuate, according to the cognitive background of members for a CL session. 74 The role of explaining ideas that were generated in a CL group may be given to all or any member of the group. 75 The role of critic or sceptic may fluctuate depending on the cognitive background of the person who questions. 84 Cognitive roles may fluctuate for different CL sessions.	Cycle 2 Cycle 2 Cycle 2 Cycle 3	Cognitive roles, like those of generator, educator, sceptic, and judge of ideas, fluctuate in a group within and for different CL sessions.
76 Some ideas may be critiqued and some may not be critiqued, or some to a lesser extent, depending on the cognitive and experiential schema of members of a group. 77 Members of a group may agree to accept ideas, judged as valid or with the condition of suspending judgement of an idea, as those of the group. 78 The process of asking for help may increase the cognitive participation of the receiver of help and of other members in a CL group and the process of giving help may be beneficial for the giver of help as a form of cognitive rehearsal. 83 Reflections on the cognitive participation of individual members in a group, in revealing different perceptions of cognitive participation among members, and subsequent monitoring may promote the cognitive participation in CL.	Cycle 2 Cycle 2 Cycle 2 Cycle 3	Reflections and monitoring of processes, like generating, critiquing and judging facilitate the cognitive processing of ideas in a group.
80 The cognitive processes of CL may embody significant aspects of equitable participation.	Cycle 3	Equitable participation is determined, partly, by the cognitive processing of a group.
81 Critical listening may be a process of cognitive participation. 86 Some cognitive processes, like listening critically or judging an idea, may remain unrevealed to a group during CL.	Cycle 3 Cycle 3	Listening could be a cognitive process, but monitoring such a process is problematic for a CL group.
82 Injudicious interventions by group members may curtail the cognitive participation of a member. 85 Some members may tend to take on stereotypic roles. 83 Reflections on the cognitive participation of individual members in a group, in revealing different perceptions of cognitive participation among members and subsequent monitoring, may promote the cognitive participation in CL.	Cycle 3 Cycle 3 Cycle 3	Reflections reveal constraining features of cognitive participation and patterns, like the interruption of a developing idea and stereotypic role taking, by members in a CL group.

The context was that participation patterns were determined by the fluctuating roles that were revealed and factors that determined participation levels included the nature and format of a task, the cognitive and experiential background of participants, the monitoring of cognitive processes, stereotypic role taking, peer intervention, hidden participation

processes and status of participants in relation to dominance. The processes involved were that reflection, monitoring and subsequent action on participation levels were seen as enhancing the participation of individual members. Participation was regarded from the perspectives of both social and cognitive aspects.

CL was seen to be effective if there was participation. If we look at how a context affected participation, we need to address the interaction constraints and implement processes to enhance participation and promote equitable cognitive participation. The types of interaction were facilitated initially by group processing in the form of discussion which revolved around the generation of group rules. These rules tended to be such that social aspects of cooperation were facilitated and helped in countering stereotypic role-taking. Thus constraints to participation were initially seen as those of dominance, time and language. With continual reflection and monitoring of interaction it became apparent that constraints were of a cognitive nature, as was seen in aspects like the nature and format of a topic and the cognitive and experiential background of individual members of a group. It is probable that such constraints of a cognitive nature may not be obviated by the use of rules or by simple 'turn-taking' of generating and appraising ideas. It may involve cognitive processing embracing processes that promote self-confidence in a secure learning environment, wherein ideas are validated or not validated in a constructive way.

9 items (items 3l, 3r-s; 5.1i, 5.1g; 6e; 7d; 10a, 10f) on 'cognitive aspects' and 'participation' were developed. The colleague's reflections on "participation of group members" and on aspects that "students have developed" further reinforce these propositions. Information from the interviews yielded that groups had used strategies, like taking turns to generate ideas and asking for clarification of ideas, to ensure cognitive participation. Perhaps these strategies emanated from their focus on cognitive monitoring in the last cycle.

The audit trail table for 'participation' is in Appendix XIII, page 10.

## 5.9 Propositions about Group Rules

On group rules one proposition was developed as displayed in Table 5.9.

**Table 5.9** Group Rules

CONSTRUCTS	TIME	PROPOSITION
1 A rule generation activity may be regarded as a reflective activity and, is an important component of CL, in that it may reveal, to students, constraints of effective CL. 3 Group rules may help to monitor dominance in a group. 45 Students may see the need for group rules to implement effective CL. 46 Students may see the need for group rules to be monitored by the group, for possible modification and evaluation of observance of rules and provision for such activity is recommended.	Cycle 1  Cycle 1 Cycle 2  Cycle 2	Group rules and rule generation activities are favourably looked upon by students, in that they provide ways of monitoring their CL, group reflection and processing.

Group rules were seen as engendering effective CL. Rules were generated, implemented and modified during monitoring and reflection.

Within the context of student partiality towards group rules, a process of focussing on generating group rules and their reflective implementation for effective CL emerged.

Items 10c, 11c and 11d of the reflective questionnaire corroborated the proposition. The colleague's reflection was that the process of drawing up the rules was beneficial in itself.

The audit trail table for 'group rules' is in Appendix XIII, page 11.

## 5.10 Proposition about Motivation and Student Induction

A major construct that emerged from *Reconnaissance I* was that all students **had been exposed to some type of group-work including some CL**, that there was some match between lecturers' and students' **perceived reasons for doing CL** and that most students **preferred the CL approach**, over individualistic learning in traditional lectures. Their preference was illuminated during the cycles of CL practice, as embodied in a proposition that was developed displayed in Table 5.10.

**Table 5.10** Student Motivation and Induction

CONSTRUCTS	TIME	PROPOSITION
8 CL may provide opportunities for students to give their own ideas and to share ideas.	Cycle 1	In providing opportunities for students, like giving and sharing ideas, reflections, building self-confidence and self-esteem and pre-service preparation of classroom practice, students' preference of CL over the traditional lecture mode for learning and, student motivation are reinforced.
14 Cooperative learning may be seen as a preferred learning mode, over traditional individualistic modes, for most second year Natural Science students who have been exposed to CL in their first year of studies.	Cycle 1	
25 Students may perceive pre-service experience in the practice of CL as helping prepare them for a CL ethos in the classroom and in the education community.	Cycle 1	
64 CL and reflective sessions may help individuals to overcome personal inhibitions, constraining classroom interactions and consequently, practising CL may help in building self- confidence and self-esteem in a cumulative way.	Cycle 2	
65 Students may be motivated to learn cooperatively in small groups.	Cycle 2	

During the inquiry students were perceived to be motivated to learn cooperatively. The aspects of increase in self-confidence in their personal ideas about concepts and self-esteem were major factors promoting motivation. Students were motivated partly in recognising that they were constructively involved in their own learning and that they were developing ideas about classroom practice. Reflections about their CL practice enhanced motivation. Effective CL developed progressively with a concomitant enhancement of motivation.

The particular aspects of the CL context were conducive to motivation.

8 items (items 2a-h) on student induction and motivation were developed on the reflective questionnaire. The colleague's reflections on "grouping", on "participation of group members" and on ways in which "students have developed" indicate the motivational and developmental aspects of the proposition. In the interviews all students felt that CL was

an effective way of learning for them, with 11 finding it a preferable way and one (S3) feeling that there was a "place for CL and traditional lectures". One student (S11) felt that the experience had reinforced his faith in CL.

The audit trail table for 'motivation and student induction' is in Appendix XIII, page 18.

### 5.11 Proposition about Action Research

I had been constantly reflecting and theorising about, the use of action research in introducing and implementing CL as an innovation, as represented by constructs 63 and 79. Thus one proposition was made in this respect as displayed in Table 5.11.

**Table 5.11** Action-Research Methodology

CONSTRUCTS	TIME	PROPOSITION
25 A cycle of action research reveals aspects other than what was planned to be illuminated.	Cycle 1	Action-research methodology is an effective way of understanding the nature of CL and of systematically introducing and implementing CL innovation during a course of lecture sessions.
63 Action research may be a suitable way of introducing and implementing CL for both students and lecturer and of revealing many aspects about the nature of CL.	Cycle 2	
79 Action research is seen as a suitable way of revealing the nature of CL and of introducing and implementing CL for both students and lecturer and this is reinforced during practice.	Cycle 3	

The constant processes of monitoring and reflection of CL embodied in the action-research way of implementing CL were seen as expediting systematic and effective action, thus promoting an understanding of the nature of the CL process. As the research progressed the momentum of learning about the nature of CL, about action research and about the students increased for me. At the same time students were learning about science concepts, about action research and about themselves.

A continual appraisal of a particular context expedited the processes involved to make CL effective.

Reinforcement of the proposition was provided by the colleague's final reflective comments on "Action Research implementation". Corroborating evidence was seen in the

student reflective questionnaire, in the guise of their positive reflections on monitoring (items 3a-f; 5.1a-j; 5.3a, 5.3d, 5.3f). In their interviews, at least two students (S2, S10), said that they would implement CL using feedback in the classroom, hinting at an action-research format of implementation.

The audit trail table for 'action research' is in Appendix XIII, page 19.

### 5.12 Propositions from Minor Themes

Propositions emanating from those constructs generated by themes that did not straddle cycles or those that were saturated/quenched in one cycle are displayed in Table 5.12.

**Table 5.12** Constructs from Minor Themes

CONSTRUCT	TIME	PROPOSITION
Lecturer Constraints: 23.1 A novice CL facilitator may need consciously to act to promote processes conducive to the idea that students are in charge of constructing their own ideas about science and science concepts in a CL environment, during CL practice. 23.2 Ways of releasing control in the classroom during CL may be learned in situ, during practice and may be problematised as needing continual reflection, by a lecturer, who is a novice at CL practice.	Cycle 1  Cycle 1	Since a novice CL facilitator needs to promote the idea that students are in charge of constructing their own ideas about science and science concepts, ways of releasing control in the classroom needs to be learned reflexively during practice of CL.
Utilitarian Issues of CL at Pre-service Level: 24 Students may perceive pre-service experience in the practice of CL as helping prepare them for a CL ethos in the classroom and in the education community.	Cycle 1	Pre-service experience in the practice of CL help prepare students for a CL ethos in the classroom and in the education community.
Group Size: 47 Students may not problematise the effect of group size on participation for effective CL, in interpreting the issue as it relates to the management of different class sizes.	Cycle 2	The effect of group size on participation for effective CL, needs to be problematised by the lecturer.
Changing Groups: 48 Although the changing of groups may be desirable, the timing of the change may be problematised.	Cycle 2	Although the changing of groups is desirable, the timing of the change needs to be problematised.
Self-Esteem: 64 CL and reflective sessions may help individuals to overcome personal inhibitions constraining classroom interactions and, consequently, practising CL may help in building self-confidence and self-esteem in a cumulative way.	Cycle 2	Practising CL helps in building self-confidence and self-esteem in a cumulative way.
Learning Environment: 66 A CL ethos may provide a secure environment for learning for all students. 67 A CL ethos may promote lecturer-student interactive relationships, desirable for effective learning.	Cycle 2  Cycle 2	A CL ethos provides a secure environment for learning for all students and, promotes lecturer-student interactive relationships desirable for effective learning.

Although these themes are termed 'minor themes' they are important contextual issues in that, inter alia, individual lecturers may negotiate the distribution of power



idiosyncratically and group size and the changing of groups may be negotiated according to various criteria like that of class size and duration of topics. The promotion of self-confidence and self-esteem, the interactions and the secure learning environment provided by the CL situation cannot be overlaid in understanding the nature of CL. Pre-service experience of CL was seen as important for teacher preparedness although prescriptive practice was not aimed for.

On lecturer constraints one proposition was developed. This 'constraint' to the implementation of effective CL informed by constructivist notions, was continuously addressed by me during the course of the inquiry. There were 3 items (items 8d, 8f; 12f) on the reflective questionnaire.

The context was that the lecturer was accustomed to an authoritarian learning environment. The process engaged with was reflective learning within and provision of, a learning environment informed by social constructivism.

The audit trail table for 'lecturer's role' is in Appendix XIII, page 12.

On utilitarian issues one proposition was developed. The context was that students were learning within a CL environment. By virtue of the fact that it was within their pre-service education, this exposure to CL was needed for it to transfer to their classroom practice as well as in the education community.

4 items were developed on such use on the questionnaire (items 12b, 12f, 12i, 12l). In their interviews, all students were definite about implementing CL in their future classrooms, some mentioning the use of strategies they learnt, some mentioning employing the use of the constructivist principle of starting with children's ideas. At least two students spoke about gradual implementation using feedback in practice, hinting at the action-research format.

The audit trail table for 'utilitarian issues' is in Appendix XIII, page 13.

On group size one proposition was developed. During the CL implementation the issue of the size of a group for effective participation was problematised neither by the lecturer nor by the students. The envisioned process of experimenting with different group sizes was inappropriate in this context.

Two items (items 8a-b) were developed on group size. The reflection on "grouping" made by the colleague ("*the only restriction I make is in terms of size*"), was reminiscent of this problematisation. In their interviews, students were divided in their opinion of participation levels in 6-member and 4-member groups: 6 students felt that participation levels of individuals were less in a 6-member groups than in the 4-member one and 6 students thought that there would not be any difference.

The audit trail table for 'group size' is in Appendix XIII, page 14.

On changing groups one proposition was developed. The issue of when to change groups should be seen in the context of the desirability of such change on the part of the learner and the design of a learning programme.

Two items (items 8c, 8g) were developed about this aspect on the questionnaire. A commentary of this may be seen in the colleague's reflections on "grouping". In their interviews, all students said that groups should change, 8 felt that groups should change in the course of the year and three students felt that this should occur after each CL session.

The audit trail table for 'changing groups' is in Appendix XIII, page 15.

On self-esteem one proposition was developed. Seen within the context that a pre-service programme aims to build self-esteem and self-confidence, the reflective processes involved in CL and the nature of CL enhanced self-confidence and self-esteem.

One item (item 4p) about self confidence was developed on the questionnaire. The colleague reflected that "*students have developed tremendously in terms of...increase in confidence*".

The audit trail table for 'self-esteem' is in Appendix XIII, page 16.

On learning environment one proposition was developed. The CL context was perceived to provide a secure learning environment. Continual reflective practice about various aspects, like those of participation, was implemented towards addressing this goal.

11 items (items 2d; 5.1i; 5.3b-e; 9f-g; 11a; 12j-k) about learning environment were developed on the questionnaire. Reflections made by the colleague, like "a good scene was set (spirits were high)" and "during this time [reconnaissance] students were more relaxed...", provide some reinforcement to proposition 13. All students said that learners were more comfortable in a group situation, for reasons like the security of exposing ideas to fewer people and having more confidence in a small group.

The audit trail table for 'learning environment' is in Appendix XIII, page 17.

The 37 propositions about the 11 main themes and 6 minor themes were deductively tested a year later. Details of the testing is provided in the next chapter. One of the tools of the corroboration was the reflective questionnaire (Appendix X) completed by students at the end of the semester. This questionnaire consisted of items which were statements made by students in their reflective essays (Appendix IX). These statements were abstracted and collated from the essays. Further corroboration includes information gleaned off the final reflections made by the colleague (Appendix VI). In the main, however, a retrospective interview with the colleague (Appendix XV, Note 10), representing a case-analysis, was used as a major source of corroborating evidence.

## CHAPTER 6

### TESTING PROPOSITIONS

I have chosen to use a retrospective interview (RCI, Appendix III) with the colleague who participated in the research, as a source of corroborating evidence for propositions. A rationale for the choice and the process of proposition testing are outlined below.

#### 6.1 Rationale

As discussed in an earlier chapter (Chapter 3: 3.6), the three traditional quality criteria of objectivity, reliability and validity, as they are usually interpreted by researchers that operate within an experimental context, may not be applied in action research. The traditional triad of quality criteria was replaced by 'trustworthiness criteria' as outlined by Egon Guba (Lincoln, 1990). An outline of the 'trustworthiness' of findings have been discussed in Chapters 3 (3.6) and 7 (7.2).

Four quality criteria put forward by Altrichter and others (1993) include *considering alternative perspectives, testing through practical action, ethical justification* and *practicality*. The research was seen as being 'compatible with educational aims and democratic human values', to satisfy their third criterion and 'research design and data collection methods' were seen as being 'compatible with the demands of teaching', to satisfy the fourth criterion.

For Altrichter et al (1993) sources of alternative perspectives lie in three main areas, namely, other peoples perspectives, perspectives gained of other research methods and perspectives of other comparable contexts. **A case for the retrospective interview with the colleague, lies in the latter in that I am looking to gather information of her experiences of CL within her practice, in relation to the propositions that were developed within my practice.** The other sources of perspectives mentioned above are seen as within-case testing wherein my own understanding of a research situation before, during and after certain steps in the research process were triangulated with other participants; and using a variety of methods of obtaining data and triangulating the

sources of data.

On 'testing through practical action', Altrichter et al (1993) have the following to say

*There are two ways of scrutinising theories: critical analysis (reflection ...) and investigation through action (p 77)*

During the research constructs were developed through critical analysis. These constructs led to action strategies that were developed and put into practice. The ongoing 'practical action' way represented a way of reflectively testing the constructs that had been emerging. Constructs were inductively generated and deductively tested through action with each progressive cycle of the research in an ongoing way. The final propositions represented a culmination of what was constructed at that point of an ongoing research. This type of testing within the process of research is backed up by J.Elliot (cited in Altrichter et al, 1993) in whose view

*the implementation and evaluation of action-strategies [is] a form of hypothesis testing (p 155)*

and that of Altrichter and others, who say

*Developing action strategies in practice corresponds to the testing of hypothesis in traditional research (ibid: 156).*

Miles and Huberman (1994) commented that the tactic of 'replicating a finding' could be used in various ways which represent various levels of confidence. They say that lower down at the

*elementary level you are replicating as you collect new information ... higher in the confidence scale, you can test an emerging hypothesis in another part of the case or data set (ibid: 273).*

The retrospective interview as a source for corroboration, was seen as yielding a new data set in extending it to a new case.

In order to test the propositions again, in a deductive way, it seemed appropriate that I interview the colleague participant a year later, so that reflections could be made about aspects embodied in the propositions. In the spirit of triangulating perspectives the following were incorporated in addition to the retrospective interview (RCI):

\* a reflective questionnaire (RQ) completed by all students at the end of the

semester in 1995;

\* the colleague's reflective note (CRN10) made at the end of the semester in 1995;

The reflective questionnaire (Appendix X) consisted of items that were statements made by students in their reflective essays which were written by all students. These statements were abstracted and collated from students' reflective essays (Appendix IX). The statements were made using the language of the essays and were validated by 25% of the students before being administered.

The colleague's reflective note (Appendix VI: CRN10) comprised reflections about the experience with the action-research inquiry into cooperative learning (CL) during the first semester of 1995.

The interview was a detailed retrospective one with the colleague and was concerned with the corroboration of propositions. The colleague represented a case that she had made CL part of practice and had implemented it with various groups during 1996. Furthermore, she was the lecturer for the 1996 third year Natural Science course followed by the students who had participated in the inquiry during 1995. The interview yielded data which were triangulated with some documentary evidence as follows:

- \* course evaluation reflections made by students at the end of the 1996 course and
- \* teaching practice evaluation reports

## **6.2 Corroboration of Propositions**

### **6.2.1 Dominance**

The propositions were

*DOM#1 Dominance patterns surface, whereby some members dominate CL, for various reasons, like cognitive ability or language proficiency, during CL practice.*

*DOM#2 Conscious and overt reflections by students and lecturer, on aspects of dominance incorporating group and class reconnaissance, is needed if the*

*implementation of effective CL is to be successful.*

*DOM#3 Certain ideas and processes that are perceived as dominating are retained by groups as necessary for progress in CL.*

*DOM#4 Dominating practices create unequal cognitive participation.*

Some corroboration of DOM#1 may be seen in:

\* RQ as in item 4c, *We learnt how not to dominate/withdraw*, with which nobody disagreed.

\* RCI as in, ... *this year - there was some dominance that did operate ...*

Some corroboration of DOM#2 as

\* RCI as in, ... *but I think - if I had to look back and compare ... in second year was probably more [dominance] - because the students had worked it out.*

Only one item on dominance was developed on the questionnaire, indicating that this constraint was not regarded as significant at the end of the study. Perhaps students no longer found this constraint relevant at the end in that they may have felt that they had developed to a point where they had overcome the problem of dominance. If we reflect on what the colleague said in her interview about dominance, it would seem that dominance rears its head in initial 'new' experiences with CL.

### **6.2.2 Language**

The propositions were

*LANG#1 Heterogeneous grouping based on language proficiency levels, helps CL and language development.*

*LANG#2 Monitoring language aspects helps the promotion of interaction by developing strategies to improve language.*

*LANG#3 Time constraints are especially relevant when members are not speakers*

*of the language of discussion.*

Some corroboration of LANG#1 may be seen in

\* RQ as in item 1d, *As an English second language speaker I found that my fluency in the language has improved*, which yielded 10 responses, 7 of which were positive, 1 negative and 2 non-committal.

\* RCI as in, *I am basically of the opinion that it [heterogeneous language grouping] - is the only way that one should actually be working here at this college*  
...

Some corroboration of LANG#2 may be seen in

\* RQ as in item 1j as, *The language usage was a challenge and we learned to understand each other by helping each other*, which yielded 10 positive, 1 negative and 1 non-committal responses.

\* RCI as in, ... *I have heard - [S10] actually pronouncing a word for example for [S7]...*

Some corroboration of LANG#3 may be seen in

\* RQ as in item 1i as, *The language usage of the group was a constraint to my learning and I found this irritating*, which yielded 6 positive and 6 negative responses.

\* RCI as in, ... *it's very difficult because it actually depends on the content that you are working with ... in terms of language they would speak without hesitating - and they would share openly...- they were not embarrassed ...*, indicating that time is a constraint.

### 6.2.3 Time

The propositions were

TIME#1 *Groups do not manage time for themselves, during CL.*

TIME#2 *Time is to be considered in the curriculum, since more time is needed for*



*construction of ideas and for monitoring (group processing).*

Some corroboration of TIME#1 may be seen in:

\* RQ as in 2 items 6a-b (6a - *At first we did not manage the time allocated for CL well, but with experience we managed time effectively*; 6b - *It is up to the group to manage the time allocated*), showing a concern by students for this aspect. 2 students disagreed with 6a and 6b.

\* RCI as in, ... *we would monitor together - it would be formalised - how long it would take - within the group they would organise ... - they always tried to stick within the limits - that the whole class had organised*, showing that groups had developed the ability to manage some aspects of time.

Some corroboration of TIME#2 may be seen in:

\* RQ as in 4 items 6c-f (6c - *We should get more time than was given for CL*; 6d - *The time given ensured optimal participation*; 6e - *Certain topics require more time than was given for effective CL to occur*; 6f - *Much was accomplished in a relatively short period of time because of the CL approach*). 1 student disagreed with 6f.

\* RCI as in, ... *I have - and I think the reason why I have done that [incorporated time in the study programme] is I actually reflected on what happened in the past - and the fact that - for a particular session - if it took me a lecture I would look back...*, showing that the colleague was incorporating the time aspects in the programmes she planned based on her reflective experiences.

#### **6.2.4 Alternative Concepts**

The propositions were

*AC#1 Science concepts and alternative concepts are constructed in CL practice.*

*AC#2 CL interactions and products reveal, reinforce or shift only some alternative concepts; careful observation, planning and guidance by the lecturer is required to detect and shift alternative concepts when group members do not have the schema*

*necessary for this.*

*AC#3 Planning for the detection and shifting of alternative concepts could entail considering the design of a group product.*

Some corroboration of AC#1 may be seen in:

\* RQ as in the following items: 3b - *CL has helped me learn about concepts about plants*; 3e - *CL helps reveal alternative conceptions ('misconceptions')*; 3g - *I was motivated to think about some things because I was compelled to make an input*; 3h - *I was exposed to more ideas about a concept from different people, than my ideas alone*; 3i - *By sharing ideas we enriched our thoughts on the subject*; 3m - *In CL I learnt not only about concepts but also about life skills*; 3o - *CL was an effective way of learning for me because of my poor Biology background*; 3r - *CL experiences have made me improve the way I formulate ideas and express them coherently*; 3k - *In CL members help each other to better understand concepts which may be difficult to do alone*; 3s - *CL experiences have taught me how to argue and explain points more clearly, with which most people agreed (1 disagreed with 3g).*

\* CRN10 as in reflections on student development in working through, *misconceptions that they had on their own, in their groups and also in the large [class] group, go towards reinforcing the proposition.*

\* RCI as in, *... obviously there is a lot of growth that can take place - if people can recognise what the real concepts are and what the alternative are ...*

Some corroboration of AC#2 may be seen in

\* RQ as in item 3e - *CL helps reveal alternative conceptions ('misconceptions')*, with which all agreed; 3f - *CL helps correct my 'misconceptions' which may have remained if I did not share my thoughts*, with which 11 agreed and 1 was non-committal.

\* CRN10 on how *Misconceptions can be addressed* by taping.

\* RCI as in, *... one can recognise that and probably brainstorm it...*

Some corroboration of AC#3 may be seen in

\* CRN10 as in, ... *by taping...*

\* RCI as in, ... *gauge whether you need to be concerned about it or not... you have to know your students more.*

### 6.2.5 Topic

The propositions were

TOPIC#1 *The nature and format of a CL task are significant determinants, of the kinds of cognitive participation by members in and the effectiveness of CL.*

TOPIC#2 *The clarification of the topic may be done by written guidance and by peers and criteria and sometimes goals should be overt.*

Some corroboration of TOPIC#1 may be seen in

\* RQ as in items: 7a - *The topics were suitable for CL; 7d-Students should be given some work on a 'new' topic to prepare before a CL session; 7h - Some Natural Science topics are unsuitable for CL; 7j - Work should be divided within a group.*

\* RCI as in, ... *no matter who I am working with and what section I am dealing with, there is always scope for it [CL] ...*, about topics suited to CL; and, ... *if the focus is group contribution what you actually have to do - is give them the work - they go home as individuals - look through it and as a group make contributions or input, so I think the formatting would be as what I mentioned now and they would have to share it in the classroom setting to ensure that there is participation of all individuals in group, about a format of a topic.*

### 6.2.6 Assessment

The propositions were

\* ASSESS#1 *A combination of lecturer, self and peer assessment is suitable for CL assessment. A presentation of group ideas may be assessed by both lecturer and*

*peer groups. Peer assessment may be gradually implemented with negotiated criteria.*

*\* ASSESS#2 The assessment of a group's CL needs to include the group interaction processes and the production of ideas; assessment may include the evaluation of the participation and generation of ideas, in addition to the product.*

*\* ASSESS#3 Pre-service students, in requiring practice in CL for it to be effective, need to be inducted into a test format, which includes items reflective of CL aspects; group assessment, may initially need to be limited to continuous assessment practice.*

Some corroboration of ASSESS#1 may be seen in

*\* RQ as in item 9b - Students should negotiate whether they want group marks or individual marks.*

*\* RCI as in, group assessment - prac investigation; and, Given group marks, given criteria of assessment ... they delegated.*

**Note:**

This introduces the idea that what was negotiated was that groups themselves decided on individual member participation. The example that was cited by the colleague was an instance when some members of a group were unhappy about 2 particular members' contribution. The assessment was that these students were awarded zero marks on ascertaining their participation.

Some corroboration of ASSESS#2 may be seen in

*\* RQ as in items: 9c - Group marks may not reflect individual participation because it is not possible for all students in a group to contribute equally; 9d - An individual student may be deceived into believing that he/she understands all that is learned by the group; 9f - CL helps the teacher learn about pupils' ideas; 9g - CL helps the teacher learn about pupil participation.*

*\* RCI as in, what they would actually say - they would sit back and say, 'What do you have to say?' - so obviously they are aware of the fact that there should be equitable participation.*

Some corroboration of ASSESS#3 may be seen in

\* RQ as in 9a - *We were unaccustomed to group assessment and this meant that we needed to reorientate our perception of assessment.*

### 6.2.7 Monitoring

The propositions were

MONIT#1 *Rule generation and group rules help in group processing, such as ensuring on-task behaviour, and monitoring CL.*

MONIT#2 *Conscious and overt reflections by students and lecturer, on constraining aspects, like dominance and language proficiency incorporating group and class reconnaissance, help in the implementation of effective CL.*

MONIT#3 *Students perceive the practice of monitoring their CL practice, as affecting effective CL, and find reflective activity motivating.*

MONIT#4 *Since some students regard the practice of individual member observation of a group's CL in a way different to those underlying the practice of reflective practice, time for all members to reflect personally, and in their groups, needs to be incorporated in classroom CL practice for CL to be effective and reflexive.*

Some corroboration of MONIT#1 may be seen in

\* RQ as in item 10c - *Group rules ensure participation by all members, with which 1 disagreed; and item 11c - Group rules work well for the social aspects of cooperation, like listening, respecting each other, etc, with which nobody disagreed; and item 11d - Group rules are adequate to ensure participation of 'shy' members, with which nobody disagreed.*

\* RCI as in, ... *they were monitoring but not in terms of writing down.*

Some corroboration of MONIT#2 may be seen in

\* RQ as in item 5.1 - *Reconnaissance sessions were beneficial because they made us*

*a. look at how we worked in the group*

*b. give views on how we worked*

*c. listen to views on how we worked*

*d. improved communication in our group*

*e. evaluate our progress*

*f. Reconnaissance was a good way of evaluating myself in relation to the group*

*g. It helped reveal aspects preventing optimal participation by members*

*h. It improved the quality of future interactions*

*i. It is a satisfying activity for me - it makes me feel good*

*j. It helped clarify conceptions,*

*with which nobody disagreed.*

\* CRN10 as in reflections about 'taping' and 'reconnaissance'.

\* RCI as in, ... *most cases reflection is taking place...of certain things that you have picked up during the session ...definitely would [affect future action].*

Some corroboration of MONIT#3 may be seen in

\* RQ as in items: 5.1a-j (in MONIT#2 above); 5.2e - *It enhances participation, with which nobody disagreed; 5.3d - It is a way of evaluating oneself, with which I disagreed; and 5.3f - The class feedback on reflections helps our learning, with which nobody disagreed.*

\* RCI as in, *I definitely think [students find monitoring helpful]... because - it is not just what will happen to them at college but also how they will take it into their own practical experience...*

Some corroboration of MONIT#4 may be seen in

\* RQ as in item 5.2a - *Member observation impedes participation for the observer so it should not be used, with which 4 disagreed.*

\* CRN10 as in her reflections on "reconnaissance" and on "taping".

### 6.2.8 Participation

The propositions were

PART#1 *Factors that determine the distribution of cognitive participation, include the nature and format of tasks, and dominance in a group.*

PART#2 *The cognitive and experiential background of a participant determines his or her cognitive participation.*

PART#3 *Cognitive roles, like those of generator, educator, sceptic, and judge of ideas, fluctuate in a group within and for different CL sessions.*

PART#4 *Reflections and monitoring of processes, like generating, critiquing and judging facilitate the cognitive processing of ideas in a group.*

PART#5 *Equitable participation is determined, partly, by the cognitive processing of a group.*

PART#6 *Listening could be a cognitive process, but monitoring such a process is problematic for a CL group.*

PART#7 *Reflections reveal constraining features of cognitive participation and patterns, like the interruption of a developing idea and stereotypic role taking, by members in a CL group.*

Some corroboration of PART#1 may be seen in

\* RQ as in item 6e - *Certain topics require more time than was given for effective CL to occur*, with which nobody disagreed; and 10f - *Division of work within groups is desirable to ensure participation.*

\* RCI as in her comments about dominance (DOM).

Some corroboration of PART#2 may be seen in

\* RQ as in item 7d - *Students should be given some work on a 'new' topic to prepare before a CL session*, with which nobody disagreed.

Some corroboration of PART#3 may be seen in

\* RQ as in item 3l - *CL forces you to express yourself clearly and properly so others can understand*, with which 1 disagreed; 3r - *CL experiences have made me improve the way I formulate ideas and express them coherently*, with which nobody disagreed and 3s - *CL experiences have taught me how to argue and explain points more clearly*, with which nobody disagreed.

Some corroboration of PART#4 may be seen in

\* RQ as in item 10a - *Ways of helping us overcome constraints to participation help us move towards equitable participation*, with which nobody disagreed; and 5.1g - *It helped reveal aspects preventing optimal participation by members*, with which nobody disagreed.

Some corroboration of PART#5 may be seen in

\* RQ as in item 5.1i - *It is a satisfying activity for me - it makes me feel good*, with which 2 disagreed.

\* RCI as in the response to the question about participation (PART)

Some corroboration of PART#6 may be seen in

\* CRN10 as in, ... *the fact that participation of group members was addressed, students were aware that their participation was important and that they could gain even more if they participated fully...*

Some corroboration of PART#7 may be seen in

\* RQ as in item 5.1g - *It helped reveal aspects preventing optimal participation by members*, with which nobody disagreed.

\* CRN10 as in the reflections on "participation of group members" and on aspects that "students have developed".



### 6.2.9 Group Rules

The proposition was

*GRRULE Group rules and rule generation activities are favourably looked upon by students, in that they provide ways of monitoring their CL, group reflection and processing.*

Some corroboration of GRRULE may be seen in

\* RQ as in item 10c - *Group rules ensure participation by all members, with which 1 disagreed; item 11c - Group rules work well for the social aspects of cooperation, like listening, respecting each other, etc., with which nobody disagreed; and item 11d - Group rules are adequate to ensure participation of 'shy' members, with which nobody disagreed.*

\* CRN10 as in the reflection that the process of drawing up the rules was beneficial in itself.

\* RCI as in comments on group rules (GRRULE).

### 6.2.10 Motivation and Student Induction

The proposition was

*MOTIV In providing opportunities for students, like giving and sharing ideas, reflections, building self-confidence and self-esteem and pre-service preparation of classroom practice, students' preference of CL over the traditional lecture mode for learning and, student motivation are reinforced.*

Some corroboration of MOTIV may be seen in

\* RQ as in items 2 a-h: 2a - *CL is an enjoyable way of learning; 2b - CL is the most enjoyable way of learning; 2c - CL makes us put more effort into our learning; 2d - I found the Natural Science lectures most comfortable and open because of CL; 2e - CL sessions are not boring because we are practically involved in our learning; 2f - CL experiences motivate me to learn more; 2g - CL is an effective way of learning; 2h - In CL I appreciate the opportunity to work*

*with people I would not normally work with, to which 1 student disagreed with 2b and one with 2h; and in item 12a - I enjoyed the CL experiences, and 12b - I will plan for such experiences for pupils, with which nobody disagreed.*

\* CRN10 as in the reflections on "grouping", on "participation of group members" and on ways in which "students have developed".

\* RCI as in, ... *one of actual comments I also got on an evaluation sheet - that they really would love to work within groups with every new aspect - that is introduced - first before there is any discussion on it ... they still are motivated, backed up by the evaluation response.*

### 6.2.11 Action Research

The proposition was

*AR Action-research methodology is an effective way of understanding the nature of CL and of systematically introducing and implementing CL innovation during a course of lecture sessions.*

Some corroboration of AR may be seen in

\* RQ as in item 5.1 (under MONIT in 6.7 above), with which nobody disagreed; and item 5.3 about reflective notes - 3a - *The option of writing reflective notes creates a way of having a say in our learning, with which nobody disagreed; 3b - It informs the lecturer about our feelings on what occurs in the sessions, with which nobody disagreed; 3c - It reveals attitudes about what occurs in the sessions, with which nobody disagreed; 3d -It is a way of evaluating oneself, with which nobody disagreed; 3e - There should be individual feedback given to a student's reflection by the lecturer, with which 2 disagreed; 3f - The class feedback on reflections helps our learning, with which nobody disagreed.*

\* CRN10 as in the final reflective comments on "Action Research implementation".

\* RCI as in, *As far as I am concerned, working with action research is fantastic ... you probably reflect more on that than anything else - that obviously comes in with action research.*

### 6.2.12 Minor Themes

The proposition:

on lecturer constraints was

LECTCONS *Since a novice CL facilitator needs to promote the idea that students are in charge of constructing their own ideas about science and science concepts, ways of releasing control in the classroom needs to be learned reflexively during practice of CL.*

on utilitarian issues was

UTIL *Pre-service experience in the practice of CL help prepare students for a CL ethos in the classroom and in the education community.*

on group size was

GRSIZE *The effect of group size on participation for effective CL, needs to be problematised by the lecturer.*

on changing groups was

GRCHANGE *Although the changing of groups is desirable, the timing of the change needs to be problematised.*

on self-esteem was

SELFESTEEM *Practising CL helps in building self-confidence and self-esteem in a cumulative way.*

on learning environment was

LENV *A CL ethos provides a secure environment for learning for all students and, promotes lecturer-student interactive relationships desirable for effective learning.*

Some corroboration of LECTCONS may be seen in

\* RQ as in items 8d - *Groups should be structured by the lecturer so that there is*

*a balance of sexes and cultural/language groups, with which 2 disagreed; 8f - The lecturer should stipulate the condition of sex and cultural group balance and let students choose their own groups, with which nobody disagreed; and 12f - As a teacher, providing CL experiences for pupils will help me to better understand and know my pupils, with which nobody disagreed.*

\* CRN as in, *It shows the importance of using strategies to get students to share ideas that they have or may have.*

\* RCI as in, *... before it can take place - the scene must be set - organisation and planning of it ... then I see myself as a facilitator and ... to ensure that people are participating.*

Some corroboration of UTIL may be seen in

\* RQ as in item 12b - *I will plan for such experiences for pupils ; 12f - As a teacher, providing CL experiences for pupils will help me to better understand and know my pupils, with which nobody disagreed; 12i - The CL experiences of the course has made me confident as a prospective Natural Science teacher, 12l - We need to be exposed to CL experiences in our pre-service education because we need to maximise learning; with which nobody disagreed.*

\* RCI as in, the comments about the strategies used by a student [S1] in a lesson during teaching practice (UTIL) backed up by the official evaluation report.

Some corroboration of GRSIZE may be seen in

\* RQ as in item 8a - *The 4 members per group ensured optimum cooperation and participation, larger groups would limit participation of every member, with which nobody disagreed; and 8b - Larger groups of up to 6 members are suitable for larger classes, with which 1 strongly disagreed.*

\* CRN as in the reflection on "grouping", *... the only restriction I make is in terms of size.*

\* RCI as in, *... group number was looked at ... 4/5.*

Some corroboration of GRCHANGE may be seen in

\* RQ as in item 8c - *Groups should not change because class discussions help in*

*exposing students to a wide range of ideas, with which 4 disagreed; and 8g - Groups should change for students to experience a wider range of ideas, with which nobody disagreed.*

\* CRN10 as in the reflections on "grouping".

\* RCI as in, *Groups worked together for 1 semester - we did speak about changing but they were comfortable... With 2SP students I did change them at the beginning of second term... to mix them - culture, sex, levels etc. and then I placed them into groups... One girl was not happy with her group...*

Some corroboration of SELFESTEEM may be seen in

\* RQ as in item 4p - *CL has helped me develop self-confidence, with which nobody disagreed.*

\* CRN as in, *... students have developed tremendously in terms of...increase in confidence.*

\* RCI as in, *[A student] contributed a lot this year...If you look at [S9], if you compare [S9] to what she was at the beginning of second year - she has developed so much - in terms of standing up in front of group - before she would smile and go into a shell - she would stand up now and - even the way she would project her voice.*

Some corroboration of LENV may be seen in

\* RQ as in item 2d - *I found the Natural Science lectures most comfortable and open because of CL, with which nobody disagreed; 5.1i - It is a satisfying activity for me - it makes me feel good, with which 2 disagreed; 5.3b - It informs the lecturer about our feelings on what occurs in the session, with which nobody disagreed; 5.3c - It reveals attitudes about what occurs in the session, with which nobody disagreed; 5.3d - It is a way of evaluating oneself, with which 1 student disagreed; 5.3e - There should be individual feedback given to a student's reflection by the lecturer, with which 2 students disagreed; 9f - CL helps the teacher learn about pupils' ideas, with which nobody disagreed; 9g - CL helps the teacher learn about pupil participation, with which nobody disagreed; 11a - Building trust among members of a group is required for effective CL, 12j -*

*Learning is promoted in the relaxed, secure environment of the CL situation, with which nobody disagreed; 12k - CL has the potential to transform the classroom environment by taking away fear and tension from pupils and providing a relaxed environment in which the pupil's potential may be optimally developed, with which nobody disagreed.*

\* CRN as in, ... *a good scene was set (spirits were high) and during this time [reconnaissance] students were more relaxed...*

\* RCI as in, *Oh, definitely [cooperative learning approach increases rapport] ...you discover more about your own students.*

### **6.3 Conclusion**

Thus it may be seen that some propositions were corroborated. The particular retrospective case and instruments did not yield evidence for the corroboration of at least three propositions.

A display of the sources of corroborating evidence may be seen in Tables 6.1 and 6.2. A glance at the table reveals no corroborating evidence for three propositions (DOM#3, DOM#4 and TOPIC#2). This should be regarded with some scepticism. The absence of corroborating evidence for DOM#3 and DOM#4 itself, is indicative of the possibility that the constraints involved in the dominance propositions, had been incorporated into the way in which students were operating. As mentioned earlier, for example, the context within which students had operated changed in an ongoing way and students' level of consciousness may have been enhanced by activities like reflection and monitoring. In this way the lecturer's consciousness about particular aspects about CL, for example, about topic clarification could be enhanced as well. Thus a case for testing the development of aspects about the nature of CL (like working towards the elimination of constraints) would rest within further action in an evolving context that is always new.

**Table 6.1:** Sources of Corroboration

PROPOSITION	RQ	CRN10	RCI
DOM#1	X		X
DOM#2			X
DOM#3			
DOM#4			
LANG#1	X		X
LANG#2	X		X
LANG#3	X		X
TIME#1	X		X
TIME#2	X		X
AC#1	X	X	X
AC#2	X	X	X
AC#3		X	X
TOPIC#1	X		X
TOPIC#2			
ASSESS#1	X		X
ASSESS#2	X		X
ASSESS#3	X		
MONIT#1	X		X
MONIT#2	X	X	X
MONIT#3	X		X
MONIT#4	X	X	
PART#1	X		X
PART#2	X		
PART#3	X		
PART#4	X		
PART#5	X		X
PART#6		X	
PART#7	X	X	
GRRULE	X	X	X
MOTIV	X	X	X

**Table 6.2:** Sources of Corroboration (contd.)

PROPOSITION	RQ	CRN10	RCI
AR	X	X	X
LECTCONS	X	X	X
UTIL	X		X
GRSIZE	X	X	X
GRCHANGE	X	X	X
SELFESTEEM	X	X	X
LENV	X	X	X

The 37 propositions, by themselves provide an extensive picture of the way in which CL can be seriously introduced and handled in a class of this kind. However, there are many implications and a deeper discussion is needed to bring out the full impact of what was learned. Such detail is provided in the next chapter.



## CHAPTER 7

### IMPLICATIONS AND PROSPECTS

This concluding chapter includes a discussion of some implications of the propositions which were developed by the inquiry, some limitations of the study, some recommendations for pre-service education and a commentary about some significant features of the study.

#### **7.1 Implications**

The propositions give rise to some generalisations that may apply in contexts similar to the case study. The following are some implications concerning the propositions that were generated around the fifteen significant areas of the inquiry. Some of these implications and others that may be made could be subjects of further investigations.

##### **7.1.1 Constraints**

One cannot be prescriptive in anticipating the kinds of constraints in implementing cooperative learning (CL). These may emerge over time and a gradual and responsive overcoming of constraints is envisioned. The idea of 'heterogeneous grouping' needs to be considered in relation to the constraints of dominance and language. Generally, a relatively greater time allocation needs to be considered in CL and particularly, in considering the differing language proficiency levels of group members.

Conscious and overt reflections by students and the lecturer, on aspects of dominance, incorporating group and class reconnaissance, may be needed if the implementation of effective CL is to be successful. Monitoring language aspects helps the promotion of interaction, by developing strategies to improve language. The issues related to the use of English as the language of instruction require that more time be incorporated in the use of any teaching approach. This is apparent in a multi-linguistic CL group and time constraints are especially relevant when members are not mother-tongue speakers of the language of discussion.

Past researchers, eg., Terwel (1994), have seen dominance emerge in small groups and many, like Johnson and Johnson (1987), have focussed on the aspect of managing dominance. Elizabeth Cohen has identified "dominating or retiring from group work" as aspects that require certain strategies she dubs as being 'generic' ones to CL (Hooper, 1992). She suggested that such generic strategies were often facilitated with group rules; group rules could facilitate dominance reduction and facilitate time management. **To this I would add the potential of monitoring by group processing, reflections and feedback**, in the management of dominating or withdrawing patterns.

Dominance patterns may arise for various reasons, including cognitive ability and language proficiency. According to Cohen (1994), although difference in "academic status" was the most powerful of the status characteristics that effect inequalities in participation, differences in "peer status", based on aspects like "perceived attractiveness or popularity", and "social status" based on aspects like "gender, race and ethnicity", could affect interaction, as well. **To this I would add differences in 'language status'**. McAllister (1995) found that the level to which students are equipped for group work was partly related to their ability to communicate.

Thus, it would seem that difference in language ability would also compound the status effect in interactions. In this inquiry, however, all students preferred the heterogenous language grouping strategy, since they focussed primarily on the enhancement of language proficiency, being socialised into the perceived benefits of improving their English language proficiency. In focussing on verbal interactions in a CL situation, Lonning (1993) found that CL provided the means of teaching and learning verbal interaction skills and an environment conducive to practising such skills. In the South African situation where most students are speakers of languages other than English (as in the class in my sample) and where English is the language of instruction, **CL has potential in redressing such disadvantages, given that there is no immediate move to change the language of instruction in South Africa.**

### 7.1.2 Alternative Concepts

One needs to plan sessions to reveal alternative concepts. Various workers in the field of social constructivism have worked on the aspect of alternative concept construction and conceptual change. Some models designed to address conditions for conceptual change, like those of Driver and Oldham (1986), involve peer discussions in examining the personal concepts that students held. This may be useful, but in this inquiry, in using group consensus to access these, many alternative concepts remained unrevealed. CL activities were designed to encourage students to make their ideas explicit to their peers and themselves so that there may be restructuring, modification, extension or shifts of ideas. In the approach in which learning is seen as a process of constructing meaning, the engagement with alternative concepts provide opportunities to reflect on learning strategies and the improvement of these strategies. Thus the teacher should encourage learners to monitor their progress and provide the support for this. CL provided the opportunity for students to clarify and exchange ideas with peers, to construct new ideas and to evaluate these new ideas. **New and different strategies involving the design of tasks and monitoring, may be required to yield more information to reveal idiosyncratic alternative concepts and to realise effective conceptual shifts.**

### 7.1.3 Topic

The nature and format of the topic need to be considered in planning sessions for CL. Time and group composition are important aspects to consider in selecting the topic and when designing the format.

Research on cooperation suggests the benefits of CL for a range of subject areas and tasks. Tasks are those involving rote-learning, retention tasks, memory skills and problem solving abilities (Johnson et al, 1981). Among other views are those of Phelps and Damon (1987), who distinguished between tasks that require reasoning and those of rote learning; Kempa and Ayob (1991), who saw appropriate task analysis and task structuring as important for effective group-work; Ross and Raphael (1990), who saw differences in

task structure as affecting communication patterns; and Edwards and Stout (Blosser, 1993), who saw CL tasks as those involving the practice of new concepts and when discussion, higher order thinking and 'brainstorming' were needed.

Cohen (1994), however, noted the variability of findings and suggested that these benefits could be obtained only under certain conditions, central to which was the nature of the task. She posited the total amount of interaction as more critical for achievement gains in an "*ill-structured problem that is a true group task*" than in a "*clear-cut*" one that could be done by individuals (ibid: p4). Furthermore, she said that interaction types would vary with the instructional objective. If "*routine academic learning*" was desired, then a task with "*clear procedures and right answers*" might be useful, but if "*learning for understanding or conceptual learning*" was desired then an "*ill-structured task*" might be useful (ibid: p4).

In this inquiry, both my students and I saw the possibility of the nature of the task affecting interaction patterns and Cohen's proposal may be argued, in that the overall goal of the specific task or of CL should be addressed in developing the curriculum.

Many students felt that all 'topics' were appropriate for small group CL. Many researchers have addressed the issue of what may or may not be appropriate for CL. Bossert (1988) suggested that CL activities benefitted students for all subject areas; Johnson and Johnson (1987) cautioned

*Despite the overwhelming evidence of the power and importance of cooperative learning experiences ... the current research findings are incomplete. The appropriate use of competitive and individualistic goal structures has not been sufficiently explored. Teachers should use all three goal structures in an integrated way...* (p. 41);

and Cohen (1994) suggested that a significant aspect for productive small groups was

*whether or not the assignment given is a true group task and whether or not it is a problem with an ill-structured solution* (p 30).

Further research is required in the area of **what tasks and what formats of tasks** are conducive to effective cooperation in learning in small groups.

#### 7.1.4 Assessment

The assessment propositions may significantly affect curriculum, in that assessment procedures involving formative assessment and peer and self assessment practices are innovative in South Africa. Both teachers and students may need relatively more time, for its induction. Examination structures may need to be changed. The pervasive historical promotion of competition and individual achievement, is anathema to CL practice.

Assessment issues have been discussed by various authors, like Johnson and Johnson (1987). McAllister (1995) found that students benefitted from assessing their work within their group. In this inquiry, students looked upon peer assessment favourably. Lumpe and Staver (1995) promoted the idea of contextualised assessments during rather than after group-work. **A case for some contextualised assessment may be made**, in proposing that assessment include interaction aspects. This ties in well with the idea of continuous assessment practice.

#### 7.1.5 Monitoring

Time will need to be allocated for group processing and for induction into this innovative practice, for both teacher and students. Furthermore, the concept of monitoring may be perceived as 'threatening' to a lecturer who is schooled in authoritarian practice.

McAllister (1995) suggested that students benefitted from "analysing their work" as it affected their planning and that the teacher's "sensitivity and alertness" were important. This is suggestive of including monitoring by both teacher and students. Sapon-Shevin and Schniedewind (1992) echoed Johnson and Johnson (1987), Hooper (1992) and others in their call for group processing which incorporated reflection and planning future action. Jackson (1994), in discussing a CL study, said that strategies like "*metacognitive strategies, such as self-evaluation, reflection, thinking about thinking, analysis and planning, self-regulation, checking, prediction, monitoring and reality testing*" (p 167-168) are said to help learners to learn how to learn . Thus, apart from its **perceived benefit for effective CL practice, monitoring may be seen as beneficial in helping**

**learners learn how to learn.** Students become more aware of what they are doing and this improves their learning - a meta-cognitive experience.

### 7.1.6 Participation

For CL to be effective, interaction aspects of participation should not be allowed to stagnate at the social level. It should develop to the use of varying types of cognitive interaction by individual members. The idea of status effects on cognitive participation, potentially, has far-reaching connotations of action, especially in changing 'disadvantage' patterns, related to apartheid ideology.

The **cognitive participation of individuals may be seen as unequally distributed**, among members of a group and over different sessions. In this inquiry, the vision of equitable participation had not evolved by the strategies used by the groups. It may involve more than strategies and monitoring. In the research a participation pattern was revealed. In an evolving way it begins by seeing students falling back on adopting inequitable roles like scribe and reporter and searching for a 'leader' in the absence of the authority figure of an instructor. With social group processing, however, inequitable roles become revealed. With progress there seemed to be an awareness that the nature of interactions depended on more than such roles and the goal of equitable cognitive participation may loom within group processing.

An aspect pertaining to equitable participation that may need to be studied in this context may be that of the relationships between **status and equity** of participation in CL, as discussed earlier. Cohen and her co-workers demonstrated that an intervention called 'multiple ability treatment' (an intervention that assumes that many different abilities are relevant in a group task and wherein students come to believe that each group member possesses some abilities) reduced the effects of status on interaction (Cohen, 1994). She proposed that status effects may be modified by using "*scripted interaction and turn-taking*", in the case of more routine tasks and using "*differential expectations for competence*" (ibid: p 25), for ill-structured problem tasks (i.e. tasks which do not have clearcut procedures or 'right answers'). Interaction is said to be a significant factor in

such tasks. Hooper (1992) called for interaction training and scripting, as well.

As far back as the 1970s, Barnes and Todd (1977) had concluded that if students were not taught interpersonal social skills and cognitive skills, interaction might not be at desirable levels. Social skills included the ability to control progress through tasks, manage conflict, the ability to modify and use different viewpoints and the willingness to give mutual support; while cognitive ones included constructing meaning and recreating experience, among others.

Webb (1982), in urging researchers to focus on interactions, suggested that the effectiveness of small group learning depended on the amount and kind of student interactions that occur. In the debate about how to ensure participation in a small group, a number of strategies have been proposed: with detailed structuring of interactions, as one extreme, to simply asking students to help one another or to come to a consensus, as the other extreme. Extreme structuring might even involve 'scripting' with conversational strategies (Cohen, 1994). Assigning roles was another strategy that was proposed. Such strategies may be rejected by practice that is informed by social constructivism. Cohen (1994), however, suggested that we inquire into the conditions under which structuring instruction might be productive to interaction, instead of outright rejection. Perhaps, **if students are involved in monitoring interaction, they may find and negotiate ways of reducing the effects of status in interactions.** Such a strategy may not involve the lecturer or teacher in regulating interaction levels. On the other hand, the type of participation may be seen as developing progressively, through development stages, from 'social' participation to 'cognitive' participation. If this is the case, then the **timing of different types of monitoring** becomes significant. The evolving process experienced by the students allowed for such monitoring.

### 7.1.7 Group Rules

Time needs to be allocated for students to generate and monitor group rules.

Many researchers, like Johnson and Johnson (1987), regarded the negotiation of group

rules as being beneficial for effective CL. To this end many researchers have outlined strategies, including asking students to generate their own cooperative strategies and encouraging feedback in implementing them. Hooper (1992), in arguing for ways of introducing Cohen's generic group learning strategies, suggested the use of establishing rules to promote CL. Sapon-Shevin and Schniedewind (1992) saw student generated rules as helping devolve power to students in the learning situation. This may prove a worthwhile step for us, in **changing the authority relationships in the classroom.**

### 7.1.8 Lecturer Constraints

I caution that the lecturer be prepared for a feeling of being 'deskilled'.

Slavin (1980) posed the question "*What are the effects of cooperative learning on teacher's role perceptions, attitude...?*" For me, the current learning environment is pervaded by a view promoting the authority of a lecturer in knowledge validation and other related roles currently practised. CL required me to change my practice in this regard, since my routine role was incompatible with democratic processes inherent in a CL ethos, like empowering students in knowledge construction and encouraging them to be responsible for their learning. I found that this came about **progressively during my conscious efforts of not being prescriptive in our CL implementation.**

I found that my role, generally, was to ensure that **topics were clarified, that the relevant materials were provided, that students were aware that I was an available resource, that feedback in reviewing learning and assessment were given, as well as, to provide guidance to facilitate unfamiliar skills, like peer and self-assessment, monitoring learning and managing time. I envision a situation where students become self-regulatory.**

In such a scenario, a lecturer's intervention may be primarily that of planning meaningful topics, subject matter or learning outcomes, negotiating criteria and goals, working to provide the environment conducive to CL, planning and providing opportunities for reflective activity and developing a curriculum responsive to such aspects.



### **7.1.9 Utilitarian Issues**

The CL practice needs to be extended into teaching practice experiences of pre-service students and this may have an impact on school-college negotiations to promote such practice.

Johnson and Johnson (1986) suggested that the place to begin effecting CL implementation might be in pre-service education. How this process transfers to classroom practice for prospective teachers may be evaluated in the teaching practicum unit or in the field as teachers. I recommend that the practice and research be extended to include this.

Students experienced CL and developed the skill of learning this way. An implication here is that by being exposed to this important stage, pre-service students need to use and develop skills related to conducting and managing CL in the field.

Furthermore, within the CL context students experienced different and appropriate assessment styles. They were exposed to using alternative assessment techniques. An implication here is that they need to develop the skill in doing so in the classroom.

### **7.1.10 Group Size**

The effect of group size on participation and its relationship to class size is perceived as problematic in the ubiquitous large classes of our institutions.

Various authors have referred to the issue of optimum group size for CL. According to Foster (1987) a group of 4 or 5 was an optimum size for desirable interactions and monitoring. His rationale was that a triadic (3-member) situation usually excluded one member in interactions, a dyadic (2-member) situation involved minimum viewpoints and interaction and a larger group might promote the 'splintering' of a group and neglect of group responsibilities. Heller and Hollabaugh (1992) suggested an optimal size of 3 or 4 for problem-solving, in that a dyad might not possess sufficient conceptual and procedural

knowledge and that a larger group might present other problems. They promoted the idea of a triad, based on their research that showed its efficacy, as opposed to a 4-member group, whereby at least one member was a relatively poor contributor in problem-solving. This seemed to be the situation in the groups of our inquiry. **Perhaps a triadic situation needs to be studied in this regard.** Hooper (1992), in reviewing the issue of group size, said that individual effort tended to decrease with increase in group size. Students themselves had suggested group sizes, not larger than a six-member one. This corresponded to a request by students in a study by Jackson (1994). McAllister (1995), in echoing the preference of small group sizes in the literature, suggested added benefits to the greater proportion of opportunities for individuals to make input, in that 'shy' pupils felt more confident in a small group and in that the organisation of small groups required less skill, than large ones.

#### 7.1.11 Changing Groups

Group changing may require relatively more time, especially in considering the anticipated 're-processing' that could occur within 'new' groups.

Based on her research, McAllister (1995) suggested that CL introduction might benefit from a situation whereby students work with friends of their own choosing, in the early stages. This was used in this inquiry for the first session only. **Students and I felt that changing groups would enhance the CL experience**, although we did not inquire into this aspect since subsequent changing of groups did not take place. Students had indicated the idea that more social construction of ideas could occur with interaction with members of other groups.

A related aspect was inquired into by Naidoo (1992) in an investigation, wherein he saw a role in his position of facilitator in a CL environment, as facilitating inter-group relationships by acting as a bridging agent across CL groups. In my inquiry I saw the post-CL class discussion and the reviews as facilitating co-construction of concepts.

### 7.1.12 Self-Esteem

A goal of pre-service education should be the building of self-esteem of all prospective teachers, especially those disadvantaged by their educational histories. CL represents a way of enhancing this.

The literature links CL with the effect of raising self-esteem, eg., Slavin (1980). Slavin (1991) said that several researchers had found that CL 'techniques', like *TGT*, *STAD*, *Jigsaw* and *TAI*, increased students' self-esteem. Johnson and Johnson (1985) echoed this and said that it involved finding out about one's self-worth. Hooper (1992) reviewed the literature on self-esteem to deduce that when students perceived support from peers, self-esteem was likely to increase. In linking CL with improved 'race' relationships, Johnson, Johnson and Maruyama (1983) proposed that as self-esteem increased, prejudice decreased. McAllister (1995) suggested that **'shy' students felt more confident in a small group** situation than in larger ones. Based on my inquiry, I tend to agree with this idea and with the idea that **support dynamics within the small group increases self-confidence and self-esteem grows progressively.**

Thus CL may be beneficial to most South African students, who may suffer low self-esteem. Blay (1994) reported that such students lacked confidence in doing tasks in certain subjects like mathematics and science.

### 7.1.13 Learning Environment

Much of our schooling is characterised by little or no student-student or student-teacher interactions. CL may provide a non-threatening environment for induction into such interactions.

Basili and Sanford (1991) reported about literature which suggested that *"if concept learning requires students to give up previously held concepts, then an atmosphere must prevail in which students feel free to express their ideas"* (p 294). The small group setting of the inquiry provided opportunities for students to express, explain, debate and clarify

their ideas and misgivings and relate experiences. This may have been done freely, in the absence of an authoritative figure. Experiences like these may be all the more valuable in the context of transforming past learning environments and in promoting **a culture of learning**, an aspect which is targeted by the *Reconstruction and Development Policy* (1994) of the Government of National Unity in South Africa. Jackson (1994) characterised the learning environment of a small group as a warm, secure one in which students and the teacher became involved in the learning process and in which they felt confident. It was his opinion that peer interaction represents "an essential component of an effective learning culture".

#### 7.1.14 Motivation and Student Induction

A culture of learning, that may be lacking in many of our institutions, may be promoted by CL.

In considering the psychological basis for saying that CL had strong motivational value in science education, Caprio (1993) found that the group structure, in allowing students to take more risks, reduced anxiety especially in 'science-anxious' students. To serve its motivational function, he said, "*the cooperative-learning activity must transfer control from the teacher to student*" (ibid: p 280). Johnson and Johnson (1987) suggested that attitudes that students might have towards their studies might have a positive effect on motivation. That CL experiences tended to promote higher motivation to learn, was reiterated by many workers in the field of CL (Johnson and Johnson, 1985). Thus, it would seem that **previous exposure to small group work experiences enhanced the motivation of the students to embark on the CL of the course and the implementation of CL was facilitated**. Furthermore, in giving students the opportunity to **negotiate their own learning**, motivation to sustain the CL may have been enhanced.

#### 7.1.15 Action Research

It would seem that an innovation like CL may need to be gradually implemented. Action research, which matches the monitoring and group processing practices inherent in CL, is

a suitable way to introduce and implement such an innovation, especially in introducing innovative practice, with its usual accompaniments of fears and insecurities, especially related to authoritarian ideology which most of us have operated in historically.

I respond to the question asked by Sapon-Shevin and Schniedewind (1992: 11), "*How can individual educators become more reflective about implementing cooperative learning?*", by proposing that one way of doing this is by implementing CL using an action-research methodology.

The work of Naidoo and Reddy (1994), in using action research to implement CL was suggestive of its potential efficacy. I extended their research design to include a focus on the dynamics involved within the CL groups to extend the theory they had generated. The research finding that action research was an effective way to introduce CL in the college context, not only corroborates their findings, but also implies that the theory may be extended by future research in the pre-service domain. Such theory is wanted, especially in the context of pre-service education, in that it may promote the introduction of the innovative education practice of CL within schools.

But the action research did more than provide an effective way of introducing and implementing CL. Through action research an overview of the nature of CL was revealed. It uncovered a whole package of aspects related to CL, yielding a multifaceted picture. Such a picture may not be seen when using other research methods, in which a single or a few aspects are focussed on and interrogated at a time. In the action-research way the diversification, interrelatedness and development of many aspects are seen at the same time - a complete 'picture' as it were instead of a 'snapshot'.

Findings about an individual aspect, eg., 'dominance', could be gleaned from a different approach to the research, perhaps in a deductive way. But although the propositions developed by this action-research study were separated into individual themes, they were the many aspects inquired into by a single study. This is the advantage that action research has - that a situation may be analysed to reveal its multifaceted interrelatedness, as is the nature of CL. This research in itself developed seventeen themes which yielded

thirty-seven propositions!

During the action research, certain aspects were planned to be focussed on in any one cycle, for example, the foci in Cycle 1 were the perceived constraints to cooperative learning (CL), viz., dominance, shyness, noise, 'off-task' behaviour, withholding of ideas, conflict, group composition, time and topic. But other issues emerged during the cycle in an inductive way (student induction to CL, alternative concepts, cognitive outcomes, assessment, lecturer constraints and utilitarian issues of CL), so that at the end of the cycle new aspects were planned to be focussed on and deductively illuminated in the next cycle. This new cycle generated more aspects and so on, producing an evolving set of aspects which gave an in-depth picture of the nature of CL.

Thus it is my view that the picture of a situation generated by an action-research inquiry is a more complete one than the pieces that may be generated by other forms of research. An added bonus to this is that it occurs in one's own practice wherein theories are born and validated through practice and not independently validated and then applied. A heightened sense of knowledge and understanding is developed while engaged in the process of improving practice.

Furthermore, students were exposed to the action-research methodology of the study. This has implications in the field of their own professional development and may represent one way by which prospective teachers learn about action research. Wood (1988: 149), a teacher who was involved in an action research partnership with a 'student teacher', suggested that, "*Learning about action research should be included in pre-service programs...it should be integrated throughout the pre-service sequence*". Many education researchers, among whom are Lawrence Stenhouse in the UK, Stephen Kemmis in Australia and John Elliot in the UK, have urged teachers to research their own practice in order to enhance their practice, their intellectuality, their contribution to educational theory and their involvement in developing curricula. The study suggests that using action research as a methodology of research and as a method for introducing CL can facilitate these practices.

## 7.2 Limitations of the Inquiry

The input from other participants, like students and the observations and reflections made by my colleague, could not be predetermined and may be different to that anticipated. In keeping with my resolve not to be prescriptive, I did not negotiate a structure for the colleague's observations of the sessions. Many of these observations were used as triangulating data and perceptions, but more of this may have emerged if the brief was more succinct.

Not only are our students unique, but also the lecturer in action research is unique as a research instrument, eg., what I constructed out of particular contexts may be constructed differently by another practitioner, since actions and views of participants filtered through my own epistemological and methodological perspective. The very selection of information that was used as data may be idiosyncratic - others may select differently from the data corpus and may generate different propositions. I echo Merriam (1988) in recognising the problems that may emanate in using a 'human as instrument': eg., my biases could affect how data were seen, recorded and interpreted; and, being the lecturer, I affected and was affected by the setting. Such interactions may have led to 'distortion' of the situation, a situation Merriam (ibid) characterises as, "*the schizophrenic aspect of being at once participant and observer*". But, I echo her recognition of the advantages of using such an instrument: the reliance on my sensitivity, my tacit and propositional knowledge, gave me the ability to better understand the complexity of the human interactions involved in the CL inquiry. Furthermore, I found that I progressively learnt and refined the way I used myself as an instrument, by being aware of aspects like triangulation and being attentive and responsive to the data gathered.

The 'testing' of constructs could not always be done in a deductive way, using 'a priori' constructs. The generation of propositions from emerging constructs, presented an initial challenge for me, in that it put a strain on my 'scientific' training. Such a challenge, I met with a perspective on notions of knowledge and research paths as tentatively and contextually constructed. This perspective was what I started with and what I continually refined in the process of the inquiry.

But, I encountered another set of constraints in the handling of qualitative data to 'fit' positivistic notions of validity and reliability, advocated by some research workers. Many find the case study problematic and limiting in the generation of 'valid' knowledge. This has been discussed in the methodology section (Chapter 3), where I used the notion of trustworthiness, instead.

The perceived limitation of case-study inquiry is that of external validity, which notion may be rejected by many researchers who use action-research. Piaget's notion of accommodation may be used to address this in its assertion that

*humans reshape cognitive structures to accommodate unique aspects of what is being perceived in new contexts* (Kincheloe, 1991:136).

Through looking at a range of comparable contexts, similarities and differences emerge. Teachers will have to decide whether a research proposition is relevant to a particular context, whether the proposition needs to be accommodated in a context's uniqueness or whether it is irrelevant to certain contexts. Propositions are not prescriptive in telling teachers what to do, but the research itself can help teachers raise questions and consider possibilities. According to Kincheloe (1991) for the constructivist, the notion of external validity is transcended in the way the action research is compared to other groups. We can engage with it as a means of furthering investigation and questioning our practice, rather than as a body of knowledge that can be replicated or validated. I used the major methods of ensuring rigour, those linked to reliability and validity checks, used by many qualitative researchers, among which were the criteria of *adequacy* and *appropriateness of data*, the audit trail and *verification with participants*.

A real limitation was the time constraint of the semester and the student boycott action, that arrested the research. Ideally I would have liked to continue into the next cycle that would inquire into aspects of status and equity.

There was the challenge of the selection and analysis of mounds of data, as well, the scope of which was underestimated by a novice researcher like myself. Some data overload was experienced, but this, I feel, could occur with any inquiry that I may undertake.



Furthermore, I caught myself, at times, searching for the security of authoritative 'how to' prescriptive procedures, but I came to realise, often in the inquiry process, that much of what I needed was 'new' and 'contextual information'. I learnt much about this from other emerging work in the tradition of action-research qualitative methodologies.

### **7.3 Some Recommendations for Pre-Service Education**

Based on my induction into CL practice and the maintaining of CL praxis, I recommend that CL be experienced by pre-service students, not in a piecemeal way, but systematically, over a course. Students' experience of self-monitoring of their CL and monitoring and feedback of their CL work by their peers and lecturers, may help them overcome perceived constraints to CL implementation and equitable participation. They construct and gain insights into how CL might be practised in the classroom and in their theoretical perspectives. It is my opinion, however, that this experience be extended, to introducing and implementing CL in the classroom during teaching practice, with systematic monitoring by themselves, their peers, resident teacher and their lecturer.

I recommend the use of action research, based not only on the experienced advantages of improved practice and theoretical perspectives for all participants, but partly because of the feeling I had of doing the 'right thing' and that students 'learnt' from and 'enjoyed' the experience. The learning environment promoted by such action research was characterised by more peer and student-lecturer 'quality' interactions than in my usual experience, and the progressive enhancement of self-esteem, provided fertile ground for co-construction of ideas. Such aspects may help create the longed-for culture of learning and capacity building, so needed in our society, that is recovering from the ravages of an apartheid era. But, patient, careful and conscious student induction into an action-research modality, may be needed to enhance the experience, in providing more student input in reflecting and planning than we experienced in the inquiry.

An important aspect that needs to be considered in implementation of CL praxis is that of considering time in the nature and format of topics, the reflecting, group processing, group changing and monitoring dimensions and a different type of assessment. Careful

curriculum planning is needed. This may not be possible for colleges that follow prescribed curricula. The case for practitioner participation in curriculum development, should be championed, if we want to introduce the innovatory practices of both CL in practice and action-research to inform our practice.

Finally, many look at innovations as modifying practice and integrating it into standard practice, as exemplified by a statement about implementing CL, made by the Johnsons:

*... teaching is a continuous process of developing more effective procedures through modifying old procedures and integrating new ones into one's standard practices.* (Johnson and Johnson, 1987:178)

It is my view that this attitude may not apply to the implementation of CL as an innovation. CL is not merely an innovation, but has a potentially transformative function. Inherent in CL practice is an underpinning philosophy of education, in the same way that practice informed by constructivism has. It involves confronting our current (standard) practice and its cohort of tacit knowledge that is informed, mainly, by our experiences and theory which may have become tacit knowledge by a process of consensual socialisation and transmission of knowledge about what teaching and learning involves. It may not be possible to introduce a potentially transformative practice like CL by modifying standard practice to integrate it.

I see action research, in its function of revealing everyday practice and its potential to generate theory about effective actions and practice, as being compatible to the introduction and implementation of a potentially transformative practice like CL. It was particularly useful in revealing the nature of the various types of interaction that occurred within a CL group. Implementing CL is not about creating 'a good fit' between its practice and the rest of one's teaching. The overarching implication for the introduction of CL into a course within the current milieu of individualistic learning, is that it may need to be undertaken within a supportive institutional environment, for students and lecturers to benefit from its underlying democratic principle of cooperation.

## 7.4 Concluding Comments

Some features which I felt were particularly important in the inquiry were about:

- \* the detected pattern of moving from a management focus to a cognition focus in interaction; report-back time;
- \* the experience with change;
- \* reconnaissance as a reflective and prospective encounter;
- \* the learning environment;
- \* action research and the worthwhile experience.

A commentary about these aspects follows.

On reviewing the trends that have emerged in this inquiry, I could detect a shift from initial **managerial concerns** of participation to social concerns of participation later and finally to **cognitive concerns** of participation. This interaction pattern may be seen as reflecting the history of research in the area of CL, as was discussed in Chapter 2:

- \* a period of time when research centred around the management of CL, evidenced by efforts at developing techniques or models to enable teachers to manage CL in the classroom (as evidenced by the work of Slavin);
- \* a period of research into small group interactions emphasising social aspects, with attempts at developing strategies to improve social interactions (as represented by work of the Johnsons in USA);
- \* and the present period of research which includes an emphasis on the cognitive aspect of interactions in the small group.

Implementing the important aspect of the **report-back** and class discussion after a CL session, can be a problem, especially with our present obsession with 'top heavy' overloaded science syllabi. In reviewing our course designs, we need to ask ourselves questions about the selection of course material - both about science and about science education. I found that a CL activity that took approximately 15-20 minutes could generate a 15-20 minute class discussion for a three group class. I found that the class discussions which emanated from each group report crucial to learning. It cannot be 'underplayed' because it represents a culmination of the learning process, the social

construction of knowledge, in a sense. For larger classes more time would be required for more group reports and more class input during discussions.

Furthermore, we need to inquire into the nature of the report back as it represents feedback to a class and further social construction of ideas. I found poster presentations less time consuming than just verbal reportage. The poster represents a record of what occurred, as well.

Introducing CL in a course meant a consistent experience which involved **change**. There is a need for people to feel their way through changes. I feel that involving students in their own learning about CL, as well as, about science, meant that a learning environment involving planning, monitoring, reflecting and responding was important to minimise external prescriptions from a lecturer or literature. It involves a change from notions of prescriptive practice (an ethos of 'do this..' and 'don't do this...') to ones of experimental and reflective practice (an ethos of 'let's try, reflect...'). The educational value of change could not be underplayed in this inquiry.

Many see change as inextricably linked to being a professional. The reflective professional explores the implications of such changes and ways of changing routines of practice (Stenhouse, 1975). The potential for an innovation to be practicable and worthwhile leads the professional practitioner to engage with the changes involved. This potential can be developed inside the context in which the innovation is to be implemented. In this way the practitioner as a significant participant is operating as a professional. The potential for CL as a way of learning was inquired into and I perceived the action research as an approach of reflective practice as enhancing my professional practice.

An important learning construct emanated from my experience with **reconnaissance** and what the reconnaissance process symbolised and meant for me. Reconnaissance represents a complexity of processes and a focal point of each cycle. Many processes converge at this stage. It involves learning by re-visiting and analysing preceding 'reflections in action' and 'reflections on action'. Furthermore, it aims for planning of future action (in a

sense, 'reflections for action'). Thus reconnaissance represented a nexus of retrospective learning which informed future purposes and plans and incorporated the building of constructs using information that diffused in, from students, the lecturer and outside sources. Students themselves were involved in planning at this point and students enjoyed the reconnaissance sessions, a notion that is embodied in construct 60. Reconnaissance was one of the forms of practices constituting student reflexive practice. I saw it as one way of inducting novices into the profession. An important learning in this type of reflection is that in this time of 'stepping back' as a respite from the flow of activities and entangling problems we have the opportunity to cope constructively with issues involving change.

Comments from students' reflections about their experience of CL in the course revealed their partiality to the secure **learning environment** that the small group presented. I found that the learning environment of the small group in CL provided opportunities for people to change their concepts without feeling threatened. Students were observed to take that risk of exposing their personal concepts for group processing and co-construction of concepts in the small group.

As a lecturer I found that the experience of CL and of action-research **worthwhile** for all participants. For me, analysis revealed many things that were not anticipated, about the nature of CL and the expedient use of action research in helping me unfold its many facets, facets that may have been ignored or relegated to being not relevant by another type of study. The inquiry was made possible partly because of the supportive nature of the colleague's input. The feeling that it was of worth was encapsulated by the following sequence of an audio-taped dialogue at the end of the course:

*Lecturer: ... we learnt so much - by looking at it - and continually - reviewing what we have done -*

*Colleague: Yes*

*Lecturer: - so do you think that the action-research strategy was a good strategy to use for such - an innovation?*

*Colleague: Absolutely - I think you - and the students were jointly involved in -*

*Lecturer: - learning -*

*Colleague: - constructing what else was going to follow - and also looking at problems and highlighting problem areas - so I think - definitely - that's the way it should actually take place - and it doesn't matter what course you're actually*

*doing - that is the way it should take place.*  
*Lecturer: I have learnt a lot from the students -*  
*Colleague: - I have - I have -*  
*Lecturer: - and from the whole exposure*  
*Colleague: - definitely ...*

The following extracts from the students' final reflections (Appendix IX) may give a picture of the experience for students:

*[Working] with my group had [has] helped me to achieve high marks, [It has] also helped me in getting through some misconceptions I had. [Working] ... with different people has improved my language and the skill of working with different people ... (S1);*

*My experience with cooperative learning have [has] thought [taught] me how could [to] use it when I go Pract Teaching or even later in my career ... (S2);*

*The first in-depth experience of co-operative learning..As normal I did not recommend it as something important, but as the day continued with my experience of it, I began to feel the effectiveness of this method of learning ... (S3);*

*... our science lessons I feel were the most comfortable and open classes...Cooperating in the groups were [was] very successful because we implemented it and investigated the obstacles hindering it ... (S4);*

*I enjoyed group work and it taught me to work co-operatively with other students, respecting their views and respecting one another ... (S5);*

*I think working cooperatively is a wise suggestion because an individual cannot think the same as [an]other - one can think differ[ently to] or better than the other [another]... (S6);*

*As students we gain a lot in group learning; there are skills - we learn life skills like how to debate and to give others freedom of expression and how to criticize [criticise] points not people...if people were to have this understanding we can have a peacefull [peaceful] country ... (S7);*

*We were all aware that the total group effort would constitute and determine final assessment, which we all would have to settle for ... (S8);*

*... I have found that I can work with people I am not used to working with ... makes me being one member of the group and it has also build [built] up self-respect... (S9);*

*These experiences helped me to understand another culture because the group added folk wisdom into discussions ... (S10);*

*When we examined the issue of participation equity I noticed good results after honestly discussing identified problems and agreed on solutions...[Reflective notes] enabled us as students to have an influence on how we learnt even in terms of management ... (S11);*

*Our learning takes place under a very relaxed situation and students often related their own personal experiences and some of these experiences are really informative ... (S12).*

## REFERENCES

- African National Congress 1994: *A Policy for Education and Training*, ANC, South Africa
- Adams, P.E. and Tillotson, J.W. 1995: Guest Editorial: Why Research in the Service of Science Teacher Education is Needed, *Journal of Research in Science Teaching*, 32(5), 441-443
- Altrichter, H., Posch, P. and Somekh, B. 1993: *Teachers Investigate their Work: an Introduction to the Methods of Action Research*, Routledge, London
- Barnes, D. and Todd, F. 1977: *Communication and Learning in Small Groups*, Routledge and Kegan Paul, London
- Basili, P.A. and Sanford, J.P. 1991: Conceptual Change Strategies and Cooperative Group Work in Chemistry, *Journal of Science Teaching*, 28(4), 293-304
- Blay, J.E. 1994: The New Government's Educational Policy: Implications for Classroom Practice, *South African Association for Academic Development: 1994 Conference Proceedings*, 115-124
- Blosser, P.E. 1993: Using Cooperative Learning in Science Education, *The Science Outlook*, ERIC/CSMEE
- Bossert, S.T. 1988: Cooperative Activities in the Classroom, *Review of Research in Education*, 15, 225-250
- Bruffee, K.A. 1987: The Art of Collaborative Learning, *Change*, 19(2), 42-47
- Cannon, J.R. and Scharmann, L.C. 1996: Influence of a Cooperative Early Field Experience on Preservice Elementary Teachers' Science Self-Efficacy, *Science Education*, 80(4), 419-436
- Caprio, M.W. 1993: Cooperative Learning - the Jewel Among Motivational Teaching Techniques, *Journal of College Science Teaching*, 22(5), 279-281
- Carr, W. and Kemmis, S. 1986: *Becoming Critical: Education, Knowledge and Action Research*, Falmer Press, London
- Cohen, E. G. 1994: Restructuring the Classroom: Conditions for Productive Small Groups, *Review of Educational Research*, 64(1), 1-35
- Committee on Teacher Education Policy (COTEP) 1995: *Norms and Standards and Governance Structures for Teacher Education*, South Africa Davidoff, S. and van



- den Berg, O. 1990: *Changing Your Teaching: The Challenge of the Classroom*, Centaur Publications, Pietermaritzburg
- Davidson, N. 1985: Small Group Learning and Teaching in Mathematics: A Selective Review of Research, in R. Slavin, R. Hertz-Lazarowitz, G. Webb and R. Schmuck (eds.), *Learning to Cooperate, Cooperating to Learn*, Plenum, New York.
- Department of Education, March 1995: *White Paper on Education and Training*, Government Gazette, Notice No. 196 of 1995, Parliament of South Africa, 375(16312)
- DeVries, D. and Slavin, R. 1978: Teams-Games-Tournaments: A Research Review, *Journal of Research and Development in Education*, 12, 28-38
- Driver, R. and Oldham, V. 1986: A Constructivist Approach to Curriculum Development in Science, *Studies in Science Education*, 13, 105-122
- DuBois, M.H. 1995: Conceptual Learning and Creative Problem Solving Using Cooperative Learning Groups in Middle School Science Classes, in S. Spiegel, A. Collins and J. Lappert (eds) *Action Research: Perspectives from Teachers' Classrooms*, 83-100
- Edwards, C. and Stout, J. 1990: Cooperative Learning: The First Year, *Educational Leadership*, 47(4), 38-41
- Elliot, J. 1981: *Action-Research: a Framework for Self-Evaluation in Schools*, TIQL Working Paper No.1, Cambridge Institute of Education, mimeo
- Elliot, J. 1991: *Action research for Educational Change*, Open University Educational Enterprises, Milton Keynes
- Erickson, F. 1986: Qualitative Methods in Research on Teaching, in M.C. Wittrock (ed.), *The Handbook of Research on Teaching*, Macmillan, New York
- Foster, G.W.M. 1987: Adolescent Development and Group Inquiry, *Science Scope*, 10(3), 122-123
- Government of National Unity 1994: *Reconstruction and Development Policy*, Government Gazette, South Africa
- Hart, S. (n.d.): Collaborative Classrooms, in T. Booth, W. Swann, M. Mastirton and P. Potts (Eds.), *Learning for All: Curricula for Diversity in Education*, Routledge, London

- Heller, P. and Hollabaugh, M. 1992: Teaching Problem Solving Through Cooperative Grouping, *American Journal of Physics*, 60(7), 637-644
- Hooper, S. 1992: Cooperative Learning and Computer-Based Instruction, *Educational Technology Research and Development*, 40(3), 21-38
- Hopkins, D. 1993: *A Teachers Guide to Classroom Research*, Open University Press, Buckingham
- Jackson, B. 1994: Cooperative Learning: A Case Study of a University Course in Systems Analysis, *Educational and Training Technology International*, 31(3), 166-179
- Johnson, D.W. and Johnson, R.T. 1974: Instructional Goal Structure: Cooperative, Competitive, or Individualistic, *Review of Educational Research*, 44(2), 213-240
- Johnson, D.W. and Johnson, R.T. 1981: Effects of Cooperative and Individualistic Learning Experiences on Interethnic Interaction, *Journal of Educational Psychology*, 73(3), 444-449
- Johnson, R.T. and Johnson, D.W. 1985: Student-Student Interaction: Ignored But Powerful, *Journal of Teacher Education*, 22-26
- Johnson, R.T. and Johnson, D.W. 1986: Action Research: Cooperative Learning in the Science Classroom, *Science and Children*, 24(2), 31-32
- Johnson, D.W. and Johnson, R.T. 1987: *Learning Together and Alone*, Prentice-Hall, New Jersey
- Johnson, D.W., Maruyama, G., Johnson, R. and Nelson, D. 1981: Effects of Cooperative, Competitive, and Individualistic Goal Structures on Achievement: A Meta-Analysis, *Psychological Bulletin*, 89(1), 47-62
- Johnson, D.W., Johnson, R. and Maruyama, G. 1983: Interdependence and Interpersonal Attraction among Heterogeneous and Homogeneous Individuals: a Theoretical Formulation and a Meta-Analysis of the Research, *Review of Educational Research*, 53, 5-54
- Jones, R.M. and Steinbrink, J.E. 1989: Using Cooperative Groups in Science Teaching, *School Science and Mathematics*, 89(7), 541-552
- Joyce, B. and Weil, M. 1980: *Models of Teaching*, Prentice-Hall, Englewood Cliffs, New Jersey
- Kempa, R.F. and Ayob, A. 1991: Learning Interactions in Group Work in Science,

*International Journal of Science Education*, 13(3), 341-354

- Keys, C.W. 1995: An Interpretive Study of Students' Use of Scientific Reasoning During a Collaborative Report Writing Intervention in Ninth Grade General Science, *Science Education*, 79(4), 415-435
- Kincheloe, J.L. 1991: *Teachers as Researchers: Inquiry as a Pathway to Empowerment*, Falmer Press, London
- Kohn, A. 1991: Group Grade Grubbing Versus Cooperative Learning, *Educational Leadership*, 48(5), 83-87
- Kohn, A. 1992: Resistance to Cooperative Learning: Making Sense of its Deletion and Dilution, *Journal of Education*, 174(2), 38-56
- Lazarowitz, R., Hertz, R.L., Baird, J.H. and Bowlden, V. 1988: Academic Achievement and On-Task Behavior of High School Biology Students Instructed in Cooperative Small Investigative Group, *Science Education*, 72(4), 475-487
- Lemke, J.L. 1990: *Talking Science: Language, Learning and Values*, Ablex, Norwood
- Lincoln, Y.S. 1990: The Making of a Constructivist: A Remembrance of Transformations Past, in E.G. Guba (ed) *The Paradigm Dialog*, Sage Publications, Newbury Park, 67-87
- Lonning, R.A. 1993: Effect of Cooperative Strategies on Student Verbal Interactions and Achievement during Conceptual Change Instruction in 10th Grade General Science, *Journal of Research in Science Teaching*, 30(9), 1087-1101
- Lord, T.R. 1994: Using Cooperative Learning in the Teaching of High School Biology, *The American Biology Teacher*, 56(5), 280-284
- Lumpe, A.T. and Staver, J.R. 1995: Peer Collaboration and Concept Development: Learning about Photosynthesis, *Journal of Research in Science Teaching*, 32(1), 71-98
- McAllister, W. 1995: Are Pupils Equipped for Group Work without Training or Instruction? *British Educational Research Journal*, 21(3), 395-404
- Merriam, S.B. 1988: *Case Study Research in Education: a Qualitative Approach*, Jossey-Boss, San Francisco
- Miles, M. B. and Huberman, A.M. 1994: *An Expanded Sourcebook: Qualitative Data Analysis*, Sage, Thousand Oaks
- Miller, L.M. and Castellanos, J. 1996: Use of Technology for Science and Mathematics

- Collaborative Learning, *School Science and Mathematics*, 96(2), 58-62
- Naidoo, P. 1992: *Collaborative Teacher Participation in Curriculum Development: A Case Study in Junior Secondary School Science*, M.Ed. Thesis, Rhodes University, South Africa
- Naidoo, P. and Reddy, S. 1994: *Teaching of a Large Science Class: A Case Study at University of Durban Westville - South Africa*, Paper delivered at NARST annual meeting 26-30 March 1994, Anaheim, California
- National Education Coordinating Committee 1986: *Principles that Govern Peoples Education*, Memo
- O'Donnell, A.M, Dansereau, D.F., Rocklin, T.R., Hythecker, V.I., Lambiotte, J.G., Larson, C.O. and Young, M.D. 1985: Effects of Elaboration Frequency on Cooperative Learning, *Journal of Educational Psychology*, 77(5), 572-580
- Okebukola, P.A. 1986a: The Influence of Preferred Learning Styles on Cooperative Learning in Science, *Science Education*, 70(5), 509-517
- Okebukola, P.A. 1986b: Cooperative Learning and Students' Attitudes to Laboratory Work, *School Science and Mathematics*, 86(7), 582-590
- Okebukola, P.A. 1992: Concept Mapping with a Cooperative Learning Flavor, *The American Biology Teacher*, 54(4), 218-221
- Okebukola, P.A. and Jegede, O.J. 1988: Cognitive Preference and Learning Mode as Determinants of Meaningful Learning Through Concept Mapping, *Science Education*, 72(4), 489-500
- Peterson, P.L. and Swing, S.R. 1985: Students' Cognitions as Mediators of the Effectiveness of Small-Group Learning, *Journal of Educational Psychology*, 77(5), 299-312
- Phelps, H. and Damon, W. 1989: Problem Solving with Equals: Peer Collaboration as a Context for Learning Mathematics and Spatial Concepts, *Journal of Educational Psychology*, 81(4), 639-646
- Ross, J.A. and Raphael, D. 1990: Communication and Problem Solving Achievement in Cooperative Learning Groups, *Journal of Curriculum Studies*, 22(2), 149-164
- Roth, W-M. 1994: Student Views of Collaborative Concept Mapping: An Emancipatory Research Project, *Science Education*, 78(1), 1-34
- Ryan, F.L. and Wheeler, R. 1977: The Effects of Cooperative and Competitive

- Background Experiences of Students on the Play of a Simulation Game, *The Journal of Educational Research*, 70, 295-299
- Sapon-Shevin, M. and Schniedewind, N. 1992: If Cooperative Learning's the Answer, What Are the Questions? *Journal of Education*, 174(2), 11-37
- Schön, D.A. 1983: *The Reflective Practitioner*, Temple Smith, London
- Sharan, S. 1980: Cooperative Learning in Small Groups: Recent Methods and Effects on Achievement, Attitudes, and Ethnic Relations, *Review of Educational Research*, 50(2), 241-271
- Sharan, Y. and Sharan, S. 1987: Training Teachers for Cooperative Learning, *Educational Leadership*, 45(3), 21-25
- Sharan, Y. and Sharan, S. 1990: Group Investigation Expands Cooperative Learning, *Educational Leadership*, 47(4), 17-21
- Slavin, R.E 1980: Cooperative Learning, *Review of Educational Research*, 50(2), 315-342
- Slavin, R.E. 1991: Synthesis of Research on Cooperative Learning, *Educational Leadership*, 48(5), 71-82
- Stenhouse, L. 1975: *An Introduction to Curriculum Research and Development*, Heinemann, London
- Stephens, J., Dyche, S. and Beiswenger, R. 1988: The Effect of Two Instructional Models in Bringing About a Change in the Understanding of Science Concepts by Prospective Elementary Teachers, *Science Education*, 72(2), 185-195
- Stuessy, C.L. and Naizer, G.L. 1996: Reflection and Problem Solving: Integrating Methods of Teaching Mathematics and Science, *School Science and Mathematics*, 96(4), 170-177
- Terwel, J., Herfs, P.G.P., Mertens, E.H.M. and Perrenet, J.C. 1994: Co-operative Learning and Adaptive Instruction in a Mathematics Curriculum, *Journal of Curriculum Studies*, 26(2), 217-233
- Tingle, J.B. and Good, R. 1990: Effects of Cooperative Grouping on Stoichiometric Problem Solving in High School Chemistry, *Journal of Research in Science Teaching*, 27(7), 671-683
- Tobin, K., Tippins, D.J. and Gallard, A.J. 1994: Research on Instructional Strategies for Teaching Science, in D.L. Gabel *Handbook of Research on Science Teaching and Learning*, Macmillan, New York, 79-81

- Walberg, H. 1984: Improving the Productivity of America's Schools, *Educational Leadership*, 41, 19-27
- Watson, S.B. 1992: The Essential Elements of Cooperative Learning, *The American Biology Teacher*, 54(2), 84-86
- Watson, B. 1995: Relinquishing the Lectern: Cooperative Learning in Teacher Education, *Journal of Teacher Education*, 46(3), 209-215
- Webb, N.M. 1982: Student Interaction and Learning in Small Groups, *Review of Educational Research*, 52(3), 421-445
- Williamson, J. 1990: Co-Operative Learning in Western Australia: Some Preliminary Data, *Education Research and Perspectives*, 17(1), 66-75
- Wood, P. 1988: Action Research: A Field Perspective, *Journal for Education and Teaching*, 14(2), 135-150.

# APPENDIX

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DESCRIPTIVE-INTERPRETIVE REPORT 1  
SESSIONS 1-5

## BACKGROUND

The department of Natural Science at Edgewood College offers a four-year Natural Science option for the SP/JP students. My colleague selected the areas of study for the first semester of the Natural Science II course for 1995, and outlined the projects assignments and seminars related to the course. I negotiated to conduct a part of the course spanning three areas of study: classification of plants, morphology of anthophytes and reproduction of anthophytes. Sessions on these were conducted between 15.02.95 and 10.04.95. Two tests were conducted in the period. An outline session allocation was negotiated with the colleague and the research plan that emanated consisted of three cycles, each cycle comprising aspects planned around an area of study.

## THE RESEARCH

The research as a case study focussed on the introduction and implementation of CL in the course, using action-research. Each cycle of research began with a reconnaissance session. A final reconnaissance was made after the last lecture session.

## CYCLE 1

This is a descriptive-interpretive report of the introduction of CL over the first cycle of the research, comprising 5 lecture sessions, 80 minutes each, using the first topic of the course: an introduction to 'plant' classification.

## Student Interviews I

Interviews of the 12 students who chose the course were held over 2 days before the first lecture session I conducted. The intention of the interviews was to obtain information on (or to illuminate) students' experience and perceptions of reasons for using CL in lecture sessions. Ten interviews were audio-taped with the permission of all students, and 2 were recorded as notes in a reflective diary kept by me (because of a technical problem with the audio-tape procedure). These notes were subsequently confirmed by the interviewees (S2 and S10). Apart from the contextualising aim of the interviews, I perceived the conduction of the interviews as a way of 'entering' the case study, a way of introducing myself to the students, familiarising myself with their names and voices, and establishing some rapport with them. I could say that the latter had occurred, to some extent, in perceiving an absence of the usual attendant constraints of a first lecture, conducted by a lecturer unfamiliar to students, during the first session when a CL environment was relatively easy to establish.

The short interviews (6 - 15 minutes each) were conducted in convenient 'free time' periods at the convenience of students. The interviews were semi-structured in that a checklist was used (Appendix V). At each interview an attempt was made to make the student comfortable by generating a discussion on the student's social and academic experiences and on his/her current motivation to continue on the chosen path of teacher education. All students were positive in their motivation to continue with their studies in teacher education. 3 students, S8, S11 and S12 have had work-place experience.

The interviews revealed that all students had been exposed to group-work in their first year courses, especially in Natural Science and, to a lesser extent, in English, Education Studies and Mathematics. Some students, however, said that it was employed only in Natural Science. This was confirmed in responses that indicated that some type of group-work was done, made by lecturers to a questionnaire given to a lecturer each of the departments of History, Education, English, Mathematics, Geography and Physical Sciences (Appendix IV). At least 3 students (S7, S9 and S11) said that they had not experienced group-work at school level.

The types of group-work that students said they were exposed to included 'the discussion of ideas'. The responding lecturers extended this to include



problem solving (Maths), for seminars, essays and projects (Education), for practicals (Physical Science) and for group trails (Geography).

Student perceptions of the objectives of their first year group-work were:

- sharing ideas;
- interacting with other students;
- learning from each other;
- eliciting ideas of students;
- constructing 'knowledge';
- participating (even if just listening) in construction of ideas;
- obtaining a range of ideas from different students;
- finding out things for themselves;
- as promoting critical thought ('use our brain');
- encouraging creative thinking and acting and using imagination;
- improving relationships between students;
- encouraging the participation of 'shy' or 'scared' students;
- as enabling students to teach using group-work;
- improving education;
- basing strategies on research stating that most learning is through group-work;
- basing strategies on the perception that students work better with friends in their own language groups and
- interacting to come to common understandings.

These perceptions of reasons for group-work have been corroborated by past research as shown in the literature (Johnson and Johnson, 1985) and may be regarded as some of the reasons for group-work sessions given by some lecturers and by myself. Literature adds to this list, eg., on improving inter-ethnic skills, language proficiency and communication skills (Barnes and Todd, 1977; Johnson and Johnson, 1985).

Objectives for group-work given by lecturer response to questionnaires, included cooperatively solving problems, giving hands-on experience to improve learning, widening the scope of responses, promoting learning through sharing ideas, fostering the ability to compromise, promoting active learning, extending the knowledge and initiative of students, developing cooperation and giving experience of studying group dynamics. Apart from the absence of the 'problem-solving' objective, these reasons given by lecturers echo those of students in the main.

Thus a fairly good match between student, lecturer and my perceptions may be seen, and it could be claimed that

- a. Students exposed to group-work perceive reasons for group-work in ways similar to those of their lecturers and other researchers.
- b. The introduction of CL in this course may be based on a consideration of student perceptions of their CL experiences; and CL may be introduced in the manner that students have been accustomed, so that these may be illuminated and the relevant action taken.

All students were of the opinion that group-work should be part of learning for students; some even ventured that it should be so for pupils at school. They were positive about some group-work experiences and many (8) preferred cooperative learning for learning new things; one (S11) preferred CL for 'weak' areas only, one (S9) for revision only, and one student (S12) preferred to learn alone. Furthermore they had elected to do the course. Thus it was claimed that

Cooperative learning may be a preferred learning mode for most second year Natural Science students who have been exposed to CL in the first year of study.

#### Session 1

The contextual experiences of students were taken into account in the preparation of the first session. This preparation entailed more time, effort and manipulation of the physical environment for learning (and research) than was the usual case for me in negotiation with the department and the colleague lecturer. I decided that the first cycle of the research start with CL practice as that which had been internalised by the students.

A constructivist base was used for the session: students' ideas on

classification were elicited, based on their view that a goal of CL was to elicit and share ideas on topics. Students chose their own groups; each group had four students. Own choice of groups was used to keep the CL practice as 'natural' as possible and in keeping with previous practice in the Natural Science course. This was not negotiated with the colleague observer who noted 'reason for own choice' in her observations (colleague's note 1) - it was discussed later.

The decision to continue with CL as had been practised, focussed on the students' perceived problems of CL practice (summary of Student interview 1, including dominance, participation, language, topic clarification, noise, not 'sharing', and 'coasters'), was taken with a view to 'illuminate' them in the first cycle. These were reported and tentative constructs were generated during and at the end of the cycle.

At the beginning of the session a review of the interviews was given both as a way of confirming what was said and as a way of identifying the aspects that were being focussed on. Permission for using names in the review was sought and granted. I perceived the strategy during the introduction, as ensuring a secure, trusting, 'transparent' environment for CL. The research context had been explained before (at the interview) and permission for audio-taping group sessions was sought and granted. A gradual introduction for student input as reflection and planning in the research was planned. I saw the review as an attempt to get students involved, as well as feedback that was asked for by some students. Furthermore some students had asked questions on the research. Although it posed a good opportunity for the introduction of the idea of student reflective journals, this was postponed to the next cycle, since it was perceived that exposure to the dynamics of group-work and reflection on some of these aspects would enhance the focus required for the journal. Other unfamiliar procedures, like self- and peer-evaluation were planned for this stage, and the intention was to avoid an overload of such experiences in the initial stages.

The first CL activity was in response to questions/instructions posed by the lecturer as in the session plan (Appendix III).

The colleague lecturer observed (note 1) the session and my observations were written later on the day in a research diary (Appendix XIV). The group discussion session in each group was audio-taped. The following were illuminated as critical aspects:

Topic clarification: The question 'Why classify' had to be clarified for 2 groups (diary, p12 TOPIC; colleague's note 1, TOPIC). A student perceived that topics and instructions were problematic areas during the student interviews. Time was taken for a member of each group to copy the instructions from the OHT (diary, p 12 TOPIC). Thus I made a tentative claim that

**Topics and instructions should be clear, articulated and written for group discussion and for time management.**

Time: Although the discussions were completed in the allotted time, presentation time was not allocated and managed for each group (diary, p14, TIME; colleague's note 1, TIME), and I made a tentative claim that

**Group reports should be allocated equal time distribution in the interests of fairness and sharing of all group ideas, and so that questions, responses and comments are generated by all presentations.**

The Group Goal: The aim was to elicit ideas, for students to share these ideas on the topic and to come to some consensual agreement on these ideas. Although this aim was not made explicit it was seen as being achieved (diary, p12, TOPIC; colleague's note 1, PART1), and I claimed that

**Students who have been exposed to group-work perceive the aim of some group-work as to elicit ideas from members, to share ideas and to reach consensus, even if such goals are covert.**

The strategy of not revealing the goals of the activity, was a deliberate one for the session, for the purpose of illuminating what students perceived as the goals of CL in this activity. I was left with a dilemma: on the one hand, it is suggested that goals should be overt in the interests of learning, but on the other hand, stated goals may impede subsequent learning. I decided that

the issue of overt goals be considered with reference to the nature of the activity.

Poster Presentation: The contents of two posters were not clearly visible (diary, p13 ASSESS; colleague's note 1, PART2). One presenter (S5) asked for input from individual members during her presentation. Differing perspectives of this act existed: the colleague lecturer saw this as increasing the participation of members of the group and I saw it as revealing S5's lack of internalisation of group ideas. On seeking confirmation of the perceptions, S5 and members of her group said that they had decided on the strategy. Thus, I claimed that

**Perceptions of the reason for certain group strategies of presentation differ and confirmation of the rationale behind the strategies may be needed.**

'Misconceptions'/Alternative Concepts: Certain alternative concepts were revealed on the poster and clarified during class discussion (diary, p13 AC; colleague's note 1, AC); during the presentation (diary, p13 AC; colleague's note 1, AC); and in the audiotape playback (session 1 tape, AC). Some alternative concepts, revealed by the playback, were in addition to those revealed by the poster and presentation. Thus, I claimed that

- a. Poster presentations may be used as a strategy to reveal learning, consensus agreements and alternative concepts.
- b. All alternative concepts may not be revealed by posters and presentations and ways of revealing alternative concepts in classroom practice may be regarded as problematic.

Participation: Observations concerning participation were made during group discussions (diary, p15 PART1; colleague's note 1, PART2), during the class discussion (diary, p13 PP, p 14 PP; colleague's note 1, PART3, PART4, PART5) and by the playback. The playback yielded more information than the classroom observations of the CL activity; all members participated, some talking more than others (session 1 tape). Thus, a tentative claim made was

**Monitoring participation levels by classroom observation may yield partial information and is regarded as a problematic.**

Dominance: I perceived that S2 and S10 in Group A, S8 in Group B and S12 in Group C as talking the most; in directing activity, both S2 and S8 were perceived as being 'managers', bringing members 'on-task' (session 1 tape). I found that

**Finding ways of monitoring and revealing dominance patterns, as other patterns of participation, is problematic.**

I regarded student participant observation as an option, but decided to defer this to the next cycle of research and practice.

Social Aspects: Students were perceived to be enthusiastic and to enjoy the group session (diary, p15 AR), and I claimed that

**Students enjoy interacting and learning in groups.**

The aspects of 'topic clarification', 'poster presentation', 'participation' and 'dominance' were discussed as problems in group-work by students during the interviews (student interviews I). The aspect of 'alternative concepts' was referred to by a student (S12 - 'ideas coming from students themselves...not always correct') during his interview. Furthermore a lecturer mentioned 'dominance' as a problem, another the 'time justification' and another 'participation' in the questionnaire responses.

## Session 2

Groups were reorganised to reflect language and gender heterogeneity: the previous Group A comprised women only and had 2 English speakers and 2 siZulu speakers, whereas Groups B and C had 1 women and 3 men each with Group B having 1 English speaker, 1 siSuthu and 1 siZulu speaker, and Group C with all 4 Zulu speaking members. Members were redistributed so that each group had 2 women and 2 men. Serendipitously, redistribution using gender criteria resulted in the groups being heterogeneous as far as language was concerned, in that each group had one English first language speaker. Thus the language issue was not preempted. Students were amenable to the changed groupings

although I had not consulted them about this, perhaps encouraged by the comment that women generally work well together - on reflection, a subversive one of reverse gender prejudice (which encourages stereotyping) and in poor taste, even if it was said in jest!

### Activity 1

This focussed on the historical development of biological classification systems. The strategy used was as outlined by O'Neil (1990) in her journal article 'Introduction to Classification: Kingdoms' but using group discussion instead of individual activity at each stage. At the end of the activity students handed in their classification sequences of 2-column, 3-column and 4-column groupings of the 7 organisms that they observed in diagrammatic form.

The activity was perceived by me as worthwhile in that students were engaged in an exposure of the tentativeness of science 'knowledge' and that 'knowledge' about classification may be regarded as being in a state of flux (diary, p18 PART1). The aim of showing the historical development of knowledge about classification through group interactions was seen as being achieved (diary, p18 PART; colleague's note 2, LROLE, FORMAT). Each stage generated some conflict, doubt, confusion and consensus (diary, p18 PART1; colleague's note, PART1). Critical questions were asked during the group and class discussions (diary, p18 STIND; colleague's note 2, PART2).

The activity was structured so that there was a combination of group discussion and class discussion at each stage (colleague's note 2, FORMAT). Students were perceived to be enjoying the session and showed excitement in questioning (diary, p18 STIND; colleague's note 2, MOTIV). Instructions given were perceived to be clearer in this session (diary, FORMAT)

The claims I made on reflection of the activity were

- a. Such an activity is appropriate for a combined group and class discussion.
- b. The group and class discussion helps clarify concepts.
- c. The nature of the task involving group members sounding out ideas and the subsequent class discussions may stimulates critical questioning by students.
- d. Students' successful engagement in activities mirroring those of biologists of history may increase student confidence.
- e. A group product and reporting help monitor achievement aims pertaining to concept learning goals of groups.

### Activity 2

This was a group discussion on 'what is a plant' (problem-solving) to elicit, share and pool ideas. A poster was developed by each group on the topic and the discussion was audio-taped in each group.

Collaboration: All members of groups were perceived to participate with much 'discussion and deliberation' (colleague's note 2, PART3). The tape playback also revealed this and input of ideas from every member was heard (session 2 tape). On cross-checking between taped playback and the posters, it was observed that some ideas of each member's input was used to draw up the posters, except for one member's input in Group B (S6), which input was minimal. Some ideas were discarded by agreement, eg., S8's (Group B) idea of 'animals also have cell walls' and some were clarified, eg. S3's distinction between 'movement' and 'locomotion'. More information on participation was revealed on playback than on classroom observations. Students enjoyed the session (diary, p19 AR). Cooperation during poster assessment was observed (diary, p19 ASSESS; colleague's note 2, ASSESS). I claimed that, in the absence of taping.

**Monitoring group member collaboration is problematic in the classroom.**

Dominance: Talk-time was dominated by S1 and S2 in Group A. S8 (Group B) seemed to want to direct/bring members 'on-task' (session 2 tape). I claimed that

**Monitoring dominance patterns in the classroom is problematic.**

Alternative Concepts: These were about day and night gaseous exchange patterns in plants (session 2 tape, AC). Posters revealed such alternative concepts also (diary p19, AC; colleague's note 2, AC). Undetected alternative concepts occurred as revealed on the tape playback, eg., Group B - 'plants are....lazy'; Group C - 'plants will use carbon dioxide...for respiration' (transcripts 2 & 3). More information on alternative concepts was revealed on playback. Alternative concepts on poster could be clarified by the lecturer (diary, p18 AC). Claims made about alternative concepts were

- a. Posters reveal some alternative concepts.
- b. Monitoring the clarification and explanation of alternative concepts within groups is problematic.
- c. Group members may not be sophisticated enough to pick up certain alternative concepts.

Assessment: Groups assessed posters and gave scores for content (max 5) and appearance (max 5) with some guidance from the lecturer in a class discussion context (diary, p18 ASSESS; colleague's note 2, ASSESS). Peer assessment was perceived as stricter than lecturer assessment by both the colleague and myself (diary, p18 ASSESS; colleague's note 2, ASSESS). In awarding marks groups did not give reasons for the scores (colleague's note 2, ASSESS). I spoke about criteria on the evaluation of poster quality. The posters were perceived to be better than previous ones (diary p18, PART3). Students found inter-group (peer) assessment as fair (diary, p26 ASSESS; 'most/least liked aspects') and enjoyable.

Individual written notes on 'what I learnt about classification thus far' were assessed by me (max 5). This revealed some concept learning development of students with most students obtaining a mark of 3.

Individuals also scored their own participation in the CL groups (max 5) and these ranged between 3-4 showing a feeling that they worked well in the groups.

The claims that I made about assessment were

- a. Intergroup peer assessment may be perceived by students as fair and enjoyable.
- b. Peer assessment practice may be introduced gradually.
- c. Given criteria of poster (product) assessment may help in the production of better quality posters (products).

Group-work Evaluation: Individuals statements were made on what was liked most/least in CL practice. There were 3 people who did not respond to what was liked least and 2 who found 'nothing' that they did not like. Other dislikes were that alternative concepts were not explained during group-work (S10), insufficient time to learn from others (S11), the views of others not being considered (S6), the compulsion to consider other views (S12), there was a dominant person in the group (S3) and men dominate (S1 - a women who was in the all women group in the first session). S1 went on to say that a small percentage (~55%) of her total contributions was used.

S1 and S3 were in the same group with S2 and S4. S1, a women, mentioned dominance by male members, whereas S3, a male member, mentioned a (nameless) person as dominant. The lecturer's initial perception of S2, a woman, as being dominant, at least in 'talk-time' was ruled out by S1's perception and S4, a male member, was not perceived as being dominant by the lecturer.

Generally the 'least liked' aspects correlated with the 'problems' mentioned at the initial interviews although other 'problems' of group-work mentioned during the interviews were not mentioned as 'least liked' aspects, viz., 'shy' members (S8 mentioned that CL was an advantage for shy members), language problems, 'coasters', not sharing ideas, 'noise' problem and inadequate clarification of topics.

There were 12 different 'most liked' aspects. and these correlated well with their initial perceptions of group-work. Mention was made of liking the lecturer's input in clarification of 'strange' terms and more information (S4) and satisfaction was expressed of the way marks were allocated (S7).

I claimed that

a. Reflective activity is important to reveal certain constraints (like dominance, time, resistance to the incorporation of other ideas) to effective CL to students.

b. The things that are most liked about CL may outweigh those that are least liked during CL implementation.

c. Some women perceive men as being dominant in CL practice and may prefer to work with other women during CL.

d. Confirmation of identification of a dominant member/s in a group with group members may be required as perceptions may differ.

d. Positive initial perceptions may be expressed subsequently as preferences with CL implementation, and may be thus reinforced.

e. Some initially perceived problems of CL may be maintained and reinforced with practice.

Session 3

#### Activity 1 : Transcript Analysis

Based on what was heard and analysed during playback of the audiotapes of the first two sessions, it was decided that a focus on 'undetected' 'misconceptions' or alternative concepts be used at the beginning of the third session. This strategy was discussed with the colleague who was in agreement. Although some of the discussion in Group A was observed by her, no observation notes were made.

Each group was given a short transcript of what had been said in a CL activity, for the purpose of identifying 'undetected' alternative concepts, and to look at ways of overcoming such situations. It was hoped that this would lead to a discussion of strategies that may be needed to facilitate such detection.

Group C did not identify the alternative concepts: that 'plants will use carbon dioxide - for respiration'; but focussed on 'day/night' gaseous exchange in plants instead (diary, p21 AC3). My prompt facilitated the identification (diary, p21 LROLE), and members saw the significance of ignoring alternative concepts (S12 - 'Oh..yaa..'). I claimed that

Students (and pupils) may not have the necessary schema for detecting alternative concepts.

Group A was observed by the colleague lecturer who reported that they had detected that the response given by two members to another member's idea that 'I don't have an endoskeleton', did not dispel the alternative concept, but reinforced it. During the class discussion it was emphasised that in certain instances during CL, members are so intent on making their own points that some things said may be 'blocked out' (diary, p23 AC). I claimed that

Some mistakes/alternative concepts, perceived as incorrect by other members, may remain unclarified and are reinforced.

In Group B, S7 interpreted the idea that 'the rain or an animal...feed them (plants) with water' as a language idiosyncrasy since he said "In Zulu we say feed the plant with water". It was brought to their notice that the English speaker among them (S8) failed to detect this alternative perception and that this could be seen as problematic. They were also asked to focus on the appropriateness of the words 'lazy' and 'not active' used to describe plants and it was agreed that these were inappropriate and that words referring to 'locomotion' were intended (diary, p21 LANG).  
I claimed that

a. Language idiosyncrasies and everyday language may reinforce alternative concepts.

b. Relevant analysis of transcripts may help students perceive such activity

a worthwhile activity for effective CL practice.

### Activity 2 : Group Construction of CL Rules

Based on the assumptions that exposure to CL and reading about CL skills could facilitate the construction of CL rules for unit groups, on analysis of the reflective responses in what was 'least liked' and 'most liked', on the perceived importance students had of such rules and on a similar tentative idea emanating from tape playback analysis, a session on group discussion and construction of tentative rules was planned for this session (diary, p19 STIND LROLE). The activity was posed as a strategy for students to organise group sessions and there was agreement that it was a positive strategy (diary, p22 AR). The discussions of groups A and B were inadvertently taped. Thus, I claimed that

Students involved in CL may perceive the generation of group rules as a positive strategy to help ensure effective CL sessions.

Many rules that were generated reflected examples given in the literature like in Brandes and Ginntis (1986, p40).

I claimed that

Student generated group rules may be seen as similar to those of other CL situations.

Dominance: Although all members participated in groups A and B, on reviewing the playback one member of group B (S8) was perceived to dominate talk-time and direction of talk, even resisting attempts of bringing him 'on-task' (as perceived by group members) by members. Some rules, however, were generated cooperatively by the group. In group A, S2, an English speaker, was perceived to take on the roles of explainer, initiator and scribe, but all inputs were discussed in the agreement of rules.

I claimed that

An English speaking student may tend to initiate, explain and clarify ideas in a group whose other members are second language English speakers.

I saw this as being potentially advantageous and disadvantageous - advantageous in that clarification may help promote participation of other members and disadvantageous in that such self-imposed roles may perpetuate dominating patterns.

I claimed also that

- a. A member may be dominant by nature.
- b. Group members may perceive dominating processes.

On reviewing the group rules that were generated I claimed that

After exposure to some spontaneous CL, groups may generate rules similar to ones that are generated by other groups.

### Activity 3: Classifying

The intention of the activity was for groups to coordinate the selection of relevant observations inherent in a present classification system (the 5 kingdom system) used in the course, using 10 specimens (from the garden) traditionally grouped as plants by previous historical systems. My intervention was limited to time prompts and response to group request for clarification of terms (gametophyte and sporophyte, by group C) (diary, p22 LROLE). The non-intervention strategy made me feel at a 'loose end' and uncomfortable (the colleague was not present for this period).

I claimed that

The periods of non-intervention during group CL sessions may be unfamiliar for the teacher and perceived as in tension with the 'traditional' duties of a teacher in teaching and learning in the classroom.



I was involved in planning tasks, observing, time management and facilitating class discussions. Playback revealed that all members made inputs that were subsequently used in the written task responses. S8's 'dominating nature' was monitored and it seemed that insecurity of 'knowledge' of certain concepts generated appeals for confirmation and explanations of ideas (he 'sounded out' ideas) from other members. His perceived 'dominance' was seen as limited to issuing instructions pertaining to organising the 10 specimens in order, before observations began (session 3 tape). I claimed that

**Dominance patterns may be related to cognitive demands of tasks, cognitive ability and cognitive security of individual members in a CL group.**

Generally members helped each other in focussing observations made on specimens. In two groups, alternative concepts were related to the placing of non-Plantae specimens into Plantae divisions, and non-anthropophyte ones into anthropophyte classes. The format of the hand-out representing a classification system may have been a problem for these groups. Group C members seemed to coordinate their observations well, although errors (two) were made in placing the grass specimen in the accepted division. The written task responses confirmed the use of ideas, alternative to scientifically accepted ones. I claimed that

**Verbal clarification by the lecturer may be needed to reinforce written reference hand-outs.**

Students were given a copy of a journal article 'Young People's Ideas on Plants' to read, as a way of encouraging reflection on common alternative concepts, based on a claim that

**Reading about research on areas related to a topic may extend reflective ideas on the topic.**

#### **Session 4**

Session 4 comprised one period (40 minutes) since the colleague conducted a classification exercise with students in the second period. All students participated (session 4 tape; diary p24, MONIT), although S8, in Group B and to a lesser extent S10, in Group C tended to manage the activities. This gave strength to previous claims about dominating patterns in these groups.

#### **Session 5**

The session was planned so that students worked cooperatively on a task for 40 minutes with a class report back of 20 minutes, each group using about 5 minutes for this. The plan was adhered to probably because of clear instructions on time limits. The group task was to design an activity suitable for a standard 5 class on the topic 'classification' as it appears in a department syllabus, incorporating CL. I claimed that

**Practice in group collaboration as in the implementation of CL at pre-service level may be perceived as enabling such practices at the classroom level.**

Collaboration on selecting teaching material was seen to occur in the group session. Each group focussed on different material: Group A on 'grouping things', Group B on 'observations' related to the classifying process and Group C on 'observations' as had group B but also on the 'construction of identification keys'. I claimed that

**Group collaboration on curricular concerns during pre-service years may enable students in such collegial collaboration practices in the field in later years.**

Much discussion was observed (diary, p27 PART) and it was perceived to be due to the open-ended nature of the task, and the larger proportion of time allocated for this task than for previous ones. I claimed that

**The more open ended the task the more time may need to be allocated for the task.**

During the CL session a member of group B (S8) walked across to another group and was asked to return to his group by the colleague lecturer, who perceived the act as violating the idea of group member participation. The act was perceived later in discussion with the colleague as possibly representing an



attempt for help. I claimed that

a. Report back sessions may be insufficient to serve a need for intergroup sharing of ideas.

b. Certain students may want to change groups after a few sessions.

Each group used a member who had not reported back thus far to present the report back, this without lecturer intervention possibly applying rules related to roles that they had generated. I made the claim

a. Groups may take it upon themselves to rotate roles in CL sessions.

b. A focus on the generation of rules may help in equitable distribution in group tasks.

## CONCLUSION

The first cycle of 5 lecture sessions had generated an unwieldy number of tentative hypotheses. The AR approach yielded information on other aspects not planned to be illuminated -

**AR reveals more than what is anticipated**

A reconnaissance session was planned by me with negotiation with the colleague (memo and discussion), partly on the rationale of student research participation and student development of practice informed by reflective practice, and partly for the planning of the next cycle.

## DESCRIPTIVE-INTERPRETIVE REPORT II SESSIONS 6-11

This is a descriptive-interpretive report on cycle two which was initiated with *Reconnaissance II* in session 6 and comprised a further five sessions.  
**Session 6**

This session was introduced by contextualising both the stages of the course and the research. The idea of subconscious and conscious reflective practice was introduced and the latter was mooted as a potentially worthwhile exercise. Thus agreement for the reconnaissance session was obtained.

The following aspects abstracted from the analysis of the previous lecture sessions were discussed in groups: dominance, language, time, alternative concepts, group size, group rules and changing groups. The discussion of each aspect was semi-structured in that dilemmas (at least one per aspect) were proposed as foci in a hand-out ('Reconnaissance II'). Students discussed these with the vision of sharing ideas in the class report back using a poster presentation of a statement on each aspect. Students were perceived to be on task (diary, p32 PART; colleague's note 3, PART).

The session was concluded with the following review presented by the lecturer to encourage reflection, due to time constraints (groups wanted more time for discussion) disallowing further class discussion:

1. It was agreed that some form of dominance, 'intentional or unintentional' (Group A input) may occur in CL practice. Questions posed - what strategy(s) could we use to address this problem; how can talk-time be controlled; what if this talk is perceived as worthwhile?
2. It was agreed that language proficiency may be enhanced by talking - how should this be encouraged?
3. It was agreed that time may always present a constraint since a topic may engender many different ideas - how do we control this?
4. It was agreed that alternative concepts may be reinforced during group discussions and that some were detected through tape playback - how can a teacher detect this in the classroom where there are many groups working at one time?
5. It was agreed that a group size of 4 members was feasible in this context and that using larger groups could limit individual participation of members.
6. It was agreed that group rules may be necessary in addressing many problems, experienced and foreseeable.
7. It was agreed that the topics thus far were appropriate for CL - are all topics appropriate?
8. It was agreed that the possibility of sharing 'new' views as a result of changing groups was a worthwhile reason for such a strategy. It was agreed, however, that report back sessions were adequate in this case and that the

groups should not change - what do we do if certain members are 'bored' with their group; should intergroup contact during CL be accommodated as a strategy?

The idea of monitoring was also mooted, partly as a response to the positive responses on group rules by all groups, and partly as a way of facilitating reconnaissance, in the guise of building in:

- \* observation of each group by a group member with observation notes for CL sessions, administered on a rotating basis;
- \* a journal of reflective notes (semi structured) kept by each member.

The class seemed amenable to the suggestions and a hand-out outlining some guidelines on monitoring ('Monitoring') was distributed for reading to each member.

Roles seemed to be rotated in this session, eg., there were two new presenters. The students seemed to be on-task. Time had to be extended - I perceived that it was an absorbing task and that motivation was probably related to the relevance of the discussion on how each group worked. Participation was perceived to be high during the group discussions. On classroom observation the perception of the colleague and myself, was that there was much debate, explanation, consensus building, openness and 'uninhibited' inputs.

The discussions of the first 3 aspects were taped in different groups: language in group A (chosen on the basis of a comment made by a member, S1, that another member, S4, could speak in Zulu if he wished), dominance in group B (on the basis of a perception that one member, S8, tends to dominate group discussions), and alternative concepts in group C.

#### Language

The transcript of the discussion on 'language' revealed that 3 members, S2, S3 and S4, mostly participated in generating ideas, with the fourth one's, S1's, input limited to reading out instructions. S2 seemed to be the organiser, and being English speaking tended to clarify S4's ideas even interrupting him at times (twice in this 6 minutes or so), whereas S3 tended to rephrase S4's ideas for clarification. S3 was perceived to be unhindered by his second language usage and his proficiency is displayed in the expression of his ideas. Although both S1 and S4 had problems with expressing their ideas, S4 was undeterred by it in that his input was frequent. His input was perceived to be of a high level of cognition. Some of his 'valid' ideas, however, were not used and some even rejected by the group members. S1's idea that a second-language speaker found it more difficult to understand scientific terms was accepted, but not extended into discussion. There was evidence of 'listening murmurs' indicating that members listened to each other.

The paucity of S1's input may be seen as stemming out of insecurity of expressing herself in a second language, by being unsure of concepts (perceived to be an 'average' student), exacerbated by members ignoring her ideas. S4, on the other hand, was perceived to be an 'above average' student and group CL was seen to have potential for him in the development of language proficiency, especially since he was seen to be uninhibited in his input, thereby enhancing his performance. His self-esteem was perceived to be higher than S1's, although he regularly apologised for ideas, that were seen as invalid by the others.

The group was seen to value S2's, and to a lesser extent, S3's ideas, without regarding them as dominating. The group, however, referred to dominance as being both intentional and unintentional in their report, perhaps indicating that they had worked through this aspect. Mention was also made of the problem seen by English second language members, in interpreting instructions given in English.

Group B's input in the report back confirmed the idea that second language speakers lacked confidence and group C decided that group CL discussions helped in the development of language.

The claims I made on 'language' were

- a. Instructions may need to be clarified not only by the teacher, but also, by peers in a group at the beginning of a CL session; members who are

proficient in the language of discussion may be included in a group for the clarification of instructions and concepts.

b. Members of a group may be made aware of practices that discourage inputs.

### Dominance

The transcript of group B's discussion revealed that most ideas of the group emanated from S5, S6, and S7, with S8 asking for assurances that he was not 'bossy' (which assurance was given), perhaps arising from S6's idea that he was the dominant person of the group: and with S8, initially attempting to direct their discussion to a specific focus by asking, "So, how do you think we should eliminate one person being dominant in future." The initial ideas, however, revolved around S7's assertion that a prerequisite for participation be an understanding of the topic and possessing information on the topic and that a person with such information be allowed to dominate the conversation.

Most of the conversation was in the form of a conflict concerning individual talk time between the idea that a person should be checked if an idea is perceived as not valid, initiated by S6 and S5's responsive idea that a person should be allowed to speak through his or her idea even if others perceived the idea as not valid. S7 in attempting to resolve the conflict by saying that S5 had a good point and, "I'm not denying it", ended up cautioning the group on time constraints and defending S6's idea, by saying that interruptions were necessary at times, to which he had support in S8's comment, "If it's irrelevant we don't have listen to it". The statement on the group poster, however obscured the conflict in that it reported a decision that 'a person may not be interrupted' in favour of S5's argument.

All the members seemed to be fluent speakers and unhindered by second language usage. No mention was made of dominating patterns resulting from superior language proficiency.

Group C had reported a decision to delegate tasks within the group to help them eliminate any dominance.

Claims that I made on 'dominance' were

- a. Groups become aware of dominating occurrences, and generate rules to obviate these on reflection.
- b. Time may be set aside for the detection and reflection of dominating practices during CL sessions.

### Alternative concepts

The transcript on group C's discussion of 'alternative concepts' revealed that ideas were generated mostly by S10 and S11. S9's input was limited to an instance of attempting to clarify an idea of a member, perhaps in trying to clarify for others, and another of anticipating a word to complete a statement made by a member. Apart from the idea that hindsight may reveal earlier alternative concepts possessed by a person, an idea accepted by the group, S12's input was limited to agreeing in his characteristic manner ("Oh! Ya-a"). Other ideas accepted on ways of revealing alternative concepts were S11's of 'recording' (rephrased by S10 as 'a poster') in a group product, 'evaluating' decisions, and that a member's alternative concepts may be perceived by some other member but may not be expressed due to language constraints. S10's ideas that were accepted were that teachers should deal with alternative concepts immediately (the only idea used in their report) and that group learning helped reveal alternative concepts.

S9's participation was perceived by me to be that of listener, whereas the colleague on listening to the group's discussion on dominance, observed it to be that of 'observer' (colleague's note 4, PART). Perhaps S9 was 'shy' during the colleague's observation, since she had mentioned, in her interview, that she was a shy person.

No mention was made of teacher observation of groups, as a way of revealing alternative concepts, by any of the three group presentations. Group A echoed the idea that the report back was a way of revealing alternative concepts, and group B the idea that hindsight would reveal it. Group A also mentioned that teachers should always guide learners to shift alternative concepts, omitting

to focus on the 'absence' of the teacher from a particular group's discussion. Claims that I made on 'alternative concepts' were

- a. Students do not find it significant that alternative concepts may go undetected and thus reinforced by social approval in peer interactions; lecturer intervention in the form of guidance, supported by literature information, in such a case may be required to focus students on looking at ways to improve the detection of alternative concepts.
- b. Saturation has been reached on the assertion that group products like poster reports may help in revealing alternative concepts.

#### The Other Aspects

**Time:** Group A commented on the limited time they perceived for discussion in CL sessions of the course, and Group B observed that it takes some people a longer time to express ideas; but only group C made a decision to manage time in a flexible manner dependent on the nature of a comment. The time spent in CL was perceived to be worthwhile by Group C although more time was needed for CL than for traditional lessons, whereas Group B thought that because of time constraints, time should be managed for both CL and traditional lesson formats. This was highlighted in the class discussions by me, as mentioned earlier.

**Group Size:** This aspect was perceived to be trivialised, with proposals like one of about 6 (group B), up to 8 (group C) and depending on size of class (group A). This was highlighted by me in class discussion, as reported.

**Group Rules:** All decided that these were necessary, for discipline (by group A), to avoid chaos (group B) and that it should be monitored (group C).

**Appropriateness of Topics:** Group A found CL appropriate for problem solving, Group C for sessions as in the course, and Group B as part of a lesson, with the introduction by the teacher, who had to be careful not to pre-empt children's ideas, which they thought were valuable.

**Changing of Groups:** Group C was against this because they thought that members 'bonded', whereas groups A and B felt that it was a good idea to fulfil the need to socialise/familiarise with ideas of others (group B), and to develop skills of working with different types of people (group A). All groups, however decided against changing their groups. Further claims I made were

- a. Students may not see the need to plan with the assumption that the time involved in CL may need to be considered as a curriculum concern.
- b. Students may need to visit questions around the idea that all topics are appropriate for CL.
- c. Students perceive that group rules may be necessary for effective CL.
- d. Group size may be seen by students as a trivial aspect of CL management.
- e. Students involved in CL within particular groups may resist changing groups.

#### Session 7

Peer observation was implemented, using observation forms and was to be implemented on a rotating basis. S3 chose to observe in group A, S8 in group B and S10 in group C.

Students were involved in 2 activities, viz.: making poster sketches of monocot and dicot specimens indicating main morphological features; and on choosing a part, each group discussed the definition, functions and types of the part and made a poster representing the discussion to be used in a report.

The focus of observation during the activities were the factors that had been discussed during the reconnaissance session.

#### Time

Allocations of time were strictly adhered to, promoted by external factors like the regular prompts given by the lecturer and the time specifications given in the activity hand-out. Time, however, was not controlled during the questioning period after each report and the peer group assessment of the posters had to be postponed for the next session.

Member observation revealed that group C did not manage their own time, perhaps depending on external time prompts, and group B had (group A's observer had not responded to the time aspect).

I made claims that

- a. Groups may habitually rely on external prompts to manage time.
- b. In managing time, I need to manage that allocated to responses during class discussions.

### Dominance and Participation

I perceived that all the students were participating (diary, p37-41 PART; colleague's note 4, PART). In group A, S2 presented; S3 observed and had decided not to participate in discussions. Playback of the second activity revealed that most inputs were made by S2 and S4, who 'sounded out' ideas with each other. Fewer ideas of S4's contribution were taken, most being valid ideas than not; whereas all except one idea (that had been clarified by me at S4's request) of S2, had been taken and used in the presentation. S1's contribution, however was limited to 3 inputs and, generally, to agreeing with what was said.

S2 tended to clarify and rephrase contributions. She also corrected pronunciation and listened critically. S4 tended to rescind his ideas easily on opposition. He listened reflectively to all contributions. S3 clarified on occasion towards the end, although he had decided not to participate as observer.

In group B all members participated including S8, who was the observer for the session. S6, S7 and S8 helped with the ideas and lay-out of the poster whilst S5 wrote. S6's input was less than the other inputs, limited to directing members to a task on two occasions and to general agreement, although one of her ideas was used. A suggestion from her regarding the poster was opposed by S7. S7 seems to direct and select ideas of the group. His ideas were taken in the main. There seemed to be patterns of dialogue between S7 and S8, with S8 'sounding out' his ideas on S7 and accepting censure of ideas, even though some valid ones were regarded as invalid. S7 tended to clarify, especially for S8, and I perceived him as dominant, generally.

A conflict had arisen around S5's idea that the definition and function should not be the same, and S7's idea, which was supported by S8, that it should remain together. S8 seemed to have confidence in S7's suggestions and there seemed to be a 'ganging up' against S5's ideas in a new pattern of dominance. S5 did not succumb without a strong argument. S6 did not enter the conflict and remained aloof in the debate.

In group C, a pattern of dominance seemed to be emerging, with S11 dominating both the conversation, taking on the role of directing and taking over the poster production from S12. His dominance, however, seemed to be paternalistic in that he undertook to giving praise for S9's input, that was used in the presentation. S9's input was higher than in the previous session, perhaps in anticipation of her presentation. S12's contribution was limited to agreeing to what was said. Most of S11's ideas were taken. S10 who was the observer for the session, clarified for the group in one instance.

The claims I made on 'participation' and 'dominance' were

- a. In equal gender groups, males may tend to group together in a conflict situation with a woman member, especially if another women member does not enter the conflict.
- b. Language proficiency of a second language may determine participation.

### Alternative concepts

Once again alternative concepts were revealed by a product (the poster). These represented most of the alternative concepts that had arisen during the discussions, although the ignored valid ideas were not revealed. Group A was perceived to be the most productive in the generation of ideas. The poster, however, did not represent this.

I claimed that

- a. Most alternative concepts in a discussion may be revealed by a product.
- b. The product may not reveal all ideas (including valid/invalid and discarded) generated in a discussion.
- c. A task product may be designed to reveal more, as far as ideas generation and alternative concepts are concerned.
- d. The most productive group may not produce the best product and this may have implications for assessment.
- e. The presentation may obscure the quality of the production of ideas.
- f. Assessment of CL may need to include the group interaction process and the production of ideas and this may be implemented by means of finding ways of assessing the total input/participation of members, the acceptance of inputs/rejection on substantiated grounds, the validity of ideas (the quality of ideas), giving help including support in listening, agreeing, clarifying, formulating products, and assessing group mutuality.

## Language

In group A, S3 (an English second language speaker) and S2 (an English first language speaker) were seen to be fluent and articulate; S1 had average language proficiency and was an average achiever; and, although S4 had problems in expressing his ideas, he was seen as not being deterred by this, in his participation. His language constraint, however, was noted as constraining him in defending his sometimes valid ideas.

S4's case presents a research question - a motivated second language person, undeterred by language constraints in participating, may enhance his/her performance by interacting with ideas in a CL environment.

In group B, all were perceived to be proficient in the language, although 3 members were English second language speakers.

In group C, S10 (English first language) and S11 (English second language) were proficient in the language, whereas S9 and S12 (both English second language) were reasonably proficient, although S12 took time when speaking.

I claimed that

- a. In the absence of language constraints other inequalities, like those of gender, may be significant and may be revealed in determining patterns of interaction in CL.
- b. Cognitive roles may emerge in group discussions, and these may be seen to fluctuate according to the nature of the discussion and managerial roles imposed by a group.
- c. The anticipation of presentation by an individual may increase the participation of that individual, and this has management implications.

## The Product and Assessment

During the clarification of alternative concepts apparent on the first poster, it was perceived by the students that the discussion, questioning and guidance by the lecturer, were needed for learning and for group and self evaluation processes.

I claimed that

- a. A report back class discussion may be seen as a reflective practice.
- b. A product may be designed to include lists indicating what was accepted/discarded, what was consensually arrived at, what was not consensually arrived at, and other aspects reflective of ideas that were generated; and this would enhance assessment practice.

## Monitoring

Member observations of group A, revealed: that all participated (confirmed by the playback and my observation); that all tried to make each other feel good, all were listening and paying attention to each other, usually asking questions of each other, and trying to answer questions (confirmed by playback); that there was no dominance in talk time, no one person issuing instructions and no organiser (different to my perception); that roles were

rotated; and that rules were used, especially one pertaining to members expressing themselves so that all understood.

Member observations of group B were confirmed on playback, with the exception of the observation that members always tried to answer questions (S6's question had gone unanswered), and that all had a chance to lead (not S6, as revealed on playback).

The observers of groups A and C noted that alternative concepts were made and that those in A were clarified by the lecturer and those in group C by a member but was ignored. Group C's observer also mentioned that members did not listen to replies and that if members listened to one another's point of view, interactions would be improved. My perception, however, differed in that I perceived that they listened critically.

I felt that observers tended to interpret the aspect of role rotation as those of managerial ones. Group A seemed to work within an intergroup competitive mode in the poster production, according to their observer.

I claimed that

- a. Member observation may be seen as worthwhile both for reflection and for obtaining different perspectives.
- b. A need to distinguish between managerial and cognitive roles may be reflected on, in describing rotating roles.
- c. Saturation may be reached in the idea that students may not have the necessary sophistication to detect alternative concepts.
- d. Anticipation of assessment may encourage inter-group competition.

## Session 8

The colleague's observation notes were of a procedural confirmation nature (as in the previous session). Students were reminded of their observation and reflective practices. A review highlighting certain aspects was made:

- . said that reinforcements of alternative concepts by peer social approval may not shift alternative concepts later
- . suggested that the strategy of making the 'ideas generation lists' to be enforced for the session
- . suggested that questions be limited to one per group
- . reflected that anticipated presentation may enhance participation.

The peer group assessment of posters was commented on by the colleague (during the session) as not being carefully awarded, since she noted that marks awarded for content seemed incongruent with what was on the poster. It did seem as though groups were aiming to award an overall mark of 50% to each group. Students did not react to this and did not modify their marks. My response was that since they had been guided on a previous occasion and that the alternative concepts had been indicated on the poster, it seemed possible that fairness in awarding marks would occur.

I pointed out that playback had resulted in the perception that group A had been the most productive and yet the poster did not represent that. The implication for assessment was posed for reflection and the implementation of productivity evaluation (with its various aspects) was proposed for CL activity in the session.

## The CL Activity

Students were to pool the information they had gathered on modifications of the part they had chosen to study, and to select 4 of these to be represented as illustrations on a poster. A list of ideas that were not used was to be generated for reflection at a later stage. This was to have been a rough poster to focus on the second activity spanning the remaining part of the session and a further session culminating in a 'teach session' of twenty minutes for each group on Wed 15.03.95.

The time limit of 15 minutes for the activity was adhered to. The poster display revealed that group B had misinterpreted the concept 'modification'. It seemed that group B had not done the relevant research, an idea perceived by perusal of the product, playback and perusal of S5's reflective note



("...because I had not ...prepared beforehand"), although they gave assurances to the effect that they had researched the topic. On playback only some members of the other groups were perceived to have done the relevant research.

Playback also revealed that ideas were generated in all groups although the discussion of each idea was seen to be high in group A. S2 and S3 generated most ideas in this group, with S4 verbally rehearsing these ideas in 'sounding out' the ideas on S2 and S3. One each of S3's and S4's ideas and 2 of S2's were used on the poster. S1 was involved in the making of the poster and in agreeing to what was discussed. The group accepted all but one idea (S3's example of the carrot as a modified stem) were accepted by the group, although these included some invalid ones.

Group B's strategy was of generating the minimum number of examples and placing these on the poster as they were made with very little discussion amounting to brief accepted clarifications given by proposers (2 from S7, 1 from S8 and 1 from S6). S5 was involved in observing and agreeing to the examples. Only two examples of the 4 that were proposed were valid. Productivity was evaluated as being very low in this group.

In group C, a list of examples was given by S10, probably because she had done the required research, and this seemed to inhibit the proposal of examples by others. Also it seemed that these examples were not understood by some (eg. S12's later idea of 'spines' which had been in S10's list). An idea given by S11 was accepted, and S9 had not internalised the concept (as revealed by her idea of palm leaves used for basket making). Again S11 had been perceived to be clarifier for S9, whereas S10 clarified for the group. The productivity of the group was perceived to be low since most of the ideas used and selected were those of one member.

I claimed that

a. Saturation was achieved in the ideas that:

- \* Assessment of group CL may include the evaluation of the participation and generation of ideas, in addition to the product. 'Participation' may include aspects like initiating, clarifying, accepting, rejecting with substantiation, judging and collating of ideas and the resolution of conflicts; 'generation of ideas' may involve the overall cognitive productivity of the group.

- \* Alternative concepts may go undetected in a product.

b. Inadequate and unequal preparation of assigned work by members may result in ineffective CL.

### Reflective Note on Action Research

The reflections in the research diary (eg., p 46) to the effect that the AR methodology was appropriate for implementing CL innovative practice, generated a claim related to my initial research question.

Action-research may be a suitable way of introducing and implementing CL practice.

### Session 9

Students continued with the research on modifications which had started in session 8, and discussed their strategies for the 'teach session' scheduled for session 10. Students were asked to hand in their reflections on the CL involved in preparing for the 'teach session'. Some students (S2, S3 and S10) handed in reflective notes after the 'teach session'. The groups were also asked to generate a list of 'ideas used' and 'ideas not used' for this period of preparation and these were handed in after the 'teach session'.

The reflections of 2 members of group A, indicated that participation was good in the group, although one (S3), thought that he could have participated better. Participation was regarded by the other member (S2) as generating ideas ("... each one was given a chance to air views and ideas with regard to the lesson plan and activities"), as critiquing ideas ("If a person felt that an idea won't be suitable to use he (sic) would say so") and as explaining



ideas ("If we didn't understand something another person was always willing to help"). In group B, "...everyone participated fully.." according to S5's reflective note. The group C member's (S10) reflection indicated that the group "worked well together to get the notes done". These thoughts about the participation level of members may be seen as coinciding with those of my observations, that groups had worked collaboratively during this research and planning period (diary, p47 PART; p48 PART).

This aspect was further illuminated by the interviews that focussed on 'participation', in that personal participation levels were seen to be at varying degrees, eg., S6 and S11 were happy about their participation (S11 - "I participate as well as I should ..promoted by a desire to find out what I may not know.."; S6 -"..improving - as get more ideas - feel free to give mine.."); S3 felt that, although he had made an effort, he did not think it was a "maximum" one; S1 felt she participated well for certain sessions but if the concept was "new, new, new... may not participate well"; and S9 felt that it was "not as well as I should ... I need to refer to books..". S1 and S9 had been perceived to be the least participating in their groups by me (eg.,diary, p45 I PART) and by S11 referring to S9's input (interview with S11). S6's participation had been perceived to be fluctuating by me (eg., p45 I PART).

I reflected - perhaps if individual reflections were undertaken diligently a more detailed picture of personal participation would emerge for students.

To obtain a 'richer' picture of participation levels of members of a group, interviews (Student Interview II) were done with 5 students, although 6 were planned (one student did not make the interview): S1 and S9, who had been perceived as comparatively low participants, S6 as fluctuating in participation levels and 1 other member of reasonable participating status per group. The interviews were also motivated by the perception that equitable participation had been a problematic issue (made from observations of sessions, eg. session 8 CL and tape analysis of that, observations made by the colleague lecturer, eg., as in the diary (p 45 I PART), and in the colleagues note (note 3 PART) and reflections made by students as observers, eg., 'Evaluation of Group-work', S10, 6/3, and as in their reflective notes, eg., "enhance the process ... more participation", S3, 15/3).

### Student Interviews II

A few introductory questions on checking perceptions of CL were asked at each interview. All students interviewed still thought CL to be worthwhile, with S6 saying it is the "best" for learning, S9 that the sessions in the course had "encouraged her", S3 saying that it was "more useful than theory" and that the problems of CL that he had mentioned in the last interview, were being worked on "indirectly...in the process being 'solved'" and S11 changing his view that students were not "well informed" since he felt that although "some ideas may not be correct" there were "elements of truth".

The focus on participation revolved around the aspects of 'language', 'shyness', 'self-esteem', 'patterns of dominance', 'topic', 'roles', 'concepts', and 'reflection', which aspects were included in a checklist used during the interviews.

S6 did not see herself as shy and S11 saw himself as a person who had overcome his shyness through past experiences as a shop-steward and local chairperson of a paper union; S1 as not shy in the group ("it helps being in a group to overcome shyness"), S9 as still a little shy but not in the group ("may make more input in class..better than last year"), and S3 as sometimes shy. Group members were seen to have helped in increasing participation of perceived 'shy' members by S3 who said that they were aware of his shyness and "they help by asking questions..' [S3]...?'", by S9 who spoke about the group members helping her in that they "listen to input whether its a sentence...share my opinion" and by S11 who referred to helping S9 overcome her perceived shyness.

The confidence and self esteem of those interviewed had been perceived by them to have increased and this was seen to be ascribed to CL experiences in the course. They found that these types of experiences had helped in promoting their participation: with S3 saying "CL promotes confidence..is much.. by sharing ideas one evaluates oneself - where stand in a group - if keep knowledge to oneself even if wrong - cannot evaluate" and that CL was more

effective than whole class discussions in building confidence "shy and cannot get used to them in short while"; S6 saying "because small group ... therefore everyone has chance to speak" and that it can lead to more confidence in class; S9 saying that confidence gleaned during group-work may allow one to make more input in class; S1 saying that it had increased this year; and S11 finding that confidence increased by CL especially with his "particular problem" of having a limited biology background. S11 also felt that S9 was not "yet fairly confident" and that the group "is trying - not recurringly...to put questions to her". S11 also had attempted to use strategies learnt from his past experiences, like "if someone raises a point and he or she does not carry on and is ignored, then I come in" and he felt that the group "compromises a lot" in that an input may be rejected or ignored before it had been discussed and in that the person making the input also "compromises" by not pursuing it.

I made a claim that

**CL sessions may help overcome personal inhibitions constraining classroom interactions and consequently, practising CL may help in building self-confidence and self-esteem in a cumulative way.**

Furthermore the students interviewed seemed more 'open' in vouching information than at the first series of interviews (eg. S1, S3, S9, and S11 - diary, p54 RN). This may be tentatively ascribed to familiarity with the lecturer or even an increase in confidence on their part, among other hidden factors; or it may be seen as the development of a certain rapport desirable for a CL and participative environment.

I claimed that

**CL implementation using an action research methodology, in illuminating student ideas and allowing a more collective reflective interpretation of individual ideas and events, may help in promoting rapport between teacher and students.**

This is the very environment that is regarded as conducive to CL, i.e. CL and its prerequisite environment may be seen as mutually promotive, sustainable and constructive.

Giving their ideas seemed to be a desirable prospect for students, especially when ideas of the lecturer were 'sounded out' on them (diary, p56 AR; S1 - suggestions) and the feeling that they were involved in the inquiry into improving CL practice was perceived (diary, p56 AR).

I claimed that

**Research tools such as reflective interviews may help students perceive their involvement in improving practices like CL.**

An 'openness' on the part of students had been perceived by the lecturer, eg., in their reflective notes (as in S5's reflective comment, "sometimes it's not good because you sometimes tell yourself that the members will do the work", wherein she alluded to the 'free-riding' aspect that could develop in CL work). I claimed that

**Reflection may lead one to face one's personal participation problems thereby potentially enhancing future participation.**

As far as dominance patterns were concerned, 4 students of the 5 interviewed noted that there had been some patterns at the beginning, but that this had changed, to some extent, as the course progressed. The changes were generally ascribed to the CL sessions on group rules and on the 'reconnaissance' discussion on this aspect in session 6 (S6 - "participation is increased now because of working on dominance"). S9 saw the change as slight but "not like before", although she felt that members were not overpowering, in that they "do know my situation"; whereas S11 from the same group found that the progressive nature of introducing increasingly unfamiliar concepts in the course, perceived by him, had precipitated a feeling that "everyone is at a unified level" - alluding to dominance patterns that might have emerged due to inequitable concept background of members of differing school backgrounds. Mention was also made of the idea that a member with more information than

others on the topic under focus, may dominate the discussion but this was not seen as a dominating pattern: S9 - "[S10] was dominant...but this was for group progress", or as not confined to a single member as seen by S3. S10, however reflected, in a note, that she had been trying to "move out because ...don't want to be the person the group relies on.

S3 mentioned that dominating patterns did not exist in his group, although "one gives instructions sometimes", which was also alluded to by S1 of the same group as, "one was dominant, now less". The 'problem' S3 had referred to in his reflection of what he liked least, after session 2, as one person dominating, he said had been based on previous experiences - a misinterpretation of what was asked for earlier in the course.

Although they said that dominating patterns had receded, S1 alluded to 'talk-time' dominance of 2 members in group A - "they talk and talk .. limits other participation...sit and watch them talking" - which she felt that they were unaware of and that she "told one yesterday". S10 also reflected on this, referring to 2 named members (S11 and S12) of her group and she found that it had repercussions on time limits - "The group battles with time because [S12] and [S11] enjoy talking and try to make each fact they know known instead of giving [S9] a turn to speak" (reflective note S10, 13/3). This had not been focussed on by both S9 and S11. It should be noted, however, that S10 did not include herself as someone that should have "a turn to speak", perhaps because she was "trying to move out" (reflective note S10, 13/3).

I claimed that

**Group reflection may help in minimising dominating patterns of talk-time; students interpret dominance as in talk-time primarily and, to a lesser extent, as in the frequency of generating ideas in concept construction.**

Reflecting, identified as in reflective notes, member observations and sessions like that of the 'group rules construction' and the 'reconnaissance', were generally regarded as being helpful for future participation by all those interviewed, eg., "know what to do maybe tomorrow - can do " (S1), "I wrote about misconceptions (sic) in our group - helps me gain a lot" (S9), "good idea for each person to reflect - because it will make someone who is not participating to realize that ...depend on others...so next time.." (S3), "reconnaissance helps - because members may not be aware of what he or she does" (S11). Both S3 and S11, who had been involved in member observation of the group found it a worthwhile activity for their own awareness, eg., S3 said, "I have picked up most of these points here" referring to his proposed idea that each "person should reflect...help someone who is not participating"; S11 suggested that the "telling" by one member based on that members observations may not be effective and may be questionable on the grounds of democracy, but that it may be more effective "if all reflect - if put together a picture of feelings of the group". Students may be perceived as planning actions based on reflection, eg., as borne out by S5's comment, in a reflective note, "For the future I think that we should as a group go at the same time to the library ... because ... some of us tend to doge [dodge] the word [work]".

The poor response to the idea of writing reflective notes may be ascribed to inadequate contextualising by the lecturer, encapsulated by the comment, "...wrote reflections - don't know if correct - read guide again - found out what to do" (S1), indicating the perception of a prescriptive nature of the format of reflections.

I claimed that

**Members of a group of CL learners perceive the idea of 'reflection' as a worthy process to improve CL practice, but the structure of reflection as problematic.**

Perhaps, more guidance should have been given and this could be a focus in planning the next reconnaissance session scheduled for session 12.

The **language proficiency** was regarded as adequate by all students interviewed, although the proficiency of some members was seen as having an impact on time in that it took longer for some to express ideas, eg., S11 - "... thinking and formulating ideas...ability is there but time is a constraint", S1 - "they

understand me - but sometimes become impatient". S9 stated her language proficiency level as one of the constraints for her participation level. She mentioned that "by talking language has improved", a view that was shared by S3 ("..when you talk a lot...the more one practises'), and S1 ("improving...because more talking").

It was felt that all members understood the language used by their groups. According to S10's reflective note (15/3) the language "barrier" had been hindering their progress, as when she commented, "[S11], [S12] don't put sentences short and sweet... I personally must slow down, because I like things done in a hurry."

S1's idea that it was easier for English first language speakers to understand scientific terms (reconnaissance playback analysis, group A) had been modified somewhat when she said that it was easier for both English first and second language speakers to understand if they had done the required preparation, referring to the CL session on 'modifications'; however, S6 who was in the group that initially had misinterpreted the concept 'modifications', did not think that science language was a specific problem for English first or second language speakers since, "the group works through it". Both S3 and S11 thought that both types of speakers had the same problem with science language, as stated by S3: "I don't think first language people have a better understanding of scientific terms."

I claimed that

**Language proficiency per se is not perceived to be a problem affecting participation, but the longer time required for second language speakers in expressing ideas is seen to be a problematic aspect.**

I felt that this time constraint affecting participation could be discussed in the reconnaissance session, with a focus on looking at ways of promoting equitable participation for future action.

All students felt that giving help, eg., in response to a request or when it was deemed necessary for group participation, benefitted the member who helped in that cognitive rehearsal ensues (S3 - "..realise how to do things and realise certain mistakes...by saying it out"; S12 - "because focus on the thing ...gets revised"; S1 - "because the thing one is explaining is like revision"; S9 - "...better kept in mind"; S6 - "by saying what's on her/his mind ... you regain - you do not forget about it"). It was generally felt that requests for help increased general participation of group members, in that it "promotes discussion" (S11) and, in that it benefitted the member who asked for help by allowing further participation of the member (S1 - "helps me participate"; S9 - "if explained...participate better"), although one student, S6, felt that the receiver of help did not participate.

Participation was promoted by the clarification of concepts within the groups, and it was generally felt that if a topic under study was understood by a member, that member tended to participate optimally.

Of the 5 students interviewed three students found the sessions leading up to the presentation of the 'teach' activity as one in which there was much participation. Two students, S3 and S11 found the reconnaissance session as most suitable for participation by members and, S9 felt that it was "equal to" the previously mentioned sessions. S1 was not sure which session engendered most participation ("..wrote down which was best...[reconnaissance]...I think it's that one). On the other hand, S11 felt that the classification activity, and S9 the initial poster activity on 'modifications' was not suitable for participation (S11 - "classification...took time"; S9 - "...because I didn't know what modification was") and S3 felt that some topics allowed more personal participation ("..you know more in some - some less...don't know what to say...just sit there").

The claims I made in this regard were

- a. Students may be urged to ask and give help to increase equitable participation in the co-construction of concepts.
- b. Clarification of topic and concept by the group may promote equitable participation.

c. The nature of the task or topic may determine levels of participation by individual members or by the group as a whole.

It had been noted by S5 in her reflective note about the 'classification activity', "...I did not participate the point being that I did not understand what was going on..."

Tasks which had more open structures, wherein all ideas were taken and critiqued, eg., in the 'reconnaissance' session or in the planning of the 'teach' activity, seemed to engender more participation and promote the participation of members who were perceived to be less participative in their groups; whereas tasks requiring a certain conceptual background or cognitive ability, were found to be those that did not promote equitable participation. Perhaps if these latter types of tasks were structured so that they aim for an 'ill-structured solution' (Cohen, 1994) and where there is no 'right answer', a more equitable participation pattern would be revealed.

However it was noted that the way a particular group approached a task partly determined a pattern of participation, eg., group A had used a strategy whereby members generated examples which were critiqued and 'judged' for selection during the 'modification' poster activity in session 8 (referred to by S9 above); whereas group B generated the required four examples which were selected, with minimum clarification, as they were generated and members of group C were constrained in their participation by one member producing an extensive list of examples at the onset of the activity. Students had been required to have prepared for the session with some research, and the inequitable participation patterns of groups B and C were seen as partly arising from inadequate preparation that could have emerged as iniquitous conceptual understanding.

The traditional **managerial** roles, like those of presenter and scribe were seen to be undertaken on a rotating basis, within a group. **The cognitive role** of generating ideas was seen to be problematic in Group C where one person (S10) was perceived by S9 to have dominated in the past but, as pointed out by S9 and S11 of the same group, this had not been the present case. S1 of group A felt that all members generated ideas, although S3 of the same group felt that a leader (who brought the group on-task) should be chosen on the basis of ability to generate ideas. S6 stated that most of the ideas selected in group B were those of S7 and S8, although she said that all members generated ideas. All members of group C were perceived to be involved in selecting and collating ideas (S9 - "...I say..why don't you write this and then we discuss it and write it down"). S3 said that all ideas were selected whereas S1 of his group felt that there was some selection done by the whole group. S11 did not see much critiquing of ideas in the group but S9 felt that S12 especially questions ideas, which she thought helped the group ("because maybe I do have a question - at that particular time I didn't think about that question - it does help all of us"). S1 felt that the group took all ideas with not much critiquing taking place, conflicts having been resolved using an external resource. She did feel however that S4 required explanations of S2's ideas often. I had perceived that S4 did much critiquing (gleaned off playback of other sessions, eg., during session 7). S3, on the other hand, found that some members did not "wait for the whole development of an idea, for consolidation.." and mentioned that the group being aware of this, had been attempting to "work it out". S5 saw S7 in the group, as a person who usually resolved conflicts over selection and judging ideas, although everyone tried to help. She also saw most explaining of ideas being done by the person who "has more information", whereas S3 felt that this ought to be done by all members in a group. Much of this was being done by S2 in the group according to S1 and according to a perception gleaned off taped session (eg., session 7). All members participated in explaining ideas in group C according to S11. It has been perceived, however, on playback analysis, that most explaining had been undertaken by S10 and S11 (eg., session 8).

I claimed that

Participation may be more equitable if skills relating to the cognitive aspects of CL were developed.

It had been revealed that students may need to learn not only managerial/social skills but also how to **generate ideas**, how to **explain** ideas so that their peers understand them, how to **critique** ideas and how to **judge** and **select** them for equitable participation to occur. The contention developed was that students may not be adept at these processes, since they may not have been exposed to learning experiences of such cognitive roles and that providing an environment conducive to construction of such learning may be needed.

A reconnaissance period was planned (coinciding with the next cycle) to help bring the cognitive aspects of participation into focus in each group. This entailed planning for reflections on member interactions, to plan how each member could act to improve his/her participation in the cognitive development and processing of ideas. Further action in the course was to be based on decisions emanating from the session.

### Session 11

#### Test - Classification and Morphology

The test incorporated a 10 mark item generated by each group. Thus each student was required to answer a 20 mark section of items given by other groups. In effect ~ 30% of the test comprised peer-generated items. An item comprising 12 marks (~18%) was for pair-work response. Of the lecturer-generated items, 3 of 45 marks may have been regarded as purely of the 'recall' type. The peer-generated items, however, were all of this type. Thus in effect ~ 35% of the test was made up of 'recall' type questions.

Aspects that students found as being 'unfamiliar' were the 'peer-generated' and 'cooperative response' types of questions: in session 13, during the class discussion of student performance in the test, the colleague lecturer mentioned that the test had included types of items that students were unfamiliar with and were not exposed to in their first year course (Diary, p65 ASSESS). In reassuring them, she contextualised the marks obtained, as not very significant. The class average for the test had been 51%, 6 students scored over 50% and 6 below 50%. Based on this perceived 'poor performance' a review strategy was negotiated, incorporating a rewrite by students, not for assessment purposes but for remediation, prior to a review of the test. Students had indicated their willingness to try the strategy and were perceived to view it as worthwhile (Diary, p65 ASSESS).

It was claimed that

a. Students may need to be inducted into a new test format inclusive of items reflective of CL aspects of the course.

b. Formative assessment, as represented by continuous assessment, in the form of a college record mark, may be regarded as a 'fair' type of assessment.

Formative assessment included marks obtained for tasks during CL sessions, incorporating peer-, self- and lecturer-assessment - a type of portfolio profile of performance.

During the test session, students had been guided on aspects like how to proceed through the test items and with time prompts for the CL section.

I claimed that

The management aspects of tests that incorporate CL aspects, being different to those in the teacher's and students' experience, may require reflective practice.

## DESCRIPTIVE-INTERPRETIVE REPORT III

### SESSIONS 12-17

This is a descriptive-interpretive report on cycle 3, ushered in by session 12, a reconnaissance session. Cycle 3 comprised a further five sessions.

Session 12  
*Reconnaissance III*

The reconnaissance focussed on some **cognitive aspects** of participation. I outlined some reasons for the focus in a hand-out ('Reconnaissance III') given to students. A short problem-solving activity was used as a basis for reflection by groups (guided by the hand-out). Each group had been asked to note these reflections and decisions were made regarding the promotion of the ideal of equitable participation by each group. These decisions were presented in a class discussion.

Group A's noted reflections showed that all 4 members generated at least one proposal regarding the problem (S1 had made one, the others two each). They had chosen S1's proposal to reflect on: they found that the idea had been clarified by S1 and other members, the clarification had been accepted by the group, a question regarding the proposal had been asked by S2 and answered by S1, all members had helped and the proposal had been judged for validity; they also noted that they had to clarify members' ideas, had judged the "relevance" of each idea, question it and then had made selections.

The taped 5 minute part of the reflective activity revealed S2 questioning S4 about his perceived limited participation at the beginning of the discussion. His response indicated that he had needed to clarify what had been required before he could participate. It seemed that this was done by listening to the inputs of other members. I claimed that

**A lack of verbalisation may be perceived as a lack of cognitive participation and may obscure the cognitive aspect of critical listening.**

S2 had also questioned S1 about her initiation of the discussion this being perceived by S2, as unusual for S1 ("You contributed first - how come?"). S1's input, however had been curtailed, according to her, by S3 ("..I was disturbed...by you") and she perceived her optimal participation as being affected by this.

I claimed that

**Some cognitive participation may suffer through injudicious interventions by members.**

Group B had focussed on S6's proposal for reflection. Her proposal had been accepted with an explanation by another member, S7 and with clarification by S6. According to the taped discussion they had perceived all members to have been "equally" active in their participation, and no member had been perceived as being dominant, although they felt that one member "had contributed more than others", which feature they felt had been helpful in shifting "misconceptions".

I claimed that

**Iniquitous cognitive participation may be perceived differently by the teacher and students.**

S6's cognitive participation had been perceived as less than others in the group by the lecturer (eg., Diary, p45 PART1), but it was S6 who said, "I think we all participated - equally - there was no one that was passive".

Group C's reflections revealed that 4 proposals had been made on the problem (no names were appended to each proposal). They had chosen S10's idea to reflect on and found that S10 had explained her proposal, that S11 had "asked questions to aid clarification" and that S12 had helped during the clarification. They noted also that ideas had been selected by assessing the validity of each idea; and that S10 and S12 had contributed more than others. The taped discussion revealed S10's confession that she had contributed more than S9 and S11, and S9's agreement that S10 had contributed the most; S12's idea of "self-searching" on one's contributions. S12 thought that he had "contributed optimally" in the exercise. S11 mentioned that he had weighed up a contribution that had been made in the group and, having satisfied himself of its validity, had agreed on it. This thought was taken up by S9 who felt that the ideas that had been posed had been ideas that she had personally agreed with ("ideas that was on my mind"). This, she felt had gone towards the



creation of a perception of her low participation by others ("..and only come with the ideas of water").

Thus S9 and S11 both concurred with the view that an absence of verbalisation of an idea did not necessarily mean that there had been a lack of cognitive activity. S10, however, had suggested that ideas that "were the ones in our minds" should be verbalised ("should have the chance to actually say our ideas") and that they should have a "round and have a turn to say the ideas". All group members agreed to these suggestions for future implementation in their deliberations during CL.

I claimed that

**The act of a verbal proposal may not provide us with the full picture, in indicating the cognitive activities involved in cognitive participation during CL.**

Decisions were taken by each group and these were presented with the aid of posters, during the class discussion that terminated the session. The poster of each group had a different title - 'CL Session' by group A, 'Future Strategies' by Group B and 'Participation Equity' by Group C - showing different emphases of discussions. All groups had decided that all members should be provided with opportunities to present ideas ("Everybody should be given a chance to 'talk'" by Group A, "Everybody must be given an opportunity to contribute" by Group B, and "Equal chance to express views - ensured by deliberate rotation of points" by Group C).

Some reference to 'free-riding' was perceived, in that group A decided that "everybody must pay attention" and Group C that, "all members must participate in discussions". Topic clarification seemed important for participation, in that Group A had decided that the "question [should be] clarified for the whole group" - probably because S4 had not initially understood the particular problem that had been given, as perceived from his comment that diagrams should be given with the problem statement (diary, p61 TOPIC) - and, in that Group B had decided that, "everybody must understand the question".

The problem of interruptions during discussions had been given prominence by Group A in its decision that members "should not disturb - because idea may disappear", by Group B that members "should be given the opportunity to say what they think of the question, whether it is right or wrong..." and by Group C that "everyone must listen".

Time constraints seemed to have been problematised in group A's decision that they should "share work to save time" and they should "listen to instructions" and in Group C's decision that a member's "statement should be to the point". Consensus making strategies may be seen to have been implied in Group B's decision that "conclusion should be reached" and in Group C's decision that a member should "put a statement for members to clarify before conclusion".

I made claims that

- a. Focussing (reflecting) on the cognitive aspects of participation may illuminate personal participation patterns.
- b. Group reflection of cognitive participation aspects may promote group decisions which could enhance the effectiveness of future CL sessions, thereby promoting the implementation of effective CL practice.

A reflective note written by S11 of Group C referred to reflection as a worthwhile activity in his meta-reflection, "For the first time I could see the fruits of introspection...". Furthermore students had commented on this at the beginning of Session 13, eg., S7 said that it had made him aware of certain interactions and that with practice each session had been an improvement of the previous one (diary, p64 MONIT).

I made a claim that

**The idea that equity in participation may be promoted by exercises, involving reflections on cognitive aspects of participation, may be seen as a worthwhile idea by students in the implementation of CL practice.**



## Session 13

This session represented the first on a series involving reproduction of anthophyte plants. After a brief review of the parts of a plant, the topic was introduced for discussion in groups. Students were reminded about the decisions, that they had taken, on equity in participation (diary, p64 PART1, colleague's note 6, PART).

I observed that all members of the groups were involved in the CL discussions to generate ideas on how anthophyte plants reproduce and participation seemed to have improved (diary, p64 PART4). The taped playback revealed that, for the 15 minute taping, S1's participation seemed to have been of a more cognitive nature in that she (and S4) questioned S2's 'invalid' ideas and listened 'attentively and critically' with verbal rehearsal of ideas that had been generated by S2. S1 and S4 had been involved in asking for clarification and selecting the ideas, whereas S3 was perceived as 'collating' the ideas by prompting. S2's role in the session seemed to be that of 'generator' of ideas. Her ideas were posed for clarification during the discussion and were presented with modification at the lecturer's (inadvertent) intervention in shifting an alternative concept. The group seemed to have equated sexual reproduction with self-pollination and asexual reproduction with cross-pollination, illuminated by the taped playback. These alternative ideas had been modified to scientifically acceptable ones, on the poster that was presented during the report back class discussion. This may have occurred when the colleague had observed, during their CL activity, that they had drawn a flower under a column marked 'asexual reproduction' and I intervened by asking 'guiding questions' leading to the acceptable version of the concept. This had been questioned also by the colleague lecturer, to which the response was that, another member had been writing the headings (diary, p64, LROLE). The presentation, however, had revealed that there may have been an alternative concept held by the group (even before the playback of the taped discussion), in that only self-fertilisation was discussed as sexual reproduction by the presenter, S3 (colleague's note 6, AC; diary p64, PART2).

I claimed that

**Episodic and de-contextualised interventions (in the absence of observations of preceding interactions) may be non-constructive, in that resultant incorrect perceptions may produce inappropriate interventions.**

Group B's presentation and the tape playback revealed a discussion of sexual reproduction only (diary, p64 AC2). On being questioned about this, however, S7's response indicated that the group had briefly discussed asexual reproduction, but had not included it on the poster. S7 seemed to have generated the ideas on sexual reproduction, with S5, S6, and S8 prompting with confirmation and questions leading to clarification and acceptance. S8's idea that "sometimes you take a stem and you plant it - it roots" had been 'ignored' in that it had not generated a discussion: what followed was an anecdote, recounted by S7, about his mother's ideas on the wisdom of keeping a non-fruit-bearing paw-paw tree in the same garden as the fruit-bearing "wives".

It seemed that S7 was still dominating the generation of ideas and directing the group's decisions in accepting ideas as valid ones.  
I made a claim that

**Decisions emanating from reflections on cognitive aspects of participation, may need to be reinforced for some groups and members.**

S5's critique of the recounted story as, "- male cannot produce another plant..", had been rebutted with the comment, "not a scientific study", by S7 - the idea had not been extended and looked at critically during the group discussion, although this had been done during the class discussion at S7's initiation (diary, p64 SELF-ESTEEM). S6's question, "Does a female fertilise itself?" had been given a terminal answer ("..it can") by S7, which response had been accepted by her. There had been no 'critical discussion' of the idea.

In group C's discussion and during the class discussion, S11 had recounted a story involving a 'childhood belief' about the reproduction of watermelon plants: that pips that were taken into the mouth of a person "would germinate but ..produce a - different kind of melon than watermelon".

These 'folk wisdom' anecdotes promoted the idea that the context of our everyday knowledge were important contributors to the constructions of classroom science concepts (diary, p64 SELF-ESTEEM).

I claimed that

**Eco-cultural contextualisation of concepts (using, eg., 'folk wisdom') and student interpretations of these, could represent starting points in the construction of classroom science concepts.**

Jegade (1995) speaks about such construction of concepts. This idea was reinforced at the beginning of session 14 : students were asked to gather at least one idea each, of what people (eg., farmers, farm-workers, gardeners, garden-nursery workers, herbalists, mothers and other relatives and others) in the community, thought about the propagation of plants.

#### Session 14

Session 14 incorporated observations done by individual members of the structure of (different) flowers (hand-out: work-sheet, 'Anthophyte Sexual Reproduction'). Based on an earlier decision, this had been included to encourage equitable participation in the subsequent group discussions that had been planned: on distinguishing between the types of flowers of the classes of anthophytes, on the functions of the parts, on the problem solving activity involved in how a fruit was formed and on constructing the life cycle of a plant. The time involved in each aspect was managed well, with adequate class discussion during the presentation of the posters that were prepared. These were assessed: students were asked to choose the type of assessment: peer group assessment or lecturer assessment. Groups had chosen lecturer assessment (perhaps because of their experience of the last poster assessment) but a 50/50 combination of lecturer-peer assessment had been negotiated. This and other group marks were combined with individual assessment of part of the work-sheet responses.

Students seemed to have grasped the main concepts involved in sexual reproduction, and those that were problematic, eg., carpels of the gynaecium, the meanings of 'whorl' and fusion of the non-essential whorls of monocots (terminological, in the main) were discussed during the class discussions. S11, who does not have a high school biology background, was given guidance in the form of additional resource material which he could refer to. His input and responses were of good quality.

In group C, S12 had generated most ideas with S11 questioning for clarification and S10 agreeing with the ideas. S9 was perceived to have been least participative of the group - she gave a single idea (an example of a seed that is resistant to digestive juices of animals). It was noticed that the generation of ideas was not restricted to one person in the group, but that the role seemed to have fluctuated (eg., S10 in session 8, S11 in session 7). S9, however, had not been a main generator of ideas in the sessions.

I made claims that

- a. Cognitive roles may fluctuate according to the cognitive backgrounds of members for each topic.
- b. Some members may tend to take on stereotypic roles (perhaps emanating from their own perceptions of their abilities and those of others).

The playback of the tape revealed that the overall cognitive participation had improved. I felt that S1's participation, in group A, had improved, in that she had generated the main ideas during the period of taping ("...dark purple with a white marking - so it is pollinated by the carrion flies"; "...can be self-pollinated because female part below the male part.."). The ideas had been accepted by S2 and S4, although S3 seemed hesitant in accepting the idea by critiquing and posing an alternative idea ("..are bees not attracted to those flowers?").

In group B all 3 members (S6 was absent) were perceived to be involved in generating ideas (S7 - "...attract birds-", S5 - "...and insects -", S8 - "...and - butterflies, moths..."). There were been interactions that were perceived to be different from that of the dominating patterns commented on previously - both S7 and S8 were involved in helping S5 internalise the

concepts of pollination and dispersal, within a friendly and secure context.

There seemed to be an improvement in the 'critical listening' interactions in group C, something that had been perceived as a problem in previous sessions by a member's (S10's) observation (as the following transcript portrays:

*S11 - Fruit - we'd say it comes from the flower ...it's in the flower...*

*S10 - ...what you said could be a misconceptions (sic) ...this comes from the ovary.*

*S12 - the ovary itself ...*

*S11 - now I see ...ya - what confuses me is that the ovary itself is - part of the flower [laughs softly] - so you say - it comes from the ovary...*

S10's reflective note, "Our group is beginning to work well together again. Everyone is getting an equal chance to express their views", seems to confirm the perception that interactions had improved.

All members of group C were perceived to have been cognitively involved in the group discussion (S12 - "... must be pollinated by insects..", S10 - "I think it's more bees...it's like a bluey colour", S11 - "...other than bees, there can be insects that may be attracted to these", S9 - "...ones that animals will disperse - are the ones that are exposed..")

I made a claim that

**Time, set aside for reflection on the cognitive aspects of participation, may be regarded as worthwhile in that it may promote:**

- \* the subsequent effective participation of members whose previous participation had been perceived as being low
- \* a non-threatening environment of peer interactions which promote the accommodation of shifts in concepts
- \* effective cognitive processes, like the generation of ideas, the critiquing and clarification of ideas and critical listening during interactions.

#### Session 15

Member observation of some cognitive processes were done in each group.

In Group A, S3 and S4 were absent - S10 from Group C joined Group A. The taped discussion of one of the examples of asexual reproduction of anthophytes in session 15, revealed that S2 generated the ideas, which had been clarified by all members and critiqued and collated by S1. S10, however, did most of the explaining during clarification. S10, as observer, noted that for an example she observed, S2 had generated 2 ideas and S1 1 idea, that S1 had asked a question which had been answered by S2 and that S2 had explained her idea.

I felt that the increase in cognitive participation, generally perceived in this group, and the general distribution of cognitive processes among the members of the group, may have been linked to the reconnaissance focus on cognitive processing. Thus I claimed that

**Reflections on the cognitive participation of individual members in a group, in revealing different perceptions of cognitive participation among members, and subsequent monitoring may promote the cognitive participation in CL.**

Cognitive roles seemed to have fluctuated in Group A, although S3 was perceived to be the 'sceptic' in the CL he participated in and I claimed that

**Cognitive roles may fluctuate for different CL sessions.'**

The taped part of Group B's discussion revealed that S7 had not participated (he had decided not to since he had been observing) and S5 and S8 generated the ideas about the example of asexual reproduction. The ideas were questioned and critiqued mostly by S5 and S8 and to certain extent by S6. Much of the explaining and justification had been done by S6 with the collation by S8. Here it seemed that generally S5 and S8 were the 'sceptics' and S6 was the 'educator'.

For the discussion of another example, in the session, S7, as observer, had noted that 3 ideas were generated by S8, 2 of which had been accepted 'as is'. A question related to the third idea had been asked by S6 and answered by S7.

Thus it seemed that cognitive roles fluctuated and cognitive processes were distributed among members of group B, as well. The cognitive processes involved in group B's CL, may also be seen as resulting from the strategies they had proposed, during reconnaissance, as in Group A.

I saw S5, however, as consistently being a 'sceptic' in the sessions of the cycle. Similarly I felt that S3 was the sceptic in group A. Based on this I claimed that

**Some group members may tend to take on stereotypic roles.**

In Group C, S12, as observer noted that all 3 members were involved in generating ideas on the example, that S11 and S12 were involved in explaining the ideas, that S11 asked a question on the idea and S12 answered it. He observed that both S11 and S12 asked him for help in clarifying their alternative idea (that the part was a stem, not a root). This explanation resulted in a shift for both S11 and S12. The idea had been judged by S11 and S12 and all members evaluated its validity. No further information on the cognitive processing of ideas were available -the discussion was, inadvertently, not taped. Based on the limited information, however, it could be said that the quality of cognitive participation had improved, probably linked to the strategies they had decided on in session 12. My claims that were generated by the observations in the other two groups were strengthened - S12 was the 'educator' and S11 the 'sceptic' in this session, whereas others were seen to take on these roles in other sessions; S9 seems to be 'stereotypical' in her questioning position.

Generally, it seemed that the cognitive participation of individuals in a group was unequally distributed among members of a group.

#### Session 16

Each group presented a report on their research into an area of seed germination.

Group A seemed to have worked well together in their investigation into hypogeal and epigeal seed germination. From the set-up that Group B presented and their presentation it seemed that they had not understood what their topic was - there was some inconsistency between their aim of identifying the origin of the root, stem and leaf and their procedural design. Group C seemed to have worked well in comparing the progress of growth of different seeds.

I had reviewed the topic 'germination' after the presentation. It seemed that the format whereby groups experimentally investigated ideas on the topic and a subsequent review of the topic was a good idea in that there seemed to be personal motivation and internalisation of learning.

This session strengthened the claim that learning is enhanced by CL and by employing constructivist notions.

#### Session 17

Test: Anthophyte Reproduction

Students chose partners to work on item 6 of the test. Management of the test seemed better than at the last test and I claimed that

**Immersion into and practice in 'new' test formats incorporating CL aspects expedites the management of such tests.**

Furthermore, on marking the test I noted that the performance of students had improved, generally.

#### COMING OUT OF THE EXPERIENCE

To obtain insight into the overall experiences of participants of the course the following was done:

- \* all students wrote reflective essays
- \* statements were abstracted from these essays to formulate a

questionnaire relating to general experiences of students  
\* the authenticity of these statements were corroborated by 25% of the student population  
\* all students responded to the corroborated questionnaire  
\* all students were interviewed  
\* the colleague and I had a reflective dialogue  
\* the colleague made a final reflective note

Based on the reflections made by the students, the colleague and myself, I felt satisfied that the experience of using action-research to introduce and implement CL was a worthwhile one, a feeling that seemed to permeate the whole experience. The report has generated many claims. After a final reconnaissance, these claims and data were analysed to develop themes for my next set of reports, the analytic-theme reports.

My reflections during the process, as embodied by my claim during cycle 2, that the action-research methodology, itself, was a suitable way of introducing and implementing CL as an innovation, were seen as part of the process of analysing the research question related to this. Student reflections at the end of the course, corroborated my feeling that action-research in its axiomatic aspect of reflection, embodied a way of including students in their learning.

## APPENDIX II

### ANALYTIC-THEME REPORT

This commentary is constructed by creating categories of assertions that emerged in the interpreting of evidence, and clustering these categories into emergent themes of each cycle.

#### ANALYTIC-THEME REPORT I

The processes involved during the first cycle, which represented practising CL in a spontaneous and intuitive manner, were studied, with a view to illuminate the ideas about CL that students came with as gleaned off their interviews (Student Interviews I). The illuminations thus gleaned contributed to the foci for planning of the subsequent cycle.

Student interviews and lecturer questionnaires may be regarded as part of the first reconnaissance activity.

**Note:** In doing this it may be noted, on hindsight, that there could be a natural progression of a process approach to CL (then a more technical execution during cycle 2 due to an overarching orientation towards a focus on 'problems', leading to a more critical stance in the search for equitable participation in the subsequent cycles).

#### THEMES

Themes that were isolated for inquiry were:

- \* linking initial student and lecturer perceptions with what occurred in the cycle
- \* an illumination during the cycle of the perceived constraints to CL
- \* an illumination of student induction to CL
- \* a focus on the management of alternative concepts
- \* management of cognitive outcomes of CL
- \* utilitarian issues of CL
- \* lecturer constraints

#### 1. THEME : STUDENT AND LECTURER PERCEPTIONS

**RQ:** Were the perceptions of students, on the aims of CL, the types of CL and their preferred ways of learning, illuminated during Cycle 1 and what action pertaining to these was envisaged and taken in the cycle?

Initial student perceptions of what group-work is, seemed to correspond to those held by the six lecturers (from the departments of Education, Geography, Mathematics, English, History and Physical Science) who had completed a questionnaire (items 1, 2 and 3) on this.

From the student interviews it was understood that all 12 students had been exposed to some type of group-work/CL in their first year of study, especially in the Natural Science I course (with some mentioning only this course and more especially the biology component of the course), but also in their courses in Education, Maths, English, Geography and History. This was corroborated by questionnaire responses of the 6 lecturers. Their first experience of CL seemed to be at college level, as indicated by 3 students.

The types of group-work indicated by students, included the discussion of ideas (all students) as the type employed mostly by the subjects involved. Lecturer responses included this as a type of group-work, but extended it to include problem-solving (Maths and Geography), seminar, essay and project work (Education), laboratory work (Physical Science) and trail work (Geography). Mention was made of 'games' by one student and problem-solving by another (in Maths), doing group assignments by 4 students, lab work by one student, group discovery by one student, looking at conflicting sides in an issue by 2 students, project work by one student, 'brainstorming' by one student and making presentations by 2 students, as group activities they had been exposed to. Thus there seemed to be a match in perceived types of group-work experienced between students and lecturers.

The reasons perceived by students for doing group-work were as outlined on Table 1 (note: numbers are minimum)

REASON	NO.	STATEMENT
sharing of ideas	4	S9-"share different ideas"
interacting with other students	4	S2; S6; S9; S10-"to interact with one another"
learning from one another	1	S3-"learn from each other"
communicating with one another	1	S4-"to make students to communicate"
to cooperate	1	S4-"to make students to ...cooperate...gain ...partnership"
eliciting ideas of students	1	S1-"what each thinks"
obtaining a range of ideas	2	S6-"different ideas from different children"; S4-"more ideas during group discussion")
finding out things for themselves	1	S5-"find out things on our own"
improving relationships between students	1	S12-"improve relationships between students"
enabling students to use the strategy when teaching	1	S6-"to be able to teach in group-work"
improving verbal communication	2	S9-"encouraged to speak"; S4-"gain language"
encouraging the participation of 'shy' or 'scared' students	3	S12-"fear of asking when not clear in the whole class but in groups not so"; S9-"shy, I do not really respond in class"; S1-"not shy in group...friends"
as based on the perception that social interaction in a shared language with friends promotes good work	1	S1-"can get along with own friends and talk to them...can give ideas better"
improving education	1	S7-"if started earlier it would have improved our education"
constructing 'knowledge'	5	S5-"present our conclusions"; S10 and S2-"common ideas"; S11-"participatory"; S12-"present our ideas after brainstorming"
promoting critical thinking	2	S5-"use our brain"; S9-"think and act creatively and use our imagination"
as based on research on the worth of CL	1	S7-"research has shown that most of learning is through group working"

The reasons given by lecturers for using CL strategies were understood to be to:

- broaden the scope of responses and to explore different approaches/interpretations (English)
- cooperate in solving problems (Maths)
- develop cooperation (Education)
- learn through sharing ideas (History, Geography)
- encouraging debate and fostering the ability to compromise (History)
- activate involvement in learning (Education, Physical Science)
- stimulate each other (Geography)
- give the experience of studying group dynamics (Geography).

It was noted that there was a match in many of the perceived reasons for using CL in lectures between the students and lecturers. This promulgated a claim that

1

*Students exposed to CL perceive reasons for such strategies in some ways similar to those of lecturers and other researchers, indicating that learning outcomes of such experiences as perceived by lecturers may be understood as being effective.*

Lecturers listed achievements of their objectives to examples of CL that they had used in their courses in positive terms. These outcomes were some that were included in the student list as perceived reasons for CL.

To introduce CL into the Natural Science II course, I decided to allow the strategies used by students to develop intuitively and spontaneously, with a view to illuminate these perceptions in their practice. This was according to the claim that

2

*The introductory phase of CL into the course may be in the mode of spontaneous and intuitive practice based on common experiences of the students who have had previous exposure to CL experiences.*

#### Frequency of CL in the course: a CL ethos?

All students were of the opinion that CL should be part of their learning; some even venturing that CL should feature in the school classroom. Many (8) preferred CL for learning 'new things'; one (S11) for weak areas only, one (S9) for revision only, and one student (S12) preferred to learn alone. Mention was also made by some that most learning should be in groups (S10, S2) while others felt that there should be a 'balance' between individualistic and CL.

All lecturers questioned, seeing CL as worthwhile, thought that CL should be part of the courses they offered, but with varying frequency: on responding to the approximate time that should be spent using CL strategies, the responses included 12,5%-17% (English), 30% (Geography, History), 60%-70% (Physical Science), 80% (Maths) and as much as possible (Education).

These observations may indicate a willingness on the part of both students and lecturers to make CL part of the learning experiences in the lecture room. Thus it may be claimed that

3

*Cooperative learning may be a learning mode, preferred over traditional 'transmission' modes, for second year Natural Science students, who have been exposed to CL in the first year of study.*

The scene seemed to have been set for a serious study of CL in the course. It was acknowledged that students had past experiences of CL and lectures of the first cycle were planned based on these contextual experiences. It was decided that the first cycle of the research begin with CL practice as that which had been internalised by students from experience. A claim was made pertaining to this research approach, that

4

*A constructivistic philosophy may be used to inform the introduction of*



### *CL in a course of study.*

The CL activities were monitored to illuminate the perceptions and test the related claims that had been made.

In the first lecture session, students were asked to discuss a set of questions in their groups and to deliver a report using a poster. No instructions were given as to how this should be achieved. The processes observed in each group, however, revealed that they saw the aim as generating and sharing ideas and to reach consensus on these. This may be seen as illuminating their initial perceptions relating to some reasons for a CL approach (as outlined above) and this illumination may be seen as confirming their perceptions. Claims 1 and 2 were seen as being partly reinforced and were tentatively modified as

5

*Students who have some CL experience may perceive the aim of some CL activities as to elicit ideas from members, to share ideas and to reach consensus, even when such goals are covert.*

Although the intended aim of the activity was not made explicit, students understood it as had been intended. The dilemma for me was that, on the one hand, aims should be overt in the interests of educational democracy but, on the other hand, the research question asking for illumination of initial perceptions, promoted the use of a covert strategy. Furthermore, the nature of some topics preclude a statement of aims. The claim begged here was

6

*Goals of learning may be stated overtly when such statements do not interfere with subsequent learning.*

It was observed, in the initial sessions (eg., session 1), that students enjoyed interacting and learning in their groups. This may be seen as linked to claim 3 above. Furthermore, when students reflected on what they liked most in the CL activities of sessions 1 and 2, it was found that there were more positive than negative responses, although they were asked to reflect on what was least liked, as well. There were 3 people who did not respond to what was liked least and two who found 'nothing' that they did not like. The remaining 7 students focussed on issues like 'time', 'concept clarification', 'consideration of other views' and 'dominance', in writing about what was least liked. The latter responses were interpreted, not as evidence of not liking CL *per se*, but as reflections on constraints to effective CL.

Only 1 student (S1 who was subsequently observed as enjoying CL -interview II) made no response to what was liked about her CL experience. There were 12 different 'most liked' aspects which may be seen as correlating well with their initial perceptions of CL; and 2 other aspects, including liking the way marks were allocated. Thus claim 3 may be seen as being illuminated, reinforced and amended to include the claim that

7

*Positive initial perceptions of the worth of CL, may be subsequently expressed as preferences, with practice in CL and may be reinforced by such implementation.*

## 2. THEME : CONSTRAINTS TO CL

RQ: Did the perceived constraints mentioned by students (at the first interviews) surface/were they illuminated during the first cycle, and were they focussed upon by the process?

In summary the perceived constraints to CL were given as: dominating individuals (4 students mentioned this as a constraint), the potential dominance by English first language speakers (1), inability to construct consensus (1), having a problem with accepting other views (1), withholding ideas (1), noise during CL activities (2), inadequate teacher guidance (1), inadequate topic clarification(1), non-participating 'lazy' members (2), non-participation of 'slow thinkers' (1) and non-participation of 'shy' members (4 - although 3 other students thought that it would benefit 'shy' members). The lecturers surveyed concurred with the constraints of

dominating members (1), dominance of first language speakers even if the ability was lacking and 'lazy' members (1); and mentioned other perceived constraints to implementing CL to include 'off-task' behaviour (1), conflict among members as to who should report (1), grouping criteria using the 'reality' of racial and academic disparities (1), and the dilemma of justifying the greater amount of time perceived to be required by CL (2).

Thus, there were instances where a student and a lecturer had common perceptions about certain constraints: 2 students and a lecturer saw a problem with 'lazy' members, 3 students and a lecturer with 'dominating members' and 1 student and a lecturer with 'language dominance'. The issue of criteria of grouping, mentioned by a lecturer, was alluded to by a student (S9), who spoke about 'slower thinkers' not participating. The time constraint was not mentioned by students, although 2 lecturers had mentioned it.

During the first cycle, these perceived constraints were kept in mind, to illuminate students' initial ideas about CL and to focus on, for potential action.

#### Constraint : Dominating members

On analysis of the tape playback of part of session 1, S2 and S10 in group A, S8 in group B and S12 in group C were perceived by me as dominating talk time. Furthermore, S2 and S8 were perceived to be directing activity, in the guise of self-imposed 'managers' bringing members 'on task'. The claim was that

7

*Some individuals may dominate some processes in CL and this should be made overt.*

The action decision was that, some way of monitoring and revealing dominating processes should evolve by focussing on it with students, who could problematise the question of constraining or facilitating aspects of domination. Another claim in this regard was

8.1

*Ways of monitoring and revealing dominating processes is problematic, in the absence of prescriptions from the CL facilitator.*

This was problematised because the idea was for me not to be prescriptive.

In the tape of part of session 2, after students were redistributed in different groups using an equal gender criterion, it was observed that the talk-time was dominated by S2 again and S1 in group A. In group B, S8 seemed to want to direct members to be 'on task'. This observation reinforced claim 8 above.

The students' reflective activity of listing what was 'most liked' and 'least liked', undertaken at the end of session 2, revealed that dominance was seen as a problem by at least 3 students (S1 - a student that initially perceived this as a constraint, and as male dominance now; S4 and S3, both males). This led to the claim that

8.2

*A reflective activity is an important component of CL in that it may reveal to students the constraints to effective CL.*

Furthermore, my perception of who was dominant in group A seemed to be at variance with at least one group A member (S1), who indicated that it was a male member, and not the two women members, as perceived by me. Perceptions of dominant members varied among members of the group, as well: S4 and S3. Thus it was felt that students themselves needed to identify dominating people or processes.

Some illumination of dominance as a constraining process of CL, had been provided in the sessions. Of the initial perceptions during the interviews, S8 had mentioned it as a constraint, although he had said that it could be

worked out by the group, S3's perception was reinforced in the practice, S1 had mentioned it initially and her perception could be seen also as being reinforced by the CL sessions and S6, who perceived it in her group practice, had not mentioned it initially in the interview.

An action decision to implement an activity leading to the construction of group rules planned for session 3, was made by me, based on the claims and comments outlined, as well as other factors (discussed under the relevant themes).

An analysis of the taped part of the activity regarding group rules, revealed that, once again S8 dominated the contents and direction of group-talk in group B, even resisting attempts to bring him 'on task' (as perceived by members); and S2 was perceived to use the potentially dominating roles of 'initiator' and 'explainer' of ideas. The list of rules that were generated, however, indicated that members had perceived these processes as dominating, that such processes were constraining and had to be monitored, in the aim of minimising or overcoming them, as embodied and interpreted in group A's rules: "Each day - leader should change - prevents domination"; "Each one - seen as equal in a group"; "Each should be given a chance to express his (sic) views". Claims on dominance were modified to

9

*Group members could perceive dominating patterns on reflective problematisation and make decisions on the future monitoring of such aspects.*

*Group rules help to monitor dominance in a group.*

During the 'classifying activity' (following that of rule generation) of session 3, it was observed that S8 did not dominate, perhaps because the rules generation activity revealed and illuminated his behaviour to him, or perhaps he had been insecure with the ideas he may or may not have had on the topic (as indicated by his comment, "...I think - I'm not sure.." on the tape). This prompted the claim that

10

*Dominance patterns may be related to cognitive demands of tasks, cognitive ability and cognitive security of certain individual members, who are perceived to be potentially dominating by nature.*

In the next reported session (session 5) roles seemed to have been rotated, at least as indicated by the role of 'reporter' and 'scribe'. The claim that

11

*Groups may take it upon themselves to rotate roles to minimise dominating patterns*

was indicated by some rules that were generated: "Each day -leader should change - prevents domination" by group A, "Each s[tudent] have a turn.." by group C.

It would seem that a focus on the generation of rules provided opportunities to redress the constraint of domination, as perceived by the students, leading to the claim that

12

*A focus on the generation of rules may help in equitable participation in group tasks.*

Thus 'dominance' was an aspect that was focussed on for illumination and action by groups and the lecturer decided to include it in the reconnaissance session that was planned for the next session. The reconnaissance session was identified as a turning point ushering a new cycle (cycle 2) of research.

#### Constraint : 'Shy' Members

Four students referred to 'shyness' being a constraint to CL (S3,S5,S8 - "some shy"; S6 - "quiet children"). On the other hand, 2 students (S1 and S9) found their 'shyness' a constraint in a whole class situation and not in a small

group one and 1 student's perception (S12) was that some students, who were afraid to speak in a whole class situation, benefitted by small group CL.

S8 noted his 'best liked' aspect of the CL sessions, as the idea that members were not "shy or embarrassed", by their alternative ideas and he saw this as an advantage for the CL approach.

Thus, although 'shyness' had been regarded as a possible constraint to CL by 4 students, 4 other students had a different perspective of it and after the first 2 sessions it had not been illuminated as a constraint but rather that CL may benefit 'shy' students. Based on the idea that 'shy' students may be shy in the class situation and that the small group situation may benefit them a claim was made that

13

*The small group situation of CL may pose less risks for participation of those students who see themselves as non-participants in a whole class situation, than a whole class one.*

No strategies to encourage such participation were indicated in the group rules generated in session 3, perhaps because members did not see it as a constraint in their practice over the previous 2 sessions.

#### Constraint : Noise

The amount of 'noise' as a potential constraint to CL practice had been mentioned by 2 students (S11 and S10) at the interviews. This constraint did not surface during the cycle, perhaps because of the relative size of the class and that the learners were adults.

#### Constraint : 'Off-Task' Behaviour

This had been mentioned as a possible constraint to CL by a lecture (History). During her interview, 1 student (S1) felt that 'lazy' students may constrain CL practice, and 1 lecturer referred to the aspect of 'coasters', as a possible constraint.

It had been interpreted that S8 had been perceived, by his group as being 'off task', by the analysis of the tape playback of the group rules generation activity and he was cautioned about it by members of his group, who attempted to bring him back 'on task'. His input, however, had not been regarded as subverting the discussion and was used to formulate a rule (rule 2 of group B - "We need to have a common point of reference - minus past prejudices and ill knowledge which was deliberately fostered amongst us"), but rather as a problem within the time constraint, that had been imposed by me: students were aiming to produce a set of rules within the time limit.

Some group rules that were generated, may be seen as embodying the promotion of 'on task' behaviour (group A - "Group leader ensures that the topic is discussed..."; group B - "If we are given work, we must do it"; group C - "Take work seriously"). Thus, it may be said that, although 'off task' behaviour was not articulated as such by students, they perceived 'on task' behaviour as promoting CL.

#### Constraint : Withholding of Ideas

During the interview a student (S3) felt that, at times, students "keep ideas to themselves and not share them" and that this could be a constraint. It was perceived, from class observations, made by myself and the colleague, however, that generally, students were contributing ideas. The instances perceived as non-participation of particular students had not been ascribed to unwillingness to share ideas. In the list of students' 'best liked' aspects, the giving and sharing of ideas featured significantly. This illuminated some initial student perceptions of the reasons for doing CL. S3, himself noted "One can evaluate ...his ideas with reference to other..." as what was liked most about CL.

On the other hand, 1 student (S12), who had mentioned the problem of being "compelled to consider views of other people even if such views lack sense" as his 'least liked' aspect of CL, a reiteration of his initial perception, however, noted, "I like the sharing of ideas most".

These observations contribute to the claim that

14

*CL provides opportunities for students to give their own ideas and to share ideas.*

This claim reinforces aspects of claim 5.

#### Constraint : Conflict

The constraining effect of conflict situations, had been articulated variously as the inability to construct consensus (S11), having a problem with accepting other views (S12), withholding ideas (S3) and arguments on issues (S6), by students in their interviews. Some of these were reiterated as 'least liked' aspects of CL as: S12 - "compelled to consider views of other people"; S3 - "one person can - dominate the group and does not want to accept other viewpoints"; and S6 - "others views may not be considered".

On the other hand, some students noted 'conflict' positively as their 'most liked' aspect of CL: S5 - "share ideas and have conflicts but at the end we come up with a conclusion"; S2 - "debates"; and S11 - "even if there was no agreement but there was a settlement".

Combining these two views it may be claimed that

15

*Conflict is an inherent aspect of CL and problematising this may help groups manage it.*

The rules generation activity had been planned, partly to focus on such problems. Group A (including S3 as member) had a rule indicative of the focus as, "At end everybody should agree on a point and come to a conclusion" and group C (whose members included S11 and S12) as, "Consensus - majority rule". Group B (with S6 as member) did not have a relevant rule.

The planned reconnaissance session was to focus on the aspects 'domination' and 'group rules', wherein it was hoped that the problem would be revisited by the groups.

#### Constraint : Group Dynamics

A lecturer (Physical Science) posed the criteria for composing groups, as a problem and cited "racial and academic disparities" as "real problems" and differing abilities as an aspect to be considered in composing groups. In her interview a student (S9) spoke about "slow thinkers" being constrained by "fast thinkers" in a group. This posed a dilemma for action: on the one hand, literature suggests that heterogeneous grouping has many advantages and, on the other hand, a lecturer and a student were problematising criteria of group composition, perhaps to indicate the perspective of composing homogeneous groups for effective CL, also backed by some literature (especially in that on 'tracking').

A decision had been taken to allow students to choose their own groups, for session 1 and, in keeping with claim 2, heterogeneous groupings according to the criteria of gender and language proficiency, were used for subsequent sessions.

Observations of session 1 yielded a perception that English first language speakers (S10 and S2 in group A, and S8 in group B - group C had only English second language speakers) had dominated talk time. This had been noted as a possible constraint by a lecturer (Maths). The action taken was that groups were rearranged, primarily on the grounds of gender balance which resulted in a distribution of 1 English first language speaker per group. The criterion of abilities was not considered since it was difficult to assess this, as perusal of past performance did not illuminate this. Differing educational backgrounds were catered for by the language criterion. Varying language proficiency levels of the English second language speakers were observed on listening to the taped playback of parts of session 1 and 2, and it was serendipitous that each group had a range of levels of proficiency.

The 'race' problem, referred to by a lecturer, was tackled in a potentially

constructive way, to increase inter-cultural communication.

Claims made on observations of session 3 included

16

*Language idiosyncrasies that reinforce alternative concepts may be revealed in a group heterogeneously composed on the basis of language and culture*

and

17

*An English speaking student may tend to initiate, clarify and explain ideas in a group, heterogeneously composed on the basis of language.*

Claim 16 emerged on the illumination given by a student (S7), about why a member of his group said that plants were fed with water: that it was a transliteration of the Zulu phrase referring to watering plants. Claim 17 was made on perceptions gleaned off the analysis of the taped part of session 3 where S2 in group A, was observed to dominate the processes of initiating ideas, clarifying and explaining ideas of members, in her group. This could be perceived as disadvantageous in the sense of being a dominating process, but also advantageous for group comprehension of ideas.

Further action on the language issue was planned, in that 'language' was in the agenda, among other problematic areas for the reconnaissance session.

The question of effective group size emerged in session 5, when a group (group B) presented the idea of having 5 pupils per group for a CL activity they had planned for a standard 5 class of 35-40 pupils. This idea was not identified for discussion in the session, by the students, but was problematised for the reconnaissance session planned.

#### Constraint : Time

Two lecturers problematised the justification of the longer time that they perceived as required by CL. During the report back, after the CL activity of the session 1, the last group to report had insufficient time to do so, because equitable distribution of report back time was poorly planned and managed by me. This was problematised and addressed in subsequent sessions, whereby time was managed and stipulated for report back and other sessions.

Although students had not mentioned time as constraint in the interviews, the time factor surfaced during their practice of CL in the guise of a reflection made as a 'least liked' aspect of CL by a student (S11 in group C), who noted "time seemed to be against us as there seemed to be much to learn from others".

Only one group (group A), however, incorporated the idea of managing time in their group rules as, "Those expressing views should be aware of the time", perhaps because of my practice of specifying and cuing for time during sessions.

Thus, it was posed that the time for study of a topic using CL may be more than that employed in traditional lecture practices; and that students were unaccustomed to managing time for themselves. These ideas had management and curriculum implications. The dilemma existed whereby, on the one hand, I specified time limits for activities as a way of managing time and, on the other hand, students saw the need for more time needed for certain activities. The nature of the CL activity was seen to influence time planning, in that, in session 5, it was observed that a larger proportion of time had been allocated for the task. This promulgated a claim that

18

*The more open-ended the task the more time may need to be allocated for the task.*

Open-ended tasks were those that generated many ideas and discussion.

#### Constraint - Topic

One student (S7) had experienced, what he considered to have been poorly

managed CL at school: he had located the problem in inadequate teacher guidance and topic clarification.

In session 1, two groups had asked the lecturer for clarification of the task that was given and it was observed, that the topic was inadequately stated, needing lecturer guidance. This was considered for future CL sessions and it was decided that written instructions related to CL tasks (eg., on time limits, mechanisms of reporting and feedback and task topic) were to be verbally reinforced and clarified me. An observation of inadequate handling of the classification scheme used by students in session 3 illuminated the promotion of such a consideration and a claim pertaining to this was made as

19

*Verbal clarification and guidance by the lecturer may be needed to reinforce written instructions.*

Furthermore claim 5, which concerns covert goal perception and claim 6, which problematises the idea of overt goals, may be seen to be illuminated, in that it was decided that such goals and also criteria for group products should be made transparent, where relevant, in future sessions. It had also been said that strategies, decided by each group for presentation in report back sessions should also be made overt. These ideas presented themselves in the form of an claim that

20

*Strategies and criteria should be made overt in a CL environment.*

I observed that the first activity of session 2 (on the tentative nature of classification systems), effectively involved a combination of group, class and lecturer interactions. Thus, it was proposed that there were different types of CL strategies that may be employed and a claim made was that

21

*Two ways by which CL may proceed are: from group interaction to whole class interaction in the form of report back; and as iterative group-class-lecturer interactions in a session.*

I observed that some critical thinking crystallised during session 2 and this may have been ascribed to the nature of the task, which involved the 'sounding out' and subsequent presentation of ideas during the class discussion. The appropriateness of a topic was problematised for the reconnaissance session planned.

I observed, also, that the report back sessions may have been insufficient for inter-group sharing and construction of ideas and that changing groups could help in this regard, for students to experience a range of ideas. A focus on this issue was also planned for, in the reconnaissance session.

### 3. THEME: INDUCTION TO CL: WHY STUDENTS DID NOT RESIST CL

RQ: Is it because they prefer the CL approach over the traditional lecture? Is it that their experiences have given them positive messages about CL? Is it a preferred learning mode?

From the initial interviews (student interviews I) all, except one student (S12), were seen to prefer learning in groups. Even the student, who preferred learning alone liked some CL for revision purposes. One other student (S11), mentioned that he preferred CL for 'weak' areas and one (S3), liked both CL and individualistic learning equally, based on his perception that some learning required individualisation. Four students (S2, S5, S8 and S9) said that, although they preferred CL, they liked to 'study' (revise) alone.

Thus only one case (S12) was regarded and identified as negative and, based on this it seemed and was assumed that a motivation for learning in groups existed. Furthermore, some experience of CL had been established in their first year of study, at least in the Natural Science course and it was seen that their preferences were based on the experiences they had.

During the first cycle of research it was observed that students 'took to' CL quite easily in that motivation was high, illuminating the claim that:



*Cooperative learning may be seen as a preferred learning mode for second year Natural Science students, who have been exposed to CL in their first year of studies.*

The claim was strengthened by observations indicating that motivation was high during the cycle:

\* In session 1 observations made by both the colleague and myself, were to the effect that students enjoyed interacting and learning during the CL activities

\* On analysis of students' reflections, in session 2, of what was 'most liked' and 'least liked' about their CL activities it was noted that the number of 'most liked' reflections outweighed those that were 'least liked'; and 'least liked' things were seen as constraints (dominant members, time, handling of alternative concepts and ignoring a member's contribution) that could be problematised in group processing and not as resistance to CL. Only one comment (S12's, the negative case identified earlier) was seen as, not reinforcing motivation, but as reinforcing his perceived resistance to CL. These negative comments, however, were juxtaposed with the positive ones made by the same students and it was understood that the strength of their positive comments outweighed their negative ones.

\* Students were motivated to formulate group rules during session 3 where a self-generated focus on constraints (including ones mentioned in session 2) were seen to be used constructively, in the generation of pertinent rules which were seen as aiming to minimise constraints. This illuminated, also, the ideas that students held, as mentioned in the interviews, whereby students acknowledged that there were potential constraints to the implementation of CL, but that the implementation of CL was not to be abandoned; rather the constraints be problematised and thus minimised.

\* Interactions were observed to be high, both by classroom observations and playback of taped parts of all sessions in the cycle - indicating that motivation was maintained in the cycle.

By the end of session 5, the stage was set for a reconnaissance session to reflect on the cycle, involving a focus on areas that may be problematised, rather than an abandonment of the CL approach (a reinforcement of feelings proposed by students in their interviews).

Thus, it may be seen that the rationale of illuminating constraints during the first cycle was implemented. Future action was planned to focus on such illuminations, beginning with a reconnaissance session, to expedite CL in the semester and to reinforce the preference for learning cooperatively. The first cycle may also be seen as critical for the introduction and implementation of CL in the course, in that CL could have been rejected by students at this stage, if their initial perceptions of its worth were shifted.

#### 4. THEME : MANAGEMENT OF ALTERNATIVE CONCEPTS

RQ: Do alternative concepts surface in CL? How may alternative concepts be handled?

Voluminous research literature exists on the social construction of knowledge and the co-construction of science concepts during CL has recently been enjoying attention by researchers. Although not mentioned *per se* during the initial interviews with students (except as "[students] put forward own views all the time", " at first I thought..students are not well informed...later ...students...not always correct...lecture will correct" - S11; "people want to say different things" - S6; "I want my ideas...I find it difficult...especially when totally wrong" - S12), alternative ideas had surfaced during CL, when students were made aware of them by other members in a group and when I observed these ideas and made students aware of them. Analysis of tape playback revealed, that members may detect some alternative concepts. Some examples of related observations were: in session 1, group A



members (S2 and S10) responded to S1's alternative concept that a stone is 'living' because it 'grows', in an attempt to shift her idea of equating the processes of 'expanding' and 'growing'; in session 2, S8's idea that "animals also have cell walls" clarified by S5 in group B; and in session 3, S12's concept that a plant "get its food from soil" followed by a discussion leading to a shift to the idea that "it makes its own food". Thus, a construction that was made at the onset, after session 1 and reinforced by subsequent observations, was that

23

*Alternative concepts may be shifted by group member interactions in a CL group.*

In the very first session during the class report back, it was seen that the group posters revealed some alternative concepts, and a claim was made that

24

*A poster presentation may be used as a strategy to reveal learning, consensus agreements and alternative concepts.*

These alternative concepts were discussed in the class discussion following the poster presentations, with the aim of clarifying certain concepts and perhaps shifting certain concepts, towards those acceptable to the scientific community.

On analysis of the tape playback, it was revealed that, although some alternative ideas surfaced during CL discussions and were discussed by students in their groups, not all alternative concepts may be revealed by posters and presentations, and this promulgated the claim that

25

*Some alternative ideas may surface and are discussed by students in a group during CL.*

*Some alternative concepts may not be detected by the group and may not be revealed by posters and presentations; ways of revealing these during CL implementation should be problematised.*

Claims 24 and 25 were illuminated during session 2, wherein, once again, it was observed that posters revealed some alternative concepts and that monitoring the clarification and explanation of these concepts was problematic. The claim made was that

26

*Group members may not be sophisticated enough to detect certain alternative concepts and monitoring the clarification and explanation of these concepts is problematic.*

Action taken in this regard, was that a short transcript extracted from the previous CL sessions was given to each group for critique in session 3. In two cases the ignoring of the beginning of an alternative idea, by other members of the group, was detected by the two groups concerned. This did not occur in one group (group C: who ignored "carbon dioxide ...for respiration...[in plants]", but focussed on the debate of 'night and day' gaseous exchange). This activity had been given with the intention of practising the sharpening of critical observation of member talk and thinking. The alternative outcome in the one group, further illuminated the idea embodied by claim 26, that members of a group may not be critical enough to detect and discuss alternative concepts generated within their groups. Thus the claim was modified to include

27

*Group members may not have the necessary schema for the detection of certain alternative concepts and this may reinforce these alternative concepts.*

The very nature of CL, whereby there was a co-construction of concepts, may give tacit approval of certain alternative ideas, thereby reinforcing them and preventing an easier pathway to shifts, towards concepts acceptable to the

scientific community.

Thus a dilemma existed in that, on the one hand, CL activities have the potential of clarifying personal and idiosyncratic concepts to more socially accepted ones and, on the other hand, those alternative concepts that go undetected and unresolved may be reinforced with tacit social approbation.

It was revealed also in session 3's CL talk, that everyday language could promote the keeping of alternative concepts, as referred to under language constraints.

One student (S10) had reflected that what she liked least about CL was that, "we have not had explanations and so there were misconception (sic) in the group". Her group (group C) had made a rule to this effect, "Talk about misconceptions (sic) and make [making] mistakes". As has been noted earlier, some alternative concepts had been discussed during the report back sessions, but this may not have been adequate, perhaps because these had not surfaced during the poster presentations. There were instances when groups asked me for clarification of certain ideas during a CL activity (eg. what a gametophyte and sporophyte plant was in session 5). This intervention was seen as a way of clarifying certain concepts, implemented only on request from the group and after ascertaining if members had tried to construct the concept themselves.

Thus, it was proposed that for the purposes of clarification of concepts and ways of revealing alternative ones, the processes of presentations, of class discussions during report back, of reflecting on what was learned (eg., as in the critiquing activity in session 3) and group request of lecturer clarification be kept. The aspect of 'alternative concepts' was planned as one of the foci for reconnaissance.

## 5. THEME: MANAGING COGNITIVE OUTCOMES

**RQ: How can learning outcomes during CL be promoted, revealed and monitored?**

Although there was a feeling on my part that there should be a focus on the cognitive processes involved in CL by students, students themselves had not revealed this need. Cognitive processes (like the selection of meaningful ideas, making social constructs) were considered in the design of activities by me, and may be seen as being problematised by students in the guise of working with alternative concepts by members and consensus making processes; and by me in searching for ways of revealing, monitoring and clarifying alternative concepts.

As far as the design of CL sessions was concerned, it was observed that tasks involving the sounding out of ideas (eg., 'What is a plant'), and the post CL class report back, where sharing of ideas occurred, may have promoted critical thought and learning. Thus there may have been a need to consider the nature of the topic as correlating with the learning outcomes and a claim was made that

28

*Certain learning outcomes may be promoted by and inherent in the nature of the topic of CL.*

The group product (poster, work-sheet, etc.) and report back were seen as important for consolidation of ideas, for self-monitoring of learning, and to reveal learning, consensual constructs and alternative concepts. Thus, a claim pertaining to managing cognitive outcomes made was

29

*Group products, presentations and subsequent class discussion may help with promoting, revealing and monitoring learning outcomes.*

### Assessment:

At the initial interviews, many students (S1, S2, S3, S4, S5, S6, S7, S9 and S12) intimated that they liked topping the class, while others (S8, S10 and S11) had not felt this way. All, however, said that they accepted a group mark. Two students (S1, and S3) preferred individual marks. Ten students said that they preferred to work cooperatively rather than competitively, although there seemed to be contradiction in their thinking, in that they had indicated

that they saw inter-group competition as important for various reasons, like it "is encouraging" (S9), it ensures "standards" (S8, S11), "in life we do compete" (S7), it "makes one work harder" (S5). Only one student (S10) was definitely against any type of competition.

The dilemma posed was that, on the one hand, students have been socialised by a dominant ideology that promoted and celebrated individual achievement and, on the other hand, they valued group cooperation in producing group achievement. I took this dilemma into account, in planning a combination of individual and group assessment, but without encouraging competition, even between groups, perhaps subversively, since spontaneous and intuitive strategies were aimed for in the first cycle, for the purposes of illumination.

The first assessment occurred in session 2, in the form of peer group assessment of posters (50%), a self evaluation mark for cooperation(25%) and a lecturer evaluation mark for a paragraph written individually on 'what I learnt'(25%). This was negotiated with students. Students had been guided on the criteria that they could use in assessing. It was decided during the session that criteria for products that were to be assessed, would be given, in future.

On revealing the summary of marks awarded and the criteria used in awarding the marks, students indicated that they were amenable to such a system of awarding marks. One student (S7) had noted "I'm satisfied the way marks are allocated [allocated], it is fair to everybody" in his reflection at the end of session 2. The way marks were allocated was significantly omitted by students in their noting of what was 'least liked' about the CL sessions. These observations promoted a claim that

30

*A combination of inter-group peer assessment, self-evaluation and lecture evaluation, based on overt criteria, may be regarded as a satisfactory way of assessing CL work.*

The perceived satisfaction with mark allocation, illuminated their initial perceptions and assessment was not problematised for the reconnaissance session.

## 6. THEME: UTILITARIAN ISSUES OF CL

RQ: Do students perceive CL practice in their Natural Science course as being useful in their pre-service education?

Apart from the cognitive and affective learning of CL, the CL approach was seen as facilitating induction into teaching practice. During session 5, students collaborated in groups to design a CL activity on classification for a standard 5 class. When their ideas were presented to the class, it was reflected that their pre-service exposure had helped make them competent in planning such activities at the school level. Furthermore it was seen that the collaborative exercise was perceived as enabling future collegial collaboration in the field. In the light of such reflections I claimed that

31

*Students may perceive pre-service experience in the practice of CL as helping prepare them for a CL ethos in the classroom and in the education community.*

## 7. THEME : LECTURER CONSTRAINTS

RQ: What constraining processes occur during the introductory phase of CL practice for the novice CL facilitator?

The CL study had been undertaken in practice, partly because I felt that an externally imposed RDDA model of the introduction and implementation of an innovation may be 'deskilling' for me.

During the process, being a relative novice at implementing the CL approach, I almost succumbed to old habits of an authoritarian nature: I was tempted to intervene, uninvited, in the CL discussions at times, feeling that my ideas may have been more valid, in certain cases. This temptation, however, was consciously resisted and I decided that intervention would occur at the request of a group and that clarification and explanations that were perceived to be needed were to occur only after students had worked with their ideas. Students, themselves, were learning this in the practice of CL. Thus this type of guidance was given, especially during the class discussions that followed the small group work. A claim in this regard was made that

- 32 *A novice CL facilitator may need to consciously act to promote processes conducive to the idea that students are in charge of constructing their own ideas about science and science concepts in a CL environment, during CL practice.*

Furthermore, there were times during the CL activities of the first cycle, when I felt at a 'loose end', since I had been in the habit of occupying herself with 'teacher talk', even during 'group-work'. I occupied the time during which students were involved in their groups, by moving around the groups, observing 'snippets' of processes that occurred, consciously aiming to be unobtrusive so as not to pose a threat to the perceived secure and non-authoritative learning environment that had been created in the groups. I found that, with continued practice and increasing familiarity between students and myself, students may have not regarded me as a threat in this way. Thus I claimed that

- 33 *Ways of releasing control in the classroom during CL may be learned 'in situ' during practice and may be problematised as needing continual reflection, by a facilitator, who is a novice at CL practice.*

It must be noted that I maintained the role of planning CL sessions, thereby making judgements as to what were worthwhile topics to pursue, in designing the course in collaboration with the colleague. This was not problematised and it is my opinion that it needed to be problematised, especially for the current need to transform education in the emerging democracy in South Africa. At college level, perhaps, students may want to choose what to learn in their pre-service science education. On the other hand, they may value the idea of topics that were responsive to present school science curricula, which neither the lecture or the students were involved in developing and which were considered by both lecturers in developing the course.

## CONCLUSION

The themes that were identified and discussed were those that impinged on the next cycle of learning and research. It has been indicated that a reconnaissance session (reconnaissance II) had been planned to initiate the cycle, partly because students needed to be inducted into conscious reflection in action, on action and for action.

Thus, the perception of the second cycle may be that it was of a technical nature in the sense of providing opportunities and strategies for students to reflect on their learning; and partly as a conscious intention for students to focus on the problematised areas identified and acted on, to varying extent, during the first cycle.

Furthermore, the process of generating the themes, itself, may be regarded not only as part of the methodological processes in analysing evidence presented during the cycle, but also as a reflexive process informing action and planning in the CL practice. In this vein, it may be noted that I found it difficult to separate research issues, theoretical issues and praxis.

I had noted in the D-I report that in using the AR approach more than what is expected is revealed. A claim in this regard was

- 33 *AR as a method of researching may reveal more than what is originally planned to be illuminated,*

## ANALYTIC-THEME REPORT II

Some themes that were developed in cycle one, impinged on cycle two. Apart from those identified for reconnaissance, other constructs were clustered

around new emerging themes. A significant theme that emerged from cycle two was that of cognitive participation in CL.

## THEMES

In summary then, three major strands were identified in cycle two of the research:

- \* reconnaissance foci
- \* other emerging constructions
- \* participation.

### 1. THEME : RECONNAISSANCE FOCI

The focus during reconnaissance (session 6) was on the 8 aspects:

- a. dominance
- b. language dilemma
- c. time constraint
- d. alternative concepts
- e. group size
- f. changing groups
- g. group rules
- h. topic,

selected on the basis of illumination and analysis during the first cycle. These were discussed in CL groups during the session and were monitored during the cycle.

#### a. Dominance

During the group discussion of the language dilemma in group A, it was revealed (tape playback) that 3 members were involved in generating ideas with the fourth member's (S1'S) input limited to reading out instructions. The English speaker of the group (S2) seemed to be the 'organiser' and 'clarifier' of ideas given by another member, who was perceived to be less proficient in the language. The group was seen to value S2's and, to a lesser extent, S3's ideas, without regarding them as dominating. This group had reported (by their subsequent poster presentation) that they regarded dominance as being both intentional and unintentional, and that there was 'no dominance' in their group. A claim made here was

34

*Certain members' ideas may be valued above others and such dominance is not regarded as constraining or as dominating.*

In the next session (session 7) it was revealed again, that group A valued some members' ideas above others: some of S4's 'valid' contributions on plant morphology were not taken by the group and in effect, S4 had tended to easily rescind his ideas on opposition. S3 as the observer for the session, however, had noted that there had been no dominance in the CL activity, thereby reinforcing claim 34. The absence of dominance as perceived by members in this group was reaffirmed by such an observation made by S2, during session 8.

S1, on being interviewed at the end of cycle 2 (student interviews II), mentioned that a member had been initially dominant (also referred to earlier in their reflections during cycle 1), but she saw this member's dominance as being "now less"; whereas S3, the other member of the group, who also had mentioned a dominant person in his previous reflection during cycle 1, said that there was no dominance in the group. He did say, however, that one person gave instructions at times, but he saw this as "helping", not as dominance. Significantly, he mentioned that this person was not the one he had referred to in his previous reflective note. S1, however, contradicted herself by saying that she had brought to the attention of the group, the tendency for two people in the group who "talk and talk".

It had been revealed during the first cycle, however, that some dominating self-imposed roles occurred in group A (eg., S2 as 'manager') and in other groups, giving rise to claims 7 - 12, which indicated progressive constructions starting with the acknowledgement of dominating processes that may arise naturally in a group and student awareness of such processes, to that of the need to monitor such processes (as perceived by both students and myself), culminating in an action decision to reflect on dominating processes

during reconnaissance. Thus a new construction was made that  
35

*Students may covertly reflect on dominance during group activity (eg., as in formulating group rules) and find, on overt reflections during reconnaissance, that the strategies they used, minimised dominance.*

During group B's focus on dominance (as illuminated in the tape playback), it was revealed that one member (S8) was uncertain about his group's perception of him being "bossy", in asking for assurances to the contrary. The group had assured him that he was not regarded as dominant. Two threads of talk in this group were: a view that a person who had an understanding of and information on a topic under discussion be allowed to dominate; and a conflict situation between a member's (S6) proposal (supported by 2 other members) that a person be checked if his or her idea was perceived as not valid and another member's (S5) one that a person be allowed to speak through an idea, even if other members perceived it as not valid. The reported decision of this group, however, supported the latter view, contrary to the perception of consensual agreement, based on a majority view. This group valued one member's idea above the others. This illumination strengthened construction 34 made earlier. Based on the perception that conflict had been resolved contrary to my expectations, the following claim was constructed

36

*A group may resolve a conflict in its own peculiar way, which may be unconventional.*

In session 7, however, another pattern was revealed in this group (group B). Most of S7's ideas were taken by the group, with S8 accepting S7's censure of his ideas. S7 and S8 (and perhaps S6 according to S7's comment during the preparation of the teach session in session 9 that "she sides with us"), seemed to concertedly oppose S5's ideas during a conflict situation observed in the tape playback. This was contrary to what had been observed in session 6. In session 8, during the generation of examples of and discussions of modified plant structures, it was perceived that group B had inadequately prepared as requested by me. This was corroborated by member observation wherein S5 noted that interactions could improve, "if the group would...prepare the work beforehand". The group selected examples proposed by S7, S8 and S6, with little discussion. S5 agreed with these - perhaps in acknowledgement of her inadequate preparation, revealed later in her reflective note ("I had not... prepared my work beforehand"), or perhaps she had been the observer for the session (she had mentioned that she observed more than participated) or, in submission. She had alluded, however, in her reflective note on plant morphology, to her dependence on others to do the required work, at times. Thus, it could be said that in this case her withdrawal during CL, probably, was due to a lack of motivation, rather than dominance.

Member observations made in group B for both sessions 7 and 8, corroborated the idea, that they held, of there being no one dominating person in their group. During her interview at the end of cycle 2, S6 said that the rule generating session of cycle 1 had helped the group work on dominance, giving strength to claim 35.

Dominance was seen as being managed for the "good of the group" in Group C's poster report. This view seemed to echo that of S3's in group A (discussed above). A construction made in this respect was that

37

*Students may perceive some dominating processes, as necessary for progress in CL; these perceptions may differ from those of the lecturer.*

Thus the students' own perceptions, on what constituted dominance in CL processes, were regarded as significant in this group, and the group was regarded as using what they perceived as effective strategies to limit dominance. This may be linked also to the reflection I made, following claim 17 of cycle 1, that S2's domination in initiating, clarifying and explaining ideas, could be perceived as advantageous for group comprehension of ideas.

Mention was made, also, of "deligation [delegation]" of work to limit dominance in group C's poster report. S9's minimal input, as revealed on tape playback of this group's discussion on 'alternative concepts' during the reconnaissance session, was perceived as being constrained, not by dominance of other members but, possibly, by other constraints of participation (like being 'shy, a self-given attribute, on being observed by the colleague observer during the session).

During the CL activity of session 7, I found, on observation of the taped playback, that S11 had dominated the conversation and in directing the group's activities (even taking over the poster writing from S12). Member observation of group C by S10 during session 7 corroborated this, by noting that one person did most of the talking. In session 8, however, this was not illuminated. Member observation by S11 during session 8, was that there was no dominance in that session.

In her reflective note of session 8, S10 reflected on her perception of the groups reliance on her validation of ideas, as promoting her dominance, which she personally tried to guard against by using strategies of 'withdrawing' and, at times, cuing members with counter questions, when help from her was sought. Thus it may be seen that, although the group may not see her as being dominant, S10 felt that there was this potential and her related action may have emanated through her conscious reflection. This, together with other instances of reflection leading to action like the reconnaissance focus on dominance, whereby action strategies had been tendered and the idea embodied in claim 35, engendered the construction that

38

*Dominance during CL may be minimised by action based on deliberate reflections by members and reconnaissance of such reflections by the CL group.*

Personal reflection was seen as important in this way, in correlating S10's further reflection of session 8 that, "The group battles with time because [S12] and [S11] enjoy talking and try to make each fact they know known instead of giving [S9] a turn to speak", with an absence of such references by both S9 and S11 in their interviews at the end of cycle 2. S10 had not included herself as one who should be given 'a turn to speak', and this could be attributed to her idea of her "trying to move out". Both S11 and S9 had mentioned that there had been a dominant person (named by S9 as S10) but that this was not the case now. The idea that the group did not perceive S10 as dominant, has already been alluded to above. S9 extended this with a view that S10's dominance was perceived by the group as helping the progress: an instance reinforcing claim 36. S11 had mentioned his perception that the reconnaissance had helped the group progress in minimising dominance, thereby reinforcing claim 38.

#### Overarching decision on the aspect dominance:

On clustering the claims made in cycle 1 (claims 7-12) and those of cycle 2 (claims 33-37) and on the assumption of saturation of observations on dominance, an overarching construct was generated that

Dominating processes may surface during CL and conscious and overt reflections on aspects of dominance, both by students and the lecturer, incorporating group and class reconnaissance may be needed, if the implementation of effective CL is to be successful.

Furthermore, it seemed that students had focussed on the managerial roles regarding dominance, like monitoring talk time, rotating roles of scribe, leader, reporter and organiser of work and not, on dominating processes related to cognitive participation, like domination patterns of participating in generating ideas, explaining and clarifying ideas, questioning and critiquing ideas, judging and accepting ideas. Based on this idea, a reconnaissance session focussing on equity in participation was planned for session 12 (session 11 being a test session).



## b. Language

Aspects of language in CL interactions surfaced during cycle 1 and claims 16 and 17 were made in this respect. Claim 16 emerged on the illumination given by a student (S7), on why a member of his group said that plants were fed with water: that it was a transliteration of the Zulu phrase referring to watering plants. Claim 17 was made on perceptions gleaned off the analysis of the taped part of session 3, wherein S2 in group A was observed to dominate the processes of initiating ideas, clarifying and explaining ideas of members in her group. This could be perceived as disadvantageous in the sense of being a dominating process, but also advantageous for group comprehension of ideas. Furthermore, a lecturer (Maths) had referred to her feeling that first language students tended to dominate in CL.

Further action on the language issue was planned, in that 'language' was in the agenda among other problematic areas for the reconnaissance session.

During the reconnaissance session (session 6), the tape playback revealed that the English speaker (S2) of the group tended to clarify instructions and S4's ideas, whereas S3 tended to rephrase S4's ideas for clarification. S3 was perceived to be unhindered by his second language usage and displayed language proficiency in expressing ideas. These observations, together with claim 17 of the first cycle, generated constructs that

39

*Instructions may need to be clarified not only by the lecture, but also by peers, at the beginning of a CL session; members who were proficient in the language of discussion may be included in a group to expedite this.*

*Small group CL may provide the opportunity for help in the expression of ideas, by less proficient speakers of the language of discussion.*

S1's idea that an English second language speaker found it difficult to understand scientific terms was accepted but not extended by the group in the session. During the interviews at the end of the cycle, S1's idea was illuminated on probing: 2 people (S3 and S11) of the 3 people questioned on this said that first language speakers were not advantaged in understanding science language (S3 - "I don't think first language people have a better understanding of scientific terms"); the third person, S1, reiterated her idea, but modified it on reflecting on the CL activity on 'modifications' of session 8, by saying that it was easier for both English first and second language speakers to understand science concepts, if they had done the required preparation. S6, whose group misinterpreted the concept 'modifications', did not think that science language was a specific problem for English first or second language speakers since, "the group works through it". Thus it may be posed that

40

*Both first and second language students may find science language difficult to understand.*

A paucity of input by S1 of the group, may be seen as stemming out of her insecurity in expressing herself in a second language, or by being unsure of concepts exacerbated by members ignoring her ideas. Group B's input in the report back poster confirmed the idea that an English second language speaker may lack confidence in ideas.

On the other hand, although both S4 and S1, in group A, seemed to have problems in expressing their ideas, S4 was perceived to be undeterred by it in that his input was relatively frequent in the group. I regarded S4 as an 'above average' student, and group CL seemed to improve his language proficiency, especially since he was perceived to be uninhibited in his input, thereby improving his performance. This was reinforced by group C's report that CL helped the development of language in a group.

In S4's case, it may be said that high self-esteem counteracted poor language proficiency in promoting participation in CL. During group A's report back by S3, S4 mentioned that it was difficult for an English second language speaker to express ideas.

Thus, a dilemma on the issue of language was posed: on the one hand, poor



language proficiency coupled with low self esteem which may be generated by poor language proficiency or may perpetuate it, may constrain CL interactions, while on the other hand, CL may provide the secure environment required for development of language and self esteem.

In the class discussion during the report back, it was agreed that language proficiency may be enhanced by talking. How this could be encouraged was posed as problematic.

During session 7, the tape playback of group A's discussion revealed a pattern similar to previous ones, whereby S2 tended to clarify and rephrase contributions and corrected pronunciation, probably following strategies the group had decided on in relation to the promotion of language development - indicating that the group was involved in encouraging language development, thus giving reinforcement to claim 39, in part. Based on the idea that this may have been inspired by the reconnaissance session's focus on the language dilemma, it was claimed that

41

*Reflections on language issues involved in CL may promote the monitoring and development of language.*

Furthermore, member observations in each group indicated that members had expressed themselves so that all understood and observers of groups B and C indicated that members were given opportunities to rephrase inputs so that all understood. This was further corroborated by statements made during the interviews at the end of the cycle: S3 had mentioned that all members understood the language used in his group (group A) and S1, also in group A said that she understood the language. During his interview S3 indicated that his group had reflected on the language issue by saying that they had decided not to use mother tongue in their CL interactions. This may be posed against an earlier comment during cycle one by S1, when she had requested S4 to "speak Zulu". It seemed, however, that a decision in this regard had been made, on reflection.

S1's input in group A's discussion seemed to be better in this session. A construct based on this case was made that

42

*Second language speakers may improve their language proficiency in the small group environment of CL.*

The three students (S1, S3 and S9) who were questioned about language development during their interviews, said that the practice of using the first language improved their proficiency in the language. This may be seen as strengthening claim 39.

Although S4 seemed to have problems in expressing his ideas, he was undeterred by this in his participation. S4's language constraint, however, was noted as constraining him in defending his sometimes valid ideas. S4's case engendered a proposal that

43

*A motivated second language person, undeterred by language constraints in participating, may enhance his/her performance, by interacting with ideas in a CL environment.*

In group B all were perceived to be proficient in the language although 3 members were second language speakers. In group C, S10 (first language) and S11 (second language) were proficient in the language, whereas S9 and S12 (both second language) were reasonably proficient, although S12 took time when speaking. S11 tended to clarify for S9 and S10 for the group. S9's poor input generally (although relatively better in session 7) may be seen, not as being constrained by language. By her own admission during her interview, S9 saw herself as not being very proficient and this she saw as "one of the reasons for not participating".

Group A's discussion in session 8, revealed S4 verbally rehearsing ideas generated by others in sounding them off S2 and S3. This gave some strength to claims 40 and 41. In group C, S11 was perceived to be clarifier for S9,

again, whereas S10 clarified for the group. These observations reinforced the idea embodied by claim 39. Member observations in all groups again indicated that members were expressing themselves so that all understood and were given opportunities to rephrase inputs for better understanding. Furthermore, the observer in group C noted that the idiosyncratic usage of a term had been clarified by the group. With reference to claim 16 of the first cycle, this could be seen as a way of working through potential alternative concepts, by a heterogeneous group.

S10's reflective notes on sessions 8 and 9, indicated the dilemma faced by an English speaker in a heterogeneous group, when she said "the group battles with time because [S12] and [S11] ... try to make each fact they know known..." and in the next note, "took a long time because [S12] and [S11] did quite a bit of talking" and then as she concludes, "... the problem of language does affect our group because [S11] and [S12] don't put sentences short and sweet because of the barrier of the language". She resolved her dilemma by saying, "I personally must try to slow down, because I like things done in a hurry". This type of practice may be one way of managing CL, in a multilingual environment for first language speakers, who had been disadvantaged by apartheid, in being deprived of interacting with members of other groups in the community.

The second language speakers themselves may have been aware of the problem mentioned by S10, as indicated by some comments in their interviews: S1 said that her group members had become impatient with the time she took to say something, at times; the time taken by second language members in expressing ideas, was also referred to by S11 who saw a "slight problem" because of time limit, in that it took more time for such members for "thinking and formulating ideas" and that "the ability is there but time is a constraint". A claim based on this was that

44

*Language proficiency per se, may not be a constraint to effective CL and participation, but the longer time required for second language speakers in expressing ideas, may be seen as problematic.*

#### Overarching decisions on the 'language' aspect

Based on the evidence that led to claims 16 and 17 of cycle 1 and claims 39-43 of cycle 2, it was decided: that rehearsal promoted the development of language and the CL environment provided the stage for such practice; that reflection and reconnaissance helped in personal language development and in promoting group monitoring of development; and that language proficiency may be seen as affecting equitable participation.

On CL groups composed heterogeneously on the basis of language proficiency, it was posed that such grouping further facilitated language development. The implication for a longer time involved for CL, stemming, not only from the nature of CL, but also from the perception that more time was required in such groups was noted as a planning criterion.

#### c. Time

In cycle 1, it was posed that the time for the study of a topic using CL, may be more than that employed in traditional lecture practices and that this had management and curriculum implications. Two lecturers had problematised the justification of the longer time they perceived as required by CL. This was problematised for reconnaissance discussion in session 6. Group A reported that the time given was insufficient for CL work, group B that, at times, more time was required and group C saw the need for more time given for discussion and regarded the time spent in CL as worthwhile. The curriculum implications, however, were not discussed although the management issue was alluded to by students. Thus it was proposed that

45

*Students may not be experienced enough in CL practice or in curricular policy issues, to reflect on the curricular implications of the relationship between time for CL and a curriculum favouring CL.*

It was noted, also, that although students who were interviewed saw group reflections as improving their CL practice, they had not alluded to the

curricular implication of time being devoted to such activity. Claim 44 may be modified to include curricular implications as

46

*The longer time, envisioned by CL for groups composed heterogeneously for language proficiency, may have curricular implications.*

The reflection, that students were unaccustomed to managing time for themselves, had been made during cycle 1 and was seen as having management implications. It was posed, during reconnaissance, that time may always present a constraint in CL, since a topic may engender many different ideas - how to control this was problematised. During sessions 7 and 8, it was noted that the time allocations were adhered to, and that this had been promoted by external prompts given by me and by those of the activity hand-out. Furthermore, member observation during session 7, revealed that group B had managed time and that each person's input was timed as, "as long as is necessary", that group C had not managed the time and member input was not timed; and during session 8, that groups A and B had not managed time or timed each member's input. Based on these observations it was claimed that

47

*Groups may habitually rely on external prompts to manage time.*

Furthermore, in cycle 1 the dilemma existed whereby, on the one hand, the lecturer specified time limits to activities as a way of managing time and, on the other hand, students saw the need for more time given for certain activities. Claim 18 of the first cycle, indicated that the nature of the task determined the time given. In session 6, group C reported that "time should be determined by the way it is used", which reflection was seen as reinforcing claim 16. Thus a claim was made that

48

*All aspects of a session, including class discussions, may be catered for during the planning stage by anticipated time allocations; time allocations may be adhered to, in a flexible way, by both lecturer and group management of time.*

Furthermore, it was reflected in session 6, that the report back period had taken up much of the time allocated for the class discussion and it was decided that time should be planned more carefully to include effective class discussion. Thus, it was decided at the end of session 7, that the questions during class discussion be limited to one per group. This had taken place during session 8, wherein it was reflected that time was well planned and managed.

#### Overarching decisions on 'time'

There should be a careful allocation of time in planning sessions with consideration given to the nature of the CL tasks; accompanied by flexible management of time during the sessions by lecturer and group management of time. The remaining sections that were planned for by the colleague for the semester were modified, in consultation with the colleague, with time being considered.

#### d. Alternative Concepts

During the reconnaissance (session 6), group A reported that the group product and the report back helped clarify alternative concepts and that the lecturer should guide this; group B that "time will solve this" and this was explained to mean that "as students' levels increase" the "misconceptions (sic) are taken care of with development of level and ability"; and group C that alternative concepts "must be dealt with immediately" by the group or lecturer. Based on the observations that alternative concepts may be reinforced during group discussion by social approval or by ignoring them, that some of these alternative concepts, undetected by the group or by the reports, were observed on taped playback (as in claim 24) and, that students may not have the necessary schema for detecting some alternative concepts (claim 25), the lecturer problematised ways of detecting such alternative concepts in a classroom with many groups working at the same time.

The tape playback of the group C's discussion on alternative concepts, revealed: S12's idea that hindsight may unravel alternative concepts, S11's ideas of 'recording' (rephrased as a 'poster' by S10) of 'evaluating decisions' and his idea that language constraints may prevent a member from expressing a perceived alternative concept, S10's idea that teachers deal with alternative concepts immediately (the only idea used in their report) and her idea that group learning helped reveal alternative concepts. All these ideas were accepted by the group. Their poster and report, however, did not reflect this.

Thus, saturation had been reached on the ideas that had surfaced in the first cycle: that group products reveal some alternative concepts (claim 24), that group members may detect some alternative concepts (claim 25) and that report back class discussions helped clarify some alternative concepts (claim 24).

It was significant, however, that no mention was made of teacher observation as a way of revealing alternative concepts, although mention had been made of teacher guidance in shifting alternative concepts. Thus it was claimed that

49

*Students do not find it significant that alternative concepts may go undetected and thus reinforced by social approval in peer interactions; lecturer intervention in the form of guidance, supported by literature information, in such a case may be required to focus students on looking at ways to improve the detection of alternative concepts.*

The reports by groups during session 7 reinforced the idea that a product (the posters) may reveal alternative ideas (claim 25). It was noted, however that most of the alternative concepts, that had been observed on playback of CL discussions of the session, had been revealed by the report. Thus modified claims made were that

50

*Most alternative concepts that arise during CL may be revealed by a product*

and

51

*A task product may be designed to reveal more alternative concepts.*

Session 7 also provided reinforcement for claim 27: group A's member observer noted that certain alternative concepts were ignored, even on attempted clarification by her.

At the beginning of session 8, a review given by me, included the proposal that reinforcement of alternative concepts by peer social approval, may promote the likelihood of resistance to shifting alternative concepts later. On analysis of the taped playback of the CL activity of the session, it was noted that alternative concepts may be detected (eg., S9's idea of 'palm leaves used for basket-making', as a modification of the plant's leaves), or may go undetected (eg., S3's idea of the sweet potato representing a modified stem) and may be detected in the product (eg., group [B]'s poster showed their alternative idea that primary and fibrous roots were modified roots). These observations led to reinforcement of claims (24, 25, and 26) made in the first cycle and those of the second cycle made thus far.

Action based on claim 51 was taken, in that groups were asked to include lists of ideas that were used and those that were not used, with their group products, partly as a way of revealing undetected alternative concepts. This was initiated in session 8 (although only one group made this for session 8). Some alternative concepts were revealed by such lists, eg., "grass plants has no midrib" (group C).

During session 9 (the research and preparation session for group presentation in session 10), I guided members of group B towards a shift in their alternative idea of the concept 'modification'. The examples of modified roots that were used in their presentation during session 10 indicated such a shift. The idea of lecturer guidance in shifting alternative concepts had been mentioned by students during reconnaissance and during interviews. Generally, when it had been perceived to be needed, lecturer guidance had been used during class discussion of alternative concepts revealed during reports, on

reviewing observations made on taped playback and when requested by a group. Thus I found that

52

*Lecturer guidance may be needed to promote shifts in alternative concepts, that may have been revealed to the lecturer, when these alternative concepts remained undetected by group interactions.*

Observations related to claim 23 of the first cycle, were judged to be saturated, since it had been observed that some alternative concepts had been detected by members in a group during the CL activities. Examples of such observations were: in session 7, S7 attempted to shift S8's alternative idea of 'main root'; S2's clarification of S3's idea that a carrot represented a modified stem in session 8; and S9's comment, during her interview, that the group had helped her to shift her idea of 'modification'.

S1 mentioned in her interview, that peer input on shifting alternative concepts helped, but that it was "sometimes confusing because I have grown with it" and she suggested that it would help reinforce her shifts if groups were to review such concepts. This observation correlated with the idea of the persistence of alternative or naive concepts given by literature, especially in constructivistic research in education. Suggestions informing practice in this respect include the idea of co-construction of ideas during concept accommodation inherent in the peer interactions involved in CL. The Vygotskian idea of co-construction with more knowledgeable peers, as in S1's case within her group, may be seen as promoting her shift and her suggestion was regarded as being worthwhile. Thus such review was encouraged by me, appended with the idea of reading.

[Note : Students had been given a reading on research on common or naive concepts of children (Wood-Robinson, C. 1991 Young People's Ideas about Plants, *Studies in Science Education*, 1991, 119-135) during the first cycle. Furthermore students had been asked in a test, to critique statements with alternative concepts commonly held by students.]

#### Overarching decisions on 'alternative concepts'

It was acknowledged that peer help in shifting alternative concepts was a desirable component of CL and that there were limitations in peer recognition of alternative concepts. It was decided that a group product may be designed to reveal more alternative ideas and that there be lecturer guidance on revealed alternative ideas, in the absence of peer guidance.

#### **e. Group Rules**

Group rules had been generated during session 3 of the first cycle, partly as a response to ways of limiting dominance, but its effect had not been evaluated overtly by students.

All groups reported that group rules were necessary : for discipline (group A), to avoid chaos (group B) and that it should be monitored (group C). Thus it was claimed that

53

*Students may see the need for group rules to implement effective CL.*

Member observation during sessions 7 and 8, yielded that both groups A and B had observed their rules during both sessions and that their existing rules were adequate. Group C's observer concurred with this for session 8, but the observer for session 7 had felt that the group had not observed certain rules and that their rules needed to be modified. In her reflective note for session 9 the same observer (S10) mentioned "...we deligated [delegated] jobs" and "We came to a consensus [consensus] about the lesson", showing the adherence to at least two of their rules. S2's comments like "each one was given a chance to air their views and ideas" in her reflective note for session 9, indicated that the group had been observing their rules. S5's reflections on sessions 8 and 9 also indicated observance of rules.

During session 7, group B's observer had noted that the group had "agreed to

speak English only" indicating that their rules had been modified, although he had noted that rules were "so far okay".

Thus, it was perceived that, although groups were not requested to observe, evaluate and modify their rules, they had done so, to some extent. A claim generated to this effect was

54

*Group rules may need to be monitored by the group for possible modification and evaluation of observance of rules.*

#### f. Group Size

The question of effective group size had emerged in session 5 and was problematised for the reconnaissance session planned. Group A proposed a flexible approach dependent on the size of a class, group B a size of about 6 students, and group C up to 8. On class discussion centering around effective participation of members of different group sizes, it was agreed, however, that groups remained as they were, indicating a preference for the 4-member group. Thus it may be claimed that

55

*Students may not problematise group size as in its effect on participation for effective CL, but may interpret it as an issue related to managing different class sizes.*

#### g. Changing Groups

In session 6 groups A and B reported that they had felt that changing groups was a good idea, since it "develops skills of working with different types of people", according to group A, to fulfil the "need to socialise/familiarise" themselves with others, according to group B. Group C reported that they did not think it was a good idea since people "bond" in a group. All groups, however, decided against changing their groups. A claim they made in this regard was that

56

*Changing of groups may be desirable but the timing of the change may need to be problematised.*

In her reflective note of session 8, S10 (of group C) wrote, "I personally don't know all the people and I think it would be an experience for us all to change groups, to get new ideas and get to know the people in the class", which echoed what groups A and B had said during the reconnaissance.

Thus it seemed that there were both advantages and disadvantages to changing groups, according to students. Perhaps if this issue were to be viewed in the context of the transforming educational environment and social order in SA, the option of changing groups would augur well for integration ideals.

#### h. Topic

During reconnaissance, group A reported that problem-solving was appropriate for CL tasks; group B reported that an appropriate format would be a class introduction by the teacher without pre-empting the 'knowledge' children may possess, followed by a group discussion; and group C felt that the format used by the course was appropriate for CL.

The format that had been used thus far was varied: mostly informed by constructivism whereby ideas were first generated in groups followed by group construction of concepts (sessions 6 and 7 in this cycle); a session in this cycle (session 8), wherein students had to prepare individually beforehand, by reading information, then pooling and selecting information for a report; two sessions in this cycle (sessions 9 and 10), in which groups prepared and presented a teach session to the class.

During the cycle, observations made in the class by the lecturer and the colleague, by taped playback of parts of the session, by member observers, by some student reflective notes and from interviews, yielded information that

indicated that students were on-task for all sessions. The participation levels, however, varied and was judged (playback and classroom observation) as being lowest in session 8 (relatively lower in groups B and C). It was rated by at least one interviewed student (S9), as the one in which she had participated the least; and a reflective note of another student (S5) as one in which her participation was unsatisfactory. Both ascribed this to not doing the required preparation. Group B's observer had noted also, that if members had prepared the work "beforehand" participation would have improved. The perception gleaned off such observations was that not everyone had done the required preparation for the session.

Perhaps if the required preparation for session 8 were done as a group activity, participation levels may have been better. This was the feeling of at least one student (S5) when she remarked in her reflections, "...I think that we should as a group go at the same time to the library for our research because if we go one by one some of us tend to doge [dodge]...". This, however, has implications for course design, since the class had met as a class unit only for the Natural Science course. Thus such group preparation may need to be done during lecture time.

On the other hand, it may have not been the format of the task but the nature of the task that promoted less participation. The task entailed the generation and selection of 4 examples which may engender discussion limited mostly to justifications for an example suggested by a member (as had been the case in group C's discussion), which justifications may not be necessary if everyone did the required preparation, unless a member had not understood the information presented in his or her readings. Furthermore, the task was considered to be restrictive in that it was not completely open-ended.

Member participation in group A's discussion during this session, however, was perceived to be the highest of all groups. Members of the group had prepared for the session. There was much rehearsing and 'sounding-off' of ideas by S4 on S2 and S3 and all members generated ideas, whereas group B's strategy had been to generate the minimum number of examples, placing these onto the poster as they were generated with very little discussion amounting to brief unchallenged clarifications given by the proposers. Only two examples, of the 4 that were proposed by group B, were valid and it was perceived that they had not internalised the concept 'modifications'. Participation, learning, productivity, and group interactions conducive to effective CL, may be perceived as not being hampered by the nature of the task, in group A, whereas required preparation (format of task) may be seen as hampering group B's effective CL. Thus a construction was made that

57

*The nature and the format of tasks may be determinants of the effectiveness of CL.*

The reconnaissance session (session 6) was rated the best for participation by 4 (S1, S3, S9 and S11) out of 5 students interviewed, and second best by one student (S5) who found the preparation for the 'teach session' during sessions 8 and 9 the best. S11 found the latter second best and S9 rated them as equal to the reconnaissance for participation. My observations (classroom and taped playback) and that of the colleague indicated that participation levels were high during the reconnaissance session ("This is so good for the students" - colleague).

Perhaps students were personally motivated to contribute in the CL activities during reconnaissance, which involved looking at personal reflections in coming to a construction on each aspect. The group constructing aspect may have given the CL sessions high motivation for interaction since it presumed high mutuality. Furthermore, it was considered as open-ended, in that all constructions were regarded as valid.

In the same vein, mutuality was considered to be high in tasks involving the preparation of the teach session, since each group was required to teach their section to the class and it was perceived that effective teaching by a group was aimed for. I noted high levels of participation during the preparation session. Reflective notes also provided insight in this respect: S5 - "For preparation of how to present and work on our chart everyone participated fully...our desire was to have a good chart and to explain everything clearly



so that everyone would understand what's going on... I learned that when you work as a group you become more interested and active toward your work and it is not easy to forget things - than being taught by a person standing for one hour in front of you"; S10 - "we worked well together...we came to a consensus [consensus] about the lesson"; S2 - "All Group members were willing to participate...willing to help when and while the lesson began and went on...willing to correct... or remind them of something they had forgotten...willing to give advice..."; S3 - "was interesting and enjoyable". The varying presentations indicated the open-endedness of the task. A claim was made on task nature that

58

*Open-ended CL tasks may engender high participation levels for effective CL.*

My observations and member observations of a CL activity in session 7, indicated high participation although Group C's observer (S10) felt that they were not always listening to each other. My perspective, based on observations of the interactions perceived on the playback, however, was different to that of S10, interactions like

*S12 - a function*

*S11 - many functions...*

*S12 - more like spoons, not like a leaf-*

*S11 - some leaves are like spoons...*

*S11 - ...Is there anything else...?*

*S9 - a midrib - this one is bigger -*

*S11 - Thank you, thank you. God bless [S9]'s good idea...*

*S10 - What about the petiole?*

*S11 - Oh, this thing...*

The CL activities of session 7 were planned such that high mutuality could be engendered.

A view that emerged during the interview with S3 was that some areas were best dealt with individualistically. On being cued, he could not mention any Natural Science topic, presumably because he may have regarded the topics dealt with in the course as suitable for CL work; but he gave examples in another subject where he felt that personal meanings were made when reading theory and that a discussion following such readings was useful for "comparison with what others say". He also felt that some topics allowed more participation since "you know more in some" and others less since "you don't know what to say". He extended this, however, by saying that the way a topic was structured helped participation. Thus it was perceived that S3 felt that the nature of the topic was inappropriate for participation, at times, and the format of CL tasks involving a topic at other times.

On being interviewed, S9 said that she thought that there should be a balance between CL and individual learning, since she tried "to analyse what we discuss in trying to absorb that thing", although her statement may be regarded as self-evaluation of learning and not as a wish for individualistic learning *per se*. S11 had found the activity on 'classification of plants' of the first cycle as one in which the group had "difficulty for participation". This activity had required a certain degree of familiarity with some biological terms. S11 and some other students were perceived to have lacked such familiarity: S11 had not done biology in his high school years (from standard 7 onwards - he had matriculated more than 19 years ago). Thus, it was deemed important that the lecturer take the varying cognitive background of members within a CL group, in planning a CL task.

## 2. OTHER EMERGING CONSTRUCTS

Other emerging themes of cycle two included

- \* assessment
- \* monitoring
- \* self-esteem
- \* motivation and



\* learning environment

**THEME: ASSESSMENT**

On comparing the poster presentation and playback analysis of session 7, it became apparent that some valid ideas, like those of S4 in group A, that students had were not revealed by the product. This had implications for group assessment and a dilemma was posed that a group chose what was to be represented on a poster, but that very selection affected the assessment of what was on the poster. This was problematised with students during the next session and a suggestion was made that the task product be designed to reveal more, to include the generation of ideas that were both accepted and rejected by the group.

Furthermore, a picture of the general group productivity (with components like the nature of interactions, participation of members and the ideas that were generated and discussed, the latter giving an indication of cognitive participation) was not apparent on a poster and could not be assessed fairly in a product, like the posters that had been generated.

It was also reflected that the group that was perceived to be most productive (assessed as group A on analysis of the tape playback) had not succeeded in producing the product assessed as the best by peer groups; and that the presentation by a group may obscure the quality of the social and cognitive interactions that had occurred in the group. Peer-groups had awarded all groups 50%, which judging on the product alone surprised both the lecturer and colleague. A tentative assessment of the product alone, made privately by me, differed from that of the peer-groups in that 50 % had been awarded to group A, 65% to group B and 65% to group C. On the presentation and response to questions group A and B had been awarded 60% and group C 80% by me; and on productivity as perceived on analysis of the tape playback my tentative assessment would have been: group A - 70%, group B - 40% and group C - 50%.

Based on the idea that the most productive group may not produce the best product, it was claimed that

59

*The assessment of a group's CL may need to include the group interaction processes and the production of ideas; finding ways of implementing such assessment may need to be problematised.*

In the search for ways of assessing such components, it was reflected that these may include finding ways of assessing the amount of input as an indication of participation, the acceptance and rejection of inputs on substantiated grounds (how input was critiqued) or critiquing the group's judgement of ideas, the validity or quality of ideas, the giving of help including support in listening, agreeing and clarifying, formulating products and assessing group mutuality.

The group assessment for session 8, included the evaluation of the participation and generation of ideas, in addition to the product; and students had been satisfied by this mode of assessment. Since this included analyses of taped playback, the implication for such assessment was that

60

*Each group's CL may need to be carefully observed for assessment purposes, in addition to for planning purposes.*

In the absence of taped observations it remained problematic in classroom practice. To enhance assessment, however, a product design or member observations could be designed to include lists generated by the group, indicating what was accepted and discarded, what was consensually arrived at and what was not, and other aspects indicating the way in which ideas may have been generated. To address this suggestion the idea of lists of 'used' and 'unused' ideas had been implemented for sessions 8 and 9. Lists that were made by groups included valid and invalid ideas in both lists of 'used' and 'unused' ideas. Thus a new claim was made that

61

*Assessment of group CL may include the evaluation of the participation and generation of ideas, in addition to the product.*

'Participation' could be interpreted to include aspects, like initiating, clarifying, accepting, rejecting with substantiation, judging and collating of ideas and the resolution of conflicts; 'generation of ideas' may involve the overall cognitive productivity of the group.

Students had perceived, during session 1, that the discussion following the CL activity, in which the reports were presented and in which clarification and questioning by students and by me and in which I had given guidance, had been needed for group and self-evaluation. The colleague also noted this during the sessions. Lecturer guidance during CL periods, like when a group requested help was also perceived as helping assessment. Thus a claim was made that

62

*Lecturer guidance and interactions with students in negotiating concepts may help students in their self and peer group assessment.*

Furthermore, it had been decided in cycle 1, that criteria for assessment may be given covertly when assessment had been negotiated during a class discussion as in session 1, or overtly when instructions had indicated what was required, as for the task in session 9. The criteria used by groups to assess the posters in session 7 belied internalisation of such criteria, as had been indicated by the surprise expressed by both the colleague and myself, on the marks awarded. It was observed by the colleague that peer assessment practices should be justified by them and a claim made in this regard was that

63

*Initial guidance in peer-assessment given to students may need to be reinforced during subsequent assessments and criteria used may need to be substantiated by them.*

The idea that criteria negotiated by students may differ from those of the lecturer for reasons that may be difficult to uncover, however, was reflected upon against the broader debate of validity of any assessment and whether assessment was a worthwhile activity for evaluating learning.

The assessment of the 'teach presentations' by groups to the class (session 10) was done by the lecturer and colleague. It was observed that although students were asked to base their work on constructivist views, one presentation had not used it to inform their practice; and although they had to use CL in their presentations, one presentation limited CL activity to 2 minutes of the allocated 20, another used information given by one group only and had not specified time allocations for activities, and the third presentation had grouped students but used constructs of individual students instead of group constructs. Thus the presentations were not of a standard that had been anticipated by the criteria and the lecturers. It was reflected that teacher use of CL in the classroom may require reflective practice, implying a gradual progression towards effective classroom CL. Thus it was claimed by that

64

*Pre-service students may require practice in classroom CL for CL to be effective.*

Although group assessment had been given for CL activities (except for the activity in session 2 when individual students gave a mark in self-evaluating their participation and when the lecturer gave a mark for an individual written paragraph of what was learnt), the test at the end of the cycle (session 11) was designed to assess individual learning mostly. Approximately 19% of the test required pair work and approximately 30% included peer group-generated questions. The latter had been included partly on the basis that groups had been involved in generating information, especially on morphology and modification of anthophyte plant parts. The quality of the questions, however, was perceived by the colleague, by me and by some students, as poor.

It was perceived that within the formal testing context the induction of group assessment had been executed with some difficulty since such an experience had not been in the students' repertoire. Thus it was claimed that

65

*Students may need to be inducted into a test format which included items reflective of CL aspects.*

66

*The management of tests which incorporate CL aspects may be different from those in the lecture's and students' experience and may require reflective practice.*

Furthermore, it was perceived that the college environment would limit such assessment during an examination. Thus it was claimed that

67

*Group assessment may need to be limited to continuous assessment practice, as in a college record mark; formative assessment of this type may be regarded as a 'fair' type of assessment.*

This had implications for the respective weighting of college record marks and examination marks. This was problematised with students and the colleague, who was responsible for the final assessment for the semester. The colleague had decided to continue with the plan of using a college record representing 50%, and a semester examination representing 50% of the semester mark.

#### THEME: MONITORING

During the first cycle, no formal monitoring of CL by students had been planned, although group discussion leading to the generation of group rules (session 3) was perceived as some way of reflecting on CL and acting, based on such reflections. The class discussion periods were also perceived as encouraging students to reflect on their CL. Furthermore, the discussion around the transcripts in session 3 was seen as encouraging reflection. Thus, I felt that some reflection by students occurred during the first cycle.

My input during reviews of previous sessions, had been based on reflections made me and were presented, at times, to students for reflection and problematisation, with the idea of revealing bases of action to students. This 'modelling' may have helped students in their induction into reflective practice. After the reconnaissance session, which had been planned as conscious reflection by students in their groups, the idea of monitoring their CL in the form of member observations and personal reflective notes had been posed to them. Some guidance on such monitoring had been given to students, supplemented by a hand-out outlining some types of monitoring.

The reconnaissance session was seen by students as reflecting on their CL practice and as embodying some planning of future action, as was perceived by comments made during interviews, like "Participation has increased now because of working on dominance" (S5), and, "Reconnaissance helps because a member may not be aware of what he or she does" (S11). A perusal of the posters presented during the session, yielded that reflections on an aspect produced reflective statements about an aspect, like "(CL) helps development of language in group" (group C), **planning action**, like "A person may not be interrupted while speaking" (group B), and **revealing dilemmas**, like group A's ideas that, on the one hand, changing groups would promote obtaining "different views (and) skill of working with other groups" and, on the other hand, they reported that staying in one group was worthwhile "because people bond in a group". Thus it was claimed that

68

*Students may perceive the practice of monitoring their CL practice as affecting effective CL.*

Students had indicated that they had found the reflective activities absorbing, as exemplified by comments made during interviews about their participation, like "better...because relating to personal ideas". Both the colleague and I had observed that there had been much 'debate', explanation, 'consensus building', 'openness' and 'uninhibited inputs', during the reconnaissance session. Thus it had been claimed that

69

*Students may find reflective activity motivating.*

Member-observation of CL work was implemented for sessions 6 and 7 of the

cycle, on a rotating basis. Although this had been done conscientiously, there had been mixed feelings about this type of monitoring as indicated by comments during interviews, like "it will help...as observer I have picked up most of these points" (S3) and "but observer telling group - not sure about its effect because it is from one person and not group" (S11). The idea of feedback to a group by a member was not implemented by groups, probably based on views like the latter. A perception that member observation "helps because members know someone is observing" given by a student (S11) during his interview, was different from my view of member observation feedback as helping promote effective CL and, had been regarded as subverting the process, in that it may have been seen as 'policing' rather than 'monitoring' their work. Thus a claim was made that

70

*Members of a group may regard the practice of observing their group's CL in a way different to those underlying the practice of reflective practice.*

Mention had also been made by interviewees, that a group may be more amenable to reflective inputs made by all members of a group. The option of writing reflective notes was taken up by 4 students, only, during the cycle for sessions 8 and 9, although 2 members had indicated that they had been writing reflective notes but had not handed them in. These reflections had not been fed into the groups by their members. Based on these observations it was claimed that

71

*Time for all members to reflect personally and in their groups may need to be incorporated in classroom CL practice for CL to be effective and reflexive.*

#### Overarching decisions on 'monitoring'

Based on the perceptions gleaned from interviews that the idea of reconnaissance, the CL rules activity and the practice of writing reflective notes was beneficial for effective CL and that member observation was negatively viewed by some, it was decided that, generally, students perceived certain reflective practices as worthwhile for effective CL, but the structure of some activities (like member observation) as problematic. The idea given by students that member observation was regarded as effective for personal participation but not affecting group participation was taken. Reconnaissance was planned for the beginning of the next cycle, the option of writing reflective notes was retained, lecture feedback was retained and class discussions were retained, for the purposes of reflexive practice.

The interviews themselves were regarded as a reflective activity for those members who were interviewed, since it focussed on certain issues regarding CL.

It must be noted that ways of monitoring the CL practice, like the interviews, reflective notes, reconnaissance, member observations and lecturer feedback were ways for students to practice reflexive practice, which practice was perceived to be effective for their CL practice and, at the same time, they were the research tools required by the action-research involving my own reflexive practice.

#### **THEME: SELF ESTEEM**

According to claim 13 in cycle 1, the small group situation of CL provided fertile ground for 'confidence building' for those who perceived themselves as 'shy' in a whole class situation.

The confidence and self-esteem of those interviewed at the end of cycle 2, had been perceived by them to have increased and this was seen to have been ascribed to CL experiences in the course. They found that these types of experiences had helped in promoting their participation, as evidenced by comments like: "CL promotes confidence...shy and cannot get used to them in a short while [in a whole class situation]" (S3); "[confidence] increased this year...sharing ideas increased confidence" (S1); "confidence...more than last year...because small group...[S3] encourages me for input" (S6); "not shy in group" (S9); "Confidence increased by CL - particularly...no biology

background" (S11).

They had hinted also, at the idea that such experiences in confidence building may help them in becoming more confident, in a whole class situation, as inherent in their comments: "can lead to more confidence in class" (S6); "may make more input in class" (S9).

S11 commented on how his group had been involved in 'confidence building': "[S9] is not yet fairly confident...group is trying...members put questions to her...strategies learnt...I use this: eg., if someone raises a point and he or she does not carry on and is ignored, then I come in. The group spoke about how to build up confidence...". Evidence of this was given also by S3 who said that his group had been aware of his 'shyness' and "they helped by asking ...[S3]...?", and by S9 who spoke about her group members' help in that they "listen to input...share my opinion". Thus claim 13 was reinforced and modified to

72

*CL sessions may help individuals to overcome personal inhibitions constraining classroom interactions and consequently, practising CL may help in building self- confidence and self-esteem in a cumulative way.*

#### THEME: MOTIVATION

All students interviewed still thought CL to be worthwhile, with S6 saying it was the "best" for learning, S9 that the sessions in the course "encouraged her", S3 saying that it was "more useful than theory" and that the problems that he had mentioned in the first interview were being worked on and were "in the process solved" and S11 had changed his view that students were not "well informed" since he felt that although "some ideas may not be correct" there were "elements of truth". Thus, on saturation of observations, it was claimed that

73

*Students may be motivated to learn cooperatively in small groups.*

#### THEME: LEARNING ENVIRONMENT

Claim 72 had hinted to the non-threatening environment of the small group perceived by students and it may be claimed that

74

*A CL ethos may provide a secure environment for learning for all students.*

Furthermore, the students who had been interviewed were noted as being more open in vouching information, than at the first series of interviews. This could have been ascribed to familiarity with me or to an increase in confidence on their part or it may be seen as the development of a certain rapport, desirable for a CL and a participative environment. Based on the perception that in using an action-research format for CL implementation, student ideas had been illuminated and a more collective reflective interpretation of individual ideas and events had been possible, it was claimed that

75

*A CL ethos may promote lecturer-student interactive relationships desirable for effective learning.*

#### 3. THEME: PARTICIPATION

Analysis of participation yielded the idea that there were different perspectives of what was meant by participation.

During the analysis of dominance in the reconnaissance, it had been revealed that in group A, members seemed to have valued two members' (S2'S and S3'S) ideas without regarding them as dominant. A reference had been made to intentional and unintentional dominance, which had been seen, as indicating that the group had worked through it. Based on this idea, it was claimed that, in the case of this group

76.1

*Members of a group may become aware of practices, like poor language*

*proficiency that may limit participation of members and may act on these.*

They had used the idea that members who were proficient in English provided clarification of the topic and ideas, to promote participation of all members in the group.

Similarly other groups had acted on what they saw as dominant practices that constrained participation, eg., group B - "A person may not be interrupted while speaking" and group C - "Dominance - for the good of the group".

The interviews revealed that students had perceived that dominating patterns had changed and that it had been reduced with their practice, eg., "At the beginning there was ...but better...changed because of rule session" (S6) and that their participation had improved with practice, eg., "...feel free to give mine" (S6). My perception, however, was that some members who had expressed their feeling that participation of members in their groups and their personal participation had improved, were looking at aspects relating to the management of participation (like group rules and rotation of roles) and not at the cognitive participation of members. Thus a claim may be made that

76.2

*Dominating practices whether intentional or unintentional and whether accepted by the group as desirable or undesirable may create unequal cognitive participation.*

As had been noted my perception, during analysis of productivity of groups for assessment purposes, was that cognitive participation was a significant component of participation.

Claims 57 and 58, indicating that the nature and the format of the task were important considerations of the effectiveness of the CL activity may be reasserted, in the light of the idea that the productivity of the group may be affected by such considerations and that the productivity may be determined by the type of cognitive participation of members of the group. Thus it may be claimed that

77

*The nature and the format of tasks may be significant determinants of the type of cognitive interactions that may occur to effect CL.*

Unequal preparation for the CL activity in session 8 was seen to have produced unequal cognitive participation especially in group C.

Similarly, it may be claimed that other constraints that groups may or may not have managed for engendering participation, may have been looked at from a management point of view i.e. in managing CL as a type of learning that was 'new' and in the process of being implemented; but in focussing on these management aspects of CL implementation, it seemed that the cognitive aspects of participation had been ignored to an extent. Thus a focus on the cognitive aspects of participation had been suggested by such observations and the reconnaissance session of the next cycle was planned to this effect. To enhance such reconnaissance the student interviews planned at the end of the second cycle were structured to reconnoitre some of these cognitive aspects, by focussing on participation of individuals.

Five students had been interviewed of the original plan of interviewing six students (two of each group) - one student had not presented himself and had not proffered his excuse timeously.

When questioned on their personal levels of participation, S1 of group A, said that she felt that she participated well in her group, but what limited her participation was that she may "know the thing" but "don't know how to express it" and that "they sometimes ignore" her although not often. S3, also of group A felt that he had "made an effort" to participate. He found that if a person is "not used to people" that if one had a "different point of view" and that if one had a "lack of knowledge" it can hinder and limit participation. He commented that his initial view that people may "keep ideas to themselves" expressed in his first interview had not occurred in his group. Thus it had seemed that in group A language proficiency for one member, and cognitive

background, differing views and unfamiliarity in a group were the constraints to participation.

In group B, the one member (S6) that had been interviewed, felt she participated well ("as well as I should") and that her participation was improving and was promoted by her feeling that as more ideas were developed she felt "free to give " her ideas. Thus it would seem that in her case participation had been possible in an environment of 'freedom' of expression of ideas.

Of the group C interviewees, S11 felt that he had been participating as well as he should and that this had been promoted by his "desire to find out what - [he] - may not know" in 'sounding-out' ideas on others; whereas S9 felt that her participation was not as well as she desired and that her input was limited in that she "needs to refer to books because...", she may not know what was being discussed. Thus it would seem that, for S11 in this group, 'sounding-out' of ideas (probably since he had a poor biology background) promoted his participation, whereas her perceived poor cognitive background limited participation for S9.

To summarise, then, it seemed as though cognitive background was seen as limiting participation by at least two of the five students interviewed and the environment of the small group promoted the expressing of ideas by at least two of the five students interviewed. Thus it was claimed that

78

*Cognitive background of individuals may affect the individual participation of members in a CL group.*

and that

79

*The small group environment of CL may promote participation.*

These ideas were planned to be focussed upon in the reconnaissance marking the beginning of cycle 3.

Further items that needed to be reconnoitred for the purpose of the group and class reconnaissance that had been planned, were included in the interview checklist as questions designed to illuminate the patterns of the cognitive processes of generating, clarifying, critiquing, and selecting ideas in a group. The aspect of patterns of the process of help, as related to cognitive participation, was included in this inquiry.

### Generating Ideas

S1 and S11 said that all members in their groups (A and C respectively) generated ideas; whereas S6 said that the person who "explains more" generated more ideas and S3 said that the person with "ability" to generate ideas should be chosen to "lead"; and S9 said that there had been a person who used to generate ideas more often, but that had changed.

Thus, it would seem that: in group A (if S1's and S3's comments are juxtaposed), all members had been involved in generating ideas and that this role seemed to fluctuate for different CL sessions, depending on the cognitive background of the members (as corroborated by S3's comment that "not just one person doing it all the time, in response to questions on dominance during the interview); in group B that a person used to dominate in the role of generating ideas but the group seemed to have worked on this (as may be corroborated by S9's comment about a person that used to dominate "in giving ideas" and S11's that there had been dominance by a person "to a little extent before" (in response to questions on dominance during the interview). Thus it may be claimed that

80

*The role of generator of ideas in a group may fluctuate according to cognitive background of members, for a CL session.*

### Explaining Ideas

The process of explaining ideas that had been generated had been undertaken by the whole group according to S3 who said that it was "not up to the person who generated ideas to explain". S1 commented that some ideas generated by S2



had to be explained to S4. It had been observed, previously, that S4 had the tendency to 'rehearse' ideas generated by others (S2's and S3's) by 'sounding-out' these in the group and this had been interpreted as his way of attempting to understand them. According to S6, in her group the person who had generated the idea, being the one who has the information, explained the idea in most cases although others in the group also explained; and according to S11, all members had been involved in explaining an idea that had been generated, that when an idea had been given "our minds switch on to this - also add to this".

Based on the evidence of at least 3 of the 4 who were questioned on this, it seemed that it was the habit of the groups to give the role of explaining ideas that were generated by a member to all members of the group and it was claimed that

81

*The role of explaining ideas that were generated in a CL group, may be given to all or any member of the group.*

### Critiquing Ideas

On being questioned about how an idea was critiqued, S1 said that ideas were not questioned often except when there had been a conflict, in which case, the group had taken both opposing ideas, keeping them on hold, to be resolved by an 'outside' source. S3 felt that the group had been aware of the **impatience with the development of an idea** ("cannot wait for the whole development of an idea"), at times and, had attempted to "work it out". S6 saw her role as partly to question ideas and said that the group had been happy with **one member resolving conflicts** although all had tried to help in this regard. S11 felt that there had been little questioning of ideas since they had generally accepted ideas ("not been much apparent doubt of an idea"), and S9 saw the **questioning** in her group as being done by **one person mostly** ("especially [S12] does that"). She found that this had helped her and others in the clarification of an idea in that they may have had a need to question an idea but had not consciously expressed such a need.

Based on these observations and those that I had made (eg., in group B's conflict between the idea of interrupting or not interrupting someone with an 'invalid' idea; during session 7 in group A, when it was observed that S1 had questioned S4's idea that the stem 'stores' and S12 questioning S11's idea that parts of leaves may be modified as spines during session 8), it seemed that critiquing of ideas, as represented by questioning and conflict situations, had occurred and had been done by different people at different times. Thus it was claimed that

82

*The role of critic or sceptic may fluctuate depending on the cognitive background of the person who questions.*

Furthermore, not all ideas had been critiqued, probably since some ideas were understood by members to be valid, according to their experience and cognition. Thus it was claimed that

83

*Some ideas may be critiqued and some may not be critiqued, or may be critiqued to a lesser extent, depending on the cognitive and experiential schema of members of a group.*

### Group Selection of Ideas

Although S1 had intimated that the whole group selected ideas to be accepted and reported as the group's ideas, S3 had commented that there had been no selection, in that all ideas had been taken as accepted and reported on by the group. S3's comment was seen as being consistent with S1's earlier comment that the group accepted opposing ideas, in anticipation of resolution by an 'outside' source.

S6's comment on the group's acceptance of one member's role in resolving conflict, was seen as being tied up with her view that the group had taken most of the ideas of two members, "because they are valid ideas". It had been noted before, however, that during session 6, this group had accepted S5's



idea, which had conflicted with others in the group. This conflict may have been resolved by the member (S7), whose role was perceived to be as one who resolved conflicts by S6, but it had been observed that it was S5's idea that had been taken and not those of the 'conciliator'. Perhaps when S6 commented that this member's ideas had been regarded as 'valid', she had included his judgement as well. She had mentioned that "everybody selects ideas"

According to S9, all members had participated in selecting ideas and she gave an example, "when [S12] has to write a poster, I'd say: [S12], why don't you write this, and then we discuss it and write it down...".

Based on the observation that some students had intimated that all members of a group had been involved in the selection of ideas by the group and, that in some cases there seemed to be implicit acceptance by all members of certain dominant ideas, it was claimed that

84

*Members of a group may agree to accept ideas judged as valid or with the condition of suspending judgement of an idea, as those of the group.*

#### Help Processes

Asking for help was perceived, by 3 students interviewed, as increasing the participation of the receiver of help ("It helps me participate" - S1; "participate better" - S9; "helps participation" - S11;) and by 3 students as increasing the participation of other members of the group, as evidenced by their comments that, it "promotes discussion" (S3), the group members may "gain from" such requests (S6) and it "helps members" (S11).

All the interviewees perceived that the person, who had given help, had also benefitted, as the following comments revealed: "explainer is helped...better kept in mind" (S9); "...because focus on the thing - gets revised" (S11); "By saying what's on his or her mind it helps the person too - you regain - you do not forget" (S6); "realise how you do things and realise certain mistakes - by saying it out" (S3); "because the thing one is explaining is like revision" (S1).

Based on the ideas given by students on giving and receiving help, it was claimed that

85

*The process of asking for help may increase the cognitive participation of the receiver of help and of other members in a CL group, and the process of giving help may be beneficial for the giver of help, as a form of cognitive rehearsal.*

#### Overarching decisions on 'participation'

What had emerged in the cycle was that the students and I had been focussing on the management issues of participation to increase participation, in looking at the interaction within groups during CL, whereas a focus on the cognitive processes of participation may have been required to promote equitable participation. It was decided that, if equity in CL needed to be critically looked at, the reconnaissance session planned for the beginning of cycle 3, be a focus on the cognitive aspects underlying equitable participation of members in the CL groups.

This decision was promulgated by the suspicion that what the practice revealed, in the two previous cycles, were the constraints to CL implementation and ways of working through such constraints (a rather technical and process way of inquiring, perhaps productive of the research questions).

This limiting approach of the research and of the facilitation of CL implementation, was acknowledged at this stage and a more critical stance of the research had ensued, perhaps rather late in the semester (only 6 sessions, of those allocated to me, remained). On the other hand, it may be that such revelations may occur only on prolonged exposure to CL practice.

## ANALYTIC-THEME REPORT III

This commentary is an analysis of the themes underlying the cognitive aspects that were seen to be involved in participation towards a vision of equitable participation.

Cycle 3 began with a reconnaissance session (*Reconnaissance III*), which focussed on the cognitive aspects of participation, since I felt, at the end of cycle 2, that the students and I, in participating in the process of implementing CL in the course, had viewed the implementation from a managerial perspective, in attempting to enhance the participation of individual members of a group. Students had tended to focus on the frequency of individual input and not on the quality of such input. If a member's participation had been perceived to be low, they focussed on how this could be increased. Thus, action had entailed ways of increasing input rather than on ways of promoting equity. Realising that cognitive participation was significant in such equity, I claimed that

86

*The cognitive processes of CL may be significant aspects of equitable participation.*

### THEME: THE COGNITIVE PROCESSES

During session 12 (reconnaissance session), groups were asked to note their observations of the cognitive processes, in a short problem-solving exercise: I analysed this, together with the taped reflections of the their participation. The taped CL sessions of sessions 13, 14 and 15 were analysed to plot the progress of cognitive participation. Member observation of some cognitive processes involved in CL occurred in session 15, aided by guidelines.

In group A, the group analysis of the exercise given in session 12, noted that each member had generated 2 ideas; on analysing how one of these ideas was cognitively processed by the group, they noted that the idea that had been generated by S1, was justified by her, that all members helped in clarifying the idea, that a question relating to the idea asked by S2 had been answered by S1, that all members helped in critiquing the idea, in that its validity had been assessed by the group as relevant. Thus, it would seem that all members had been participating cognitively.

The taped reflections of group A, revealed S2 questioning S4 about his participation at the beginning of the discussion, that she perceived as limited. S4's response indicated that he had needed to clarify what had been required before he could participate. It seemed that this had been done by listening to other inputs. Thus although S2 perceived S4's lack of verbalisation as an instance of non-participation, S4's response indicated that he had been involved in the process of listening critically. Thus it was claimed that

87

*Critical listening may be a process of cognitive participation.*

S1 had perceived that her participation was hindered by an interruption by S3 ("...I was disturbed...by you"). Thus in her case, interruptions may be seen to have curtailed some cognitive participation. A claim based on these observations were

88

*Injudicious interventions by group members may curtail the cognitive participation of a member.*

On the other hand, S2 had perceived S1's initiation of the discussion, as unusual for her ("You contributed first - how come?"). Thus S1's cognitive participation had been seen to have improved. During session 13, S1's cognitive participation had been in the modes of questioning and collating mostly and clarifying in one instance. During this session, although ideas were generated mostly by S2 and S4, all members assisted in clarifying ideas, in questioning ideas and in selecting and collating them. S2, however, did more of the clarifying and justifying, whereas S1 and S4 did more of the

questioning for clarification. S3 was involved in collating the information mostly and was seen to be the 'sceptic', whereas S2 was seen to be the 'educator' in the group.

In session 14, ideas had been generated by S1 and S2 and, to a lesser extent, by S4. Although all members were involved in questioning and critiquing, in clarifying and in collating the ideas, the questioning had been done mostly by S4, the critiquing by S2 and S3, the clarifying by S1 and S2 and the collating by S3.

The taped discussion of one of the examples of asexual reproduction of anthophytes in session 15, revealed that S2 generated the ideas, which had been clarified by all members and critiqued and collated by S1. S10 (borrowed from group C because two members, S3 and S4, had been absent for the session), however, did most of the explaining during clarification. S10 noted that, for another example, S2 had generated two ideas and S1 one idea, that S1 had asked a question which had been answered by S2 and that S2 had explained her idea.

The increase in cognitive participation, generally perceived in this group, and the general distribution of cognitive processes among the members of the group, were perceived as resulting, partly, from the focus on cognitive processing during the reconnaissance session. The group had presented a report using their poster titled 'CL Session' in which they had intimated certain strategies that they were to use (eg., "Do not disturb") - probably on reflection of S1's comment about S3 interrupting her during session 12. This may be linked also to S3's comment about how an idea may not be allowed to develop fully because of injudicious intervention by group members, during his interview ("Clarify questions") - probably on reflection of S4's comment on not participating verbally at the beginning of session 12.

Thus, for group A, it may be claimed that

89

*Reflections on the cognitive participation of individual members in a group, in revealing different perceptions of cognitive participation among members and subsequent monitoring, may promote the cognitive participation in CL.*

Cognitive roles seemed to have fluctuated in this group, although S3 was perceived to be the 'sceptic' in the CL he participated in. Claims 80, 81 and 82 were modified as represented by the claim that

90

*Cognitive roles may fluctuate for different CL sessions.*

Group B's note on how an idea generated by S6 was processed during session 12, revealed a 'dialogue' between S6 and S7, although the idea was accepted by the group. The taped reflections of session 12, however, revealed that the group had perceived all members to have been "equally" active in their participation and that, although they had felt that a member "had contributed more than others", they had not perceived this as dominating but, as being helpful in shifting alternative concepts.

The cognitive participation of S5 and S8 had been revealed in taped parts of subsequent sessions. During session 15, taped playback showed that S5, S7 and S8 had been involved in generating ideas, which were questioned by S5, S6 and S8 and, to a lesser extent by S7, that ideas were clarified and explained by all, but especially by S7, and that S6 and S8 collated ideas. Although S7 had not questioned much, he seemed to be the 'judge' of ideas and S5 was perceived to be the 'sceptic'. S8 tended to 'sound-out' ideas.

The playback of the taped part of session 14, revealed a high level of cognitive processing by group B, in that all three members (S6 had been absent for the session) helped to construct the concept of sexual reproduction in anthophytes. Although all had been involved in generating idea, in clarifying and critiquing ideas, and in collating ideas, S7 generated the most ideas and both S7 and S8 were involved in clarifying the ideas, whereas S5 had done most of the questioning and critiquing. Here the role of 'educator' seemed to be jointly taken by S7 and S8 and that of 'sceptic' by S5.

During the taped part of session 15, in which S7 had not participated (he had decided not to, since he had been observing), S5 and S8 generated the ideas about the example of asexual reproduction. The ideas were questioned and critiqued mostly by S5 and S8 and, to certain extent, by S6, although much of the explaining and justification had been done by S6 with the collation by S8. Here, it seemed that, generally, S5 and S8 were the joint 'sceptics' and S6 was the 'educator'.

For the discussion of another example, in the session, S7 had noted that 3 ideas were generated by S8, two of which had been accepted 'as is', and a question related to the third idea had been asked by S6 and answered by S7.

Thus, it would seem that cognitive roles fluctuated and cognitive processes were distributed among members of group B, as had been noted for group A. This reinforced claim 90. The cognitive processes involved in group B's CL, may also be seen as resulting from the "Future Strategies" proposed by them during reconnaissance, as reflected on their poster. This may be seen as reinforcing claim 89.

S5, however, had consistently been a 'sceptic' in the sessions of the cycle, just as S3 in group A had been seen to be the 'sceptic' in his group. Thus a claim was made that

91

*Some members may tend to take on stereotypic roles.*

Group C, in looking at S10's idea during the exercise in session 12, noted that it had been clarified by S10 and S12, with a question to aid the clarification being asked by S11 and that the group had accepted the idea as valid based on the clarification. Their taped reflections revealed S10's confession, with S9's agreement, of her dominance in generating ideas. S12 felt that he had "contributed optimally". S11 felt that he had agreed on an idea after he had satisfied himself on its validity, while S9 felt that because she found that she personally agreed with the ideas, it may have created the perception among the members, that her participation had been low. Thus it may be seen that both S11 and S9 concurred with the view that verbalisation of an idea may not necessarily be an indication of cognitive participation. S10, however, had suggested that ideas that members had "in ... minds" should be verbalised, and proposed the strategy, which was accepted by the group, of a "round and have a turn to say the ideas".

Thus, unequal cognitive participation (as referred to in claim 76.2) in the group, had been acknowledged, on reflection and a strategy for future action proposed, reinforcing claim 89, once again. Furthermore, the idea that verbalisation may not be an indication of cognitive participation, had been hinted to by S4's actions in group A's reflections, and a claim in this regard was made that

92

*Certain cognitive processes, like listening critically or judging an idea, may remain unrevealed to a group during CL.*

The taped CL of session 13, revealed that ideas had been generated by S10, S11 and S12, with S12 doing most of the generation of ideas, that all members were involved in clarification, with S12 clarifying mostly, that questions were asked mostly by S11 who seemed to critique the idea and that S10 did the collating. S9's input had been limited to asking a question and a single instance of explaining. Thus S12 seemed to be the 'educator', S10 the 'judge' (which may be seen as linking with her reflection, in cycle 2, that the group relied on her judgement) and S11 the 'sceptic' in this session.

Session 14 saw S10 doing most of the generating, clarifying and critiquing, although all had been involved in generating and clarifying ideas and S11 in critiquing them. Questions had been asked by S9 and S11, and S10, S11 and S12 collated ideas. S10's cognitive participation was seen as improved in this session in that she had generated an idea.

S12, the observer of the group for session 15, had noted that all three members had generated ideas (S10 had been in group A for this session), that S11 and S12 had explained and that S11 had asked a question which had been

answered by S12, during the discussion of an example of asexual reproduction of a plant. He also noted that S9 and S11 had asked for his help, which was given and which led to the group undergoing a shift in a concept. Thus S12 had been seen as the 'educator' and 'judge' in this session. Although S11 had also judged an idea, S12 was perceived to be the one that the group relied on for validation of ideas, a role that had been perceived to have been that of S10.

The analysis of group C's cognitive processing during the cycle gave strength to claims 89, 90 and 91.

#### Overall Comment

Claims 89, 90 and 91 had been strengthened based on commonality and frequency of certain observations. They were thus given the status of propositions (see tables concerned with the development of propositions - chapter 5).

Claim 86, made at the beginning of cycle 3, may be reasserted in that the **cognitive participation of individuals may be seen as unequally distributed** among members of a group and over different sessions. The vision of equitable participation had not evolved by the strategies used by the groups and may involve more than strategies and monitoring. An aspect pertaining to equitable participation that may need to be studied in this context may be that of the relationships between status and equity of participation in CL.

#### COMING OUT OF THE EXPERIENCE

To obtain insight into the overall experiences of participants of the course the following had occurred to garner such information:

- \* all students wrote reflective essays
- \* statements were abstracted from these essays to formulate a questionnaire relating to general experiences of students
- \* the authenticity of these statements were corroborated by 25% of the student population
- \* all students responded to the corroborated questionnaire
- \* all students were interviewed
- \* the colleague and I had a reflective dialogue.

This information was used in corroborating propositions that emerged from the study.

#### RECONNAISSANCE IV

I had made a reconnaissance (*Reconnaissance IV*) of what was learnt about equitable participation. Students were not involved in the reconnaissance: the sessions allocated to me had passed. I reflected that aspects related to equity and participation needed inquiry. Although there seemed to be an overall increase in participation of members within a group, participation patterns persisted: there was a least participative person in each group based, not only on the frequency of input, but also on the quality of cognitive input (they tended not to 'generate' but 'question' ideas for clarification).

One aspect that may be identified in responding to why such patterns persisted, is the relationship between status and participation. An inquiry into the perceived status of participants in the small group may yield critical insight into the participation patterns observed. The status of an individual may be seen in the light of academic status, language status, gender status and popular status.

It was perceived that the least participatory members of each group (S1 in group A, S6 in group B and S9 in group C) may have enjoyed a similar status within their group: low academic, language and gender status ('popularity' was obscured). The other women members were seen to enjoy at least one other higher status category: S2 in group A - high language (and perhaps high academic), S5 in group B - high language (and perhaps high popularity), S10 in group C - high language (and perhaps high academic). There may be other complexities involved, eg., S7 in group B, may be seen as having low academic status from the perspective of the lecturer, yet his ideas were perceived to

be valid by members of his group; perhaps his popularity status had more weighting, or perhaps his language status was regarded as high by himself or by his peers.

Thus, the next cycle would have focussed on the relationship between status and participation. On resuming her series of lectures, the colleague, however, saw the need to reconnoitre other aspects, perhaps arising out of a need for her to appraise the situation, as in an introductory process at the beginning of a course.

APPENDIX III  
RETROSPECTIVE CASE INTERVIEW WITH COLLEAGUE

Checklist

Focus on gaining some information about the propositions that were generated by asking about her experiences with the current 1996 third year Natural Science class which was the 1995 second year class which participated in the study; and her general experiences CL with her classes this year. The propositions are on the areas:

1. DOMINANCE
2. LANGUAGE
3. TIME
4. AC
5. TOPIC
6. ASSESSMENT
7. MONITORING
8. PARTICIPATION
9. GROUP RULES
10. STUDENT MOTIVATION
11. AR METHODOLOGY
12. LECTURER CONSTRAINTS
13. UTILITARIAN ISSUES
14. GROUP SIZE
15. CHANGING GROUPS
16. SELF-ESTEEM
17. LEARNING ENVIRONMENT

TRANSCRIPT OF THE INTERVIEW: 06.12.96

Note: R = Researcher; C = Colleague

- R: Hi! [C], I know that you and I have been discussing the experience we had of inquiring into CL with the 1995 second year Natural Science students. I need to document some of these and to look at how they relate to the propositions developed in the research. You will have noted that there were - many propositions clustered into areas of focus. I would like to speak about each area - so shall we start with dominance?
- C: Ya - sure -
- DOM R: - it was found that there was some dominance, that reflection helped - generally - that certain aspects of dominance helped the group, and that dominance led to unequal participation - cognitive participation. What are your ideas about these aspects - during your course with these students this year? Were there any - was there -
- DOM C: In terms of grouping that had taken place this year - there was some dominance that did operate but I think if - I had to look back and compare it to what actually took place in second year - the extent to which it took place in second year was probably much more because the students had worked out how much - even the dominant person actually started becoming aware of - if they were speaking too much - because I can remember with [S2] at one point saying - 'Oh! I know' and then she would start talking and then discuss something and then she would hold back and then say 'I think so-and-so also have something to say' -
- R: - um -
- GR C: - and their groups were heterogeneously organised and people  
COMPOS who didn't speak at particular points - obviously the whole group would look at them and say - 'Okay, what do you have to say about a particular issue' - it would depend on what we are discussing at that particular point in time -
- DOM R: - um -
- DOM C: - so I think the students became - definitely aware of it during their second year and -
- DOM R: So you feel they've developed strategies?
- C: Definitely -
- R: - and they used these -
- DOM C: - and they actually used the strategies and I think - probably - I could see it in one of the groups - because there were new people that came into the other groups - and the functioning had to be built up within those other groups too -
- GR R: Did you have the same sort of groups that we had?  
COMPOS C: - they were a bit varied, yes -
- R: Okay - and what about your other - classes - I know you do cooperative learning with them - do you find that - maybe - this group is working differently from your other groups - or - have you actually worked it out with the other classes as well?
- GR C: Ya - with current second year Natural Science students they  
CHANGE are working in groups - and I know that I did change them during the course of the period as well
- R: - um -
- DOM C: - and there was dominance found within it - but I must admit that these third year students definitely knew how to organise - how to work through it - because of their experiences that they had during their second year -
- R: - um -



GR CHANGE C: - and in the evaluation form - one of the third year students actually said that they would have preferred the grouping that took place in second year - and even the rotation that took place - they would have liked to have seen more of that in their third year - so - ya -

STRAT R: - okay -

LANG C: - they definitely are aware of everything -

LANG R: You spoke about - [S2] in a - heterogeneous grouping - do you mean heterogeneous as far as language is concerned?

C: - language and also in terms of sex as well - ya-

R: Okay - what are your ideas - about - heterogeneous language grouping ? - you know - when I say that - it's mixing first and second - English first and second language speakers -

C: I am basically of the opinion that it is the only way that one should actually be working here at this college and looking at the context -

R: - um -

C: - that is taking place.

LANG R: Apart from the social aspects - do you think it actually develops language?

C: Definitely - when you actually sit back and you listen to the comments that students make - I have heard - [S10] actually pronouncing a word, for example - for [S7] - and [S2] would also be a part of that - and then they would all end up explaining and exploring the avenues - and, for example, when one looks at mental mapping and giving them a task where they have to construct a mental map - he would make an input from his sphere - and obviously his experience - and everybody came from different backgrounds and they all had different experiences - and they would all try to understand -

R: - um -

C: - where everybody else tried to fit in.

R: So [S2], [S10] and -

C: - [S7] -

R: - and [S7] - were all in the one group -

C: - that's right -

R: That's very interesting - because of dominance -

C: um - ya -

R: When they were in separate groups those are the ones that were dominant - now -

C: Oh - I didn't realise that -

R: - now it would have been nice to see who was dominating -

C: Well - I think when I spoke just now - I actually said that -

R: - [S2] -

DOM C: - [S2] would say something and then she would actually step back - a bit -

R: - um -

C: - listen to what the others had to say and they would discuss further - so it went on very nicely -

LANG R: Okay - and did they monitor their language development? -

DOM well - you said that they were correcting each other - and that sort of thing -

C: ya - I wouldn't say they recorded it - no -

R: Okay - and you feel that it has helped language development?

C: Definitely!

TIME R: Now - there was also the aspect of the - we thought for second language - people - you require actually more time to co-construct ideas -  
C: -um -  
R: - because of the language - you - they may have difficulty in expressing - their ideas in a given time - so - is this in your experience this year - are they still taking long - to express ideas?  
C: - um - I would say that - it's very difficult because it actually depends on the content that you are working with -  
R: - um -  
C: - and probably their exposure to that particular bit of content -  
R: - um -

LANG C: - but what I definitely will say is that in terms of language  
TIME they would speak without hesitating -  
R: - um -  
C: - and they would share openly -  
R: - um -

LANG C: - um - they were not embarrassed about what they said - so  
TIME there was that confidence to speak - which really was great - and not just in groups - there was a lot of presentations that had to take place -  
R: - to the class -  
C: - ya - during this particular session - and they functioned very well - obviously [S12] - is just a slow speaker -  
R: - generally -  
C: - and in his presentation he just spoke slowly and people got a bit irritated - but generally that developed -

LANG R: Oh - do you feel that there is an improvement in their  
TIME fluency?  
C: - ya -  
R: Have groups actually developed as far as managing time, this year? Remember there was the problem - with external constraints of time -  
C: - ya -  
R: - that you give something - that they must discuss it within a certain period -  
C: I must be honest - in terms of that - I think I also have a problem as well with managing time - but when I would give them an activity I would say - okay - fine - let's look at all the activities that we would have to be working on -  
R: - um -  
C: - during this lecture - 'and let's see how - you know - we are going to work it'. In many cases they would actually say to me - 'well - if that is the first the - first one we are going to do - I think - let's concentrate on that' -

TIME R: - um -  
MONIT C: - 'and the others would follow afterwards' - we were actually monitoring the time - together as a class group -  
R: - okay - as a group -

TIME C: - as a class group -  
R: What are your ideas about time with respect to study programmes - obviously you have designed your own study

programmes -  
C: - ya -  
R: - so that time has been - allocated for certain  
TIME things - what about with cooperative learning - have you  
actually allocated longer time with certain things - because of  
cooperative learning?  
C: Well - in most cases I try to - definitely try to. In some  
instances it is not possible and during a lecture session I  
actually started with cooperative learning - and then we would  
have just a general discussion afterwards - so I have -  
R: - um -  
C: - and I think the reason - the reason why I have done that is  
TIME I actually reflected on what has happened in the past - and the  
REFL fact that - for a particular session - if it took me a lecture I  
would look at how the students fared - what their comments were  
-  
R: - um -  
TIME C: - and, for example - when we evaluated the course - students  
spoke about a time issue - in terms of organising activities in  
class - and then obviously I would build - try to build it in -  
not that I always could -  
R: - so - students themselves have recognised that -  
C: - ya -  
R: - but within their groups - do they manage - like a topic -  
within a certain time?  
C: They - well - because we would monitor the time together - it  
would be formalised - how long it would take - within the group  
-  
R: - um -  
C: - they always tried to stick within the limits -  
R: - oh -  
C: - that the whole class had organised -  
R: - so there -  
AC C: - there is management.  
R: We did develop some - ideas about alternative concepts - in  
the co-construction of alternative concepts - during cooperative  
learning some alternative concepts emerge. This may or may not  
be detected - by a group - you know. Very often it was the  
lecturer that detected it. What are your ideas about this - do  
you think we need to concern ourselves about this?  
C: I think - if you understand the person and you know a lot  
about the student who has actually said it -  
R: - um -  
C: - then obviously you are going to gauge whether you need to  
be concerned about it or not -  
R: - um -  
C: - so I think it is basically their experience and so I think  
you have to know your students more -  
R: - but - I am looking at it from the context of -  
C: - of -  
R: - we may actually miss -  
C: - um -  
R: - the alternative concept - because it's during

their cooperative learning - and the other students may miss it as well -  
 C: - ya - right -  
 AC R: Do you think that we should design some sort of way of actually getting - you know - trying to find out what alternative concepts there are within a group?  
 C: I definitely think so - because obviously - there is a lot of growth that can take place - if people can recognise what the real concepts are - and what the alternative are - and I think the person who introduces that alternative probably is very hesitant - when they first do it - because they are so uncertain about what they are going to say anyway - and if one can recognise that and - I don't know - and probably brainstorm it -  
 R: - um -  
 C: and actually show them that their input is a valuable input - no matter what it is - it is valuable - and also to take it further and - to link it to the actual concept as well -  
 TOPIC R: - and the nature of the topic - I remember we - having a conversation once - and you said that - you know - actually any topic can be - it's the way we handle it - it could be - sort of - approached using cooperative learning. Do you still feel that way?  
 TOPIC C: - definitely -  
 TOPIC R: - or have you changed your mind?  
 C: No - I have not - because it does not matter who I am working with and what section I am dealing with - there is always scope for it -  
 FORMAT R: - okay - and - the format of the topic? I'm asking this because - remember the one classification activity - not classification - I had asked students to get examples of different types of reproduction - vegetative reproduction - and I told them - beforehand - to come in with ideas - now - in one group - it was just a list - and one person had done it and given the list - so there was no interaction really. In another group everybody had worked with it - so it's the format - whether you - do you give them work beforehand - or do you bring the ideas in - and it depends on -  
 C: I would -  
 TOPIC R: - also it depends on - where in the topic you are -  
 C: - you are - I think I mean - if the focus is group contribution - what you actually have to do - is give them the work - they go home as individuals - look through it and as a group make contributions or input - so I think the formatting would be as what I mentioned now - and they actually would have to share it in the classroom setting to ensure that there is participation of all individuals in the group.  
 R: - because it would affect participation?  
 C: Definitely would -  
 ASSESS R: - and assessment - what processes have you used for assessment with these - this particular class this year?  
 C: Well - if you're looking at group assessment - well they had to do a prac investigation of the rocky shore as a group - and three different groups - each group had a different problem to investigate - and they had to report on that - in actual fact the whole course was based on group investigations -

TOPIC they also had - group investigation of Marianhill Nature Reserve  
- they had a group investigation of Umhlatuzana River looking at  
pollution levels and use of water kit - they also had a group  
display basically of animals and the impact of people on animal  
populations in South Africa -  
R: - so they had fun -  
C: - ya - they also had practicals - group practicals they had  
to carry out as well - besides obviously the the other prac  
investigations - did in classroom setting - and they also had  
individual practicals, their assignments - well - I suppose  
their display was a part of the assignment -  
R: - the assessment -

ASSESS C: - the other assignments were individual.  
R: The assessment of these group investigations - were they  
given group marks or individual marks - or -  
C: They were actually given group marks - they were given  
criteria of assessment - were told obviously - group mark - and  
what they then did was when they were out in the the field -  
they actually delegated different activities to different people  
in the group - and when they started writing up the report they  
then said - okay - what did you do - what did you do - and -  
then it made a - well - a composite.  
R: But - they were not assessed individually -  
C: They were not assessed individually - but as a group.  
R: - and - did they complain about this - or did they prefer  
this - or -

ASSESS C: No - they were happy with it - and I know at one point when  
PART they had to do the display - there was a bit of friction at that  
point because there were two people from a particular group -  
who were not pulling their weight -  
R: - okay -  
C: - and they came forward - and they said that so-and-so is not  
doing their work - I spoke to these people and they still didn't  
bother to do much - so they then got naught.  
R: So there are checks and balances -  
C: - ya -  
R: What is the - sort of - percentage assessment of group to  
individual assessment for the college record - is it 50-50 - or  
C: - approximately - ya -  
R: Okay - I know we tend to assess the product - have they  
spoken about this - for example - the students that came back  
and said that these people haven't been working = and you've  
given them nought - what about assessment of actual  
participation within a group - you know - how they participate -  
who generates the most ideas - that sort of thing -  
C: I must be honest - I actually did not look at this.  
R: Do the students actually speak about that?  
C: Well - the fact that they could speak about it in terms of  
the assignment - I do not know if you want me to speak about  
assessment of participation - but ya - I think generally and -  
what they would think actually say - and even in their class  
discussion - I mean - they would sit back and say - what do you  
have to say - so obviously they are aware of the fact that there  
should be - equitable participation.

ASSESS C: - equitable participation. Monitoring - we were consciously  
PART monitoring and group processing. Did they continue to, do this -  
MONIT look at group rules, for example?

REFL C: Well - when we started of the year we - actually looked at -  
we started off reflection of second year - and I said to them -  
well - you have been through the whole experience - and let us  
speak about how you went through it and what were your  
experiences - and they actually stated that - they had learnt a  
lot from that experience - the fact that they could actually  
take that now - and they could go into a classroom setting - and  
UTIL then I said - well we spoke about it in terms of them teaching -  
and we also spoke about it in terms of organisation this year -  
GRRULE then I said to them - let us work out group rules - we generally  
discussed it - but - we did not workshop it as what had been  
done the year before -  
R: - because they'd had that experience already -  
MONIT C: - spoke generally about it -  
GRRULE R: But - would you say that they were monitoring the rules - for  
DOM example, like bringing it up - from your observations?  
C: Well - the fact that they could sit back and discuss -  
dominance - and you must not dominate all the time -  
R: Oh - like [S2]'s example -  
C: - ya - sorry - I keep on going to this particular example -  
R: No - that is fine - and of course you find that it helps -  
it's helpful to monitor - that sort of reflective thing. Do you  
think students find it helpful?  
C: I definitely think so - because - it is not just what will  
UTIL happen to them here at college - but also how they will take it  
into their own practical teaching experience.  
R: Would you say there was one particular person that kept on  
ROLE bringing people on-task - you know - sort of - a member of a  
group who would say - 'you are dominating' - or - 'you are  
taking too much time -  
C: You know that - that never - I do not think that ever did  
crop up -  
MONIT R: Okay  
C: - they were monitoring - but they were not monitoring in  
terms of writing down -  
R: No - okay -  
C: That didn't arise.  
R: I ask this because - I remember there was resistance to group  
member observation - the one sheet - they actually looked at it  
differently - like policing - you know.  
C: - and the thing is [S8], with [S4] - and he was with [S3] -  
and I think -  
R: [S5]?  
C; No.  
R: [S6]?  
C: - ya - [S6] - even that group as well together - everyone in  
this group worked well - [S8] obviously in most cases - would  
PART start talk - but he would not be in the hot seat all the time -  
because everyone else participated.  
R: Okay - but he used to be very dominant - at the very  
beginning.  
PART C; Ya  
R: Okay  
C: [S6] also was very open - and she contributed a lot as well  
this year - I actually said to her -  
R: So - you see development in her -  
C: - I actually said to her - huh - you are talking

a lot now - arn't you -  
R: Oh - that's very nice - that's with her self-confidence. Has  
this actually developed - in others - has it continued - the  
self-confidence and self-esteem?  
C: Definitely - if you look at [S9] - if you compare [S9] to  
what she was at the beginning of second year - she has developed  
much -  
R: - um -  
C: - in terms of standing up in front of group - before she  
would stand and smile and go into a shell -  
R: - um -  
C: - she would stand up now and - even the way she would project  
her voice -  
R: I'm glad - from all those students I found her the least  
participative - even - listening to the tapes - she hardly used  
to make any input. Okay - do you want us to continue with  
participation - or types of participation - like, for example -  
would [S9] actually give ideas or - just do a report back - that  
sort of thing?  
C: - um -  
R: - it's difficult to say -  
C: - I wouldn't be honest if I were to answer that - because  
really -  
R: But - in your mind - was your goal - like - equitable  
participation?  
C: Yes - I would not say that I was not conscious of it.  
R: ya  
C: I would go to a group and pick out people whom I know would  
be least participative - or whatever - I would actually say -  
what did so-and-so say in the group - or - I would actually say -  
- what are your ideas - and in this way - if a person had not  
made an input - and the group had not checked it - well - I  
don't even know that - I would get them involved as well.  
R: That has implications for assessment - we are looking at -  
things like assessing attitude - for the outcomes based  
education -  
C: Obviously we have to build them in -  
R: - because I know that even this year - for me - I didn't  
formally observe - but I know what you mean - by just a rough  
observation - and - like - going to a group and saying - look -  
all you guys are not participating -  
C: ya  
R: - but I think we should look at that more intensely. So - do  
you think that students were still happy with cooperative  
learning - or - were they bored with it -  
C: Definitely not.  
R: - or are they still motivated?  
C: One of the actual comments I also got - on evaluation sheet -  
that they really would love to work within groups with every new  
aspect - that is introduced -  
R: That's interesting.  
C: - first - before there is any discussion on it - now - some  
cases - in some of topics - I could not complete it in the  
lecture - and it really needed two lectures - or sometimes three  
lectures to complete it - and then the first session would -  
like - have group participation etc. - and then second session  
would be just class discussion or class discussion

MOTIV that would be given - so - they do - they still are motivated.  
R: These particular students - did they also fill in your evaluation sheet that you gave out at the end of the year?  
C: Yes  
R: Is it possible for me to use it - you don't mind?  
C; I have - I actually mentioned it to you - but I've got them at home -

AR R: I used action research to implement - cooperative learning - and I found that the reflective monitoring aspect of cooperative learning matched the action research process - what are your ideas about this - in your experience?  
C: - you mean -  
R: - generally - it doesn't have to relate to your particular group.

AR C: Well as far as I am concerned - working with action research is fantastic - as you have mentioned to me all the time - is that I am also doing it - but obviously I'm not being reflective and documenting it - in most cases reflection is taking place - but one is not looking at reflection overall - one is looking at reflection of certain things that you have picked up during the session - you probably reflect more on that than anything else - that obviously comes with action research.  
R: Does this reflection inform your - future plan - or -?  
C: Definitely would

LROLE R: When I first started out - I was feeling a bit constrained - because I was used to the traditional type - even if it was interactive material - I was always in the authority position of power - I found that a constraint - my own constraint - like - in what is my role, what is my expected role. What are your ideas - in your experience- How do you go about it? What would you say your role is during cooperative learning?

LROLE C: Well - firstly before it can take place - scene must be set - organisation and planning of it. Once you enter into a clas - you have to actively discuss with students and not stand in front - and say this is what you have to do. Then I see myself as a facilitator and - I suppose - and to ensure - that's part of a facilitator - to ensure that people are participating - people are having fun as well.

LROLE R: Am I hearing you right - you're saying that you create the opportunities for learning - the learning environment - you LENV  
organise that?  
C: Yes - I think the personality of person is important. You cannot have a cold, hard person trying to do it - because it's so -  
R: -you need that rapport -  
C: Yes  
R: Do you think - cooperative learning particularly - as opposed to traditional learning - traditional approach - do you think cooperative learning particularly increases that rapport with - lecturer and students -

LENV C: Oh - definitely  
R: - apart from student-student interaction - there is more lecturer-student interaction?

LROLE C: Oh - definitely - I think - amazing that at the time too - REFL  
you actually discover more about your own students - and - helps you with planning for later on -



LENV I remember one section - we spoke about - multicultural issue - started sharing information - and some of the students in a group were totally amazed by - for example - the reaction of - probably a Zulu person to an issue in the classroom - but why - why is that the case? - and what actually ended up saying at the end of it all is that - we should have generated a book - resource book from everything that came up in that class - because it was - everybody participated and were giving their input - and - it started from mini-groups - then it actually became a big class discussion.

R: I have encouraged you to write everything down - to do your research.

C: Ya - you know that book would have been ideal -

UTIL R: Ya - that's a way of doing it too - you know - because you have this goal - you will - actually sit and do it. We spoke about utilitarian issues - I mean - are they using it in the classroom? I know we haven't been - have you actually crited any of these particular students - in classroom evaluation during teaching practice?

C: No

R: - last year - you did -

C: Ya - last year

UTIL R: Do you remember [S1]'s -

C: Yes - I definitely can. She actually taught a lesson - standard six - the cockroach - and she had grouped all the pupils. They were all in a group and each group had a specimen - a cockroach in a bottle - and - definitely there was interaction within the groups. They had to observe their specimens - they had to firstly identify the specimen - and then they had to speak generally about where the specimen was found etc - it's amazing about how much of the home environment and experiences came into it - and the way she managed it - was very nice -

R: So - you think she learnt -

C: She definitely did learn - and actually said that - because I asked her afterwards. I said - you know I really was taken up with the way you have done it - and I said - how would you have felt if you actually just stood up and spoke about the cockroach - on a chart. She just said to me - the lesson would never have worked - 'Did you see the excitement on their faces?' - that's why I sat through the whole way. The downfall in that whole thing was that she did not get them to record - but she did get them to participate in terms of verbal input about what they observed.

R: And - did she encourage the kids to actually interact with each other - did she monitor that -

C: She did encourage them to interact - she did move from group to group - she would actually ask - I suppose she probably - she'd actually ask certain individuals in a group - 'are you participating - what are you doing' - so - ya

R: I'm glad - so - did her experience with us in the lecture sessions help her? Did she say that -

GRSIZE C: yes

R: What are your comments about group size for this year?

C: This year 3SP/JP groups - at the beginning of the year we spoke generally about grouping and what had taken place in 1995

REFL Students wanted to work in groups - group rules were spoken  
GRSIZE about - as refresher - group number was looked at and group  
composition - group number 4 or 5 - new members joined the group  
set up - they had started later.

GR R: What about the timing of changing of groups?

CHANGE C: Groups worked together for one semester. We did speak about  
changing - but they were comfortable with it. At times - with  
one of the prac investigation - students formed their own groups  
- not all the students were happy with this - you could check  
their evaluation comments. With 2 SP students - I did change  
them at the beginning of second term. I worked this out first -  
on how to mix them - cultural, sex, levels etc. - and then  
placed them into groups. One girl was not happy with her group -  
she wanted to change. We - her and I - discussed this and she  
said that she will try to work in the group - whenever the group  
worked I would facilitate and also ask for her input. She was  
happy to stay in the group.

R: Thank you [C] - you have been most helpful. I hope you do not  
mind me 'using' you in this way -

C: Definitely not -

R: Obviously - I will not disclose your name - although I think  
that you have done an excellent job - and you should be proud.

APPENDIX IV

LECTURER QUESTIONNAIRE

Accompanying Letter

Dear Colleague

I am currently researching the area of **cooperative learning**, towards a Master in Science Education degree. The research is to focus on the practice of cooperative learning and for this I will be working with the second year JP/SP group of Natural Science students. The methodology involves **action-research**.

As part of the initial planning of our practice, I need to have a picture of previous cooperative learning experiences of the students. I would appreciate your responses to the questions in this 'short' questionnaire relating to cooperative learning, to be used as contributory information for such a picture.

Thank you  
Rehana Schrueder.

Lecturer Questionnaire

1. Have you used groupwork/cooperative learning in your preservice courses with your students?
2. What type/s of groupwork have you used?  
Briefly describe one of these.  
What were your objectives?  
Do you think you achieved these objectives on the whole (or in part - please specify)?
3. In your opinion, are there special conditions for using cooperative learning?  
What are these?
4. Do you see any problems in using a cooperative learning strategy? Note these, if any.
5. Do you think the strategy is worthwhile? Please comment on this.
6. If you feel it is worthwhile, how much cooperative learning would you include in your course - a rough estimate?
7. Please write down any comments you wish to make regarding the **introduction and implementation** of cooperative learning.

Thank you  
Rehana Schrueder.

APPENDIX V

Student Interviews

STUDENT INTERVIEW I

Interview Checklist

Student  
Date  
Time  
Counter

Experiences

type  
group work

Perceptions

personal idea  
like  
problems: abandon/overcome

Learning Style

preferred  
competition

STUDENT INTERVIEW II

Interview Checklist

**PARTICIPATION**

- \* Do you think you are participating as well as you should?
- \* What in your opinion limits/promotes your participation?

[linked to each of the following aspects]

Shy/Extrovert:

- \* are you?
- \* anyone in group?
- \* does it limit/promote participation?
- \* what strategy in group / could?

Self-Esteem:

- \* has CL promoted it?
- \* is it greater/lower now?
- \* what aspect promotes/limits?
- \* anyone in group whose self-esteem changed?

Dominance patterns - in your opinion:

- \* any in group?
- \* who dominates talktime?
- \* who is involved in issuing instructions?
- \* what strategies?
- \* who is involved in - judging, selecting, generating, collating...?
- \* whose ideas are most valid - whose accepted most?
- \* what limits/promotes interactions - does it affect participation?
- \* is group aware of this?
- \* what is reason for dominance?

Language:

- \* any improvement - yourself/others?
- \* understand group language?
- \* understand science language?
- \* view on using a second language?
- \* proficient member - advantage?

Roles:

- \* who generates, clarifies, critiques, selects, collates, helps...?



# Student Interview I

## Interview Summary

### Student 1 (S1) (13.02.95) [\* partly taped - 'confirmed']

1. Likes college; still motivated, but "hard work"; group work in Natural Science, not others; in other lectures "just sit and listen".
2. Likes group work  
Aim: "a good way of teaching"; shy in class but not shy in group - know peers ("friends"); "not to be racist" but can get along with own friends and "talk" to them; can give ideas better in group.
3. Problems: 'lazy' students - "playing around", "naughty" - lose interest; "dominant" ones.  
Should not abandon it because of problems, but try to overcome it.
4. Prefers: CL for new learning, but not for 'studying'.
5. Marks: Likes to get 'top marks' - "everybody likes good marks"; suggest that groups discuss and learn together, but individual assignments - sometimes can have group mark; happy with group mark; individual marks - because write exams: assignments that "can't do alone" can have group mark.

### Student 2 (S2) (13.02.95) [\* not taped - confirmed]

1. Enjoys college - still motivated to continue; group work in Natural Science, no group work in others, eg., Geography
2. Likes group work - "most learning should be in groups".  
Aim: "work together" - "common ideas"
3. Problems: not experienced in her group, but others - may have 'lazy' ones; should not be abandoned, but overcome.
4. Prefers CL for learning 'new' things, but not for studying - prefers to do this alone
5. Marks: Likes to get good marks - "aim for best"; does not mind group mark

### Student 3 (S3) (13.02.95)

1. Likes college - still motivated to continue; at college "different strategies" - "lecturing and discovery type"; group discussion in Education; group work in 'Biology' - experiments.
2. Likes group work  
Aim: "to learn from each other" - discussion
3. Problems: "some keep ideas to themselves" and "not share"; dominant people; some shy; improve it by overcoming problems
4. Prefers both - some lessons require individual; more group work  
Marks: should be individual; but in terms of discussion should be group

### Student 4 (S4) (15.02.95)

1. Likes college; "encouraged". Types: some discussion - lecturer leads; some group work to introduce topic - refer to text books and discuss; whole class discussion especially in smaller classes, eg., less than 15 - discuss as group; all systems - sometimes group discussion. More group work in Science and Education, others not so much - individual; no group work in Art  
Type: assignments - group collect information as group - present - form of debate; present ideas; History - collect information
2. Prefers group work; enable more information than alone  
Aim: "to make students to communicate and cooperate"; "gain language and partnership"; "more ideas during group discussion" - "see different ideas".
3. Problems: some "for completing - one not so participative, not so active - do not finish"; no other problems seen. Strategy - when we encounter problem consult lecturer to solve. Argument - on information, to present - some swap groups - we told them 'don't divide' - resolved somewhat. Cannot leave group work because it makes people to be more active and involved; we should focus on those minor problems and see how to solve them.
4. Prefers to work alone then use group as sounding board; new things in a group; in group other things presented by others help, therefore group work
5. Marks: like high marks especially in majors; group marks, sometimes there is an individual breakdown; marks determined by group activity - "so if I know that my group was not so active...I will not be worried by the mark...;...if my group...did my best...and marks...not so good...I will be devastated"; therefore do not mind group marks  
Intergroup competition - good - others getting good marks increases motivation for good marks

Student 5 (S5) (14.02.95)

1. Likes college - still motivated. Group work - topic or problem to solve; in Education and Maths; desks arranged as group; in most subjects except English. Most group work in Education, Science and Maths; Science - group assignments; Education - discuss and then present conclusions
2. Likes group work; at first didn't - some wanted to be bosses...
- Aim: to interact with one another and find things on own; to think and use our brain. No group work at school
3. Problems: 'bosses'; some shy - feel laugh at them; should overcome problems
4. Prefer learning new things in group; study/revise on own because "I am a talkative person"
5. Marks: Group marks fine if all participate, all deserve it. Want to be top student at Edgewood, but no problem with getting same mark. Intergroup competition - good, makes one work harder

Student 6 (S6) (14.02.95)

1. Like it at college - still motivated. "Frank" lectures; different ways of teaching, eg., active in class. Different types - Education - involved in lesson...; projects in other subjects; copy note...[did not understand question on types]. Group work in English - discuss; Education - play [role-playing?]; Maths - games in group work; Natural Science - assignment, present ideas, work in a certain title and present
2. Likes group work - personal advantage - group work is best
- Aim: Want to influence us to be able to teach in groups; best is to have group work for sharing ideas - different ideas from different children
3. Problems: arguments on issues - different people want to say different things when (we) present; quiet children in class. Try to overcome problems.
4. Prefers group work - other times need individual work
5. Marks: group marks - no problem. Intergroup competition encourages us to work

Student 7 (S7) (14.02.95)

1. Like it at college - exciting. Lecturers take us as adults - different from school. History - just sit, class discussion; Maths - practical work; Education and Science - discussion in groups; assignment and group ideas. Work in first year such that we could cope - more challenging now, part and parcel of work. No group work in school - had some - but just noise - teacher doing assignment - no supervision
2. Like it [group work] very much - if started earlier it would have improved our education
- Aim "research shown that most learning is through group work"
3. Problems: no idea of the topic and if teacher does not introduce well - difficult for group work to work...teacher should walk around to identify difficulties. Continue with group work - teachers must try to overcome difficulties
4. Prefer group work; study - learn by yourself and then group. Democracy starts in group work - agreement even if stated differently
5. Marks: like top marks; happy with group mark. Intergroup competition is good because in life we do compete

Student 8 (S8) (14.02.95) [workplace experience for 5 years]

1. Likes it at college - enjoyed lecture - still motivated; not as difficult as expected. Group discussion in almost all; English literature and Natural Science - more
2. Likes group work
- Aim: to share ideas - most people had ideas - just added on this
3. Problems: some shy but managed to work through - change from within - own group worked well; dominant - there was, but we were mature enough - solved within group. Should continue with group work - initially teacher may need to employ strategies, eg., dominant ones asked to sit back
4. Prefer to learn in group for new work, but studying for exam alone
5. Marks: happy with group mark as long as others work well. Topping class - not very important as long as everybody pass. Intergroup competition - has to be some form of competition to ensure standards

Student 9 (S9) (13.02.95)

1. Like it here; encouraging. Same strategy at college - groups. More group work in Science; not at school. Assignments and sometimes topic to discuss - report when conclusion
2. Like group work encouraged to speak - because shy - do not really respond in class. Should be both group work and individual - a balance
- Aim: share different ideas, think and to act creatively and use imagination
3. Problems: fast thinkers can discuss particular topic and slow thinkers does not participate - one of problems. Separate roles - did not have that - should be done so that we can all participate. Should overcome problem - so that slow thinkers can pick up from fast thinkers
4. Prefer to learn in group; revise - in a group first and study alone
5. Marks: like to get good marks; not [a] problem if share ideas to get same mark. Competition - encouraging

Student 10 (S10) (13.02.95) [\* not taped - confirmed]

1. Likes it at college - enjoys - still motivated to teach. Lectures - various types. Group work types - common assignment, poster, ideas
2. Likes group work - preferred  
Aim: groups in which students work together and interact and come to common ideas
3. Problems: noise; teacher preparation. Should not be abandon even if there are problems
4. Prefers - CL is preferred style of studying. Most learning should be in groups - problems can be overcome
5. Marks: do not mind getting same mark as others; against competition, for cooperation

Student 11 (S11) (14.02.95) [19 years work place experience]

1. Likes college - enjoy it - still motivated - have confidence. Lecture - different strategies - mainly group work; some subjects [it is] not working well, eg., History - lecturer gives information but group work later. Education - most group work; History - discuss conflicting sides; Natural Science - group work - poster and presentations. No group work at school
2. Like learning in a group  
Aim: at first - thought - it did not do with teaching - students not well informed; later when involved - found that things coming from students themselves - not always correct - lecturer will correct and help with additional information; enjoyable - participatory even if it was just listening; triggers a way of communicating - kept busy - so that mind is always working
3. Problems: not many; some have problems in themselves, eg., can't communicate; important to overcome [problems] - learning will be enjoyable - interest
4. Prefer group learning - skills can be mastered - because of help from group-mates; revision - study in area where able, alone. Prefer to learn in group in some subjects, and where I am weak
5. Mark: agree with group mark - if students worked well - smaller curve between lower and higher - so that there is always compensation. I don't feel topping the class is important - although there was a time when it was important. Intergroup competition - uplifts standard - motivating

Student 12 (S12) (14.02.95)

1. Like it at Edgewood - still motivated to teach. Lecture - different methods - some group discussion, some, eg., in History - not so much group discussions but class discussions; Natural Science, Education, Maths - more group discussions. Some just brainstorming, in others present ideas after brainstorming
2. Like individual work  
Aim: to share ideas; improve relationships between students; get more when discuss in group - each has to contribute - fear of asking when not clear in whole class but in group not so
3. Problems: I want my ideas - personal stamp - and one has to compromise - I still have to work on it - I find it difficult - especially when [they] - are totally wrong; some hide behind other students - probably because of language problem. Should continue with group work - responsibility on teacher to facilitate learning; groups should not be too big - approximately 4 not more than 6
4. Prefer to learn alone even about new things - group revision
5. Marks: like good marks; group mark - happy if group working well. Intergroup competition - advantages and disadvantages - might work harder



## Student Interview II

### Summary - S1, S3, S6, S9, S11

QUESTION	S1	S3	S6	S9	S11
DOMINANCE	one was; now less	one may give instructions sometimes-seen as helping-not same person [as in his 'least liked' list	there was; not now - rule session helped -work on dominance	[S10] was-for group progress in giving ideas; not as much now	there was; but progress because of reconnaissance
LANGUAGE	improving-because talking; group sometimes impatient because of time; science language-1st language person understands better; easier if prepare beforehand	practice increases proficiency; all understand; should not use mother tongue; science language-1st language speaker not advantaged	[practice-not asked]; language-no problem even in science language- group works through it	practice increases proficiency; language-one of reasons for not participating	[practice-not asked]; language-slight problem because of time limit; science language-both 1st and 2nd language speakers have problems
ALTCONCEPT member explanation	helps but sometimes confusing because I have grown with it	trunk and stem - clarified by group with lecturer intervention	[not asked]	group clarifies immediately; helped her in a problem with modification	group clarifies; plus lecturer intervention was required
TOPIC best for CL	best participation-think it was reconnaissance	balance between group and individual work; individual-eg., for getting personal meaning, then discuss; some topics allow for more participation; some no participation- don't know what to say, just sit; the way topic is structured helps-allow people to participate; best participation-reconnaissance	best participation-modifications [because preparing to present]; reconnaissance to a lesser extent	balance between group and individual work; best participation-in leaf classification and reconnaissance; least participation-modification ideas, did not have ideas, could not find information in library	best participation-reconnaissance, then leaves; classification of plants- difficult for participation
MONITORING	reflective notes-wrote, but did not hand in; reflection helps because know what to do next time	each person should reflect to help participation reflection helps	like ideas of reflection and journal; it helps	wrote about misconception (sic) in our group-helps-it encourages participation, eg., in reconnaissance, dominance	reconnaissance helps because member may not be aware of what he/she does; member observation-because group is aware of it get better participation; if feedback-not sure of its effect, may be seen in light of 'telling' what to do; prefer all to reflect, not sure whether it helps

Student Interview II (continued)

QUESTION	S1	S3	S6	S9	S11
CONFIDENCE	increased this year; sharing ideas increases confidence - especially group B - I'm used to them; all members	sometimes if know stuff - then confident ; CL promotes confidence very much; by sharing ideas one evaluates oneself when in a group; if keep knowledge to oneself even if wrong - cannot evaluate; group discussion more effective than in class	confidence increased more than last year - because small group - therefore everyone has a chance to speak - see others confident - he/she becomes more confident	still a little shy - not shy in group - because of group work - may make more input in class - better than last year; writing ideas in a group increases confidence	confidence increased by CL; [S9] is born shy - no longer - not yet fairly confident; the group spoke about how to build confidence
GIVING AND RECEIVING HELP	help asked for by me - helps me participate; giving help - helps because the thing one is explaining is like revision	benefit when help others - realise how you do things and realise certain mistakes - by saying it out; ask for help - critical point of view - promotes discussion	the receiver of help does not participate; good for group if someone asks for help - may gain from others - all can gain; by saying what's on her/his mind it help the person too; you regain - you do not forget about it	if ask for help - if explained - participate better; group realise this; person giving help - can help - others; explainer is helped - better kept in mind	asking for help - helps members - all; [S12] - [S10] helped; giving help - does help one - because focus on the thing - gets revised; receiving help - helps participation; others also helped

<p>GENERATING IDEAS</p>	<p>all generate ideas - participation increased; [S2]'s ideas - have to re-explain to [S4]</p>	<p>person with ability to generate ideas - should choose this person to lead; others will be involved in discussion - if stuck - that person can bring you on task</p>	<p>person who explains more is one who has more information</p>	<p>as from now it doesn't happen - that one person generating ideas - increases participation</p>	<p>all members generate ideas</p>
<p>QUESTIONING IDEAS</p>	<p>does not happen often; accept conflict - group just takes both ideas and resolved by outside source</p>	<p>not up to person who generates to explain - throw the question to group; some people cannot wait for the whole development of idea - for consolidation - think that group is aware of this and is trying to work it out</p>	<p>my role - generate ideas and question and accept</p>	<p>especially [S12] does that - it helps - because maybe I do have a question - at that particular time I didn't think about that question - it does help all</p>	<p>all help explain - for example when the person generating idea, our minds are switched on to this - also add to this; everyone clarifies</p>

SELECTING IDEAS	there is some selection - whole group selects	in group - one person writes all points - do not select - but use all ideas	everybody selects ideas; S7] and [S8] - take most of their ideas because they are valid ideas	all participa te - for example when [S12] has to write a poster I'd say [S12] why don't you write this? - and then we discuss it - everybody share ideas	all select
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## Student Interview III

### Summary - S1, S2, S3, S4

QUESTION	S1	S2	S3	S4
LANGUAGE	leave it as mixed-1st language speakers help others	mixed- improve language proficiency	mixed-necessary for language improvement	mixed-advantage-1st language have more knowledge-benefit from them
MEMBER OBSERVATION	advantage-see the type of person-how you could handle that person	advantage-everybody's cooperation is ensured-should include observation	no advantage because eliminate people from participating; need outside person	not effective-no advantage-makes no difference
TIME	time was short-but-principle-it was right-we had to adjust according to time	time was fine-need to manage-we managed for certain activities-plan; can cut down-keep important points	some need more time-identify these-balance these	time is a key-try to manage the time given
LECTURE	in some cases, not always-because we are building our knowledge; class discussion useful-correct misconceptions (sic)	no need for lecture after CL-class discussion sufficient; read books etc. if needed	lecture necessary-as frame of reference; lecture in between-not lecture but explanation	no difference between CL and lecture-lecture and CL should not be separated-can be done during CL
PRE-LESSON PREPARATION	agree-because 'know' more for participation; not for every session	required for experiments; but not advisable for ordinary lessons-want their ideas	very good to prepare; different interpretations of references	preparation- important-determines level of contribution and participation; if want to know ideas then no preparation needed
SAME/DIFFERENT TOPIC/GROUP	same-range of ideas; parts-time, to finish the syllabus	same topic-otherwise other groups not involved; range of ideas	same always-get range of ideas; no choice	should not have same topic; parts-save time
ALL TOPICS	disagree that all topics not suitable	CL-most topics-if put your mind-can encourage group discussion because of pros and cons of most topics	not all topics suitable; for basic ideas-discussion within that framework	true that all topics cannot be done using CL
WORK/TOPIC/DIVISION IN GROUP	must divide topic-and present in group	save time-but members may not concentrate on next activity-concentrate on what <u>we</u> have to do	should be divided-some research particular areas-discuss in group	depends on kind of work; but can be easier or more difficult for individual-level of work may differ for each-but should be done
ASSIGNMENTS CL:INDIVIDUAL	50-50	50-50 - for year mark more-individual	1/2 individual, 1/2 group	50-50; make person contribute 1/2 of work by himself
PARTICIPATION: 4/6 MEMBER	no difference in participation	less participation in 6 member	not much difference in 4 and 6 member for participation	6-participation and discipline in group may be a problem; more participation in 4 than 6
GROUP CHANGING	change after a period of time	after every 6 or so topics	change after a while because one relaxes-after few session; bored	change after every session

OWN GROUP CHOICE	own choice-better; control with balance of language etc.	tend to work faster if homogeneous-but disadvantage-therefore mixture of language, gender, cultural background, race, knowledge	own-should not choose-because group can become more efficient; lecturer should give group according to abilities, personality	a member who is choosing-make sure that not one of previous group; can also decide the groups-no problem with that-as teacher-for first time they must choose-because feel better; then start to mix group according to abilities and language
GROUP LEADER	rotate leaders-or else dominant	rotate leaders-responsible for what group does-coordinate activities for the day	rotate leader-or get dominant	facilitator, not leader-must rotate
GROUP MARK	group mark for group work	easier to assess group mark-lecturer can't be at each group to assess individual	group mark for group work	group mark for group work
COGNITIVE PARTICIPATION	give each person a chance to speak	no problem in the group-all gave ideas	group tried to encourage it	to ensure that everybody involved-take turns
LEARNING ENVIRONMENT	more comfortable in group	more comfortable in group	for some people-more comfortable in group	more comfortable to speak in the group
FAITH IN CL	still have faith in CL	still have faith	place for CL and traditional lecture	still have faith in CL; if work individually-I would not have learnt as much
CL INTRODUCTION	will use it during the pract teaching	thinking about this year-most definitely use CL; learnt-how to coordinate, how pupils would react and do, etc.	learnt-yes-about introducing	pupils themselves must do the work

## Student Interview III

### Summary (continued) - S5, S6, S7, S8

QUESTION	S5	S6	S7	S8
LANGUAGE	mixed-know language better	mixed-2nd language speaker learns from 1st language	mixed-will have to get used to the longer time taken for 2nd language speaker to express-same experience in outside world; 2nd language ones will try to cope with 1st language; improves pronunciation	mixed-no hassles-should be a mix
MEMBER OBSERVATION	not important-no advantage	a little advantage; a teacher could be the one that observes	[not asked]	not important-distances person from group-no advantage
TIME	better to give unlimited time-later tell them time-time limit constrains	extend time-but do not cut down on syllabus	syllabus needs to be finished; we are not used to this type of learning-need to adjust oneself	curriculum will determine time-if use CL approach will have to be taken into account in planning-that CL is part of it
LECTURE	Lecture is good-alternate	lecture after every CL session	depends on session-if problem then lecture; 20% lecture, 80% CL-CL involves pupils	class discussion sufficient; certain sections need lecture depending on depth
PREPARATION	should prepare-library research; not for all-eg., experiments; eg., on pollination-need to research; transpiration-I had a problem-no participation	depends on the issue-general issue	should have preparation-for best CL; not for all-sometimes have to brainstorm	helps sometimes but CL is about learning together-if advance preparation we orientate ourselves in a certain way-may pre-empt constructivist ideas
SAME/DIFFERENT TOPIC/GROUP	same topic-range of ideas; if parts-we don't grab the information	advantage of same topic-range of ideas; advantage of parts-time	both; same topic-range of ideas and explanations; parts-save time	save time-in depth research-we managed to share; same topic-can get range
ALL TOPICS	all can be suitable	some topics need to be done by individual-like personal views	teachers should be creative-to mould topic to fit CL	not applicable to science-all can be CL
WORK/TOPIC DIVISION IN GROUP	roles should rotate; topic should not be divided	can be a good idea-collate work into one form	agree with division because all can participate, eg., researching; rotate roles; divide topic into parts-for organisation	work should not be divided-roles rotating; topic division-it will be one person constructing-no advantage
ASSIGNMENTS CL:INDIVIDUAL	7 individual:3 group	50-50	3 individual:10 group	50-50
PARTICIPATION: 4/6 MEMBER	both are small-okay for participation	6 is also right-no difference in participation	6 maximum-participation should be okay	for 6 member-increase time; if same time-not same participation
GROUP CHANGING	change after each session	change after a certain period	time to get used to group-change 3 times a year	after every term

OWN GROUP CHOICE	mix-but own choice	proportion-should not choose own group-may end up with people of same ability	teachers should know-on second time-teacher plays important role in grouping; adults can choose-not kids	own choice-won't work-in our situation-we have opportunity to integrate and to learn; we have prejudices-helps to create a common; male and female, language, race groups; not ability
GROUP LEADER	no group leaders-all participating, all work	each person is a leader; sometimes should use but sometimes not	group leaders should be rotating-need to practice leadership	no group leader-some will sit back
GROUP MARK	group mark for group work	group mark for group work	group mark-because work together	assessed as group
COGNITIVE PARTICIPATION	if one member had an idea-if we were not sure-ask for explanation	group-encouraging to express ideas	everybody should participate-to avoid dominance; ask-do you have any ideas?	I made sure I gave everyone a chance
LEARNING ENVIRONMENT	more confidence in group	more comfortable in group-but speaking to class also required	comfortable more in group than in class	better in group
FAITH IN CL	still have faith	still have faith	still have faith	still have faith
CL INTRODUCTION	learnt-would use strategies-especially for shy people-yes, I would use it in class	learnt-to divide class in group to do CL	learnt-group discovery and CL itself-giving space for children to give ideas	have learnt-I will implement CL-ensure no one's dominant, no one's passive...



## SIT III

## Summary (continued) - S9, S10, S11, S12

QUESTION	S9	S10	S11	S12
LANGUAGE	mixed-to share ideas and learn together	prefer mix-although irritated-get over it with practice	mixed-learnt personally that if we intermingle-language improvement-for those disadvantaged	should not impose conditions-we should accommodate feelings of students; understand each other better if same language; no advantage [to mix]-took one out of the group discussion
MEMBER OBSERVATION	helps to know a member's participation	not good; could be used to pick up misconceptions (sic) and for group processing	advantage-because someone is observing has impact on one's participation; feedback is good but sometimes not honest enough-embarrasses	no advantage-no participation-took one out of group discussion
TIME	if more time-lack in other sessions; should not cut down-should proceed as we have done	fine-learn to manage	if time increased contents of course may have to be changed-but do not know the effect on the course	if increase-will not be able to cover; time limit is necessary; time was sufficient
LECTURE	sometimes no need-if report back done	after major areas, eg., terminology; sometimes necessary; CL 90%, lectures 10%	class discussion sufficient-but lecture may be necessary-during assessment gets level of acquiring	not necessary-class discussion beneficial-enough detail
PREPARATION	a good idea; not for every-because we have to find new things-exciting	not a good idea- because must try to find out; can get theory dependent	should prepare-but not sure about for all; some things not as new-may help to prepare	not really a good idea-some in our group, [S9,S11], lacked basis-to them it may be beneficial
SAME/ DIFFERENT TOPIC/ GROUP	parts-for some; advantage of same topic-to get ideas	same topic; if parts-difficult for you to remember what other group said; range of ideas	advantage of same topic-range of ideas; advantage of parts-time	same topic-range of ideas-easier for student and lecturer to identify misconception (sic); advantage of parts-time
ALL TOPICS	all topics suitable	most, in fact all can be done with CL	don't agree that all topics suitable-but can't talk	disagree that get unsuitable topics for CL
WORK/ TOPIC DIVISION IN GROUP	roles-to ensure participation; topic should not be divided because have to share ideas	eg., for chart-good because one person can end up doing all the work; topic division-group can add-but nice to work as whole group	good for participation-saves time	particular group can decide on this
ASSIGNMENTS CL:INDIVIDUAL	50-50	1/2 individual, 1/2 group	50-50; but it may also depend on the magnitude of the course	50-50; not less than 5 to be individual
PARTICIPATION: 4/6 MEMBER	not same-but okay for large group-it is okay in large class	6-participation less-but need for large classes	6 is not very far from 4	difference in participation-force people to participate in 4 member group
GROUP CHANGING	change for every session	after a topic-eg., plants, after the term	change after some time; not after every session	change after every session
OWN GROUP CHOICE	change-so that learn with other-not own choice	advantage and disadvantage; friends-then no interaction with others; own choice with guidelines	own choice-but-mix-language levels, gender, leadership skills, abilities	must choose-because at the end of the day students should be satisfied-because assessed; we are grown-up; lecturer should not stipulate; in class-responsibility on teacher

GROUP LEADER	rotate leader	no-dominant	rotate leaders-first leader can be like a role model-others learn	disagree-no group leaders-we all should develop leadership in our training
GROUP MARK	group mark for group work	group mark	group mark	group mark for group work
COGNITIVE PARTICIPATION		each had to come up with suggestion-ask for clarification	encouragement done-times when members talked like everyone knew-certain aspects were asked for clarification	when we discuss a concept-ask member who has not contributed for feelings and views before taking a decision
LEARNING ENVIRONMENT	more comfortable to speak in group	comfortable-all got on with each other-more secure-and to suggest	didn't matter-especially because each member had to present to the class-encouraged by group activity-because number of group members less-more familiar-talk easily	I am confident enough; for some eg., [S9], more comfortable-seen confidence building in her
FAITH IN CL	still have faith	still have faith	course has made it better	CL-best method of learning-really goo for children-main method of teaching-should be at school
CL INTRODUCTION	learnt-different pupils in class-articulate and shy-CL helps these; try to facilitate-learnt from your lectures	learnt-introduce it slowly-getting them to understand that it helps them to work in CL-they start enjoying it more; take every suggestion-encouraging	learnt-before anything is handled pupils should be given the opportunity to explore and discuss towards common knowledge; not much CL in other subjects-2 instances of CL-in psychology and sociology-very seldom-2 instances this semester	learnt-will help introduce it in schools-eg., teacher should not assume that pupils have blank minds

APPENDIX VI

COLLEAGUE'S NOTES

NOTE 1

15/2//95

REFL [2SP] Review of perceptions - experiences, why, like,  
 LROLE shy, dominant — problems, learning for new info alone  
 AR or in a group.  
 hide behind competition (marks)  
 inter group competition

ETHIC Review of perceptions  
 AR Students followed and agreed with comments made.

TOPIC Questioning - Students at 1st did not understand Q1

GR CHOICE Groupwork - Students grouped themselves (Reason??)  
 GR SIZE 4/ Group  
 PART1 - Ideas were shared - all students voiced  
 views / opinions -  
 questions were raised - attempts to answer  
 questions were made — no. of laughs - at responses  
 and attempts to make responses.  
 Instruct pupils to formulate questions for each group  
 response.  
 Students responses - Presentation was simple and clear  
 PART2 Group 1 - [S5] - members of group and others also  
 PART3 supplemented feed-back.

AC Appropriate use of terms was dealt with and students were  
 LROLE clear about the meanings & differences.  
 PART4 Group 2 - [S12] - Basic Feed-back given - no group effort  
 (individual effort) - should refer to chart and use this  
 info for the discussion.

TIME Timing for feed-back - each group to be given specific  
 LROLE time eg. 5 mins.  
 meaning of classification & grouping. (problem)

LANG SC Group 3 - [S10] - reported back - rest of group passive-  
 PART other groups did not respond or question.  
 TIME General report back approx. 10 minutes at least.

NOTE 2

16/2

LROLE Activities organised - Act 1.  
Students were doubtful - discussed,  
questioned, gave reasons for their choices --

PART1 Act 2. Students were more intense and doubtful  
anything that did not fit in were placed in  
their group.

MOTIV Act 3 - students were more excited and confused.  
LENV  
FORMAT Activities were structured and interlinked - students  
PART2 views and opinions were expressed and their thinking on  
the questions were constructed - more meaning was  
derived.  
FORMAT Students - were taken through (on) the voyage of  
historical dev of classification.

PART3 Poster -  
Group work - all individuals participated - much  
discussion and deliberation took place. Eventual posters  
AC - misconceptions were clearly evident but essentially  
groups had 2 or 3 characteristics pertinent to what is a  
Plant?

ASSESS Assessments - were carried out by all groups - but  
reasons for giving a particular mark  
were not stated. Their assessment more  
strict than lecturers' assessment.

NOTE 3

1/3/95

REFL (1) Explanation of Action at this point and where to go  
AR - appropriate

Group C

DOM Dominance - Students were outright — spoke what they felt  
PART1 — spoke about efforts of the most dominant person — what  
needs to be done to sort this out - needs to delegate more  
- (good strategising) - everyone gains.  
— [ General observation of all groups]

PART2 Free discussion took place  
LENV No students [felt inhibited]  
PART3 every student in each group spoke except [S9] - she seemed  
to be more of an observer at times in her group (this  
needs to be worked on more fully in this group)

PART4 In order to make a decision - students - debated, argued,  
discussed before a final decision (statement or comment)  
was made.

PART5 Individual students in some cases had to explain sometimes  
what they stated & meant before the other students in the  
group agreed or accepted their point.

PART6 Examples were given and discussed - in some cases quite  
extensively.

TIME Students took approx. 43 mins to assess.

TIME Reporting each group 5 mins to report. —

Reporting  
Group B

PART7 Made a statement for each one - and were clear about what  
they had decided- could explain each statement - required  
group members to do this for a full explanation.

Group A

PART8 Students had worked out all aspects and could explain  
fully what they had stated.

LANG Instructions in 1st language - student enter a group  
'Blind' - a grave problem for 2nd language students in the  
group.

Group C

PART9 Some members of the group were not too clear on what the  
group had discussed in terms of some of the aspects.

TOPIC1 [S11] had to explain for [S12] — although this did take  
place in the other groups.

PART Groups varied quite extensively on certain issues. - could  
TOPIC2 be the way each group viewed a particular aspect (looking  
at it in terms of different perspectives.  
Final descisions were not always reached and solutions  
were not stated.

NOTE 4

6/3/95

FORMAT Morphology - meaning of term - source of meaning, different meanings from varying sources.  
Geomorphology - a link was made with this.  
- general meaning was discussed.

TOPIC Groups - task assigned to each  
[observing] posters of plant types drawn.  
Posters - viewed.  
- Common parts of plants worked out using thae drawings. (Root, Stem, Leaves)

FORMAT At this point - features of monocot - dicot plants - could have been raised using info on the charts. (point taken)

LPERC PART Groups worked on parts of a plant - members (tiredly) discussed and argued, gave reasons and examples about features for a part of a plant —

MONIT One member in the group was observing and completing the appropriate form.  
Aspects about Root, Stem, Leaves on posters were presented —

ASSESS assessment of information and layout was decided on for each group (peer assessment)

AC C. Report back - (Leaves)  
- (1) Absorb food - from sun - manufacture  
(2) Uses - leaf as a "breathing organ"?  
(Respiratory organ of plant)  
(3) Mid rib in dicots not monocots

LROLE - Discussion of (1) took place - it was clarified!  
- discussion of (3) took place - all leaves have mid veins.  
Student definition of leaf - some students not happy with the question (Mrs S) some stems can also manufacture food (student)

PART Working definition used especially in Primary schools.

AC What is the technical definition. (The group to work this out).  
3rd function of leaf - is a modified function -  
A. Report back. (Stem)  
(1) Storage??  
AC (2) Directs leaves to the Sun ??  
(3) Upright ??  
(4) Some give rise to flowers ??  
(5) Some stems have nodes and inter-nodes??  
Qu : from another group - what is a stem ?  
Response. Part of the plant - it is centralised (between roots and stem)  
Advice - do organise under separate headings  
B. Report back  
Definition given is a functional one —

AC \* Root hairs are modified to increase surface area —  
problem —

LROLE Discussion of this took place - lateral roots not root hairs.

NOTE 5

8/3/95

AC (A)  
AR 1. Report back on Misconceptions  
REFL - Group responses were discussed and strategies of handling  
how to deal with misconceptions needs to dev - one example  
LROLE was Suggested —  
- Observers also do not pick up misconceptions - probably  
because they are not capable of doing this

GR SIZE 2. group Size  
adequate numbers 4/5.

TOPIC 3. Are all topics appropriate ?

TIME 4. Time management

5. Presenters  
REFL Are these decided on beforehand or afterwards (end)  
PART makes a diff. 2 groups (end) 1 before probably a  
problem with participation.

ASSESS (B) Assessments of posters - All groups 5

(C) Modifications of parts of plant  
Each group to make a poster of the part of the plants that  
they investigated — general comments —

TOPIC (D) Planning —  
ASSESS Discussion of what is expected of students - topics  
etc.





NOTE 7

Observations - 5 APRIL

(1) Organisation of practical work - each group given diff specimens from the other groups.

TOPIC explanation about completing of poster for modified structures & reproduction (vegetative)

TIME Students groups - 15 mins.

GR CHANGE Group A - only 2 students - one student ([S10]) from Group C joined - observation

TOPIC Instructions on what to observe was discussed with relevant people.

LROLE Identification and naming of specimens - clarity for students

PART1 Sequence of discussion & investigation of specimens was done - (1) Specimen 1, (2) specimen 2

TIME Participation

AC Group C - 3 members - all discussed - questions - why is it? [S9] participated ; ([S12]) What will happen if you plant a section of beetroot eg. stem - will it develop into a new plant. Does a beetroot plant bear more fruit or 1. Does stem propagate ? (10 mins to discuss - then conclude that it is a root).

PART2 Could this be due to [S10] not being there ?

AC Group A - African Violet - is it petiole or stem. Examples of questions asked — What type of vegetation — do you think asexual ?

PART2 Students were actively engaged — all observed specimens, discussed, questioned, made descisions, Presentation

AC Group A - [S2] - leaves & section of beetroot

AC Radish - Roots - cut off surface and (idea hot) not sure why radish is root — stem & leaf - reasons given?

AC Group B - Turnip - sure that it is a root — Queen of the night — leaf - ideas - plant & will send out roots. Has mid vein & other veins.

AC Hen & Chicken - stem - presence of nodes & internodes.

AC Group C - Water Hyacinth - mod. part stem — section stem will dev. roots & leaves.

AC Beetroot - root plant . new stem & leaves will grow - Onion -

AC Discussion on observation of specimens was carried out with groups for greater clarity.

AC Demonstration - of carrots - with shoots — potato & other ideas for teaching (scoop out carrot)

AC Use of transparencies - to give other examples of vegetative reproduction.

LROLE Concluding statements pertaining to report back needs to be fully completed.

NOTE 8

6/05/95

Thursday

Seed germination —

- (1) Rate of growth of various seeds
- (2) Which part grows 1st ?
- (3)

Group B - Structure of seed - terminology

LANG Well presented - clarity, structures clearly presented — Factors that must be taken into consideration — How do you know this ? —

AC Seed alive — dormancy  
pressure / force —  
breathe / respire —

Do leaves develop from centre of cotyledon ?  
Explanation of epicotyl (loop) simply and well presented.

Radicle, Stem, leaves.

Dicots

Group A - 2 types of germination Hypogeal & Epigeal.

Used sunflower seeds & bean seeds.

NOTE 9

Monday 10/04/95

ASSESS Test started 1.44pm  
Instructions given to students & choice of partners was  
FORMAT made by individual students. - chose friends or who was  
available. They were not assigned to pairs - this is  
necessary for question 6.

All students started off with question 1 - observation of  
flower (specimen A)  
Students dissected the flower - using dissecting needle -

Question 3 query - soil level

Question 4.1 - students questioned what is a lily -  
structure of specimen (lily) shown -

TIME By 2.30 pm - students were pairing up to answer Ques. 6  
(only 1 group [S2] & [S10]) Others were still busy with the  
test.  
Students were instructed not to rush partner if the partner  
was still busy.

LANG Question 4 - query - meaning of critique ([S6] & [S12])

Co-operative Teaching & Learning

This is not new to me, as I employ a number of these strategies in all the courses that I teach/take.

Points :

- Grouping of students - In some courses I allow students to group themselves - the only restriction I make is in terms of numbers, in other courses I group the students - taking into account, 2nd language speakers, sex, and organisational (management) abilities of students.
- GR SIZE  
LANG
- In this course (2nd yr N.S.) - initially the students were left to choose their own group of 4 members. Student groups were homogeneous & pt to note is that they worked well.
- GR SIZE
- Students were re-grouped by lecturer - and/or could see that some were not happy and or were apprehensive about working with other students.
- GR CHANGE
- This mood or state soon changed - as students learnt about one another, got confidence to communicate & to say what they meant and also to argue - a good scene was set (Spirits were high).
- SELF-ESTEEM
- LENV  
TOPIC
- What also encouraged this was the exciting and questioning activities that they were engaged in. Also, the fact that participation of group members was addressed, students were aware that their participation was important & that they could gain even more if they participated fully in all activities. Getting groups to work out groups rules was something very new to me - even the way in which it was done. Students handled this section sensitively and also sensibly. I was amazed by some of the rules that they had decided on and also the extent to which members of a group felt free to say what they wanted. There was no antagonism or ill feelings amongst the students.
- PART
- GR RULE
- The whole process of drawing up rules seemed to bring the students closer together - each one now knew where he/she stood - (what was expected & what he/she could do). A healthy scene.
- LENV
- REFL
- The reconnaissance sessions were not very new - but what was new was the way in which it was done - each aspect / issue no matter how small was discussed and students views were looked at. Also, the direction that was decided on came from what had taken place during the sessions & then formalized during the reconnaissance sessions. During this time students could be more relaxed and any nagging question or doubt was clarified and the individual student could see what role he/she played in the sessions & how important it was.
- LENV

Note 10 contd.

- AR            Taping of session - work groups and analysing what students had said and also looking at students participation and the roles that each student assumed or played in each group was absolutely good. It shows the importance of using strategies to get students to share ideas that they have or may have. One can question these ideas more fully. Misconceptions can be addressed.
- PART        Moreover it also showed the extent to which some students are willing or not willing to accept or even acknowledge what another has said.
- AC            Action Research implementation
- AR            This is the first time that I was made aware of the practicalities of action research and also involved in documenting (reporting) on aspects of action research. I am involved with and in action research all the time but I am not consciously taking various issues and questioning what to deal with next. I know what, how, and when I want to do things and I just do them.  
So the questions of what to do, how to do it, when and where to do, also where to from here are looked at very closely and also answered.
- PART        The whole session was student-driven, participatory and co-operatively carried out.
- The students have developed tremendously in terms of the ff:
- SELF-ESTEEM    (1) attitude of themselves, of others and the subject.  
                  (2) honesty & expression of this  
                  (3) socialising  
                  (4) sharing of ideas - how to do this  
                  (5) increase of confidence
- LENV            (6) their ability to accept criticism and also other people's views.  
                  (7) individual students to work out the misconceptions that they had on their own, in their groups & also in the large group —
- AC            to see where & what was wrong and how to go about changing it, and accepting the 'true' beliefs.
- MONIT        (8) the importance of knowledge that other people have eg. gardener — and what impact (influence) that this can have on children.

I personally learnt from and enjoyed the sessions.

APPENDIX VII

STUDENT REFLECTIVE NOTES

'LEAST' AND 'MOST' LIKED ASPECTS (SESSION 2)

- S1 The changing of groups made me feel uncomfortable, because the guys were dominant.
- S2 I like working in a group bec. you get to hear other peoples views & you are able to learn, & listen & co-operate with them. I also liked the discussions we had → debates.
- I liked everything about today's Group work.
- S3 What I like most about group work is that one develop a skill of effective communication with other people. One can evaluate himself and his ideas in reference to other and make a synthesis of his ideas and that of other people. In this way one is able to grow mentally and socially.
- What I dislike is when one person dominates the group and does not want to accept other peoples viewsponts.
- S4 I am very delighted by group work and discussion concern the organism. I am comfortable by you providing more information and clues to some strange terms.
- S5 I liked working with my colleagues because working in a group we share ideas and have conflicts but at the end we will come up with a conclusion. There's nothing least ⊥ I liked. Group work is excellent EXCELLENT.
- S6 liked most about the group.  
- Is that I found new ideas from others.  
- Everyone has a chance to speak  
- Everyone is free to tell about what he/she thinks
- Least  
- Others views may not be considered
- S7 I like learning by groups because I gain skills from it. It is the most learning method to me. I'm satisfied the way marks are allocated, it is fair to every-body.
- S8 I liked the fact that all the members were honest and sincere in their contributions, and were not shy or embarassed with misconceptions.
- What I liked least is perhaps that one member was late, although he caught up with us.
- S9 Discussion was the most thing tha I liked, where I was given a chance to share my ideas and answered why I raise that idea. I also learn from others point of view.
- S10 I liked working in a group so I get everyones ideas and helps me.
- I like least that we have not had explanations & so there were misconceptions in the group.
- S11 What I liked most was discussions when one point led to the next even if there was no agreement but there was a settlement.
- But what I liked the least was that time seemed to be against us as there seemed to be much to learn from others.

S12 In groupwork - I like the sharing of ideas most.

Liked least? Compelled to consider views of other people even if such views lack sense.

S10 13.03.95

Group C

13/3

AR Reflective Journal - Poster on modification of leaves.  
MONIT  
PART The members of our group do work well together but they  
rely on me to say if what they have said is correct or  
incorrect. I see this as a type of dominance in the group  
DOM which I don't want and I try and ask their question with a  
REFL question but sometimes because of the time constraint I  
TIME don't do this.  
TIME  
PART The group battles with time because [S12] and [S11] enjoy  
talking and try make each fact they know known instaed of  
PART giving [S9] a turn to speak.  
DOM I believe I participate well but I'm trying to move out  
because I don't want to be the person the group relies on,  
instead we must all rely on each other.  
TOPIC  
It was interesting to take the leaves and see how they were  
modified  
GR CHANGE  
I personally don't know all the people in the class and I  
think it would be an experience for us all to changee  
groups, to get new ideas and yet to know the people in the  
class.

S10 15.03.95

AR Reflective Journal - Preparation of Lesson. 15/3  
REFL  
TOPIC We took the basis from previous session and started  
PART preparing notes for the lesson.  
TIME We worked well together to get the notes done but took a  
DOM long time because [S12] & [S11] did quite a bit of talking.  
PART  
Once the notes were ampiled we statred the lesson. We  
battled to come up with an exciting beginning so we  
deligated jobs. S11 collect some leaves, S9 bring an onion  
and do rough lesson Plan from discussions in group. S12 he  
made the chart and I was to try get venus fly trap and  
PART write out the notes. We came to a consensis about the  
lesson.  
LANG  
I have come to realization that the problem of language  
does affect our group because S11, S12 don't put sentences  
DOM short and sweet because of the barrier of language. I  
personally must try to slow down, because I like things  
done in a hurry.

S10 23.03.95

TOPIC Reflection of 23 March  
MOTIV

The topic was reproduction of Anthrophyte plants. I believe this was a worthwhile lesson because you see what the members of the group knew and refresh your own memory. The introduction to the lesson was worthwhile because it made me think of the visable diferences between a root and stem.

PART Our group is beginning to work well together again. Everyone is getting an equal chance to express their views.

GR CHANGE There are times when I would like to change groups because . I think we could all learn from one another.

S3

AR REFL Reflections 15/3

PART - General member participation - good

PART - Personal member participation - was adequate, but not to the maximum performance.

TOPIC - Was desireable - the whole discussion was enjoyable and nothing was undesirable.

REFL - What should be maintained for future use : - notes  
- drawing

REFL - What could enhance the process : - thorough preparation  
- more participation

MOTIV - Comments → was interesting and enjoyable.

S2 13.03.95

AR REFL Discussion of lesson plan

PART All group members were willing to participate and each one was given the chance to air their views & ideas with regard to the lesson plan and the activities we should use. If a person felt that an idea won't be suitable to use he would say so. If we didn't understand something another person was always willing to help.

Presentation of lesson

REFL Members were complemented if they had done well in their specific area that they had to work on. Everybody was willing to help when & while the lesson began & went on.

PART Members were also willing to correct the person teaching or remind them of something they had forgotten. Members of the group were also willing to give advice as to how something should be thought.



S11 20.03.95

AR MONIT Science Journal

Plant Morphology

PART For preparation on how to present and work on our chart everyone participated fully although there were misunderstandings between one another but at the end we had a conclusion. Well, I did participate most of the time but not to my satisfaction because I had not worked or prepared my work beforehand. I found that working as a group is fun and good because you exchange what you have found out on your research. But sometimes it's not good because you sometimes tell yourself that the other members will do the work and you will just add some information where necessary. Our desire was to have a good chart and be able to explain everything clearly so that everyone would understand what's going on. For the future I think that we should as a group go at the same time to the library for our research because if we go one by one some of us tend to do the word.

PART Classification - when we were given specimens (leaves, root, etc ) most of us participated but I did not participate the point being that I did not understand what was going on, the members tried to explain but they confused me more than before. I learned by listening to them that leaves are not the same some are hairy, narrow, leaf margins not smooth etc.

Modification Presentation

UTIL The group discussed how the work should be done, and we chose a person who will present the work before we discussed anything. We worked on how our chart should look like and what to put in and what to omit. Everyone showed interest and enthusiasm. We divided ourselves on people who will draw, write, and evaluate the work. I learned that when you work as a group you become more interested and active toward your work and it is not easy to forget things; than being taught by a person standing for one hour in front of you. I did participate most of the time but again not to my satisfaction.

S11 22.03.95

AR REFL Comments on a lesson 95/03/22

TOPIC The lesson was good. For the first time I could see the fruits of introspection as we were asked to look at: How we participated in a lesson on germination of seeds. We sincerely looked one to one's self and made assessments. At the end we took resolutions for our future participation which were discussed by all groups of the classroom with explanations on clarification made where necessary. We all enjoyed the exercise.

AR REFL

Wednesday  
22/03/95

Reflective Journal

TOPIC  
MOTIV  
PART

The lesson went on very good because we all had something to say because the lesson had to do with us, our learning. I participated fully because I knew what was going on and what we expected to do. Enough time was given and for the first time we timed ourselves. Presenting what we have done to the class is very good because I believe that's how one gets use to talking to people without being shy/nervous, good practice.

YIMR

SELF-ESTEEM

Thursday  
23/03/95

ASSESS

Test

The test was fine the problem was that the question were not that clear "on my side" especially 1.3. Maybe if was put in another way I could have understood better and I believe that this question confused most of us. The whole test was fine and I know the reason why I failed it. I like the way of re-answring the questions on our own before doing them in class.

Thursday

30/3/95

PART

The presentation on alien plants on Thursday was very good. I participated fully than I have ever done before. But as a group we could not work together and discuss how are we going to present and draft our assignment, so we tried what was best for us to do. We could not find any information from the library, so we just wrote down what we saw as we looked at the vine. I think that was excellent because children are now taught to discover things on their own and not to rely on books. The presentation was fine although there were a few mistakes because when one stands in front of the class you tend to forget everything you were going to do and shake a bit. But the whole presentation was good.

TOPIC

SELF-ESTEEM

S12 22.03.95

AR REFL TOPIC MOTIV REFL PART MOTIV ASSESS AC ASSESS

The group discussion we held on Wednesday, 22 March'95, was really upbuilding and interesting in that It gave us an opportunity of looking at the needs of our group problems and address them - also feel that the resolutions we arrived at are practical and will benefit each member of the group in optimising his/her participation and contribution in the discussion.

My enjoyment of the sessions has been increasing steadily each time, in particular after we have been divided into permanent groups.

Regarding the test that we wrote, I feel that the test was up to our level - it wa'snt really difficult and my failure of it, is largely due to my negligency because I didn't prepare myself for it. One thing that I did not like about the test was Group A's 2 Questions, questions 3 and 4. Question 3 was enforcing a misconception as it asked for an acceptable definition of a stem. In Science we are dealing with proven facts not with beliefs or mere acceptables.

Question 4 was stated vaguely as it seemed as it was a one word answer question. The question read thus: "List whether True or False --" but the read like this -- "the tuber is a stem modified for --- and water and food storage

The use of the conjunction "and -- and" in question 4 made the question sound as a one word answer question. It will be appreciated if group questions cuold be moderated and faults corrected before the groups are required to answer such questions.

APPENDIX VIII

MEMBER OBSERVATION

EVALUATION OF GROUPWORK

DATE :

GROUP :

OBSERVER :

<u>QUESTION</u>					
Is everyone participating?					
Are all members trying to make each other feel good?					
Are members trying to help make each other feel able to talk and say what they think?					
Are members listening to each other?					
Are members showing they are listening by non verbal actions?					
Are members voicing their appreciation of something they like?					
Are members asking each other questions?					
Are members listening and really trying to answer these questions?					
Are members paying attention to each other?					

Describe any strategy which, in your opinion, would improve interactions in this group .....

.....

.....

.....

What one word would you use to describe how the group was today? .....

What one word would describe the way you would like the group to be? .....

**Dominance**

Is there any one person talking most of the time? .....

Are all members given opportunities to talk?

Is one person issuing instructions for this/all sessions?

Is one person the organiser (ordering observations and discussions, organising the time, giving roles, etc.) for this/all sessions?

Are roles being rotated? Which ones?

Rules

Are rules being used?

Have any been mentioned in the session?

Did the existing rules suffice or did they need to be modified?

Time

Is time being managed by the group?

Is time given for each person's input?

Language

Are members expressing themselves so that all understand?

Are members given opportunities to rephrase inputs so that all understand?

Were idiosyncrasies used and explained?

Misconceptions

Were misconceptions picked up in the session? How many?

Was each one clarified by a group member(s)?

In your opinion was the clarification understood?

Were alternative conceptions arising out of idiosyncratic language clarified when they occurred?

S2

VALUE I feel that my experience of cooperative learning/groupwork is  
 COMM a valuable one. I find that I was able to communicate my ideas  
 HETEROG with people of her races. It also thought me to learn to  
 listen and accept other peoples ideas to a certain extent.

RECON Although I was comfortable with my group most of the time, I  
 found it at times a little difficult to understand what some of  
 my group memebers were saying since all of them were English (2  
 language) speakers.

ROLES By having reconnaissance sessions I feel that I was able to  
 listen to the views of other groups which at times could lead to  
 very lively and interesting discussions which I really enjoyed.

GR SIZE By having group member observing certain sessions each member  
 would have a turn to be a teacher and observe whether the rest  
 of the group kept the group rules.

TIME By working cooperatively we were able to divide the work amongst  
 ourselves - yet know what was happening. We also learnt the  
 various ideas that other members of the group have about plants.

TOPIC By working in groups we were able discuss the ideas and  
 misconceptions and to certain extent correct certain  
 FORMAT misconceptions.

TED I feel that the numbers in each group was ideal but if there was  
 UTIL a larger class each group could be enlarged to a maximum of 6  
 members per group.

UTIL I feel that the time given to certain activities were quite  
 sufficient, while in other activities our group tended to lack  
 MOTIV behind. This could be because we were slow.

The topics chosen for group discussion were ideal and even we  
 had no prior knowledge on certain topics, we were provided with  
 specimens which enabled us to learn more about the topic/item.  
 The size of groups and the time given for discussion ensured  
 that a maximum amount of cooperative learning took place with as  
 much participation by the various numbers.  
 My experience of cooperative learning have thought me how could  
 use it when I go Pract Teaching or even later in my career.  
 The use of cooperative learning has also thought me to be  
 patient with other slower members. It has thought me appreciate  
 their ideas/views but it also has thought me not to just accept  
 just any idea but rather to question and debate the various  
 ideas.  
 On the overall I enjoyed the cooperative learning experience  
 that I had and I would most definately make use of it in my  
 teaching career.

My view is that coperative learning should be adopted for other  
 groups in future because it is not only ideal but also  
 empowering.

## S5

MOTIV I enjoyed group work and it taught me to work co-operatively  
REFL with other students, respecting their views and respecting one  
NOTE another. Well, the writing of reflective notes was a good way  
of expressing our views on what was thought about the lesson  
MONIT which we had. But it would have been much better if our  
reflective notes were seen by the lecturer and returned to us  
CONCEPT with her comments.

AC As we worked in groups we learnt to discover things on our own  
TIME without referring to encyclopedia's and science books e.g. The  
assignment on Alien plants we did it by looking at the plant. I  
CONFLICT also found out that some of the things that I learnt at school  
about plants were misconceptions. Timing was okey although at  
MO first we could not finish at that given time but having to  
discuss and ?? a poster at the end wastes time because as we  
REFL discuss a certain topic we have arguments and we end up having  
NOTE no time for a poster because I believe that one should not be  
left without being clear what is being discussed.

GR  
CHANGE Member observations, I dont think that it is of any importance  
because the one who is viewing does not participate in the  
UTIL discussions most of the time and also I dont see any need of it  
because we write reflective notes but maybe some of us see it  
important but I dont.

MOTIV For the future I think the teacher should change people in  
groups after two or three weeks. Changing groups makes one to  
be used to other members, and see how others feel about things  
and how they think rather than remaining in one group. For a  
teacher, she discover things that she might have not known from  
the pupils and she can easily see who participates the most in  
discussions and who lags behind. Also this kind of learning  
reduces rote-learning.

But the sessions went well because we all student did put a lot  
of effort to it and the tests were fine although the first test  
(one of the question) was not clear enough but I enjoyed the  
whole lessons of the course.

S9

SELF-ESTEEM VALUE COLLEAGUE SHY This choice of Course was enjoyable challenge, I was treated with respect which prevents me from that inferiority and frustration feeling to arise. We were put in groups where we were actively busy with task given and we were given a chance to find our own answers to i.e. specimen given, classifying the type of plant, why do plants have different in shape? Where do new plants come from? Answers were discussed in groups where the basics of i.e. reproduction, modification of plants and plant function were introduced.

AR REFL AC TED UTIL There were times where we had field trips and visits in Botanical Gardens. One of the field trips was in Valley trust where we get a useful information about trench gardening and also Palmiet where we learn about Alien plants and ssome measure control of them. These information were collected and applied in our teaching. This has help us to get a concrete experiences of Botany and opportunity for subject (Biology) enrichment.

SELF-ESTEEM ETHOS In working co-operatively I have develop an inner calm and accept myself that sometimes I my abilities. The group has learnt to accept and understand those features where upon I was unable to express in language what was being discussed at the moment and helpfulness loyalty was more easily developed in group work.

The tape recording method was very useful because there was a lack of time for the lecturer to clarify the subject. During reconnaissance sessions we were given clarification of some misconception that was heard in the tapes. Watching Television set where germination was recorded has give advanced instructions to fast leaners and also additional explanation to slow-learners.

I think as a teacher to be, I need to arrange everything beforehand i. e. Visiting of schools in botanical Gardens, fieldwork and lesson planning. I must be able to notice learning mistakes immediately and report back in class i.e. as we had reconnaissance sessions. In schools a teacher can move around among pupils in groups and there he can quickly notice the misconceptions.

I happen to be very sensitive to the slightest indication of rejection by others, but I have found that I can work with people I am not used to work with. In our group each person was given a task to do which makes me being one member of the group and it has also build up self-respect.

I hope that Cooperative learning will be applied in other lectures.

S4

MOTIV VALUE TIME In our science lessons I feel were the most comfortable and open classes. I am satisfied with guidance among the members reflecting on what has been done. I think the only problem is that we must get more time in specific topics for information gathering. This has happened when we have to present a certain investigation, find that we lacked, Concerning our course outline and topics, I would say they are very relevant and better quality as we going to be new teachers.

CL IMPL GR RULE CONCEPT Cooperating in the groups were very successful because we implemented it and investigated the obstacles hindering it and we formed rules.

PLAN Learning about plant was very interesting among us because we don't know about different plants, their functions and adaptation as well as the names. It is something that was very relevant or related to school syllabuses.

TIME GROUP MOTIV \* I suggest that in future more information is gathered and thinks like classifications are thoroughly practise and given sufficient time.

MONIT SOC SKILL I would say most of the lectures were well organised in terms of time and groups. The amount of committed and demand in per individual was not extra or a heavy duty. This kind of sessions

COG BACKGR put forward to me that as a student I am responsible for the work and as a teacher I must entrust the work and responsibility to the children and go side with side with them. I don't have problem of working with other people, but in this sessions I have developed a skill of dealing with the problems which arises in the groups. Therefore I was very much happy with it and feel that it can carry on to other fellow students.

MOTIV The other problem I think affected me as a black student is that I lacked the general knowledge of some other aspects in Science. Although I did Biology in matric but I don't have that wide relevant information except the one which I was taught at school.

I need to start learning and read widely or broadly about topics.



S6

MOTIV VALUE Firstly may I say I found the cooperative learning to be very improving to me. This is because I learned to think as more as I can which usually appear after you have had suggestions from other members and then when you have nothing to say you worry yourself and feel being touched that how come they have said a lot where you have nothing to say? By doing so I start to think about the issue and therefore that improves my thinking skills everythime I think about how does this and that happen?

UTIL TOPIC Concerning notes and equipment I felt that everything was fair. The sessions also were not boring as they were not theoretical. We were are always doing the best way of learning as always discovering things on our own. This too must be applied with children. The sequence of work was logical as we were not dealing with different things at the same time and even if we did not finish the work we were passing on it being comple(te).

CL CONCEPT I think working cooperatively is a wise suggestion because an individual cannot think the same as other one can think differ or better than the other.

TIME topic Working with plants credited my knowledge. I thought I knew them from the high school but only to find that I gained some new information for instance I did never think of weeds ("alien plants") as being the important plants in the environment. It was also a good idea to work, with plants at one time leaving the rest aside (physics/animals) because that developed interest in the subject and it does not lead into confusion.

UTIL TED Time that we are given when discussing or for discussing is not enough. I think if we can deal with an aspect at the estimated time that will give us the allowance of expressing our views about that certain issue. The topics that we are given ar okey, they develop our thinking. It may also develop our cognitive learning. The problem is that the time given for them is nat enough. The only solution of the little time is to deal with one topic at the same time for instance when doiung the modifications we did not have the same information about everything others were doing leaves others roots or stems. It would be a good suggestion if we were to deal with one topic at the same time (the whole class deal with one thing because others have more information than other groups in each topic.

SOC SKILL

As a student this experience will help me to see how I going to lead in future. As a teacher it will help me to be able to introduce cooperativeness fo children. It will develop cooperative skills among children and they will be able to discover something without the help of the teacher although a can help there and there.

Regarding social aspects I can surely work with other people. That will help me to get to know others and for that I may gain new suggestions or viewing from others not just the same style of thinking, coming from the same person.

S12 Cooperative learning facilitates the learning process in that it affords students the opportunity of pooling ideas together in an attempt of solving problems. Individual students are helped by their group members to better understand concepts which an individual student working on his own, might have found too complicated and difficult to grasp.

MOTIV  
VALUE  
HELP

TIME Cooperative learning is also a time saver, it has made it possible for us to accomplish much work within a short time period. The shortcomings of cooperative learning are:

PART a Group evaluation - it is somewhat impossible for students in a group to contribute equally and cooperative learning disregard this fact at times. b As a result of the support and help a student gets from his or her group members, the student might be easily deceived into believing that he or she personally understand all that is learned.

PART

RECONN REFL AC REFL- NOTES MO I think that reconnaissance sessions are important in any learning since they allow us an opportunity of looking back at the progress we have made. As a result of this, we are able to evaluate our work and to correct any misconceptions we might have. The reflective notes are also essential in that they inform our lecturers about our feelings and attitudes towards what is going on in they classroom, in fact the reflective notes serve as our evaluation tools. The observations made by assigned members are not always and totally accurate in that the minds of the students who are recording these observations, are divided into two, since the students are required to participate in group discussions and at the same time to make the observations. This divides their concentration and when the students set their minds on one aspect of their assigned responsibilities the other aspect suffers. I feel that work is properly sequenced.

TOPIC

SOC SKILL

LANG

CONCEPT

TIME

I learnt that cooperative learning calls for good social skills such as respect for others, patience, tolerance, responsibility and reliability. In cooperative learning, it is essential that the individual should learn to express himself or herself clearly and properly to be understood by the others. It is also essential that one learns to control his or her emotions when conflicts arise.

TOPIC

COG- BACKGR SELF- ESTEEM LENV

TED UTIL LENV

I learnt about the main distinguishing features which determine once and for all whether a part of a plant is a root or stem or leaf.

I feel that the amount of time we spend working cooperatively should be determined by the nature of the subject matter at hand and by the content. I feel that optimum participation on the part of the students is hindered by the varying level of knowledge they have about the subject matter and this might be counteracted by encouraging the students to prepare themselves beforehand for the discussions.

As a student, I find these experiences upbuilding and enlightening. Our learning takes place under a very relaxed situation and students often relate their own personal experiences and some of these experiences are really informative.

As a teacher, I would introduce cooperative learning in my teaching whenever possible and fitting, in fact cooperative learning would be a trading mark of my teaching profession. Through cooperative learning, pupils would not only acquire academic knowledge, but would also acquire life skills. Cooperative learning can transform the class environment by

MOTIV ASSESS Cooperative learning has been fun and enjoyable. Although this was not the first time we have utilized this approach, it was the first time that the major part of our assessment was going to be largely based with this activity.

REFL LENV ASSESS Hence it required a re-orientation regarding studies. First and foremost it required trust with fellow group members. We were all aware that the total group effort would constitute and determine final assessment, which we would have to settle for.

LENV LANG AC The following was most desirable: the sense of trust and recognition of one another with each other. Firstly we all had to vocalize and communicate with each other. This opened up all barriers and helped eradicate certain misconceptions regarding each other. This was unlike the conventional approach where independent study was expected.

PART

TIME CONCEPT Undesirable aspects were honestly the fact that on occasions we were not fully participating. I guess that this is pretty normal, because even in conventional approach, students sometimes withdraw or might be feeling "out of sorts". Although it is undesirable and should be discouraged, it has to be seen as normal.

TIME Time allocation to certain aspects was sometimes limited and insufficient.

ETHOS It has been a long time since I have finished school hence I was rusty regarding plants. The approach to learning plants however entailed a hands on approach and this was good.

UTIL Time has to be managed rigidly, with some flexibility. It is easy to get carried away and forget time limits.

HETEROG

SOC SKILL I personally feel that much of education in the future is going to entail co-operative learning, Hence we as trainee teachers need to be exposed more to this approach.

Pupils will have to also get used to this approach to maximise learning.

It is important for groups to be composed of members of all sexes and races. This will consciously contribute to multicultural learning, and promotion of good relations between the different groups.

The social aspect has been great. I respect people of all races and sexes after this. While I am not saying I did not in the past, I certainly do so even more now.

Pupils will also have to get used to this approach to maximise learning.

It is important for groups to be composed of members of all sexes and races. This will unconsciously contribute to multicultural learning, and promotion of good relations between the different groups.

The social aspect has been great. I respect people of all races and sexes after this. While I am not saying I did not in the past, I certainly do so even more now.

S10

MOTIV I enjoyed the practical sessions eg looking at the leaves etc but  
TOPIC I would have enjoyed a lecture afterwards to see if our  
COG- understanding is correct and so as teachers we have the  
BACKGR theoretical background of what we've seen. People like S11 who  
have not done Biology for a while must find it difficult and does  
RECONN not understand the theoretical terminology.

DOM  
MO I think the reconnaissance sessions were beneficial because it  
made you look how you were working in the group and it gave  
opportunities to change the way things happened in the group eg  
TOPIC get rid of the dominant person in the group. I personally found  
while you were observing you listened but did not really take part  
PART in the group discussions and while writing you missed important  
facts or it causes the group to stop, start and the train of  
thought is forgotten.

ROLE The sequence of lessons was very good and it helped with the  
CONCEP understanding of more advanced concepts.

T I learnt that people have to cooperate in a group and not be  
dominant. Another important thing that was reinforced was that of  
listening and helping one another to understand the question and  
concepts. We must delegate work otherwise you get swamped by the  
INDIV work.

I learnt about the alien plants but mainly reinforced the  
knowledge I already had of plants. I also learnt about the  
kingdoms, I was not aware that there were 6. I also learned the  
terms hypogeal and epigeal, I knew that some seeds stay  
underground eg mielie and others come up eg sunflower, I never  
knew the terms used.

I think time was a problem in our group because of language  
learners but normally it would be fine. I think that the lecturer  
should stipulate 2 men in each group and 2 females and allow  
people to choose their own groups, this will ensure that people  
are comfortable with one another and this improves participation.  
I think group rules work well and sufficient time ensures optimum  
participation.

These experiences helped me understand another culture because  
the group added folk wisdom into discussions eg watermelon seeds.  
This also made me grow as a person because I was made aware that  
I'm dominant and expect perfection which in turn made the load  
heavy on me. As a teacher this helps me because it has made me  
aware how important group work is and it develops the child's  
social skills and listening skills.

I found that I could work with people I was not use to working  
with but at times it irritated me that they spoke in long winded  
sentences and slowly when I put things short and sweet to the  
point and work quickly. At times it would have been nice to work  
on some thing individually because I found that I never saw my  
group, only in Science.

I(n) my days of study I had little experience of co-operative learning. All learning was by rote. In my first year at this college I have experience of group learning but I did not take much notice of it as something effective and worthwhile in my learning process.

MOTIV The first indepth experience of co-operative learning I have received till now is in the natural science course of this year. As normal I did not recommend it as something important. But as the day continued with my experience of this method of learning, I began to feel the effecti(ve)ness of this method of learning. I began to realise that when ideas from different people are put together they result in a meaning and important conclusion. I also realise how useful to share ideas with your fellow students. This in most cases help me to correct my misconceptions which I had, and which might have not been corrected as I have not shared them with my fellow students. Most of all cooperative learning help me develop a sense of confidence in myself and others in the group since I began to know and understand myself as well as other in the group. With such understanding one can appreciate his abilities as well as those in the group.

AC REFL Moreover communication skills are also developed during the process of cooperative learning. That is as I am a second English language speaker, I have experience the improvement of my fluency in language as well as confidence in speaking the language.

SELF-ESTEEM REFL NOTE Furthermore I have also experienced the improvement of formulating ideas and expressing them in a meaningful and appropriate manner.

MO What I feel about reflections and reflective notes is that they are most important in the sense that they strike at the correct target within a person where nobody or nothing can have an assess to accept the individual himself. I think that is the reason why I felt not at ease or uncomfortable when I have to write reflective note because when you judge yourself, you access yourself in a way that nobody can do since once has an access to all the uinate thoughts, intentions and desires. If reflections and reflective notes can be done faithfully and honesly something very important can emerge from such activity. Member observation I think is effective to a certain limit. I say this because each an every person has paradigms from which they judge things and this to some extent hinders the effectiveness of this activity.

PART SHY ROLE GR RULE I have learnt during cooperative learning that I am capable of working with other peoples and that by sharing ideas one is enriching his own knowledge of the subject, and that one person can never be correct at all times and needs to admit his shortcoming and accept other people's view points.

UTIL SOC SKILL I suggest for the future cooperative learning must for the core of all subjects and that it should be implemented with caution since it is not effective for everyone e.g. introverts feel uncomfortable in group situations than extroverts who feel secure in such condition.

UTIL The aforementioned facts also affects the optimum partiucipation of the participants such as the introverts feels shy and intimidated in group discussion and cannot express freely all their ideas. The management of the groups should cater for this fact. A group leader with effective interpersonal skills should be appointed to serve this role. Group rules that takes care of all the aforementioned facts need to be laid down by the groups themselves and approved by the lecturer.

The experiences I have received from cooperative learning will help me as a student. In the sense that the skill of formulating ideas have been developed. The ability to work with other people and to accept their point of view and assessing myself have been developed. This will promote my work as a student. These ideas also applies to my profession as a teacher. Since it need good interpersonal skills. As a teacher one has to be able to work

S7

MOTIV REFL To me Natural Science (Biology) is the most enjoyable subject compare to all subject I'm enrolling. To be honest to myself my performance is not what I can be proud of. But I'm not blaming you, its my own social problems which I think only God can help me.

REFL NOTE I generally certisfied about the course refletive notes and so on. There is a sequence in the course we moved from classification of plants, modification of External parts of plants (root, stem & leaves) flowers/reproduction. This reflect clear understanding of you, lectures of your work.

LROLE AC

GR SIZE In working together : I think you also have seen that this make easeyer for you because most of the facts come from us, For you its just to correct misconceptions and add or make input here and there.

TIME HETEROG Groups are good recommending 4 to 5 members in each group. This make student to get opportunity to give their input.

PART SOC SKILL Time is also certisfacy but this depends on a class you have on that particular year because you will find that on other year you have a fast running students.

UTIL For cooperative learning you need to continue about it and this should be judged by the way student's responce, specifically marks of the groups.

TED UTIL For Optimum participation students should have/be given individual work. As students we gain a lot in group learning and there are skills we learn life skills like how to debate and give others freedom of expression and how to criticize points not people. Which I believe is a golden life skill to have. If people were to have this understanding we can have a peacefull country.

As a teacher : Since this method is not used that much in our "black schools" we use it too. And the problems that will rise can be face them and solve them easely since we also experiment it practically.

If this is successfull to use so I confident that I can apply it and be successfull.

S1 At first I didn't appreciate the groups that were set but now I  
MOTIV made a mistake. I felt uneasy and not willing to work effentially  
with my group but there was something that push me to work co-  
operatively with them (group). When we were told to form groups I  
GR thought I was going to be with my friends i.e. Bonie. I worked  
CHOICE with them though there were problems. But now I appreciate to work  
with them i.e they have improved my skills. To work with my group  
had helped me to achieve high marks. also helped me in getting  
AC through some missconception I had. To work with different people  
LANG has improved my language and the skill of working with different  
people.

SOC At first I was impatient as taking no excuse and short tempered.  
SKILL Working with my group helped to be patient and to listen to other  
LENV people while they were talking as well as to take their ideas.  
Most of it, it encouraged me to do some research in order to  
fulfill my curiosity on the matters that were discussed in the  
class. I was not used in arguing with people but now I can argue  
and explain my points as clear as I can. Most of it I have  
learned to be sympantetic.

INDIV Aspects  
REFL There were aspects which were challenging and were demanding,  
anyway they helped me alot to develop certain skills. There was  
not much individual assignments that made me feel I didn't work  
properly because I'm too proud of the work that I did by myself.

TIME The Reflective Sessions  
It was not easy to do it at first and to talk about what I don't  
like with the group. But it helped me alot. It has improved the  
communication within the group i. e the dominant people. It was  
only the session that everybody can show his or her feelings and  
it was where every member see her/himself responsible for the  
improvement of the group. The session which I enjoyed the most  
was the last one it was lively as ever also of us in the group  
participated and we shared our ideas. Member observation was a  
good idea because it gave a member who was observing an  
opportunity of studing likes and dislike of each member and how  
to handle each person as people are not the same.

TEG Suggestion For Future  
UTIL Time  
I think time should be allocated differently for different  
topics. The time for discussions must not be included with the  
time for practicals. I think practicals must be done separately.  
UTIL Groups I think must not change so that people can be able to work  
with different people. I think there must be various topics to be  
set and groups must have a choice.

SOC Experiences  
SKILL As a Teacher  
These experiences can help me in managing my own classroom. They  
can also help in getting to know all my pupils better as well as  
to understand them and their problems.

As a Student  
These experiences can help me in achieveing high marks and my  
goals for the future. They also helped me in over coming shyness.

Social Aspect  
I have found that I can work with the people that I'm not used to  
i.e All the people from my group I was not used to them but now I  
can work with them with no problem.

S11

CL-            Though, in my first year, I learnt much about group interaction  
EXPER        approach to teaching, the responsibility of applying it to the  
              group of which I also was a member was not mine as a student but  
              as a teacher.

TED  
UTIL           This year, cooperative learning took a different direction from  
              the very beginning. The roles of teacher, pupil groups,  
              individuals as well as teacher and pupil partners, were discussed  
              and clarified. It was at this stage where I learnt that I was  
REFL-        personally responsible for my own performance and progress as  
RECON        well as that of others. I learnt also that reconnaissance  
INT           sessions assured us of having a good system in place such as  
              cooperative learning. When we examined the issue of participation  
REFL-        equity I noticed good results after honestly discussing  
NOTES        identified problems and agreed on solutions such as group guiding  
MO           rules. I delighted in the way our lecturer interviewed us as I  
              realized that sometimes I was not very critical in my learning.  
              Such interviews also enabled our lecturers to compensate  
TOPIC        identified inefficiencies.

COG-           The other good thing was reflective notes on different sessions.  
BACKGR        I noticed that we seemed to be reluctant to make them, but the  
              fact the opportunity was there enabled us as students to have an  
              influence on how we learnt even in terms of management. Assigning  
              one group member to observe how the group worked in all sessions  
              accelerated participation of each member.

TED           The course was well structured. I learnt much, more especially  
ETHOS        about plants. That was enhanced by the use of actual specimens  
POL           for investigations and observations. There was no session which I  
              would regard as of less benefit especially as my Biology  
              knowledge was poor initially. I am now confident that I can teach  
              pupils Natural Science.

My view is that cooperative learning should be adopted for other  
groups in future because it is not only ideal but empowering.



APPENDIX X

Questions Extracted from Statements made by Students in the Reflective Essays

For each statement respond as follows:

SD-STRONGLY DISAGREE; D-DISAGREE; A-AGREE; SA-STRONGLY AGREE;  
N-NO OPINION.

STATEMENT

SD D A SA N

1. OUTCOMES - LANGUAGE AND MULTICULTURAL CONCERNS

- a.CL gave me the opportunity to communicate with people of other cultures.....
- b.CL gave me the opportunity to learn how to work with people of other cultures.....
- c.CL opened up barriers and helped remove some of the misconceptions I had of other groups...
- d.\* As an English second language speaker I found that my fluency in the language has improved.....
- e.Working with different people gave me some idea of how to work with different people...
- f.I have gained more respect for different cultures and the opposite sex.....
- g.The heterogenous grouping allowed for learning in the context of other cultures (eg. folk wisdom).....
- h.The heterogenous grouping promoted good relations between different groups.....
- i.The language usage of the group was a constraint to my learning and I found this irritating.....
- j.The language usage was a challenge and we learned to understand each other by helping each other.....

2. OUTCOME - MOTIVATION ASPECTS

- a.CL is an enjoyable way of learning.....
- b.CL is the most enjoyable way of learning...
- c.CL makes us put more effort into our learning.....
- d.I found the Natural Science lectures most comfortable and open because of CL.....
- e.CL sessions are not boring because we are practically involved in our learning.....
- f.CL experiences motivate me to learn more...
- g.CL is an effective way of learning.....
- h.In CL I appreciate the opportunity to work with people I would not normally work with..

3. OUTCOME - COGNITIVE ASPECTS

- a.CL has taught me to question and debate various ideas.....
- b.CL has helped me learn about concepts about plants.....
- c.CL helps us learn to discover things on our own.....
- d.CL reduces rote-learning.....
- e.CL helps reveal alternative conceptions ('misconceptions').....

- f. CL helps correct my 'misconceptions' which may have remained if I did not share my thoughts.....
- g. I was motivated to think about some things because I was compelled to make an input....
- h. I was exposed to more ideas about a concept from different people, than my ideas alone..
- i. By sharing ideas we enriched our thoughts on the subject.....
- j. We found that there were other styles of thinking and this was worthwhile.....
- k. In CL members help each other to better understand concepts which may be difficult to do alone.....
- l. CL forces you to express yourself clearly and properly so others can understand.....
- m. In CL I learnt not only about concepts but also about life skills.....
- n. CL sessions helped me achieve high marks...
- o. \*CL was an effective way of learning for me because of my poor Biology background.....
- p. CL taught me to accept my shortcomings.....
- q. CL taught me to accept other views.....
- r. CL experiences have made me improve the way I formulate ideas and express them coherently.....
- s. CL experiences have taught me how to argue and explain points more clearly.....

4. OUTCOME - SOCIAL ASPECTS

- a. I learnt how to listen and to accept other peoples ideas.....
- b. We learnt how to share work.....
- c. We learnt how not to dominate/withdraw.....
- d. I learnt how to be patient with others.....
- e. CL has taught me to work with people who I do not usually work with.....
- f. We learnt how to cooperate/help one another.....
- g. We learnt how to respect one another.....
- h. We learnt how to be tolerant.....
- i. We learnt how to be reliable.....
- j. We learnt how to trust one another.....
- k. I learnt not to criticise people but points.....
- l. I learnt to be responsible for my own learning.....
- m. In CL sessions we practised socialising with people of other cultures.....
- n. We practised socialising with the opposite sex.....
- o. We learned how to handle conflict situations with control.....
- p. CL has helped me develop self-confidence...
- q. CL has improved my communication skills....
- r. I have learnt to accept shortcomings in myself.....
- s. I have learnt how to accept shortcomings in others.....
- t. I have developed the ability to empathise with other students.....

## 5. MONITORING

### 5.1 RECONNAISSANCE SESSIONS

Reconnaissance sessions were beneficial because they made us

- a. look at how we worked in the group.....
- b. give views on how we worked.....
- c. listen to views on how we worked.....
- d. improved communication in our group.....
- e. evaluate our progress.....
- f. Reconnaissance was a good way of evaluating myself in relation to the group.....
- g. It helped reveal aspects preventing optimal participation by members.....
- h. It improved the quality of future interactions.....
- i. It is a satisfying activity for me - it makes me feel good.....
- j. It helped clarify conceptions.....

### 5.2 MEMBER OBSERVATIONS

- a. Member observation impedes participation for the observer so it should not be used...
- b. It should be used but the member who is observing should not participate in the CL activity.....
- c. It must be on a rotating basis.....
- d. It should be used to ensure that group rules are upheld.....
- e. It enhances participation.....
- f. It helps the observer understand members of the group.....
- g. It is not effective because an observer has his/her own personal values and judgements..

### 5.3 REFLECTIVE NOTES

- a. The option of writing reflective notes creates a way of having a say in our learning.....
- b. It informs the lecturer about our feelings on what occurs in the sessions.....
- c. It reveals attitudes about what occurs in the sessions.....
- d. It is a way of evaluating oneself.....
- e. There should be individual feedback given to a student's reflection by the lecturer...
- f. The class feedback on reflections helps our learning.....

## 6. MANAGEMENT - TIME

- a. At first we did not manage the time allocated for CL well, but with experience we managed time effectively.
- b. It is up to the group to manage the time allocated.....
- c. We should get more time than was given for CL.....
- d. The time given ensured optimal participation.....
- e. Certain topics require more time than was given for effective CL to occur.....
- f. Much was accomplished in a relatively short period of time because of the CL approach...

7. MANAGEMENT - TOPIC

- a.The topics were suitable for CL.....
- b.The class discussions after a CL session helped consolidate concepts.....
- c.A lecture is necessary after a CL session..
- d.Students should be given some work on a 'new' topic to prepare before a CL session.
- e.Aids, like using specimens, help in learning about unfamiliar topics cooperatively.....
- f.All groups should deal with the same aspects simultaneously so that a range of different ideas are presented.....
- g.Groups should choose aspects from a given list.....
- h.Some Natural Science topics are unsuitable for CL.....
- i.Working together helps us construct concepts.....
- j.Work should be divided within a group.....
- k.More individual assignments should be given.....

8. MANAGEMENT - GROUP DYNAMICS

- a.The 4 members per group ensured optimum cooperation and participation, larger groups would limit participation of every member...
- b.Larger groups of up to 6 members are suitable for larger classes.....
- c.Groups should not change because class discussions help in exposing students to a wide range of ideas.....
- d.Groups should be structured by the lecturer so that there is a balance of sexes and cultural/language groups.....
- e.Students should choose their own groups....
- f.The lecturer should stipulate the condition of sex and cultural group balance and let students choose their own groups.....
- g.Groups should change for students to experience a wider range of ideas.....

9. MANAGEMENT - ASSESSMENT/EVALUATION

- a.We were unaccustomed to group assessment and this meant that we needed to reorientate our perception of assessment.....
- b.Students should negotiate whether they want group marks or individual marks.....
- c.Group marks may not reflect individual participation because it is not possible for all students in a group to contribute equally.....
- d.An individual student may be deceived into believing that he/she understands all that is learned by the group.....
- e.Support and help received by an individual in a group helps achievement.....
- f.CL helps the teacher learn about pupils' ideas.....
- g.CL helps the teacher learn about pupil participation.....

## 10. MANAGEMENT - PARTICIPATION

- a.Ways of helping us overcome constraints to participation help us move towards equitable participation.....
- b.Group assessment promotes participation by all members.....
- c.Group rules ensure participation by all members.....
- d.Own choice of groups ensures participation by all members.....
- e.Time limits constrain participation.....
- f.Division of work within groups is desirable to ensure participation.....
- g.At times other constraints, like the state of one's health or feeling weary, limit individual participation in a group.....

## 11. MANAGEMENT - SOCIAL SKILLS

- a.Building trust among members of a group is required for effective CL.....
- b.All members need to be aware that they must cooperate so that the group assessment is accepted by all.....
- c.Group rules work well for the social aspects of cooperation, like listening, respecting each other,etc.....
- d.Group rules are adequate to ensure participation of 'shy' members.....
- e.A group leader with effective interpersonal management skills should be used to ensure participation of 'shy' members.....

## 12. USE/ETHOS

- a.I enjoyed the CL experiences.....
- b.I will plan for such experiences for pupils.....
- c.I am now aware that, as a student, I can learn in CL situations.....
- d.It has taught me how to formulate ideas ...
- e.It has taught me to be responsible for my own learning.....
- f.As a teacher, providing CL experiences for pupils will help me to better understand and know my pupils.....
- g.CL has increased my understanding of concepts in Biology.....
- h.It has helped me develop personally by developing positive social habits.....
- i.The CL experiences of the course has made me confident as a prospective Natural Science teacher.....
- j.Learning is promoted in the relaxed, secure environment of the CL situation.....
- k.CL has the potential to transform the classroom environment by taking away fear and tension from pupils and providing a relaxed environment in which the pupil's potential may be optimally developed.....
- l.We need to be exposed to CL experiences in our preservice education because we to maximise learning.....
- m.The CL experiences have taught me to criticise points not people, and this important lesson should be extended to all to promote peace in our

Results of Questionnaire [n = 12]

Item	SD	D	A	SA	N	Item	SD	D	A	SA	N	Item	SD	D	A	SA	N
1a	/	/	7	5	/	5.						9a	/	2	4	/	6
b	/	1	6	5	/	2a	/	4	4	1	3	b	/	/	7	3	2
c	1	3	2	4	2	b	2	7	1	1	1	c	/	/	6	4	2
d	/	1	4	3	2	c	/	1	6	3	2	d	/	/	7	2	3
e	/	/	6	6	/	d	/	/	5	3	4	e	/	/	1	1	/
f	/	1	6	4	1	e	/	/	3	4	5	f	/	/	9	3	/
g	/	1	4	5	2	f	/	1	6	2	3	g	/	/	6	4	2
h	/	/	5	6	1	g	/	3	4	1	4						
i	4	2	2	4	/												
j	/	1	6	4	1												
2a	/	/	4	8	/	5.						10a	/	/	8	2	2
b	/	1	4	5	2	3a	/	/	4	6	2	b	/	2	4	3	3
c	/	/	4	5	3	b	/	/	4	7	1	c	/	1	6	4	1
d	/	/	5	7	/	c	/	/	5	8	1	d	/	1	5	2	4
e	/	/	3	8	1	d	/	1	5	5	1	e	/	4	6	/	2
f	/	/	3	8	3	e	/	/	6	3	1	f	/	1	7	3	2
g	/	/	5	7	/	g	/	/	6	4	2	g	/	/	6	2	3
h	/	1	4	6	/												
3a	/	/	1	10	1	6a	/	2	6	2	1	11a	/	/	5	6	1
b	/	/	6	0	1	b	/	2	6	0	4	b	/	/	1	1	1
c	/	/	2	0	1	c	/	2	6	1	4	c	/	/	9	0	1
d	/	/	2	0	1	d	/	2	6	1	4	d	/	/	9	0	1
e	/	/	0	0	1	e	/	2	6	1	4	e	/	/	9	0	1
f	/	/	0	0	1	f	/	2	6	1	4	f	/	/	9	0	1
g	/	/	0	0	1	g	/	2	6	1	4	g	/	/	9	0	1
h	/	/	0	0	1	h	/	2	6	1	4	h	/	/	9	0	1
i	/	/	0	0	1	i	/	2	6	1	4	i	/	/	9	0	1
j	/	/	0	0	1	j	/	2	6	1	4	j	/	/	9	0	1
k	/	/	0	0	1	k	/	2	6	1	4	k	/	/	9	0	1
l	/	/	0	0	1	l	/	2	6	1	4	l	/	/	9	0	1
m	/	/	0	0	1	m	/	2	6	1	4	m	/	/	9	0	1
n	/	/	0	0	1	n	/	2	6	1	4	n	/	/	9	0	1
o	/	/	0	0	1	o	/	2	6	1	4	o	/	/	9	0	1
p	/	/	0	0	1	p	/	2	6	1	4	p	/	/	9	0	1
q	/	/	0	0	1	q	/	2	6	1	4	q	/	/	9	0	1
r	/	/	0	0	1	r	/	2	6	1	4	r	/	/	9	0	1
s	/	/	0	0	1	s	/	2	6	1	4	s	/	/	9	0	1

4a	/	/	5	8	/	7a	/	/	8	4	/	12a	/	/	2	9	1
b	/	/	4	7	/	b	/	/	8	4	/	b	/	/	4	8	/
c	/	/	1	8	/	c	/	/	8	4	/	c	/	/	4	8	/
d	/	/	3	9	/	d	/	2	6	3	/	d	/	1	4	8	/
e	/	/	6	5	/	e	/	/	7	3	/	e	/	/	7	4	/
f	/	/	5	7	/	f	/	/	5	6	1	f	/	/	4	7	/
g	/	/	6	5	1	g	/	1	4	7	4	g	/	/	4	7	/
h	/	/	7	5	/	h	/	/	4	4	3	h	/	/	4	7	/
i	/	/	7	4	1	i	/	/	4	4	3	i	/	/	5	6	/
j	/	/	7	4	/	j	/	/	8	4	2	j	/	/	6	3	/
k	/	/	5	6	1	k	1	2	7	5		k	/	/	5	5	/
l	/	/	6	5	1				5	2		l	/	/	5	5	/
m	/	/	5	5	1							m	/	/	5	7	/
n	/	/	3	7	2							n	/	/	5	1	/
o	/	/	2	7	2							o	/	/	2	7	/
p	/	/	7	3	2							p	/	/	3	8	/
q	/	/	6	3	3												1
r	/	/	10	2	/												2
s	/	/	7	4	1												1
t	/	/	9	2	1												
5.1	/	/	5	6	/	8a	/	/	4	6	1						
5	/	/	5	7	/	5	/	/	7	4	/						
6	/	/	6	6	/	6	/	5	2	1	/						
7	/	/	6	5	1	7	/	4	1	5	/						
8	/	/	5	6	1	8	/	1	5	3	/						
9	/	/	4	6	3	9	/	1	6	2	/						
10	/	/	5	6	2				6	2	/						
11	/	/	5	6	1				5	2	/						
12	/	/	5	6	4				5	2	/						
13	/	/	5	6	3				5	2	/						

APPENDIX XI

STUDENT PRODUCTS

GROUP RULES (SESSION 3)

GROUP A

TIME	1. Listen to others view
TOPIC	2. Those expressing views should be aware of $\pm$ time.
ROLE	3. One aspect should be dealt at a time
TOPIC	4. Each day - leader should change - prevents domination -
CONFL	5. Group should understand $\pm$ topic being asked
PART	6. Shouldn't be emotional involvement
DOM	7. Able to accept [the] other views
CONFL	8. Each one - seen as equal in a group
PART	9. At end everybody should agree on a point & come to a
ROLE	Conclusion.
	10. Each should be given a chance to express his views.
	11. Group leader ensures that the topic is discussed & that it moves in a proper manner.

GROUP B

PART	1. If we are given work, we must do it.
SOC	2. We need to have a common point of reference - minus past prejudices and ill knowledge which was deliberately fostered amongst us.
SKILL	3. No one's view should be left unattended.
DOM	4. Each one must accept that certain points need to be criticized.
PART	5. We must take responsibilities for ourselves.
PART-	6. Each member of the group should listen attentively to others views.
COG	
SOC	
SKILL	

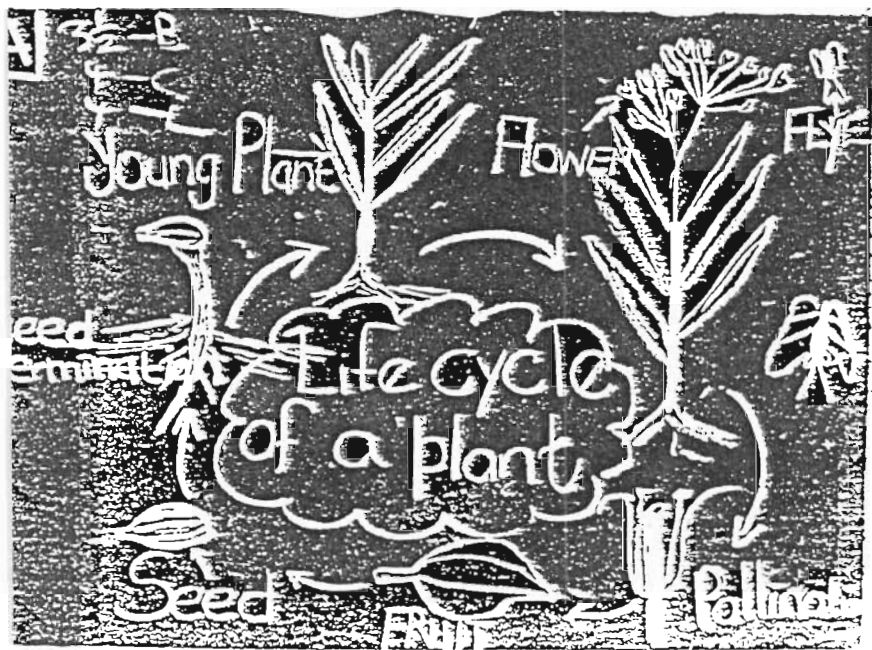
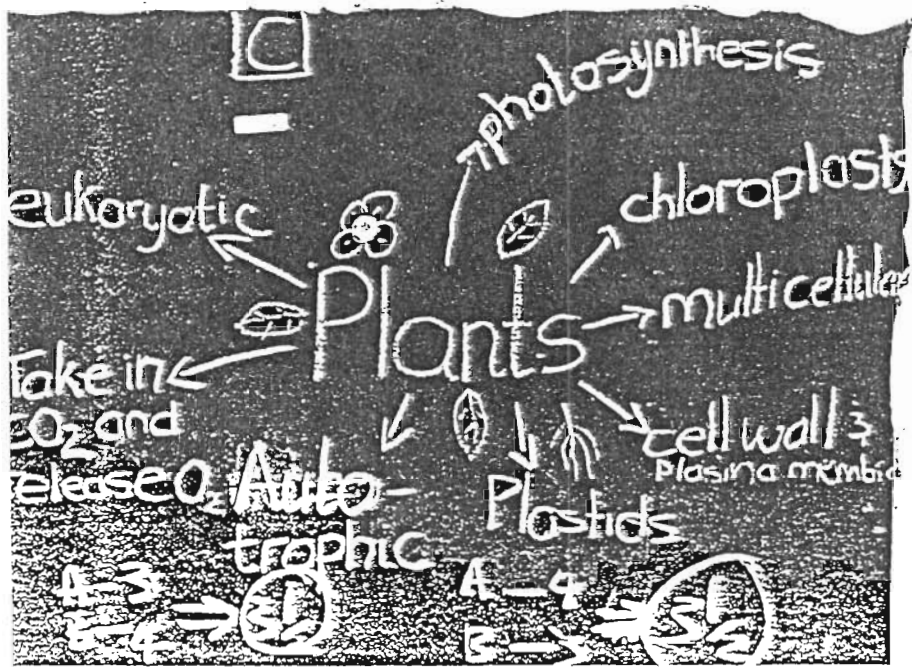
GROUP C

PART	Listening.
TOPIC	All talk about subjects - involve whole grp.
DOM	Take work seriously
PART	- Talk about misconceptions - make mistakes
AC	- Consensus $\rightarrow$ majority rule
CONFL	- Each s. have turn work
PART	- Avoid hurting one another $\rightarrow$ dont personalize
SOC	- Talk English
SKILL	
LANG	



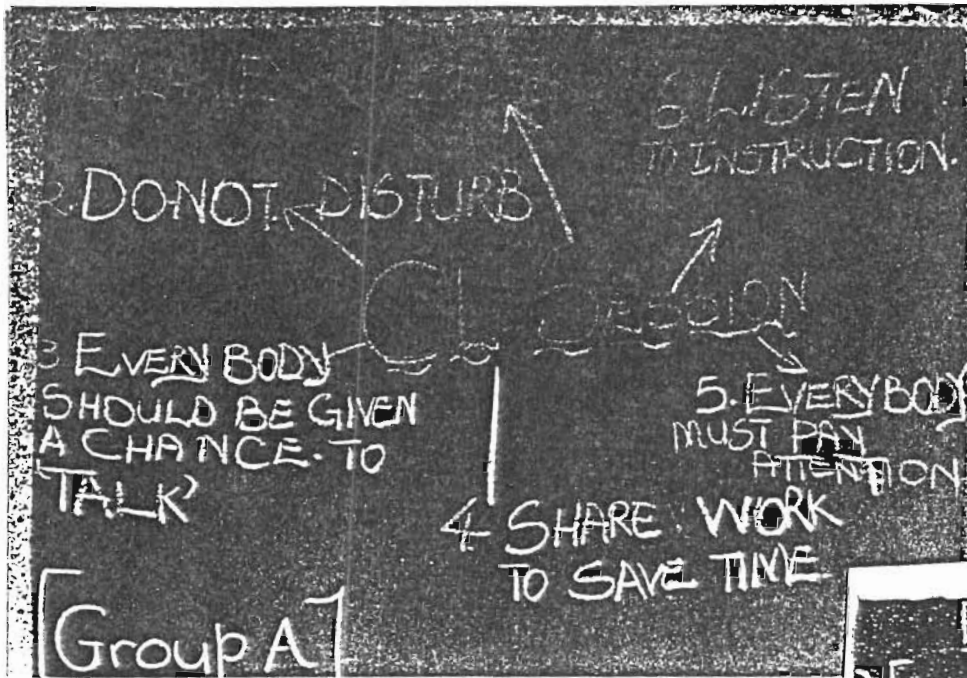
'LEAST' AND 'MOST' LIKED ASPECTS (SESSION 2)

S1	The changing of groups made me feel uncomfortable, because the guys were dominant.
S2	I like working in a group bec. you get to hear other peoples views & you are able to learn, & listen & co-operate with them. I also liked the discussions we had → debates. I liked everything about today's Group work.
S3	What I like most about group work is that one develop a skill of effective communication with other people. One can evaluate himself and his ideas in reference to other and make a synthesis of his ideas and that of other people. In this way one is able to grow mentally and socially. What I dislike is when one person dominates the group and does not want to accept other peoples viewsponts.
S4	I am very delighted by group work and discussion concern the organism. I am comfortable by you providing more information and clues to some strange terms.
S5	I liked working with my colleagues because working in a group we share ideas and have conflicts but at the end we will come up with a conclusion. There's nothing least ⊥ I liked. Group work is excellent EXCELLENT.
S6	<u>liked most about the group.</u> - Is that I found new ideas from others. - Everyone has a chance to speak - Everyone is free to tell about what he/she thinks <u>Least</u> - Others views may not be considered
S7	I like learning by groups because I gain skills from it. It is the most learning method to me. I'm satisfied the way marks are allocated, it is fair to every-body.
S8	I liked the fact that all the members were honest and sincere in their contributions, and were not shy or embarassed with misconceptions. What I liked least is perhaps that one member was late, although he caught up with us.
S9	Discussion was the most thing tha I liked, where I was given a chance to share my ideas and answered why I raise that idea. I also learn from others point of view.
S10	I liked working in a group so I get everyones ideas and helps me. I like least that we have not had explanations & so there were misconceptions in the group.
S11	What I liked most was discussions when one point led to the next even if there was no agreement but there was a settlement.  But what I liked the least was that time seemed to be against us as there seemed to be much to learn from others.
S12	In groupwork - I like the sharing of ideas most.  Liked least? Compelled to consider views of other people even if such views lack sense.



- ### FUTURE STRATEGIES
- 1) Everybody <sup>must</sup> understands the question
  - 2) Everybody must be given an opportunity to contribute.
  - 3) Points or ideas given must be clarified
  - 4) Pupils should be given the opportunity to say what they think of the question whether it is wrong or right. (Others will look at it critically)
  - 5) Conclusion should be reached

SOME POSTERS



- FIVE STRATEGIES**
- 1) Everybody <sup>must</sup> understand the question
  - 2) Everybody must be given a opportunity to contribute
  - 3) Points or ideas given must be clarified
  - 4) People should be given the opportunity to say what they think of the question
  - 5) Conclusion should be reached

**C** PARTICIPATION EQUITY

- EQUAL CHANCE TO EXPRESS VIEWS (ENSURED BY DELIBERATE ROTATION OF THE POINT.)
- ALL MEMBERS MUST PARTICIPATE IN DISCUSSIONS.
- PUT A STATEMENT FOR MEMBERS TO CLARIFY BEFORE CONCLUSION.
- EVERYONE MUST LISTEN
- STATEMENT SHOULD BE TO THE POINT.

## SESSION 12 PROBLEM SOLVING

### GROUP A - STEP 1

[S1] - Medium A - could be fertile  
- much care taken for seed X and not seed Y.  
Justified - seed won't germinate without mineral salts in soil.

[S2] - The soil was not proper for the plant, eg., clay soil instead of loamy soil. Weather conditions could also affect the plant, eg., rain (excess) would wash soil away.

[S3] - Seed was 'rotten', dry - not planted in a proper way.

[S4] - The soil may have had necessary nutrients but also chemicals which would harm the seed - soil could have been acidic; could also be wrong season to plant that seed.

### STEP 2

FIRST IDEA - FERTILE

ACCEPTED - WITH CLARIFICATION

CLARIFIED - PERSON WHO PROPOSED

" - ALL MEMBERS

QUESTION - WAS ASKED [S2]

" - WAS ANSWERED [S1]

HELP - YES (BY ALL MEMBERS)

- WAS NOT CRITIQUED

- YES IT WAS QUESTIONED - IT'S VALIDITY

HOW - LISTEN TO EACH OTHER'S IDEA AND ASSESSED THE IDEA WHETHER IT WAS RELEVANT OR IRRELEVANT - IF RELEVANT WE ASKED QUESTIONS AND TOOK DOWN THE POINT.

### GROUP B - STEP 2

[S6]'s idea was accepted with clarification

Explanation by another member - [S7]

QUESTION WAS ASKED BY: [S6]

"Will a seed planted in dark, grow better than seed planted in light?"

[S7] GIVEN CLARIFICATION - Seed required warmth to grow / damp soil.

### GROUP C - STEP 1

1. Right season - (with) the right condition  
- seed covered by hard covering do germinate. example: peach seed
  2. Dominant period for the seed i.e. winter for seed to germinate
  3. Wrong type of soil i.e. clay soil
  4. Insufficient water - seed won't germinate
- Suggestion - seed could be off.

### STEP 2

- \* Right condition
- \* Clarification - [S10] proposed the ideas and explained
- \* [S11] asked questions to aid clarification
- \* [S12] helps during clarification
- \* Group did not question validity, because it was logical and clear
- \* Selected by how people say ideas and by comparing the validity of each idea.

**A) RECOGNITION**

- DOMINANCE 
- Two Types - INTENTIONAL
- UNINTENTIONAL
- NO DOMINANCE
- LANGUAGE DILEMMA
- DIFFERENT MOTHER TONGUE
- TIME CONSTRAINT
- LESS TIME - BOTH SCHEM CONCEPTS & LIFE SKILLS
- MISCONCEPTIONS
- REPORT BACK - GROUP PRODUCT
- GROUP SIZE
- SIZE OF CLASS

REC...  
SESSION  
**DOMINANCE**

- DELIGHT
- LANGUAGE DILEMMA
- HELPS development of LANGUAGE IN GROUP
- TIME CONSTRAINT
- Need more time for DISCUSSION
- Time is spent WASTE while Misconceptions
- must be dealt with immediately

**A)**

- VERY-EFFECTIVE
- DISCIPLINE
- APPROPRIATE
- SOLVING PROBLEMS
- "NO!" T.L. BORING.
- CHANGING GROUPS
- DIFFERENT VIEWS.
- SKILL OF WORKING WITH DIFFERENT PEOPLE

**GROUP**

- up to 8 people
- Teachers initiative
- GROUP RULES
- they are very important
- Appropriate
- All sessions were
- Appropriate for group work
- It should be continued
- CHANGING GROUPS
- Groups should not be changed

**B) RECOGNITION SESSION**

1. DOMINANCE
2. A person may not be interrupted while speaking.
3. 1. MOTHER TONGUE
4. 2. SOMEONE'S LANGUAGE SKILL
5. 3. SOMETIMES WE LACK CONFIDENCE
6. 4. TIME CONSTRAINT
7. 5. BOTH
8. 6. MISCONCEPTIONS
9. 7. TIME WILL SOLVE THIS
10. 8. GROUP SIZE ± 6
11. 9. GROUP RULES - TO AVOID DISCUSSION
12. 10. APPROPRIATE - INTRO - TRANSITION
13. 11. CHANGING GROUPS
14. 12. TO SOLICIT & FAMILIARIZE

APPENDIX XII

CL SESSIONS TAPED SUMMARIES AND TRANSCRIPTS

SESSION 1

Group A: S1, S2, S6, S10

Summary on Item 1

- AC Group members write down names of members.  
 Group members initiate some alternative concepts:  
 \* S1 - can group into organisms that breathe/do not breathe - clarified by S2, S1 agreed  
 \* S1 - stone is living - S6 supports using concept that metals expand; clarified by S2 and S10; S1 agreed  
 Consensus on:  
 \* purpose of classification - to group organisms using appearance, characteristics  
 \* classify to group, to identify
- PART Input:  
 \* all members make input; Roles: S2-'manager', S10-writes on poster; all members expands on ideas

Summary on Item 2

- PART \* Input: S1 - "[examples of groups are]-plants-", "living and non-living", "lets give it another name-like fish falls under what name?", "[invertebrates have] no spinal cord", "[example of invertebrate] - jelly fish"; S2 - "man and animals regarded as one - but man has ability to do certain things that- man should be separate", "- get the larger plants-", "- flowering, non-flowering", "- hydra [is invertebrate]", "[invertebrates can be divided] -like 6 legs and 4 legs-", "aquatic [group]", "locust-exoskeleton", "[example of groups] - invertebrates", writes poster; S6 - "animals and man have feelings, emotions..can communicate - as humans - appearance different - from people", "put two groups", "[fungi are] parasite", "bacteria [a group]", "reptiles-many groups", "mammals [a group]"; S10 - "plants and animals and like fungi", "water plants", "non-vertebrate"
- AC DOM
- AC
- PART
- \* Questioning: S2 - is it called fungi?  
 S1 - fungi is group of plant? - reptiles?  
 S2 - what's invertebrate like?  
 S10 - all those are invertebrates - but what do we call them?

Summary on Item 3

- DOM S10 initiates idea that it is important for biologists to classify "We will take everything as one"; S2 extends this to
- PART include that it is important for people as well; S1 and S6 agree and do not extend; much laughter by all members

Summary on item 4

- PART \* Input: all give examples; S1 clarified topic, "that is classification-first write ten living things"; S2 directs group to think of those studied in primary school; S1 directs group
- AC to place exmples in groups; S2 directs group to give examples of plants; S10 writes on poster.
- TIME \* S6 has alternative concept, "...I don't have endoskeleton..." (see transcript - session 3, activity 1); not clarified.  
 \* Time prompt by lecturer



Group B: S4, S5, S7, S8

**Summary on Item 1**

PART \* Input: S4 - "[to put]...similar things together...", "..not  
MOTIV same in their behaviour..."; S5 - "in order for children to  
understand differences...", "makes it easier for children to  
DOM understand and remember..."; S7 - "things are not the same in  
behaviour, structures ...", "...characteristics...",  
"...adaptation...", "...do not live in water - sometimes  
AC according to adaptation..."; S8 - ..."easier to handle  
information, to process information, eg., utensils in kitchen -  
easier to process, store, remember and recall information - so  
much variety in the world...", "can present child with a whole  
lot...with categories..."  
\* Alternative idea: S5 - idea that we classify "...for  
children..."

**Summary on Item 2**

PART \* Input: S5 - "also include tradition, culture, religion"; S7 -  
TOPIC "...terrestrial", "add one - religion"; S8 - "...cold, warm  
AC booded animals, aquatic and...", "race groups"  
PART \* S7 questions idea of "race group" - "Does it fit?" - S8  
responds, "I'm aware of it"

**Summary on Item 3**

TOPIC \* S4 reads topic as 'What ideas do you have about  
PART classification?'  
LANG \* Input: S4 - "easier to get similarly..."; S5 - "...especially  
for children"; S7 - "not only pupils in class - it is a life  
skill - eg., being an advertiser - jewelry ...life skill",  
"...classify work - Zulu work, part time..."; S8 - "it is a  
good thing", "point that [S7] is making - it is a life skill -  
do you read classified section..."

**Summary on Item 4**

PART \* Input: S7 and S8 give examples; S5 questions for  
DOM clarification; S7 and S8 clarify for S4 and S5; S4 clarifies  
DOM twice; S4 directs group to "mention animals first, then group"  
- rejected by S7; S7 directs group to give group and example  
AC together - accepted; S7 directs group "let's go to plants"; S5  
LANG writes on poster  
\* Alternative ideas: S4 - "[insect]...is not an animal" - not  
clarified; S8 - gives "inanimate" as example of a group - S4  
asks for meaning of the term 'inanimate' and S8 responds, "is  
not living", S4 responds, "but we're discussing living things"

Group C: S3, S9, S11, S12

**Summary on Item 1**

PART \* Input: S3 - "in order to study - similar features",  
DOM "...otherwise confused - get better understanding"; S9 -  
"common features"; S11 - "...behaviour difference...", "...not  
only similarities, but also differences..."; S11 - "so people  
who are studying - to understand...", "...including human  
beings"

### Summary on Item 2

TOPIC \* S3 starts with list of features "...colour, size, number of limbs, gender"; S3, S9 and S12 clarified topic for S11  
PART \* Input: S3 - "two groups of living organisms...", "flying...in water", "amphibians...bees", "number of cells ...monocellular or unicellular...multicellular"; S9 - "animals...sea...land", "cold-blooded"; S11 - "...subgroups...flowers...do not bear flowers", "...mammals...reptiles"; S12 - "...seeds ...dicot...monocot...",

### Summary on Item 3

TOPIC \* S11 and S9 dismisses topic: S3 - "we were discussing biologist's ideas..."; S9 - we classified according to ideas"; accepted by others

### Summary on Item 4

PART \* Input: S3 gives examples (at least 6), by S12 (at least 2),  
DOM one by S9, none by S11; S11 asks for clarification on group of  
AC birds, "bird - what class - a different word" - no response;  
S11 asks, "we talked about flies - what group?" - S3 answers, "an insect"  
\* Discussion about whether people classify first before they understand or understand first before they classify - among S3, S11 and S12

## SESSION 2

Group A S1, S2, S3, S4

### Summary on *What is a plant?*

PART \* Input: S1 - "living organism", "root, stem", "certain plants  
LANG have flowers", "plants move in a sense...but locomotion is...";  
AC S2 - "not able to move", "take in carbon dioxide and give off  
DOM oxygen...at night take in oxygen give off carbon dioxide...  
AC animals take in oxygen and give off carbon dioxide", "plants  
have walls...animals cell membrane", "plants not able to move";  
AC S3 - "photosynthesis - produce own food", "respire...", "roots  
absorb water", " ...chloroplast"; S4 - "some can move",  
ASSESS "section in biology that says plant movement...growth...can  
grow downwards"  
\* S4's idea of 'plant movement'- S1 and S2 reject it; S1  
proposes a distinction between locomotion and movement - S3  
explains this distinction, S4 agrees  
\* Lecturer input on assessing posters



Group B S5, S6, S7, S8

Summary on *What is a plant?*

PART \* Input: S5 - "...because it has roots", "[animals]...cell  
AC membrane", "have chloroplasts", "plants have...osmosis and  
AC transpiration, animals don't have...animals breathe but  
plants...", "[plants]...cannot talk, no way of communicating";  
AC S6 - "move in water when wind", "[own food]...with help of  
DOM sunlight", "cannot help themselves by moving...to eat...wait  
DOM for something..." (see transcript, session 3, activity 1),  
"they are not active"; S7 - "...cell walls", "...uses mineral  
salts and oxygen and carbon dioxide...natural reserves", "take  
in...[carbon dioxide]...during the day, at night oxygen"; S8 -  
AC "...a plant cannot move", "animals also have cell walls",  
AC "manufacture own food", "all have chlorophyll", "they take in  
carbon dioxide", "...cell walls-I think that gives it its  
rigidity...", "its asexual reproduction..."; S8 writes on  
AC poster  
\* Questions: S8 - "Do all plants have roots, stem, leaves?" -  
S5 responds, "not all of them"; S8 - "air plants...?" - S5  
TIME responds, "maybe...invisible roots"; S8 - "it's asexual,  
right?" - ignored  
\* Interruptions: S5 interrupted by S8, S5 completes her idea  
later; S7 interrupted by S8, S7 completes his idea later  
\* Alternative ideas: S7's ideas on gaseous exchange of plants -  
accepted; S6's idea of inactivity of plants and plants 'fed'  
with water - ignored; S5's idea of 'osmosis' as characteristic  
of plant - ignored; S8's link between plant 'communication' and  
'people talk to plants' - dismissed by S5, S7 and S8 as  
'fiction'  
\* Time prompt by lecturer

Group C: S9, S10, S11, S12

Summary on *What is a plant?*

PART \* Input: S9 - "autotrophic", "takes in carbon dioxide, gives  
AC off oxygen...", "...absorbs water..."; S10 - "[root, stem,  
AC leaves]...except an air plant", "...autotrophic...", "...still  
AC a little bit of carbon dioxide at night...photosynthesis...24  
hours a day", "...a lot more oxygen [at night]", "...oxygen and  
carbon dioxide - but during day they do not respire as much  
as they do photosynthesise"; S11 - "cells...cell wall",  
AC "...structure consists of root, stems, leaves", "...sun...we  
AC mean the light", "difference in manner [it absorb water]",  
AC "plastids as well"; S12 - "...must be multicellular", "...day,  
plants use carbon dioxide for respiration, while during the  
night use oxygen" (see transcript, session 3, activity 1),  
"...people are advised not to sleep in room with plants...",  
TIME "plants are active during the day...as living organisms they  
ASSESS still need to rest-during the night they will rest"; S10 writes  
on poster  
\* Questions: S9 - "Do all plants have complete structures  
[root, stem, leaves]?" - answered by S10 and S11; S12 - "all  
plants are autotrophic?" - S11 responds; S11 - during the night  
there's no photo?" - S10 responds, "Ya, there's no sun"; S12  
question on why "people are advised not to sleep...with plant"  
- S10 responds, "because they use a lot more oxygen then"  
\* Time prompt - by lecturer  
\* Criteria for poster - by lecturer

### SESSION 3

Group A: S1, S2, S3, S4

#### Summary of Activity 2

RULES \* Input: S1 - "each person must listen to other...", "[rotate  
DOM leader] so no one dominant", "...accept other person's view and  
help support it..", "...you can talk in Zulu.." (in answer to  
TOPIC V's admission of having a language difficulty), "[when we  
present] we say, 'this and this, but there are doubts'..."; S2  
PART- - "...before the actual group discussion, group must understand  
CONFL the question...", "leader must change", "...group must  
understand-different views on different topics...", "each one  
PART- equal...", "...how we come [to] a conclusion", "...put both  
ROLES views forward [in class discussion], "...if...you don't like  
PART- her...you may not vote for her"; S3 - "one aspect must be dealt  
CONFL with at a time...", "...eg., choose a leader", "...must be  
somebody...to scribe", "...avoid to be emotional...", "...not  
TIME look down on others", "...how [do we come to]...our  
PART- agreement?", "...should come to a conclusion...", "...if there  
ROLE is no agreement...?", "...maybe...if no agreement-vote..."; S4  
LANG - "person who is talking...not take more than a certain  
amount...time...so others get a chance", "...he or she  
must...[keep] time - what time spent on a particular topic...",  
"...be supportive...", "...language...", "if [conflicting  
views]..should consult lecturer", "...[present differing views]  
to class [in a conflict situation]

Group B: S5, S6, S7, S8

#### Summary of Activity 2

PART \* Input: S5 - "[work] must be done immediately"; S6 - "...we  
RULES must help each other", "we must learn to listen to each other",  
LANG "[have an opportunity to]...give a point; S7 - "we must be  
DOM honest", "...start off with a common frame of reference when  
TOPIC each has own idea...", "...language barrier...", "...ensure  
equality", "...no dominance"; S8 - "do work given", "...learn  
PART-OFF to synthesise each view", "...how are we going to handle  
TASK multicultural...if we disagree...", "...assess the facts...",  
"...accept that a point needs to be criticised", "...not just  
listen...but attentive...", "each member must contribute"  
\* Participation: S8 speaks on past 'injustices and  
relationships' during most of the activity and says "...leave  
the rules one side..."; other members respond by attempting to  
bring him 'on task' with comments like: "that's what we  
supposed to do" , "Does that fall under rules?", "so what's the  
point there", by S5, "so [S8]...this last point..", "I don't  
understand what we're doing...", by S6 and "so just coming to  
the point...", by S7, in response to S8's comments.

Group A: S1, S2, S3, S4

**Summary of Activity 3**

PART \* Input: all members give input in classifying specimens 1, 2, 3, 4, 5, 6, 10; S2, S3 and S4 for specimen 8; S1, S2, S4 for specimen 9

AC  
LANG \* Alternative ideas: S2 - "one seed...monocot" - clarified by S3; S3 - "[seeds] in flower" - extended by S2, "at bottom...when flower is developed"; S1 - "[moss]...is Protista" - extended by S2, "no it's algae...ya, it's Protista"; S1 - "[mushroom]...is Bryophyta" - questioned by S4, accepted by others; S1, S2 - "[grass seeds]...are naked" - accepted

PART  
DOM

LROLE \* Questions for clarification: S1 asks S2, "Are you saying there is one seed on the cone?" - S2 responds; S2 - "but...seed enclosed in fruit" - S3 responds "in flower"; S4 requests explanation of monocot, given by S2; S4 - "How do we know it [is a Bryophyte]?" - S2 responds, "I don't know"; S4 - "how can you say...it is multicellular?" - S2 responds, "it can be multi or unicellular"; S4 - "dicot belongs to Anthophyta?" - S2 responds, "a flowering plant" and S1, "Anthophyta"

\* Lecturer input: on term 'gametophyte' requested by S1

Group B: S5, S6, S7, S8

**Summary of Activity 3**

PART \* Input: All members give input in classifying specimens 1, 2, 3, 4, 7, 10; S5, S6 and S7 for specimen 5, 6

AC \* Alternative ideas: S5 - "[pine] class must be monocot" - accepted by group; S7 - "[moss] is Protista..is aquatic..." - accepted; S8 - "[mushroom has] no division...nothing corresponds here ...doesn't have seeds..." - not clarified; S7 - "[mushroom] has roots-a tap root...you know when you pull out a mushroom..."; S5 - "[bryophyte]...is monocot, its got parallel veins..." - not clarified

PART  
LANG \* Questions for clarification; S5 - "is it multicellular?" - S7 responds, "because it is big...if a cell...use a microscope"; S6 - "but [grass] is not naked seeded...?" - S8 responds, "I cannot see the seeds" and S7 says "I'm thinking...brew...we call it amahewu" to which S5 says "wheat" and S8 asks "seed?" - S5 responds, "inside the flower"; S5 asks S7 for difference between 'stem' and 'stem-like' - no response; S5 asks S7 if the moss leaf net veined - S7 responds, "it's too small...need a microscope"; S8 - "is mushroom fungi?" - S6 says, "I think its Monera" and S7 says, "it is a fungi" which is accepted

Group C: S9, S10, S11, S12

**Summary of Activity 3**

PART \* Input: All members give input in classifying specimens 2, 3, 6; S10, S11 and S12 for specimen 1, S9, S10, S11 for specimen 5; S9, S10, S11 for specimen 7; S9 and S10 for specimen 9

AC

\* Alternative ideas: S11 - "[fungus has] small roots" - accepted; S12 - "[fungus] gets its food from soil" - response by S10, "...green...its chlorophyll..." and S11, "it makes its own food"; S9 - [fern] is Cycadophyta - accepted

AC

AC

\* Questions: S12 - "[mushroom] is Protista?" - S10 responds, "Protista got no roots, stems or leaves"; S12 - "this is not a plant?" - S10 responds - "this is fungi"; S10 - "What is gametophyte - does anybody know?" - S9 responds, "it's written here..." and S11, "...I think it means reproductive cells, things like spores" which is not accepted by S10

LROLE

\* Lecturer input: explains term 'gametophyte'

**SESSION 4**

Group B: S5, S6, S7, S8

**Summary of Activity**

PART Participation: inputs by all; S7 and S8 more so; S8 directs observations, at times, eg., to leafstalk and S11 resists directions; S5 directs to 'lobes'; some instances of 'sounding out' of ideas, eg., S5 on 'margins', explained by S8

DOM

Group C: S9, S10, S11, S12

**Summary of Activity**

PART \* Participation: inputs by all; S10 explains ideas for clarification, especially to S12; S11 initiates some observation actions; S10 directs to some extent

DOM

SESSION 6

Group A: S1, S2, S3, S4

Transcript: discussion on *Language*

S2: Somebody should read it out first - I think  
S1: [reads out topic]  
LANG S2: You'll understand what's being said there -  
S3: Ya  
S2: - understand?  
S4: Ya  
S2: so - in what way is language problematic?  
REFL S4: Ya - it is a fact that - the language - especially the - if  
IND you are a second language - in English - you are going to  
experience problems -  
PART S2: - problem  
S4: - when it comes in - group discussions, class discussions -  
because - sometimes - you do have a point - you can put during  
that discussion - but somehow you - you feel - lost by the  
manner how you can express this idea - so its really that - is  
a problem  
S2: You mean you find it difficult to -  
S4: Ya  
S2: - put it into words  
S4: Ya - although try to put it - but sometimes you won't put  
it as if it was your's own idea  
S2: So - it's basically because - okay we'll take this group  
for example -  
S4: Ya  
S2: - you'll are all second language English -  
S4: Ya  
S2: - and I am first language English  
S4: Ya  
S2 okay - I feel - I don't know how far I'm true - but -  
S4: Ya  
S2: you'll think in Zulu or whatever your mother tongue is -  
S3: - um  
S2: - right - but then you'll have to-  
S1: - translate  
S2: - translate it into English - and that takes long -  
S4:Ya  
S2: - ya - because -  
S4: ya  
S2:- you'll don't know the English language so well  
S4: ya  
PART S1, S3, S4: Ya  
S3: Ya - that's what's also I - I think it's that the language  
is a major problem - we discussing the issue - because we think  
a particular problem - and you have a - maybe - you've got an  
answer - and to explain the answer to - to other people - we  
cannot get the words easily - to explain the problem - and then  
the next point is that for those who have a problem in language  
- they become less participative in the discussion and those  
with language proficiency - they - tend to be the ones who do  
everything - and then they [inaud] - sort of [inaud]- like  
dominance - so - maybe other people

will see the person as a dominant person - because he is fluent in language - not because he or she is dominant - but he has the potential of expressing words more than the other people can do - ya - and then most of the ideas other people have may not be encountered - may not come out - because of the limiting aspect of language

DOM

TIME

S4 - so that's only one idea - where one person has a language advantage - most ideas will come...

S2: [interrupts] - and I also found that when you'll talk it may take me longer to understand - 'cause like - maybe in some context you'll won't use the right word - okay -

S3: um

S2: I'm just saying an example - you'll won't use - the right word - so I won't understand what you'll are trying to say -

S4: [interrupts] - so by the way - er - discussion is not effective -

S2: Ya - because you can't communicate very well in English -

S4: Ya

LANG

S2: how I can't communicate very well in Zulu can't communicate at all, forget very well! - but -

S4: [interrupts] - then -

S2: - it's difficult - because class can't discuss - because its two different mother tongues - first language and second language - so - they won't understand what [inaud]

TOPIC

S3: Ya - I agree with what you say - also, when there is - language disabilities we tend to go out of the topic - because we don't really explain what really - what seems to be the issues of the topic - because maybe - I will try and explain something to somebody else - and I'm not good at expressing what I really mean - and then you do not understand what I really mean - and you think something else - and when - in the topic - and then - in that way we go out of the topic and we discuss something else which is not relevant to the topic -

PART

just because the language is not good -

S4: - the communication is bad - then - the other thing - sometimes - because it's English - the problem is in English - so if the statement says - plants are this and this - I really don't understand - how that thing - about - er - those plants we are talking about - perhaps I only know the word 'plant' - see - I don't really understand the statement because it is in English - my second language - so - by the way - I - I - won't be effecting a good discussion

S1: - 'aykhona mabile into' - e - scientific language - science - maybe - as you are first language - maybe - you know more words than me of science - maybe when you are talking - maybe I won't ask then I will get lost -

PART

SELF-ESTEEM

S2: as well as - the pronunciation of - various scientific terms -

S4: - pronunciation

S2: - is totally different - but groups -

[S4 laughs]

S2; - I mean how you pronounce something is totally different -

S4: Ya - it's just - problem - by the way - the understanding is lost -

S3: - and it takes long to come to a conclusion - as well - if you don't know -

S4: Those feelings are different - which really generate fears in yourself - when you are - a second language - usually generates fears and - sometimes - feel as if you are afraid - to - suggest - and - to put - views during that discussion

S3: Ya - it happens - in most cases we tend to be afraid and - maybe - you don't want to express your ideas - views - because people will laugh at you -

S2: oh - you mean that you'll - the way you...

Group B: S5, S6, S7, S8

Transcript: discussion on 'Dominance'

REFL S7: [reads out topic]  
DOM S8: - you understand the first part - right?  
TOPIC S6: Ya  
S8: [S5]?  
S7: - we are not writing anything - oh - we just discussing  
S8 - so - who do you'll think is the most dominant in this  
group?  
S6: - it's you  
S8: [laughs] - me - [laughs]  
S6: Ya - we take most of -  
S8: - what's that?  
S6: We take most of your ideas - ya -  
PART- S8: It's bad for a person to be dominant all the time - right?  
CONFL S5: I don't think its bad - what about when other people don't  
know what to say - if they - have got ideas - they have to be  
dominant. If other people are quiet - if you got all the ideas  
- just say them out  
S7: - and - if you - are - at a point at which we - as members  
of the group - disagree on it - so you have to give some more  
clarification -  
RULE S6: Ya  
S7: - but - it will sound as if you dominates - it is not  
[inaud] - am I making myself clear -  
S6: Ya  
PART S8: so - how do you think we should eliminate one person being  
dominant in the future?  
[pause]  
S6: I don't think it should be - it should not be eliminated  
PART S7: Ya  
S8: - but - arn't you going to talk more about it?  
S6: Ya - because when others are quiet - there's [inaud] -  
S8: - but - we're trying to work towards -  
TOPIC S6: [inaud]  
S8: - work towards a situation - where we need - everybody to  
PART participate equally -  
S6: Ya  
S7: ya - what I'm thinking of is that - to participate - you  
need to have information - okay - then you can participate - so  
PART in order to overcome - to overcome such a situation - each  
member must understand the topic very well - from the -  
understanding - he or she must have brought - a contribution  
S8: - in [inaud]  
S6: I just want to emphasise the word - 'equally' - that you  
must participate equally - because we don't have the same -  
amount of thinking -  
S7: Ya - ya - what is your view, [C5]?  
[pause]  
S5: I'm still thinking about it  
S7: - at first - the term 'dominate' - [pause] - to me there's  
nothing wrong about it - in a group -

that much - If I may put it - there's nothing wrong about it  
that much - because you cannot say - if you've got - some  
information - let's say I was the only person who did - biology  
from standard six to standard ten - and you were doing -  
commercial subjects - it's obvious that our background is not  
the same - so - we cannot - conclude by saying we must not  
dominate - whereas I do have the - information -

RULE S6: Ya - the only thing which is wrong - if you want to put -  
maybe - some views - we must not be bossy - that you must -  
like - putting aside others' views of - maybe those who are  
quiet in class

S8: I just want to clarify a point - was I ever bossy with you?  
S6: - huh - no - I don't mean you

S5: I think another point is - in order for us to eliminate  
dominance - or [inaud] - ya - dominance - we should let one  
person at a time talk - and then - do not disturb him while he  
is talking - okay -

S7: Ya

S5: - do it in turns - and turns - and turns - and turns  
S7: okay - there is a challenge - help me - do you mean if  
someone is giving - irrelevant information - then we have to  
wait for him?

PART- S5: - that's what I'm saying -  
CONFL S7: - because [inaud] -  
TIME S8: - irrelevant -  
S7: - irrelevant -  
TIME S5: - because -  
S7: - 'til he's finished? - sometimes -  
S5: - [inaud] -  
S7: - let me finish - sometimes - you have to interrupt him or  
her -  
S8: If it's irrelevant we don't have to listen to it  
S7: Ya - because we end up - having not done anything - since  
we have a limited time -  
S5: - wait until he finishes and then tell him that - so and so  
- there you were wrong - there's another -  
S7: - it depends also - it depends - because I can do that  
information in two pages - whereas we have five minutes to - to  
discuss - you know - so we end up -  
S5: - say - for example - like me - if I say the wrong thing  
and you interrupt me while I'm talking - then - really - I  
don't like it  
S6: I'm not denying that point - but what I am saying is - this  
depends on the situation - you know - ya - I'm not denying it  
S6: - but I think so - another person - may not be aware that -  
she is wrong - by saying something - she can only think that -  
she is saying - hers is right  
S5: - but she can correct him at the end - when she is finished  
talking - not just interrupting when...



Group C: S9, S10, S11, S12

Transcript: discussion on 'Alternative Concepts'

REFL S10: [reads topic]  
AC [pause]  
S11: I think - the way in which we can have access to - to whatever misconception - is - is dependent upon the way in which we do our recording - and at the end when it's being assessed - generally - the tutor or someone comes to pick up whatever is there - and say - this is a misconception - like in the case of that we had - people were saying - oxygen or carbon dioxide was taken half - time - or whatever - so that is how we get access to this - if we record  
ASSESS C10: - when you say record - you're meaning [inaud]  
LROLE C11: - no - I mean - writing  
ASSESS C10: - if we do not - tape-record - I also think that another good thing is posters - because if groups do posters - then that is one way that we can pick up a misconception - like our misconception - because when we - your example -  
REFL S11: Ya  
S10: - I think that it's a very good way at picking up misconceptions  
S12: - or I think - another thing which might help is - that - if we - cultivate - habit of - of evaluating our work - that is the work we have done - maybe after three months - up to a period of three months - we evaluate the work we have done during the whole term - and I think it will help us - because the knowledge that we have now - will have [inaud] - that now we have - the knowledge we have - we have -  
UTIL S11: - expanded  
S12: - expanded - exactly - and - we will be in a better position to - to note some of the misconceptions - that we might have done previously  
[pause]  
S10: I think that - as a teacher - when we are teaching - if we have to do posters or things like that - if we pick up these misconceptions - we must deal with them straight away - at least we don't keep on for the child - or even as a tutor - we mustn't carry on with those misconceptions - because it's hard to break your belief of them  
PART S12: Ya - it's true  
S11: Ya - it's true - because I think - I remember when we were discussing some of the things - when we came to conclusions together - as the - as the class group - there were people who were left still with those beliefs that they had - before they came to classes here - so it is true that if we try to deal with whatever misconception at the time - it may help to clear up the new information - the correct information  
S12: Ya  
S9: - to - to do the previous misconception - or you think - you mean that misconception that happened a long time

LROLE S11: Ya - as [S10] says - she says - see - we as teachers - we  
 UTIL see students here - and there are misconceptions they - they  
 REFL have - revealed - we have picked them up - the best thing to do  
 with dealing with them is - just - do not wait until later  
 PART S9: -later -  
 S11: Ya - this is it - so - then - then we go on - solving such  
 problems  
 S12: I think another thing which might help - we are to get  
 into the habit of weighing up every - decision we come upon  
 S10: um  
 MOTIV S12: Ya - we should have a sound reason as to why - we do -  
 such and such a thing - why do we prefer - such and such a  
 thing over such and such  
 S10: - I think also groups - or working in groups helps a lot -  
 PART S11: Ya  
 S10: - because we've all different ideas - but really to do  
 that - we can pick up who's got a misconception  
 S11: Ya  
 S10: - and we can make it - try and help them to get rid off  
 that misconception  
 REFL S11: Ya  
 S10: I think that group - working in a group is very - good  
 S11: Ya  
 [pause]  
 S11: Ya - that's true - and I think - those misconceptions we  
 made last time - as the class group were grand - because we  
 made - as a majority - you remember that - there was not one or  
 two people who came out and said - so - we had almost a similar  
 idea [laughta]  
 S9: Ya [laughter]  
 [pause]  
 S12: I think another thing - which might - help each member of  
 LANG the group is that if we are - [pause] - if we do not keep ideas  
 with us - if we -  
 LANG S10: - share them  
 S12: - ya - if we - used to share our ideas - to voice our  
 feelings - we can be in a better position to help one another -  
 in that I might have - a - misconcept of a certain issue - but  
 if I voice my - views - then - the group members will be in a  
 position to - certainly - [inaud] - right - ya - but - another  
 thing which I think - is linked in correcting misconceptions -  
 at times I might - I might note a misconception that is amongst  
 - amongst the group - but because of the language problem I -  
 might not be in a position to -  
 S10: - to express yourself  
 S12: - to express myself - properly - in a way that will  
 convince the group members  
 S10: um  
 S11: Ya - I think - I would suggest that he or she  
 picks up -  
 S12: Ya  
 LANG S11: - but is not able to - [laughs] - come out clearly -  
 because of a language problem - the best thing to do is to -  
 pose it as a question  
 S12: Ya  
 RULE S11: - so that - we could regroup ourselves and look to see  
 anything - so that whoever comes up with any clear - directions  
 towards the right thing - will help it -  
 S12: ya  
 S10: I think we're finished  
 S11: - I think - looks like it

SESSION 7

Group A: S1, S2, S3, S4

Summary of Activity (Stem)

PART \* Input: S1 - "...the passage...for mineral salts?", "- some  
AC are brown", "[herbaceous and] woody stems", "[circles show]  
AC age", "leaves are attached to stems"; S2 - "also takes leaves  
AC towards sunlight", "...describe it - it's upright...most  
AC cases", "...it has leaves", "it is cylindrical", "some stems  
AC have nodes and internodes", "some give rise to flowers",  
LANG "...all are green", "...thick and thin", "[in cross-section]  
looks like triangles as well", "certain have parallell veins";  
S3 - "...don't think you have to mention [paralell veins] in  
stems-only in leaves"; S4 - "part of plant...between root and  
leaves", "storage", "[stores] starch", "[some grow sideways]-  
PART like grape tree", "but some are not cylindrical", "some stems  
AC have barks", "...stem is a trunk", "some have hairs and some  
are smooth", "some are green some are brown", "...some stems  
are soft-can break easily", "cross-section-if you cut it-  
...circles";

PART  
DOM \* Questioning S1 - initiates by question "...what do we say is  
AC a stem?"; S1 - "does it [store] -how?" - S4 responds, "store  
AC water"; S1 - "What are nodes and internodes?" - S2 explains; S1  
- "these are not cicles?" - no response; S4 - "herbaceous?" -  
TOPIC S2 responds, "soft and green"; S4 - what do we call those which  
LANG are covered...like mielie tree-stem is covered by leaves...how  
REFL can you explain that-like banana tree?" - S1 responds, "leaves  
AR are attached to stem...ya...some have leaves that..." and S2  
LROLE says, "I know what you mean"

\* Roles: S1 - writes on poster; helps with ideas for poster,  
"space for one more". S2 - appraises ideas "Ya, it does store  
water", "okay - we say it's centralised, "[barks]-won't that be  
a trunk" "...I know all are green", "[leaves are attached to  
stem]-I know what you mean", "[woody stems] - oh - ya", "you  
can't have a short tree with a thick stem"; organises work  
, "how will we describe it...", "-no-does not matter- particular  
order..."; clarifies topic, eg., S4 asks, "...we are focussing  
on?" during a sequence and S2 replies "stem'; explains, eg.,  
explains nodes and internodes; monitors language, eg., corrects  
pronunciation of 'herbaceous'; "[grape] vine-not tree"; helps  
with ideas for poster. S4 - sounds out ideas; helps with ideas  
for poster. S3 - member observer, decided not to participate  
but one instance of clarifying S2's idea at the end.  
\* Lecturer intervention - verification on 'stem and trunk' at  
request of S4 - given on checking group member's ideas first

Group B: S5, S6, S7 S8

**Summary on Activity (Root)**

PART \* Input: All gave input, eg., S5 - "...a structure which  
AC anchors...supports...absorbs"; S6 - "part of plant...",  
AC "...root hairs" ; S7 - "-it might be long-but not main  
TOPIC root...it should be thick and hard"; S8 - "two  
types...adventitious and tap"  
PART \* Questioning: S6 - "we covered all?" - S7 responds, "Ya"; S7 -  
TOPIC "there must be a definition of term?" - at end; S8 - "this is  
angiosperm-huh-help me here people..." - S7 responds, "Ya"; S8  
- "what do we call other ones-...secondary roots?" - S7  
responds, "just roots"; conflict on distinguishing between  
LROLE definition and functions among S5, with one idea and S7 and S8  
REFL with another  
AR LANG \* Roles: S5 - writes on poster; organises direction of  
discussion, "Okay, what is a root?", "..we should stop here-go  
onto functions"; S6 - organises direction of discussion,  
"definition...what is it..."; helps with ideas for poster; S7 -  
organises direction of discussion, "name the part...we should  
write root"; appraises ideas, "let's ask for help"; helps with  
ideas for poster; S8 - member observer but decides to  
participate; help with ideas for poster; helps with language  
"more simple to say 'holds it firmly..."

Group C: S9, S10, S11, S12

**Summary on Activity (Leaves)**

PART \* Input: All participated, eg., S9 - "...a midrib"; S10 -  
TIME "...petiole"; S11 - "part of plant which produces food"; S12 -  
AC "...respiration"; S12 takes relatively longer time to express  
LANG ideas  
REFL \* Questioning: S9 - "...is there any way to...describe the  
different parts?"; S10 - "what about the petiole"; S11 - "why-  
PART does it matter?"  
\* Roles: S10 - explains the different gases involved in  
respiration and photosynthesis for S12; member observer but  
decided to participate; all help with ideas for poster; S11  
took over writing on poster from S12; S11 acknowledges S9's  
input, "thank you, thank you-God bless [S9]'s good idea"

**SESSION 8**

Group A: S1, S2, S3, S4

**Summary on Activity**

PART \* Ideas : S2 - 'potato', 'onion'; S3 - 'sugar cane stem',  
AC 'vine', 'sweet potato', 'carrot'; S4 - 'strawberry'. S2 asks  
for clarification on 'sugar cane' idea, and S4 attempts to  
TOPIC clarify it but does not express it 'correctly' - no response  
LANG from S1 and S2.  
PART \* Some processes: S2 and S3 help clarify topic for S4; S2  
PART-COG spells 'vine' and 'tuber'  
\* Roles: S1 - writes poster, asks for clarification; S2 -  
AC member observer, explains ideas, questions ideas, initiates two  
ideas; S3 - initiates four ideas, explains ideas, questions  
ideas, sounds out ideas; S4 - asks for clarification, explains  
ideas, questions ideas, sounds out ideas, initiates one idea  
\* Alternative ideas: S2 clarifies S3's idea, 'carrot'; 'sweet  
potato', 'onion' - undetected

Group B: S5, S6, S7, S8

**Summary on Activity**

PART \* Ideas: S6 - 'adventitious roots'; 'metaphor [pneumatophore]',  
AC 'how many types of roots', 'complex roots'; S7 - 'sinker'; S8 -  
LANG 'primary root'  
PART-COG \* Roles: S5 - member observer, asks for clarification; S6 -  
initiates four ideas, collates information for poster, asks for  
AC clarification, explains 'metaphor'; S7 - initiates two ideas,  
LANG explains 'sinkers', directs discussion; S8 - initiates one  
idea, asks for clarification, questions ideas  
\* Alternative ideas: S6 - 'types of roots' as topic  
'modifications' - questioned by S8, "is that a  
modification...?" - ignored, with initiation of idea by S7; S6 -  
'complex root' and 'adventitious roots' as modifications -  
accepted; S8 - 'primary root' as modification - accepted

Group C: S9, S10, S11, S12

**Summary on Activity**

PART \* Ideas: S9 - 'inhlaba [aloe]', 'palms' used for basket-making;  
S10 - 'leaf tendrils', 'leaf spines', 'reduced to spines',  
'store water', 'reproduction', 'insect catching', provides each  
type with example; S11 - 'store food' with example, 'different  
PART leaves for aquatic and land', 'aloe-inhlaba' as example of  
'plant with spines'  
LANG \* Some processes: S11 - suggests that role of writing on poster  
PART be rotated - accepted; input by S10 and S11 mostly; S10  
initiates discussion by listing examples - group proceeds to  
discuss the examples; S9 - suggests 'inhlaba', S11 responds,  
AC "I'm not sure I know what you mean" - idea (valid) not pursued  
PART-COG \* Roles: S9 - agrees that 'cabbage' be used as example  
(accepts ideas); S10 - initiates most ideas, explains ideas,  
collates ideas for presentation, writes on poster; S11 - member  
observer, initiates two ideas, explains ideas, asks for  
clarification; S12 - asks for clarification, questions ideas  
\* Alternative ideas: S9 - "...palms...for basket making...",  
explained for both S9 and S12 as in the response sequence:  
S11: "...jobs that leaves do that we are concerned with-other  
things that it does for the plant  
S9: "Oh!"  
S11: "-you understand now-"  
S9: "oh.. like climber"  
S12: "ya-as it grows it climbs...plants with spines" S11: "-  
aloe"  
S12: "oh-ya"

SESSION 12

Group A: S1, S2, S3, S4

Transcript on Step 3

MONIT S2: How come-why you didn't-why didn't you participate-  
AR optimally in the beginning of the lesson?  
TOPIC S4: First of all-it was not easy to jump in to participate-  
participate-because I was not clear about- what we going to do.  
Secondly-I was just thinking about the importance-this thing-  
how it's going to relate to our subjects-as far as the-the  
subjects is concerned-in our teaching-so I-seemingly I was  
silent-  
S2: [S1]-you contributed first  
S1: Ya  
S2: -how come-[laughter]-could say-you had the answer  
PART-COG [laughter]-I knew the answers-but I had to think about-whether  
it's justified-good-do I have a justified reason for it  
S3: um  
S1: -so now-  
S3: -and another question-question is-we need to answer is  
that-a person should answer whether-he or she evaluates  
himself-he or she has contributed optimally to the discussion-  
then should ask yourself-did you-did you enjoy the- group  
MOTIV discussion-and how-how was your contribution in the discussion-  
and a person should evaluate himself-and say that-well I  
didn't-I didn't contribute much in the discussion because of  
this and this and that-  
S4: Ya  
S3: -I think that we- should follow that line  
S4: Ya-that is-so  
S1: -I don't get-to contribute  
S4: -can I-  
S3: - ya-let me just ask a question-ask a question-the question  
from her-did you enjoy the discussion we have-we were having  
just now?  
S1: - ...ya  
S4: [laughs]  
S3: How was-how was your contribution?  
[pause]  
S2: [inaud] [laughs]  
S3: -well-if you-if you just say-  
S1: - You say-I can't say  
S3: -you can say-think for yourself-how you participated in the  
discussion  
S1: -according to yourself-how I-  
S4: -according to yourself  
S3: -ya-according to yourself-how-ya  
S1: -to yourself-how I-  
S3: -no-no-you-you must first answer  
S1: -how I did participate?  
S3: no-no-you must first answer  
S1: I don't know  
S3: evaluate yourself-evaluate  
S2: It's like this-I'm going to ask myself this-how do I feel-  
what contribution did I make  
S3: Ya

PART- S2: I feel-I may feel-okay-I didn't contribute much-because I  
 ROLE was writing points-sit and writing  
 S4: ya  
 S3: -and you-  
 [laughter]  
 S3: -how was your contribution?  
 S2: I feel her contributions were good  
 S3: -he must-she must-I think it's a good thing to evaluate  
 yourself because when you evaluate yourself-you improve your-  
 S2: um  
 S3: -your way of contribution-because if other people just say  
 you are not participating-you are not participating-then you  
 are making some people feel shy-you feel-but it is good for a  
 person to evaluate himself-that I have done something for the  
 group-and I have not done something because of this reason-  
 because of-  
 DOM S4: ya  
 S1: -okay-I think [inaud]-let me give you percent  
 S4: -not the percent?  
 S1: -'ehe'-seventy percent-little percent I was disturbed-with  
 this  
 S3: -disturbed by what?  
 S1: -by you- [laughs] - we were given a turns to speak-while I  
 was speaking-okay-I was the first to speak-and you said-please  
 give [S4] a chance-while I was speaking  
 S4: ya-but-  
 S1: -I was disturbed that way-okay  
 S3: -that is your participation-it was disturbed  
 S1: -by you  
 [laughter]  
 S4: -okay-why you-you claim that you was disturbed-because I  
 also was not given a chance  
 S1: ya-but you know-the thing that was-  
 S4: -let me give my initial point-then I  
 S1: -the thing that was on my mind was that's the way-  
 S4: [laughs]  
 S1: -just [inaud]-while I was just writing the point-  
 S4: [laughs] -okay-let's get on guys  
 S3: switch off

Group B: S5, S6, S7, S8

**Transcript on Step 3**

MONIT S5: I think we all-contributed-we all participated-S7: ya  
 AR S5: -equally-  
 PART S7: ya  
 S5: -there was no one who was passive  
 S8: um  
 DOM S7: -ya-no one was dominating  
 S5: ya  
 S7: ya  
 S8: What you think [S6]-we all participated-huh  
 S6: Ya-I think so-everyone was just saying-was contributing-  
 what's coming out of their mind-their mind  
 DOM C8: Were those-were there any who contributed more than others  
 PART-COG S5: I would say-yes-especially [S7]-because he answered most of  
 AC the-what am I saying-most of the things-which were not clear  
 S8: -misconceptions  
 S5: -most of the misconceptions-yes  
 [pause-writing]

Group C: S9, S10, S11, S12

Transcript on Step 3

MONIT S11: We have ten minutes  
AR S10: -okay-I think that-[inaud]-I think that [S12] and I  
PART contributed more than [S11] and [S9]  
REFL S12: ya-I also think that-each one-it's a self search now-each  
one should-  
S10: okay  
S11 - each member should search-him-or herself-  
PART-COG S10: ya  
S12: -and see-whether he thinks he-he or she contributed  
optimally-or not  
S11: ya-in my case-I think-I looked more at what had just been  
said and then-critically looked at that-and getting satisfied I  
DOM would not contribute in any other way-because I got satisfied  
after questioning- that is the type of contribution I think I-I  
made  
S12: ya  
PART-COG [pause]  
S10: ya-I think I-contributed optimally-maybe I contributed a  
bit too much-probably I-contributed most of it  
S12: ya  
S11: -and you [S9]-  
S9: I have contributed the least  
S12: I have a feeling that I also-contributed optimally-because  
the thing that I know-I have-I have stated everything that I  
know  
S11: -and-and for you [S9]-do you think-there-there was any  
reason why it could have been not much-as you say it was least  
S9: -it was least-also the ideas-I felt that the ideas that you  
posed was the ideas that was on my mind-  
PART- S12: oh-ya  
ROLE S9: -and I only come with the ideas of water-explained- water  
S12: Ya  
S9: -only one idea  
S11: -ya-it's clear-it's clear- and of course you-  
S9: it's as what you have just said  
S11: -and again were busy recording- [laughs] -it's another  
thing  
PART-COG S12: -partly-it seems as if [S9]'s- [S9]'s concentration was  
divided-by what-  
S11: the role  
S12: -it was structured by-by what she is doing  
S11: -so [pause]- so have we answered that whoever contributed  
more-  
S9: [S10] answered this  
S10: huh  
S9: -you answered that  
S10: um  
S11: -oh-ya-that has been covered  
S10: -but-just a question-don't you think-people must-instead  
of just thinking the ideas-and asking questions about other  
people's ideas-don't you think you should be able to add your  
ideas in as well-contributing them-like what [S9]



RULE

said-she thought about them-and the ones we come up with were the ones in her mind-don't you think we should give each other the chance to-actually say our ideas-each go a round-and have a turn and say something

S12: ya

S10: -so everyone has a chance-you must verbalise your own ideas-instead of just thinking-I was remiss on that one

S12: ya

S11: Ya-I think you applied that-idea-because you said '[S11] do you contribute, what do you say'-so if we agree now-that-this will help us in future-that we'll give each other a chance-a direct chance

S12: -exactly

S9,S10,S12: ya

S11: -so from-from now on we will do that [laughs]

S12: I think-it's an excellent idea that [S10] has S11: ya it is-it is-so-is there any-thing still outstanding here?

SESSION 13

Group A: S1, S2, S3, S4

Transcript on Activity

TOPIC S4: So - by the way - there are two kinds of reproduction - is  
S1: - namely -  
S4: - there is -  
S1: I didn't even hear what you said  
S2: - two kinds of reproduction -  
PART S1: two kinds of reproduction?  
S4: ya  
S1: ya - one - whereby  
S4: - the seeds -  
S2: - that's it  
S4: -huh?  
S2: - asexual reproduction  
S4: - asexual reproduction  
LANG S2: - that's one word - asexual is one word -  
S1: - a - a?  
S2: a-s-e-x - ya  
S4: - then -  
S2: - sexual  
S4: - asexual means - what does it mean?  
S2: - waht dose it mean - like - you can get the pollen grains  
from the same plant fusing with each other  
S4: ya  
S2: - or you can - I tell you what - where you take a stem and  
AC plant it that's asexual  
S1: - and - the - sexual reproduction?  
S2: - pollen grains from a different plant - fuse with the  
PART plant -  
[pause]  
S3: How do these plants - reproduce?  
S2: - we can get bees as well  
S1: - that - transports pollen  
PART S2 - transports pollen  
DOM S4: so people - I suggest - before we go on - we talk - about  
the agents of reproduction - we first emphasise these things -  
later -  
S2: - we'll do a drawing after - we talk about it -  
S4: ya - after that  
[pause]  
AC S2: - they fall - they fall under - sexual reproduction? -  
because they transport pollen from - other plants to another  
plant - isn't it  
S2: - bees - you talking about bees? - how?  
S1: - ya  
S2: - can be the same plant, as well - bees you notice they go  
from one flower to the next flower - be it on a different plant  
- or the same - say if you have - the two differnt plants -  
there's two flowers here - okay - the bee can go from here to  
here to here - on the same plant - and that's asexual  
reproduction - but this is another flower - the bee can go from  
this flower to that flower - that's sexual reproduction  
S1: oh - these are two plants  
S2: ya  
S4: - does it transfer pollination?

S2: - huh?  
 PART S4: - does it transfer pollination - whereby the pollen - the pollen grains are transferred from the other plants to another -  
 S3: We have to focus on one example - on what we're doing - one type of reproduction - whether its sexual or asexual reproduction - I don't know whether we are doing sexual reproduction - or what?  
 S2: - okay  
 S1: - ya - this -  
 S2: Let's look at one type - asexual -  
 S1: - asexual? - anyone  
 S3: - either one - sexual or asexual  
 S2: Which one you want to do?  
 S3: - say - do sexual reproduction - and then discuss that - and then the next point - we deal with asexual - and we discuss it - because we - otherwise - will confuse each one  
 S2: - ya - okay - let's look at one type  
 S1: - okay  
 S3: - asexual or sexual - focus on the one  
 S2: Which one you want to do?  
 S4: - ya - let's take the first one - because we being -  
 S2: - asexual?  
 s1: - asexual  
 S4: ya  
 S2: okay  
 S4: First of all - asexual has - got a flower - there's the pistil - and those things - reproduction occurs - on that -  
 S2: - on the same flower  
 [pause - writing]  
 AC S3: First of all - I think it will be easier to define it first - define what it means  
 S1: okay  
 PART [pause - writing]  
 S2: - and pollination takes place within the plant  
 [pause - writing]  
 S3: - same plant - [inaud] - on the same plant  
 S2: sorry?  
 S2: pollination takes place within the plant  
 [pause - writing]  
 S3: - which means that - the male gametophyte fuses with the female gametophyte - fuses within the same flower  
 [pause]  
 S2: - you also get - a slip from a plant  
 S3: - which means -  
 [pause]  
 S2: - you also get a - a slip from a plant  
 S1: - a slip?  
 S2: - piece of stem or something  
 [pause - writing]  
 S2: - then we plant the - the stem of the plant  
 S2: - um - example - rose  
 S3: - um

[pause - writing]

PART S4: - then - you are finished it - then you should write that -  
in - asexual - flower - in asexual reproduction - the flower -  
we get the flower -

AC S1: - oh - which one we are doing now? - asexual or sexual?  
S2: Which one are we doing now - sexual or asexual?  
S4: - asexual reproduction - we got the flower - has the pistil  
- where pollen grains situated - then - explain how - does  
actual pollination takes place and how does sexual reproduction  
takes place  
S2: - it didn't ask how it takes place  
S4: - how -  
S2: - how -  
S3: How does asexual reproduction takes place?  
S1: - the female and the male -  
S4: - guys -  
S1: - fuse together and -  
S4: - guys - there's something - this thing - is not easy to  
explain - we got to -  
S1: - we'll move it up  
S4: - no - I don't mean the chart - it's okay - I mean this  
thing - this - we have this one its called [pause - writing]  
S4: - then I think - its easier - how to - explain how -  
S2: - the stigma and style -  
S4: - this - what is - called the pistil?  
S2: - no - the style  
PART S4: - the style  
[pause]  
S4: Where is the pollen grains?  
S1: - one the round one  
S3: - these are - stigmas?  
S1: - um  
S3: Which are - the male?  
S2: These are - the male and this the female  
S4: - this is called the [inaud]  
[pause]  
S4: Where is the pistil?  
S3: - pistil?  
S4: This is the stigma - wher is -  
S2: This one is - anther, filament - stigma, style  
S1: - stigma, style  
S2: - anther, filament  
S3: - where?  
S2: I'm trying to recall -  
[pause]  
S1: Where is the head of this one?  
S2: - anther, filament - ya - this is the style and that's the  
stigma  
S4: ya - okay  
S2: ya - this is the style and that's the stigma - ya - and  
then the pollen grains can be transported -  
S1: - by wind  
S2: I don't know - by wind - and falls on this -  
S1: ya - and insect

S2: - and it falls on this - on the stigma - and then travels  
down the style - down - to the ovules -  
[pause]  
S1: Let's say - this is the same plant - if this is a flower -  
and another flower here - what should happen - when the seed  
from this anther - goes down - another flower  
S3: - you know - when it travels down -  
S2: - it's within the same plant - doesn't need to be the same  
flower...

Group B: S5, S6, S7, S8

**Transcript on Activity**

DOM S8: This section - I'm not too sure - about this stuff -  
PART- S5: What kind of reproduction does it happen - when a bird  
COG takes - that particular gamete - is it gamete?  
TOPIC S7: pollen  
S5: Is it pollen? - from one plant to another plant - what - do  
PART- you call that?  
COG S8: cross pollination  
S5: - oh - that's pollination  
S6: - oh - is it general?  
S7: But what I know is that - they only - they can only  
reproduce - using the gametes of the same plant S8: ya -  
similar plant  
S7: ya - no matter if it's the same flower or not  
S8: But what about hybrids? - hybrids - two different kinds  
pollinating each other  
S7: What happens then?  
S8: no - you tell us about it  
S7: ya - in most cases the whole thing dies - because you -  
AC find that the genes are not the same since others may carry -  
the chromosomes of the - say - leaves being blades - leaves of  
others - needle leaves - depending - depending - so when the  
grouping occurs - there is a disturbance - so eventually not  
succeeding - but in most cases the leaves of the pollen - the  
pollen of the same plant - oh - inside the pollen you find the  
- the male gamete - you know  
S5: - um  
AC S7: - they are used to fertilise the flower of the - very same  
plant -  
S5: - plant - so - how does it happen? - you find the male  
gamete - in that certain plant - and then how?  
S7: I -  
S5: How does it actually happen?  
S7: I think there are - two process - there is a self-  
fertilisation and the cross-fertilisation - when they talk of  
self-fertilisation - is that the anthers -  
S6: - fertilisation - or pollin - or pollination?  
S7: - ya - of the same flower - fertilise the stigma - on style  
- of the same flower - taken - and formulate fruits or seeds  
S8: What about when pollination is cross-pollination - where  
the wind carries the pollen from one plant to another plant -  
not necessarily an animal  
S6: - ya - I think general pollination is - is - is the result  
of the wind  
S7: - wind and insects  
S6: ya  
S8: - so basically - generally - plants are produced by - their  
seeds - if you plant the seeds of one plant - you must get  
another plant - huh? - get another plant -  
S7: If you take a seed - what do you say?

PART S8: - say - you take a tomato -  
S7: - tomato is a fruit - inside - there is seeds  
S8: If you plant and leave it - you get another plant  
S6: ya  
S8: - even a paw-paw too -  
S7: - no - tomato and paw-paw - are ripened - fruit  
AC S5: Tomato is another plant - I don't know about paw-paw -  
S7: ya  
S5: Is the paw-paw a plant?  
S7: - a paw-paw too  
S5: ya  
S8: Sometimes - you take a stem and you plant it - it roots -  
S5: - um  
AC S7: My mother told me - at home we've got - three paw-paw  
plants - two are females and one is male - the whole plant -  
and I asked -  
S8: - one plant?  
S7: - no - different plants - I asked her - why do you keep the  
male one because it doesn't  
S6: - bear anything  
S8: - ya - fruit - it doesn't - and she said - 'no, it's here -  
these are the two wives of it'  
S6: [laughs]  
S7: - these two plants need this one for the process of making  
new paw-paws  
AC S8: - oh  
S7: - the presence of this one - is facilitating the whole  
process - here -  
S6: - um  
S8: - you mean if you take the male one - the others won't  
reproduce?  
PART S7: ya - 'though - that's not a - scientific way - of studying  
AC this thing - but I know that - old people seem to understand  
this thing -  
S8: - experience -  
AC S7: - since they have that -  
S8: - experience -  
S7: - ya - experience - maybe - there is self-fertilisation -  
but it's not much stronger as the cross one  
S8: What is self-fertilisation?  
S6: - from the female as it is - does a female fertilise  
PART itself?  
S7: - it can -  
S6: oh  
S5: - but it makes nonsense - it - it doesn't have the male  
gamete  
S6: - ya - I don't think so  
S5: - like - a male - a male - what do you call - a male -  
cannot produce another plant only - by male  
S7: I said that this thing's not a scientific study  
S8: - it's a belief  
S5: oh  
S8: - not a scientific study

PART S8: old wives' tale  
PART S7: - maybe it's wrong - maybe it's right  
S6: - okay - let's go back then - to our ideas - and then  
write...

Group C: S9, S10, S11, S12

**Transcript on Activity**

TOPIC S12: I think here we should look at - there are two types of reproduction - there is asexual where sex - cells are not involved - and there is - sexual reproduction - sexual reproduction - is the kind of reproduction - which is a result of the fusion of - the sex cells - male and female sex cells

PART S10: um

PART-COG S12: - and these anthophytes - they produce by means of sexual and asexual reproduction

LANG S11: ya - but I don't understand - what is meant by - sexual reproduction where there is no male - and female - S12: It's a-sexual reproduction - a-sexual reproduction S11: a - S12: - a-sexual reproduction - it is a kind of reproduction where new generations - of plants - are being propagated - by means - by using certain parts of that particular plant - maybe - its stem, a root or even a leaf - of a certain plant - of a particular plant - and plant it - and that plant will grow on its own and become a new plant - S9: - so is this called asexual? S12: - asexual - but when a new plant is being propagated for the use of - S11: - seed S12: it its seeds - then the type of reproduction is referred to as sexual reproduction

AC S11: Thank you - now I know - [pause]

AC S11: - so - what is important regarding - S12: In - in angiosperms - usually angiosperms - mainly by sexual reproduction [pause]

AC S12: - also they produce fruit - and by people eating the fruit and throwing away - the seed - they reproduce S11: Is it true that - there are seeds which do not germinate if they have gone through a person's mouth - first before they are thrown away [laughs] S10; Well - I don't know if it's true about the mouth - but if it goes through the stomach - the stomach - if it goes through the stomach - because -I mean - there's juices and everything - as you know we got lots of acids in the stomach - ya - S11: ya - 'cause - I think I heard about this when I was young when eating watermelon - watermelon has seeds - and those seeds were said to - fail to germinate - if they have been eaten - even if they have not been swallowed - S10: oh S12: I don't think - S11: - and then - oh - it was said that they did germinate - but that they produced - a - different kinds of melon than watermelon S12; I don't think that - that statement holds true under - all conditions - it depends on - maybe -

the nature of - the nature of the particular seeds - some seeds  
- can be - can be - digested - can go through the digestive  
systems of animals - but they germinate - too - once they are -  
have left the body of the animal - I will say - will say - some  
seeds - I will say - they can - some seeds - they can -  
counteract - the effects of the digestive juices that they come  
into contact with inside the body of the animal

PART

S9: - like - an example is guava

S12: ya

PART

S11: The other thing which I think is important - while still  
talking about seeds is - the - fact that seeds are different  
and - and - adapted to the type of - transportation -

S10: um

S11: - so - that - that will be easy to get dispersed from the  
main plant which produced them -

S10: um - tha's true...

SESSION 14

Group A: S1, S2, S3, S4

Transcript of Step 4



S3: okay -  
 S2: The fruit comes from the ovary - ovary of the flower  
 S1, S4: Why?  
 S4: - if you say - if you say - it comes from the ovary - the  
 ovary grows into a fruit - ovary produce something - the - the  
 whole - how can you put it?  
 S3: - flower becomes the fruit - the ovary is only one part of  
 the flower  
 S2: - can't be the whole flower - only -  
 S4: - but -  
 S2: - it's only the ovary  
 S4: - it is the ovary  
 TOPIC S2: ya - see - there's the ovary - style, stigma - when it is  
 the fruit - petals fall off -  
 S4: - fruit from the ovary  
 S2: Let's look at the question - [reads out question]  
 PART S4: - how are they pollinated?  
 S2: - the colour is -  
 S4: - blue  
 AC S1: It is - it is purple  
 S4: - blueish  
 S3: I think it's blue - pollinated by -  
 S1: - it should be carrion flies  
 S2: - flies  
 S3: - flies?  
 S4: What is this?  
 PART-COG S1: this is - the colours of the petals  
 S3: Do you think it is - flies?  
 S4: [reads out] - bright yellow -  
 S1: [reads out] - flower colour -  
 S4: - what?  
 S1: - this is dark purple with a white marking -  
 S2: First of all - is it dull - or bright?  
 S4: ya  
 PART S3: I think - we should be looking for a pollinating agent  
 S2: - that's what we are trying to find out  
 S3: - whether it is bees or flies -  
 S2: - no, no - we trying to find out -  
 S3: we mentioned bees or flies - are they the pollinating agent  
 or not?  
 S2: - that's what we are trying to find out - [laughs]  
 S4: - that's what we are trying to get , [S3]  
 AC S2: Check if it's dull or bright - then only we can see - is it  
 dull?  
 S4: ya - it's dull  
 S1: - dark purple with a white marking  
 S2: - white markings - ya - so it is pollinated by - S1: -  
 carrion flies  
 S3: Is it pollinated by these flies - because of the colour of  
 its petals?  
 S1: ya  
 S4: Yes - because of the colour  
 S1: - of the petals - they are - they are

attracted -  
 AC S3: Are bees not attracted to these flowers?  
 S1: - they are attracted to the bright yellow and the blue and orange colours  
 S4: - not this one  
 DOM S3: - so - if -  
 S2: okay - what about the flower shape?  
 S1: I think we look at - how are the female parts - it was below the - the male parts - I think it is -  
 S2: - there -  
 S4: - how is the female part?  
 S2: - the female is -  
 S1: - below -  
 S2: - below - and it's deep - you can see it forms like a deep tube - of the flower itself  
 S4: ya  
 S2: - in the flower itself  
 S4: The flower is like - like a funnel shape - huh?  
 LANG S2: ya - so - [reads] - 'simple regular flowers - the pollen often sticky' - [inaud]  
 S1: Is it sticky?  
 S2: um  
 S3: - well - what do you mean by assists?  
 S4: What is this?  
 S3: - assists  
 S1: - you can see it's - easily - you know - dispersed  
 S3: Can you see the pollen?  
 S1: um  
 S3: - is it easily dispersed by [inaud]  
 S1: I think they are -  
 S2: I don't know - I can't see it - see - there are certain flowers - when you just touch it - you find the yellow on your hand - but -  
 S1: - this one - they are sticking inside to the - to the anthers  
 S2: - anthers  
 S1: ya  
 S2: [reads] - 'scent - spicy or like rotting fruit or fermented...' - how does that smell?  
 S1: huh?  
 AC S2: - [reads]- 'crush it in between your fingers'  
 S1: ya - it resembles [inuad]  
 S4: When are we going to make the poster  
 S1: I think we're through this part  
 S2: - so - basically we found that carrion flies assist it in pollination - and how do we -  
 S3: It seems like - here - the type of pollination - is self-pollination or cross-pollination  
 S2: It can be cross-pollination  
 S1: - can be self-pollination - to female part - below the male part - pollen - it will fall easily  
 S3: - looking at the agent - we said the agent - is the fly - flies - that is cross-pollination -  
 S2: ya - here - it's found here - there's the female part here  
 S4: Okay - guys - it's...

Group B: S5, S7, S8

Transcript of Step 4

S7: First of all - all - most - we can say most - flowers - have got the bright colours in their - corolla so as to attract birds

PART S5: - and insects  
S7: - and insects  
S8: - and - butterflies, moths - birds - reddish - is when - what colour is this - huh - mauve - huh - what colour - mauve - purplish?  
S7: This is purplish

TOPIC [pause]  
S8: Put down 'birds'  
S5: But, what we are asked is - 'where - did it come from'  
S7: - 'to discuss the function of each' - oh - we have already -  
S8: Does the flower become the fruit - is it?  
S5: We could say comes from - what about the - comes from the ovary - and what about the - and the flower itself?  
S8: We don't eat the flower - we just eat the fruit  
S5: No - I'm just saying - how - did the fruit come about?  
S8: First the flower comes - on the plant - right?  
S5: ya  
S8: - and then -  
S5: - and then the -  
S8: - and then - the fruit  
S5: okay  
S7: - huh? - repeat yourself please  
S8: ya - flowers - then fruit  
S7: No - but - that one is not much specific -  
S7: - from your general observation - everytime you see a flower - on plants -

PART S7: Do you remember what I've said? - that - the fruit is formed - from the ripened -  
S8: - ovary  
S7: ya - ovary

TOPIC [pause]  
AC S8: [S5]?  
S5: - and how is pollination - we - say that it's - by birds - and wind - 'cause it's so light - when there's wind - it just blows  
[pause]  
S5: - but I'm not sure - about - pollination and dispersal - they are not the same things or - huh?  
S7: The - the dispersal - it's when dispersal of -  
S5: How is it taken from one place to another place? - or -  
S8: Birds will disperse it  
S7: - pardon?  
S8: - birds  
S7: ya - it tends to be dispersed by birds - and wind - I'm talking about seeds now -  
S5: ya  
S7: - because if a bird eats - the - the fruit - then inside the fruit there is - there are seeds - okay - maybe -

S8: You're right  
S7: - maybe - maybe the seeds inside the fruit - are not -  
digested - then it comes out - when - when - the bird is  
another - at another place - you know - that is how it  
dispersed that seed  
S8: um  
S8: okay - from one place to - another  
S5: - and - what is pollination?  
PART S7: - and pollination - it's when the pollen grain is taken  
from the - the - anthers to the -  
S5: oh - okay  
S8: - makes contact with the -  
AC S5: - so what you mean is that -  
S7: ya - to the - to the - female parts of the flower - it can  
be - of the same flower or of a different plant  
S8: - pollen grains of another flower -  
S7: ya  
S5: - so if I get you right - you saying that pollination -  
mainly is -  
S8: - is the actual contact between male and female  
S7: ya - ya - taking of the pollen grain - pollen grain -  
S5: - and dispersal - has to do with seeds - that's what you  
are saying -  
S7: ya  
S5: - that pollination is to do with pollen grains and  
dispersal is to do with seeds?  
S7: ya - ya  
S5: okay - so this one is - wind pollinated  
S7: ya  
S5: - or by insects  
S7: ya - it can be - also insects  
AC S8: ya  
S5: - and dispersal?  
S8: - it can be -  
S5: This is the seed?  
S7: ya - this is the whole fruit  
S5: This is the whole fruit  
S7: There are seeds inside  
S5: Does it have pollen inside?  
S7: no  
S5: it doesn't - so then why do you say that it is wind  
pollinated?  
S8: no  
S5: That's what confused me  
S8: The pollination part will occur - before this thing becomes  
big  
S7: ya - [reads question] - okay - see the top part there -  
S5: - we just have stamens  
S8: See the pollen grains there  
S5: ya  
S8: Pollination has to do with the pollen grains - tha's where  
we get the name pollination - right  
S7: ya  
S8: That makes cotact with the female part -

PART

S7: ya  
S8: - of the flower  
S7: ya  
S5: When do we have the fruit then?  
S7: - after -  
S8: - after that - the fruit  
S7: The - the pollen grain is taken along by - there is a tube  
off the stigma -  
S8: - down the -  
S7: - down to the -  
S5: - to the female part - ovule  
S7: ya - ovule  
S5: - and then it -  
S7: - and then - it get a fruit  
S5: okay - so it's wind - by insects - and dispersal?  
S7: - by wind...

Group C: S9, S10, S11, S12

**Transcript of Step 4**

TOPIC S10: Okay - where does the fruit come from?  
AC S11: Fruit - we'd say it comes from the flower of the seed -  
it's in - it's in the flower i in the ovary  
S10: ya - it doesn't come from the flower - comes from the  
RULE ovary  
S12: - exactly  
S19: ya - um - see here - what you said could be a  
misconception - there's the flower - that's the ovary - so this  
comes from the ovary  
AC S11: - the ovary itself?  
S10: - see - there's the parts - that's the stigma -that's the  
pistil - stigma, style - and that's the ovary  
S11: ya - al'right - ya - comes from the flower  
S10: ya  
S11: - now I see  
S10: no - it comes from the ovary of the flower  
S11: - the ovary?  
S10: um  
S11: ya - what confuses me is - that the ovary itself is - part  
of the flower - [laughs] -  
S10: ya  
PART S11: - so you say - it comes - from the ovary  
S10: ya - of the flower  
PART-COG [pause - writing]  
S11: - ah - pollination  
S9: How does this fruits pollinate - get pollinated?  
S11: - it looks - it looks - like - it can be -  
S10: I think it would be insects - because if you look at the  
flower -  
S11: - insects  
S12: - exactly  
S10: - so - if you look at this - side - so if you look at the  
AC flowers - there's the style - there's the style - there's the  
stamens - there's the ovary - so if the insect lands - it will  
dust pollen onto it - and then go to another one - and the  
pollen - will touch - the - stigma - ya - stigma of that -  
because it's on their feet - that's why I think it is insects -  
it is brightly coloured so it will attract insects  
S11: ya  
S12: It's the insects - ya - you know how you can tell -  
whether a plant is pollinated by insects - wind - or water - is  
by - looking at - at the fruit - or by looking - at - at the  
seed of the - that particular plant - if I tear it - open -  
we'll find out  
[pause]  
S11: ya - there is another one -  
S12: - it's already opened?  
[pause - writing]  
S12: - actually the type of pollination - this plant must be -  
pollinated by - by the insects  
S19: I think that's more - bees - that would pollinate them -  
because it says here - bright - yellow

[reads] - it's like a bluey colour -  
 S12: ya - really - I - I don't think - we don't need to specify  
 - if we might say insects - insects - ya  
 S11: ya - because other than bees there can be insects that may  
 be attracted to these  
 S10: It's just that - we've been given this table - I think we  
 should use it - it - it says here - often - [reads] - is there  
 a landing platform?  
 S11: ya - ya - [pause] - I can see it on this  
 S10: [reads]  
 [pause]  
 S10: [reads] - explain how the seeds are dispersed - um - this  
 must be -  
 [pause - reading]  
 S9: The ones that are dispersed are the ones that are exposed  
 S10: huh?  
 S9: - one that - animals will disperse - are - the ones that  
 are exposed  
 S10: ya - but how does it - how do the seeds get dispersed?  
 S9: - by wind  
 S10: - you think it's by wind  
 S11: ya - it looks like - it - it opens on its own - when its  
 bright - you know - huh?  
 S10: - but - don't you think it's going to - like - like -  
 S11: - will open with force and - and spray those seeds out -  
 or they gonna dry - and - and just - fall out -  
 S12: probably - it dries out - the ovary -  
 S11: Is this the ovary?  
 S12: ya - it dries out - and I think it - bursts open - and  
 releases - the seeds  
 S10: ya...

PART-COG

PART-COG

## SESSION 15

Group A: S1, S2, S10

### Transcript of Activity 1 - on an example

S2: ginger - it's ginger  
 S1: ya - modified stem for reproduction  
 S2: it's planted - planted by this piece of ginger - and roots  
 and shoots grow from the actual ginger - it has a stem - grows  
 underground  
 S10: ya  
 S2: it's modified for reproduction - also for storage  
 S10: ya - it also stores food  
 S1: Why is it a stem? - I think - it's got - like the nodes  
 S10: ya - and here's the root  
 S2: ya  
 S1: this is the shoot  
 S10: ya - it is the shoot - that is above ground  
 S2: It also has - ginger - stem - underground

Group B: S5, S6, S7, S8

Transcript of Activity 1 - on an example

S5: - a root  
S8: We just got here  
S6: This is a root - and  
S5: no - this whole thing - this whole thing -  
S6: ya  
S5: - is a root - the whole thing  
S8: - the bottom part  
PART S6: okay - but I don't think this is - the stem  
S8: the - what is it?  
S6: these are -  
S8: This has to be the stem - there are leaves attached to it  
S6: we don't have many roots here  
S8: These aren't the roots - what I'm saying -  
S6: This is a whole leaf - ya - this is - there's no stem here  
-  
[pause]  
PART-COG S5: I won't say that's the stem  
S6: I think these are growing from here - which means this is -  
directly from the roots - this is the -  
S8: Doesn't the stem always grow directly from the roots?  
S6: huh?  
S8: Does the stem not grow directly from the roots?  
AC S5, S6: It does -  
S8: right - now this is where it's growing - directly from the  
roots  
S5: Not all stems grow directly from the - not that - not that  
- stems only grow from the roots - even leaves do grow directly  
from -  
S8: [inaud]  
S5: - like this one - from this one -  
S6: Just to make it clear - does carrot have stems?  
S5: um  
S6: - because this is nearly the same as carrots - carrots -  
PART [S7]  
S8: [S7] is observing  
S6: - but he has to talk too  
RULE S5: - he is observing -  
PART S8: Write down - what you think - I definitely think this is a  
root - we all found that - right  
S5, S6: ya  
S8: this structure here -  
S5: okay  
S6: You haven't answered my question yet [S8]  
S5: - about the root  
S6: ya - because it's almost the same as carrot  
PART S5: ya - it's the same - same - not same family - but - same  
structure  
S6: - same structure  
S5: ya  
S8: It's a tap root - isn't it?  
S5: yes  
S6: uha - not sure about that -  
S8: I think it's a stem  
S5: You are not sure whether - this is the stem -



or leaf?  
PART- S6: Look at - just look at the whole thing - I think these -  
COG all these are leaves - you cannot have some -  
S8: Is this a leaf?  
S6: ya  
S8: [S5]?  
S5: yes - I think that's a leaf - it's - because it's old -  
that's why we cannot see - that - how it is - how the leaves  
AC are -  
S6: ya - that's the fact - you cannot have so many stems like  
this...

APPENDIX XIII

AUDIT TRAILS

Table 0 Data Collection

DATA SOURCES

SESS	INT	TAPE	RD	SRN	CN	SP	MO	QUES
Rel	I	SIT1-2	1-11					6 lecturers
1		{A}-ST1:{B}-ST2:{C}-ST3	12-16		Note 1	PP		
2		[A]-ST1:[B]-ST2:[C]-ST3	17-19	lists	Note 2	PP:clas- ev:lists Rules:cla Key		
3		[A]-ST1:[B]-ST2:[C]-ST3	21-23		/			
4		[B]-ST5:[C]-ST6	24		/	L-plan: report		
5			26-28		/	PP		
6RelI		[A]-ST4:[C]-ST6	32-36	S2S4 S10	Note 3	PP;PP		
7		[A]-ST5:[B]-ST4:[C]-ST6	38-42	S2S4 S5S10	Note 4	PP	S4S8S10	
8		[A]-ST4:[B]-ST5:[C]-ST6	43-46	S5	Note 5	TP:less notes:ld.list	S2S5S S11	
9	II	SIT3:SIT4	47-49	S5S12	/	P		
10 (ts)			50-52	S5S11 S12	/	PP:idea dev: rep		
11Test			58	S10	/	Test		
12RelIII		[A]-ST4:[B]-ST5:[C]ST6	60-62		/	W/sh:PP		
13		[A]-ST4:[B]-ST5:[C]ST6	64-65		Note 6	W/sh:PP	S7S10 S12	
14		[B]-ST7:[C]-ST8	67-68		/	Report		
15			69-70		Note 7	Test		
16 (ts)			72-73		Note 8			
17Test			74-75		Note 9			
End	III	SIT5:SIT6:LDT		Essay s1- S12	Note 10			RQ:S1-S12

KEYS  
KEY TO TABLE 0

SESS	Session	CN	Colleague's Note
INT	Interviews		
TAPE	Audio-tapes	SP	Student Product
RD	Research Diary	MO	Member Observation
SRN	Students' Reflective Notes	cla	Classification
RQ	Reflective Questionnaire	s-ev	Student evaluation
ST	Session tape	L	Lesson
[ ]	Group	TP	Teaching Plan
SIT	Student Interview	idlist	ideas list
LD	Lecturer Dialogue	p	Poster
S	Student	dev	Development
PP	Poster presentation	w/sh	worksheet

KEY TO AUDIT TABLES 1-17

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
[I]	Report I	MOTIV	Student motivation
[II]	Report II	LROLE	Lecturer's role
CN	Colleague's classroom note	TIME	Time constraint
SI	Student interview	AC	Alternative concept
SIT	Student interview tape	CD	Class discussion
Sess	Lecture Session	TOPIC	Nature of topic
Act	Activity	FORMAT	Format of topic
MO	Member observation	PP	Poster presentation
RQ	Research questionnaire	EVNOTE	Evaluation note
LENV	Learning environment	ASSESS	Assessment
ETHIC	Ethical consideration	REFL	Reflective action
AR	Action-Research methodology	SRN	Research note
RESTIME	Research time	PART	Participation
STIND	Student induction	GR-	Choice of group
GRSIZE	Group size	CHOICE	
GRRULE	Group rules	GR-	Group composition
GRFILE	Group file	COMPOS	
II		GR	Changing group
		CHANGE	

**Table 1 'Dominance' Audit Trail**

	ITEM	LOCATION
<b>DATA SOURCE:</b>		
Research Diary		P 16: DOM P 21: DOM P 24: DOM <sub>1</sub> , DOM <sub>2</sub> , RN P 32: DOM, RNDATA P 34: DOM <sub>1</sub> , DOM <sub>2</sub> P 35: DOM P 41: DOM P 54: DOM P 55: DOM P 61: DOM
Colleague's Notes		Note 3
Student/Group Product		Sess 3: Group rules-[A],[B],[C] Sess 6: Poster-[A],[B],[C]
Student Reflection		Sess 2: 'Least liked' lists-S6, S3 Sess 7: MO:[A]-S3,[B]-S8,[C]-S10 Sess 8: MO:[A]-S2,[B]-S5,[C]-S11 SRN: S10, 13.03.95 SRN: S10, 15.03.95
Interview		SIT I: S1,S3,S5,S8 SIT II: S1,S3,S6,S9,S11
Lecturer Questionnaire		Item 4: History, Mathematics
<b>ANALYSIS:</b>		
Audiotape CL		Sess 1: [A],[B],[C] Sess 2: [A],[B] Sess 3: Act.2-[A],[B]; Act.3-[A] Sess 4: [B],[C] Sess 6: [A],[B],[C] Sess 7: [A],[B],[C] Sess 8: [A],[B] Sess 12: [A],[B],[C]
Descriptive/Interpretive Report		I: p 10, 14, 22-23, 26, 27 II: p 3-5, 9-11, 17-18, 24-26 III: p 9
Analytic Theme Report		I: p 6-8 II: p 1-5
Corroboration		RQ: 4c Colleague Note 10 SIT III 5,6

Table 2 'Language' Audit Trail

	ITEM	LOCATION
DATA SOURCE:		
Research Diary		P 13: LANG <sub>1</sub> , LANG <sub>2</sub> P 14: LANG <sub>1</sub> , LANG <sub>2</sub> P 18: LANG P 21: LANG <sub>1</sub> , LANG <sub>2</sub> P 23: LANG P 24: LANG P 32: LANG, RN P 33: LANG P 34: LANG <sub>1</sub> , LANG <sub>2</sub> , LANG <sub>3</sub> P 35: LANG P 47: LANG P 55: LANG
Colleague's Notes		Note 1,3,8,9
Student/Group Product		Sess 1: Poster: [A] Sess 3: Group rules-[C] Sess 6: Poster-[A],[B],[C]
Student Reflection		Sess 2: 'Best liked' list-S3 Sess 7: MO:[A]-S3,[B]-S8,[C]-S10 Sess 8: MO:[A]-S2,[B]-S5,[C]-S11 SRN: S10, 15.03.95
Interview		SIT I: S12 SIT II: S1,S3,S6,S9,S11
Lecturer Questionnaire		Item 5-Mathematics, Natural Science
ANALYSIS:		
Audiotape summary		Sess 1: [A]-S2,S4,S10,[B]-S8,[C]-S12 Sess 2: [A] Sess 3: Act.2-[A],[B]; Act.3-[A],[B]; Sess 6: [A],[C] Sess 7: Act2-[A],[B],[C] Sess 8: [B], [C] Sess 13: [A] Sess 14: [A]
Descriptive/Interpretive Report		I: p 4,6,7,8 II: p 10-12,15,20-21 III: p 25
Analytic Theme Report		I: p 8-9 II: p 18-21
Corroboration		RQ: 1i Colleague's Note 10 SIT III

Table 3 'Time' Audit Trail

ITEM	LOCATION
<b>DATA SOURCE:</b>	
Research Diary	P 13: TIME P 14: TIME P 15: TIME P 18: TIME P 19: TIME P 22: TIME <sub>1</sub> , TIME <sub>7</sub> P 24: TIME P 32: TIME <sub>1</sub> , TIME <sub>2</sub> P 33: TIME P 34: TIME <sub>1</sub> , TIME <sub>2</sub> , TIME <sub>3</sub> P 35: TIME <sub>1</sub> , TIME <sub>2</sub> , TIME <sub>3</sub> , TIME <sub>4</sub> P 36: TIME P 38: TIME P 39: TIME P 40: TIME <sub>1</sub> , TIME <sub>2</sub> P 41: TIME P 43: TIME P 45: TIME <sub>1</sub> , TIME <sub>2</sub> P 58: TIME P 60: TIME P 67: TIME <sub>1</sub> , TIME <sub>2</sub> P 70: TIME P 74: TIME
Colleague's Notes	Note 1,3,5,6,7,9
Student/Group Product	Sess 3: Group Rules-[A] Sess 5: Group Pres.-[B] Sess 6: Poster-[A],[B],[C]
Student Reflection	Sess 2: 'least liked' list-S11 Sess 7: MO:[A]-S3,[B]-S8,[C]-S10 Sess 8: MO:[A]-S2,[B]-S5,[C]-S11 SRN: S10, 13.03.95 RSN: S10, 15.03.95 SRN: S5, 22.03.95
Lecturer Questionnaire	Item 2: History Item 4: English, Education Item 6
<b>ANALYSIS:</b>	
Audiotape CL	Sess 1: [A] Sess 2: [B] Sess 3: Act.2-[A],[B] Sess 6: [A],[B],[C] Sess 7: Act.2-[C]
Descriptive/Interpretive Report	I: p 3,5,6,7,9 II: p 13,14,15,16,20 III: p 26,28
Analytic Theme Report	I: p 5,8,9 II: p 21-22
Corroboration	RQ: 6a,b;c-f SIT III

**Table 4 'Alternative Concepts' Audit Trail**

ITEM	LOCATION
<b>DATA SOURCE:</b>	
Research Diary	P 13: AC <sub>1</sub> , AC <sub>2</sub> , AC <sub>3</sub> P 14: AC <sub>1</sub> , AC <sub>3</sub> , AC <sub>4</sub> P 15-16: AC P 18-19: AC P 20: AC <sub>1</sub> , AC <sub>2</sub> P 21: AC <sub>1</sub> , AC <sub>2</sub> , AC <sub>3</sub> P 23: AC P 26: AC P 28: AC P 34: AC <sub>1</sub> , AC <sub>2</sub> P 35: AC P 38: AC <sub>1</sub> , AC <sub>2</sub> P 39: AC <sub>1</sub> , AC <sub>2</sub> P 40: AC <sub>1</sub> , AC <sub>2</sub> P 43: AC P 44: AC P 45: AC <sub>1</sub> , AC <sub>2</sub> , AC <sub>3</sub> P 47: AC P 50: AC P 58: AC P 64: AC <sub>1</sub> , AC <sub>2</sub> , AC <sub>3</sub> P 65: AC p 69: AC
Colleague's Notes	Note 1,2,4,5,6,7,8
Student/Group Product	Sess 1: Poster-[A]; [B]; [C] Sess 2: Poster-[A], [B], [C] Sess 3: Transcripts; Group Rules-[B],[C] Sess 6: Poster-[A],[B],[C] Sess 7: Act.1. Poster-[A],[B],[C]; Act.2. Poster-[A],[B],[C] Sess 8: Poster-[B] Sess 9: 'Ideas' Lists-[C] Sess 13: Poster-[B] Sess 14: Posters-[A],[B],[C]
Student Reflection	Sess 2: 'Best liked' list-S4; 'Least liked' list-S10 Sess.7: MO:[A]-S3,[B]-S8,[C]-S10 Sess 8: MO:[A]-S2,[B]-S5,[C]-S11 SRN: S12, 22.03.95
Interview	SIT II: S1,S3,S6,S9,S11
<b>ANALYSIS:</b>	
Audiotape CL	Sess 1: [A]; [B]; [C] Sess 2: [A],[B],[C]; transcripts 2, 3 Sess 3: Act 3-[A], [B], [C] Sess 6: [C] Sess 7: Act.2-[A], [B], [C] Sess 8: [A], [B], [C] Sess 13: [A], [B],[C] Sess 14: [A],[B],[C] Sess 15: [B]
Descriptive/Interpretive Report	I: p 3,5,6,7 II: p 10,12-13,14-15,16,17,18 III: p 26
Analytic Theme Report	I: p 9,11-13 II: p 22-24
Corroboration	RQ: 3e,f Colleague's Note 10

**Table 5 'Topic' Audit Trail**

	ITEM	LOCATION
<b>DATA SOURCE:</b>		
Research Diary		P 12: TOPIC <sub>1</sub> , TOPIC <sub>2</sub> P 13: FORMAT P 15: TOPIC P 18: FORMAT P 26: FORMAT, TOPIC P 32: TOPIC P 34: FORMAT, TOPIC P 35: TOPIC P 41: FORMAT P 45: FORMAT, TOPIC P 47: TOPIC P 55: TOPIC P 60: FORMAT P 61: TOPIC P 68: FORMAT P 69: FORMAT
Colleague's Notes		Note 1,2,3,4,5,6,7,9,10
Student/Group Product		Sess 3: Group Rules-[A]. B . C] Sess 5: Group Pres.-[A]. B . C] Sess 6: Poster-[A]. B . C] Sess 12: Poster-[A]. B]
Student Reflection		Sess 2: 'Best liked' list-S5,S9,S10 SRN: S10, 13.03.95 SRN: S10, 15.03.95 SRN: S3, 15.03.95 SRN: S5, 20.03.95 SRN: S5, S11, S12, 22.03.95 SRN: S10, 23.03.95
Interview		SIT I SIT II: S1,S3,S6,S9,S11
Lecturer Questionnaire		Items 1,2,3,4 Item 7: English, Education
<b>ANALYSIS:</b>		
Audiotape CL		Sess 1: [C] Sess 3: Act.2-[A]. B] Sess 6: [A] Sess 7: Act.2-[A]. B] Sess 8: [A]. B . C] Sess 12: [A] Sess 13: [A]. B . C] Sess 14: [A]. B . C]
Descriptive/Interpretive Report		I: p 3,5,8,9 II: p 10,11,13
Analytic Theme Report		I: p 4,9 II: p 25-27
Corroboration		RQ: 7a-k Colleague's Note 10 SIT III



Table 6 'Assessment' Audit Trail

ITEM	LOCATION
DATA SOURCE:	
Research Diary	P 13: PP <sub>1</sub> , PP <sub>2</sub> P 14: PP <sub>3</sub> P 16: ASSESS P 18: EV.NOTE. ASSESS P 19: ASSESS <sub>1</sub> , ASSESS <sub>2</sub> P 20: ASSESS P 24: ASSESS P 26: ASSESS P 38: ASSESS P 39: ASSESS P 42: ASSESS P 43: ASSESS P 45: ASSESS P 46: ASSESS P 48: ASSESS P 56: ASSESS P 58: TEST P 62: ASSESS P 65: ASSESS P 67: ASSESS P 72: ASSESS P 74: ASSESS P 75: ASSESS
Colleague's Notes	Note 2,4,5,9
Student/Group Product	Sess 2: Posters; Student reflective lists Sess 3: Classification Sess 7: Act.2, Poster Sess 8: Participation Sess 10: 'Teach session'; Notes; Chart Sess 11: Test Sess 14: Posters; Practical Sess 16: Germination Report Sess 17: Test
Student Reflection	Sess 2: 'Best liked' list-S7 SRN: S5, S12, 22.03.95
Interview	SIT I
Lecturer Questionnaire	Item 4: Natural Science Item 7: History
ANALYSIS:	
Audiotape CL	Sess 2: [A];[C]
Descriptive/Interpretive Report	I: p 3,6 II: p 15,16,17,18,23 III: p 29
Analytic Theme Report	I: p 10,13-14 II: p 27-30
Corroboration	RQ: 9a,b,f,g

Table 7 'Monitoring' Audit Trail

ITEM	LOCATION
<b>DATA SOURCE:</b>	
Research Diary	P 10: REFL P 12: REFL P 16: REFL P 19: MONIT P 22: REFL P 24: MONIT P 32: REFL <sub>1</sub> , REFL <sub>2</sub> P 36: MONIT P 38: MONIT <sub>1</sub> , MONIT <sub>2</sub> P 41: MONIT <sub>1</sub> , MONIT <sub>2</sub> P 43: REFL P 48: REFL P 50: MONIT P 60: MONIT P 61: MONIT P 62: MONIT P 64: MONIT P 65: MONIT P 69: MONIT
Colleague's Notes	Note 1 Note 3 Note 4 Note 5
Student/Group Product	Sess 3: Transcripts; Group rules Sess 6: Posters-Reconn.II-[A],[B],[C] Sess 12: 'Problem Solving' participation; posters
Student Reflection	Sess 2: 'Least liked' and 'best liked' lists Sess 7: MO:[A]-S3,[B]-S8,[C]-S10 Sess 8: MO:[A]-S2,[B]-S5,[C]-S11 SRN: S10, 13.03.95 SRN: S2, 13.03.95 SRN: S10, 15.03.95 SRN: S3, 15.03.95 SRN: S5, 20.03.95 SRN: S5, S11, S12. 22.03.95 SRN: S10, 23.03.95 Sess 15: MO: [A]-S10,[B]-S7,[C]-S12
Interview	SIT II
<b>ANALYSIS:</b>	
Audiotape summary	Sess 3: Act.2-[A],[B] Sess 6: [A],[B],[C] Sess 12: [A],[B],[C]
Descriptive/Interpretive Report	I: p 4,5,6,7-8 II: p 10-13,13.15-16,17,19,20 III: p 24,25,26,29-30
Analytic Theme Report	I: p 5,6,13 II: p 16-27,30-31 III: p 37-41
Corroboration	RQ: 5.1a-j; 5.2a-g; 5.3a-f; 11c,d Colleague's Note 10 SIT III

Table 8 'Participation' Audit Trail

ITEM	LOCATION
<b>DATA SOURCE:</b>	
Research Diary	<p>P 15: PART<sub>1</sub>, PART<sub>2</sub>            P 16: PART            P 18: PART<sub>1</sub>, PART<sub>2</sub>, PART<sub>3</sub>            P 20, 22,27,32,33,34,38,39: PART            P 40,41,43: PART            P 45: PART<sub>1</sub>, PART<sub>2</sub>            P 46: PART            P 47: PART<sub>1</sub>, PART<sub>2</sub>, PART<sub>3</sub>            P 48,50: PART            P 55: PART<sub>1</sub>, PART<sub>2</sub>, PART<sub>3</sub>            P 60: PART<sub>1</sub>, PART<sub>2</sub>, PART<sub>3</sub>            P 61: PART<sub>1</sub>, PART<sub>2</sub>, PART<sub>3</sub>, PART<sub>4</sub>            P 62: PART            P 64: PART<sub>1</sub>, PART<sub>2</sub>, PART<sub>3</sub>, PART<sub>4</sub>            P 67: PART<sub>1</sub>, PART<sub>2</sub>            P 68,69,70: PART</p> <p>Note 1,2,3,4,5,6,7</p>
Student/Group Product	<p>Sess 3: Group Rules-[A],[B],[C]            Sess 12: Posters</p>
Student Reflection	<p>Sess 2: 'Best liked' lists-S2,S6S8,S9,; 'Least liked' list-S1,S8            Sess 7: MO:[A]-S3,[B]-S8,[C]-S10            Sess 8: MO:[A]-S2,[B]-S5,[C]-S11            SRN: S10, 13.03.95            SRN: S2, 13.03.95            SRN: S10, 15.03.95            SRN: S3, 15.03.95            SRN: S5, 20.03.95            SRN: S5, S11, S12, 22.03.95            SRN: S10, 23.03.95            Sess 15: [A]-S10,[B]-S7,[C]-S12</p>
Interview	<p>SIT I: S1,S2,S9,S12            SIT II: S1,S3,S6,S9,S11</p>
Lecturer Questionnaire	<p>Item 3: English            Item 4: Geography            Item 5: Education            Item 7: Mathematics</p>
<b>ANALYSIS:</b>	
Audiotape CL	<p>Sess 1: [A]; [B]; [C]            Sess 2: [A];[B];[C]            Sess 3: Act.2-[A],[B]; Act.3-[A],[B],[C]            Sess 4: [B],[C]            Sess 6: [A],[B],[C]            Sess 7: Act.2-[A],[B],[C]            Sess 12: [A],[B],[C]            Sess 13: [A],[B],[C]            Sess 14: [A],[B],[C]            Sess 15: [A],[B]</p>
Descriptive/Interpretive Report	<p>I: p 4,6,8,9,10            II: p 10,11,12,14,15,17,18-23            III: p 23-30</p>
Analytic Theme Report	<p>I: p 4,7,11            II: p 16,18,20,21,24,26-27            III: p 37-41</p>
Corroboration	<p>RQ: 3a-s; 5.1a,b,c,e.g; 5.2e; 5.3d,f            Colleague's Note 10            SIT III</p>

**Table 9 'Group Rules' Audit Trail**

	ITEM	LOCATION
<b>DATA SOURCE:</b>		
Research Diary		P 19: GR. RULE P 20: GR. RULE P 21: GR. RULE P 22: GR. RULE P 24: GR. RULE P 34: GR. RULE P 35: GR. RULE <sub>1</sub> , GR. RULE <sub>2</sub> P 41: GR. RULE P 61: GR. RULE <sub>1</sub> , GR. RULE <sub>2</sub> , GR. RULE <sub>3</sub>
Student/Group Product		Sess 3: Group Rules Sess 6: Poster-[A].[B].[C] Sess 12: Poster-[A].[B].[C]
Student Reflection		Sess.7: MO:[A]-S3,[B]-S8,[C]-S10 Sess 8: MO:[A]-S2,[B]-S5,[C]-S11 SRN: S11
<b>ANALYSIS:</b>		
Audiotape CL		Sess 3: Act.2-[A].[B] Sess 6: [A],[B],[C]
Descriptive/Interpretive Report		I: p 8,10 II: p 10,12,13,16 III: p 25
Analytic Theme Report		I: p 6,8,11 II: p 16,24-25,30 III: p 38-39
Corroboration		RQ: 11c,d Colleague's Note 10

Table 10 'Lecturer's Role' Audit Trail

	ITEM	LOCATION
DATA SOURCE:		
Research Diary	P 13: LROLE P 15: LROLE P 18: LROLE P 19: LROLE P 21: LROLE P 22: LROLE P 23: LROLE P 24: LROLE <sub>1</sub> , LROLE <sub>2</sub> P 32: LROLE P 33: LROLE P 35: LROLE P 38: LROLE P 40: LROLE P 44: LROLE P 47: LROLE P 56: LROLE P 64: LROLE P 67: LROLE	
Colleague's Notes	Note 1,2,4,5,6,7	
Student Reflection	'Best liked' list-S4	
Interview	SIT I: S7,S12	
Lecturer Questionnaire	Item 3: Mathematics Item 4: Education Item 7: Natural Science	
ANALYSIS:		
Audiotape CL	Sess 1: [A] Sess 2: [A],[B],[C] Sess 3: Act.3-[A],[C] Sess 6: [C] Sess 7: Act.2-[A],[B]	
Descriptive/Interpretive Report	I: p 3,4,7,8,10 II: p 10-13,17,19 III: p 26,28,30	
Analytic Theme Report	I: 14-15 II: p 22,24,29	

Table 11 'Utilitarian Issues' Audit Trail

ITEM	LOCATION
<b>DATA SOURCE:</b>	
Research Diary	P 26: UTIL P 27: UTIL <sub>1</sub> , UTIL <sub>2</sub> P 28: UTIL P 50: UTIL
Student/Group Product	Sess 5: Group Pres.
Student Reflection	SRN: S5, 20.03.95
<b>ANALYSIS:</b>	
Audiotape CL	Sess 6: [C]  Sess 10
Descriptive/Interpretive Report	I: p 9 II: p 16,18
Analytic Theme Report	I: p 1,14 II: p 29
Corroboration	RQ: 12b,f,i,l,p

Table 12 'Group Size' Audit Trail

	ITEM	LOCATION
<b>DATA SOURCE:</b>		
	Research Diary	P 27: GRSIZE P 34: GRSIZE <sub>1</sub> , GRSIZE <sub>2</sub> P 35: GRSIZE <sub>1</sub> , GRSIZE <sub>2</sub> P 70: GRSIZE
	Colleague's Notes	Note 1,5
	Student/Group Product	Sess 5: Group Pres-[A],[B] Sess 6: Poster-[A],[B],[C]
	Interview	SIT I: S12
	Lecturer Questionnaire	Item 2: English, Mathematics, History, Education Item 3: Natural Science
<b>ANALYSIS</b>		
	Descriptive/Interpretive Report	II: p 10,13
	Analytic Theme Report	I: p 9 II: p 16,25
	Corroboration	RQ: 8a,b Colleague's Note 10 SIT III

**Table 13 'Changing Groups' Audit Trail**

	ITEM	LOCATION
<b>DATA SOURCE:</b>		
	Research Diary	P 12: GRCHOICE P 16: GRCHANGE <sub>1</sub> , GRCHANGE <sub>2</sub> P 18: GRCHANGE P 27: GRCHANGE P 34: GRCHANGE <sub>1</sub> , GRCHANGE <sub>2</sub> P 35: GRCHANGE <sub>1</sub> , GRCHANGE <sub>2</sub> P 36: GRCHANGE P 70: GRCHANGE
	Colleague's Notes	Note 7
	Student/Group Product	Sess 6: Poster-[A],[B],[C]
	Student Reflection	Sess 6: Posters SRN: S10, 13.03.95 SRN: S10, 23.03.95
<b>ANALYSIS</b>		
	Descriptive/Interpretive Report	I: p 4,10 II: p 13
	Analytic Theme Report	I: p 5,8 II: p 16,25
	Corroboration	RQ: 8c.g Colleague's Note 10 SIT III



**Table 14 'Self-Esteem' Audit Trail**

	ITEM	LOCATION
<b>DATA SOURCE:</b>		
	Research Diary	P 47: SHY P 55: SELF-ESTEEM P 64: SELF-ESTEEM
	Student/Group Product	Sess 6: Poster-[B]
	Student Reflection	'Best liked' list-S8 SRN: S5, 22.03.95
	Interview	SIT I: S1,S3,S5,S6,S8 SIT II: S1,S3,S6,S9,S11
	Lecturer Questionnaire	Item 5: Education
<b>ANALYSIS:</b>		
	Audiotape CL	Sess 6:[A]
	Descriptive/Interpretive Report	I: 2,11 II: 18-19
	Analytic Theme Report	I: 6-7 II: p 27,31-32
	Corroboration	RQ: 4p Colleague's Note 10

**Table 15 'Learning Environment' Audit Trail**

	ITEM	LOCATION
<b>DATA SOURCE:</b>		
	Research Diary	P 12: LENV P 70: LENV
	Colleague's Notes	Note 2 Note 3
	Student/Group Product	Sess 3: Group Rules-[A],[B],[C]
	Student Reflection	Sess 2: 'Best liked' list-S6,S8
	Lecturer Questionnaire	Item 7: Natural Science
<b>ANALYSIS:</b>		
	Audiotape CL	Sess 6: [C]
	Descriptive/Interpretive Report	I: p 2,4 II: p 18-19
	Analytic Theme Report	I: p 11,13 II: 20,28,32
	Corroboration	RQ: 12 j,k Colleague's Note 10 SIT III

**Table 16 'Student Induction and Motivation' Audit Trail**

ITEM	LOCATION
<b>DATA SOURCE:</b>	
Research Diary	P 12: STIND <sub>1</sub> , STIND <sub>2</sub> P 15: STIND P 18: STIND, STIND P 19: STIND, MOTIV P 32: ETHIC
Colleague's Notes	Note 1,2
Student/Group Product	Sess 2: Reflective lists, self evaluation Sess 3: Transcripts; Group rules Sess 6: Poster - Recon. II
Student Reflection	Sess 2: 'Best liked' lists-S7 Sess. 7: MO:[A]-S3,[B]-S8,[C]-S10 Sess 8: MO:[A]-S2,[B]-S5,[C]-S11 SRN: S10, 13.03.95, 15.03.95; S5, 20.03.95; S3, 15.03.95 SRN: S5, S11, S12, 22.03.95 SRN: S10, 23.03.95
Interview	SIT I
Lecturer Questionnaire	Item 2: Geography Item 3: History Item 5: Education Item 6: Mathematics Item 7: Education
<b>ANALYSIS:</b>	
Audiotape CL	Sess 12: [A]
Descriptive-Interpretive Report	I: 1,3 II: 10-13
Analytic Theme Report	I: 10-11
Corroboration	RQ: 2a-h SIT III

**Table 17 'Action-Research' Audit Trail**

ITEM	LOCATION
<b>DATA SOURCE:</b>	
Research Diary	P 1: AR P 6: RESTIME, AR P 7: AR P 11: AR P 13: AR P 16: AR P 18: AR P 19: AR P 20: RN; AR <sub>1</sub> , AR <sub>2</sub> P 21: AR P 22: AR, RESTIME P 23: RESTIME, AR P 24: RN P 27: RN P 28: RN P 32: RN AR P 33: ARDATA P 36: AR, RN P 41: RN, AR P 43: RN P 45: RN P 46: RN, AR P 52: RESTIME P 54: RESTIME, RN, AR P 56: RESTIME, AR P 67: RN P 70: AR P 74: AR, RN
Colleague's Notes	Note 1, 3, 5
Student/Group Product	Sess 1: reflective lists Sess 6: Poster pres.-Reconn.II
Student Reflection	Sess 1: reflective lists Sess 6: Posters SRN: S10, 13.03.95, 15.03.95; S2, 13.03.95; S3, 15.05.95; S5, 20.03.95; S5, S11, S12, 22.03.95 SRN: S10, 23.03.95 Sess 15: [A]-S10,[B]-S7,[C]-S12
<b>ANALYSIS:</b>	
Audiotape CL	Sess 6: [A],[B],[C]-REFL Sess 12: Participation reflections
Descriptive/Interpretive Report	I, II, III
Analytic Theme Report	I, II, III
Corroboration	Colleague's Note 10

APPENDIX XIV

RESEARCH DIARY CL NATURAL SCIENCE II SEMESTER I 1995

page 1

FRI 20.01.95

Discussion with Colleague

RES Cannot take 4 SP because of semester arrangements (this after I had analysed the 4SP topics since Nov 1994!) I am to take 2SP/JP for the research.

The focus for the semester is on plant biology.

TOPIC Topics - Cytology and Microscopy...Colleague (3 lectures)

Taxonomy, Morphology and Modifications

(Anthophyte) and Reproduction of Anthophytes

...Me

Plant-water Relations ...Colleague

Ecology ...Colleague

She asked me to develop a drawing module for 2SP/JP to be used by her for 2 periods for 9 Feb - agreed. First term - ~ 24 double-periods, ending 13.04.95

Second term - ~5 double-periods, 02-19.05.95 Major assignments to be given by Angela

Trench-gardening - Happy Valley, field trip (assignment - colleague)

Botanic Gardens - field trip

Classification Game - garden

Alien and Indigenous Plants - Palmiet field trip (assignment - colleague)

Herbs, shrubs trees - talk

Usefulness of plants

Hydroponics)

RN1

AR

Evidence to be collected from sources:

Student interviews...pre - experiences and perceptions of CL; later - around March

Research-diary

Student reflective notes

Audiotaped recordings

Colleague's observations

page 5

SAT 11.02.95

RN2

At the M.Ed. research meeting - discussed the student interview format with David. I showed him a list of questions that I had developed. He advised that I should interview all students; not to write down all the questions but to use major areas in a checklist. I will use the areas: Experience of CL, perceptions of CL, 'value' of CL

page 6

SUN 12.02.95

RN3

I constructed a checklist for the student interviews and a lecturer questionnaire (qualitative) to be administered to a few (6) lecturers from different departments.

Constructed a matrix??? Must show Prem.

RN4

AR

'Phoned colleague - she expressed a wish to observe all sessions -

agreed; but I warned her not to divulge observations until after I had

written my own reflections of a session - so as not to 'contaminate' my observations. We agreed on this and to discuss our observations later. Confirmed arrangement to interview students at 11h00 tomorrow (their free period).

MON 13.02.95

NOTE : I made a key for students' names

Edgewood

Discussed overall plan with colleague - agreed with general plan; expressed concern that I may not be able to complete but on studying it again she felt that I could.

AR

11h00 : Met with students - only 9 of 12 were present. I discussed the research context of my future lectures; briefly explained about their involvement in the research, introduced the idea of action research and spoke about the importance of their anticipated 'valuable' input. Introduced the interview to the whole group; obtained cooperation for audiotaping; agreed to interview at their convenience - one student (S12) wants to be interviewed at 07h30 tomorrow!

RESTIME

The interviews began at 11h20 and ended at 11h40 - conducted 3 (S10, S2 and S1). S10's, S2's and part of S1's were not recorded - stupid me! I did not push the record button! But I wrote down what happened at 11h50. S9's interview was at 13h10, and S3's at 13h20 during lunch break. 4 more interviews are scheduled for tomorrow at 07h30, 2 during first break and 1 during second break.

Today's interviews went off well; students seemed to be cooperative and not uncomfortable with taping; seemed to be candid.

The tapes are C30 - I had requested C90 ones and paid for them but AVE gave me the incorrect ones - I will change the others on tomorrow.

Distributed L-questionnaires: Maths, Eng, Educ, Physical Science, History. Still to give one to Geog.

Interviews See File (Interviews and Questionnaires) for summaries and notes on these

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UDW

Briefly met David informally - thanked him for the advice he gave me on the interview and gave him some feedback on the interviews conducted thus far. I expressed my concern about the unrecorded parts and that I had written down what I had remembered as soon as I could on discovering the omission - he empathised and said that the notes taken were a good idea.

I met Prem very briefly - updated him on the interview story and on David's advice; showed him the lecturer questionnaire which I said was qualitative. He commented that I was lucky to be on leave and 'congratulated' me on starting the research.

RN

\* I must ask him about the matrix!

page10

TUES 14.02.95

07h30: S12 did not materialise! But I apologised because he may have arrived when I went to my office for a while. I changed the tapes to C90. Gave geography lecturer the L questionnaire. Questionnaire returns - Science and English.

Interviewed S11 at 10h35, S8 at 10h45 and S5 at 10h55 - seems to be new ideas emerging, eg., groupwork in more subjects than were mentioned by the others thus far! S12 was interviewed at 13h00 - he was first one to mention a preference for individual work;

then S6 and S7 who spoke more than was anticipated - S4's was rescheduled for tomorrow first break.

S3's interview - he sat back, has a soft voice (poor sound on tape); but cooperative. Equated discovery learning to groupwork, idea that some members do not want to share ideas and that some are shy.

AR  
REFL

A few students asked for feedback on the interviews and I promised to do this at the beginning of the first lecture (tomorrow) - explained that I needed to so that we contextualise the groupwork that we are to experience.  
\* a good idea

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WED 15.02.95

The colleague expressed concern about the few students we have; she felt that they were frightened off by the physical science component. I consoled her with the idea that perhaps those 12 who chose the option are motivated and enjoyed the style of learning employed in her course last year (referring to the 'CL' component that students had referred to in the interviews. She mentioned that the 2nd year History class was large this year. Gave her some feedback on the interviews thus far and mentioned that the prospect of CL in the course this year seemed promising.

\*check

S4's interview was at 10h40 - he looks away when he talks; no eye-contact, but not in a 'shifty way'. It is as though he needs to organise his thoughts and how he has to express himself. It may be a cultural habit - \* check this out. The review of the interviews (intended as feedback planned for the start of today's lecture) incorporated V's responses.

AR

12 students: 6 men, 6 women.

- LENV  
AR Students dribbled in - probably because the session was after lunch.
- AR The colleague came in to observe - sat in front. I welcomed her and mentioned that she would be observing; welcomed students - felt at ease with them probably because of my interviews\* with them - we seemed to be able to interact better than is normally the case on meeting 'new' students - I remembered all but 4 students' names (i.e. S4, S6, S3 and S7. I confused S3's and S7's names - both are bespectacled and look 'nerdish' or is it 'gnerdish'!).
- REFL  
ETHIC  
STIND  
ETHIC  
STIND Gave a review of the interviews - perceptions and ideas - as feedback that was promised them. Asked if they did not mind if I mentioned names in examples of responses - they did not mind (they gave consent) and it seemed as though it was good for them...to place their views in context; and the transparency - seemed to help them encounter the views of others on group learning\*.  
Some students want to listen to the tapes - what about confidentiality here! I don't mind if they listen to their own taped interviews.
- GR-  
CHOICE Chose their own groups : 3 groups of 4 students each -A, B and C. Group A - S1, S2, S6 and S10; Group B - S4, S5, S7 and S8; Group C - S3, S9, S11 and S12.
- LANG Group A - all women with 2 English 1st lang. speakers; group B 3 men with 1 E 1st lang. speaker; group C 3 men all E 2nd lang.
- TOPIC1  
AR Gave group instructions on OHT - not a good idea, not to be repeated - time was taken for a member of each group to copy from OHT; rather give copies to each group!  
Asked for group ideas on each q; to make poster -30 min. Taped group talk.
- TOPIC2  
ETHIC  
AR Groups B and C asked for clarification of q 'why classify?'  
Introduced idea of taping the group discussions - explained the research context - and as aid to both lecturer and students - they agreed to the taping.



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FORMAT Groups were to complete the discussion and poster in 30  
TIME minutes. Group A completed in 25 minutes, C in 28 and A worked  
for the allocated time; seemed to be sufficient time for the  
LANG1 discussions.  
PP1 Presentations: Group B - S5 presented - articulate; she asked  
AC for input from S7 on 'why we classify' and from S8 on 'life  
ASSESS skill' (perhaps she did not understand the points); poster not  
too clear from where I sat - writing too small and poor  
background colour (pink sugar-paper) - perhaps some 'criteria  
TOPIC for posters should be given; groupings remembered by them, eg.,  
AC1 warm/cold-blooded (comment from S5 that "ladies, not men are  
mammals - invoked laughter); the question on biologists' ideas  
LANG2 on classification interpreted as 'why?'  
Their groups of organisms - relevant in certain contexts -  
herbivores, etc.; mentioned large animals only; bread mould as  
a plant - one that does not make its own food, but uses starch  
as opposed to 'phototrophic' (sic) plants.  
AC2 Alternative concepts: 'phototrophic' instead of  
'photosynthetic' - perhaps science language a problem here -  
term 'corrected' by classmate (S12) on cuing from me ('light  
feeding')  
I discussed terms - photosynthetic and phototropic  
- use of the suffixes -tropic and -trophic - to help clarify  
the terms  
PP2 Group C - presented next - S12 presented in his slow speaking  
manner; he apologised for what he perceived as a poor poster -  
he seemed embarrassed by it - said that he did not think it was  
suitable to 'hand-in'; classified organisms according to number  
of cells - 'unicellular' and 'bicellular' (sic) which he said  
AC3 meant 'many cells' - 'corrected' by class member (S10) aided by  
my cuing; water plants/land or terrestrial plants; sexual and  
'bisexual'; classification can be based on external appearance;  
'one/two-seeded (sic); and cold/warm-blooded;

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LANG1 He queried the terms 'classification' and 'grouping'- said that  
there was no conclusion about this in his group.  
AC4 When he completed the presentation I asked what they meant by  
'one-seeded..' and a group member (S3) responded - that some  
seeds can be 'divided' into two parts and some cannot - I  
prompted for the name of the 'parts' to which a class member  
said 'dicotyledon and monocotyledon' - I proceeded by  
explaining that 'cotyledon' could mean 'seed leaf' and how this  
could be seen in the bean and maize seeds.  
TIME Before group A's presentation I said that there was not much  
time for their presentation - I must avoid this.  
PP3 Group A - good posters (2) ; S10 presented - reported quickly  
LANG2 and well; articulate and fluent; they remembered many  
classification groups, eg., vertebrates - on poster; I  
AC5 questioned 'non-living organism' (on the poster and in the  
verbal report) - I spoke about the contradiction it represented  
- and suggested that they meant 'non-living thing or matter'  
Class questions: on classification and grouping - from group C  
- I opened it to the class - some felt that there was no  
difference, S2 and S7 felt that when speaking about organisms  
it should be classification and when speaking about non-living  
AC6 things, then 'grouping'; I mentioned 'chemical classification';  
another idea I gave was that 'classification' is a formal  
system and 'grouping' is the process that classification  
systems employ i.e. groupings are made within a classification  
system according to the rules (eg., based on appearance) of the  
system.

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AR TIME STIND PART1 I ended with a quick statement from each group - on whether they were satisfied with working in a group - positive responses from all - I feel good.  
I noticed that all members were participating. Unfortunately, we did not have time for each group to share their strategies with the class.  
Focus for next session:  
\* Presentation - report back is important ( may reveal alternative concepts which may need to be clarified - in this session there were at least one/group) - need to time these - equal time for each group - and still have sufficient time for questions and comments by students.

AC TOPIC PART2 TIME \* Clear instructions be given - without hampering creativity and imagination (keep questions like the one on biologists' ideas but rephrase it to get variety of students' and biologists' ideas and the links here)  
\* Check why S5 asked for input from her group members during her presentation - was it a strategy agreed upon by the group or was it because she did not understand their ideas - speak about this  
\* Time limits during group reports - allot time and let groups decide on how much to report and who should report - problem of 'slow-speakers' (but this may be a way for such a person to become more proficient)

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ASSESS GR- CHANGE1 AR-TIME REFL \* Criterion for posters - large and clear writing - get agreement on this.  
\* Redistribute members in each group so that there are two women and two men in each group  
Tape review: no time tonight - implication here - I have concentrated on action on management issues for tomorrow's session - but need to get feedback from students on their strategies - to plan Monday's session. Is it possible to go through 1 1/2 hours of taping tonight - to be prepared for a session at 08h00 tomorrow - all the Thursday sessions may suffer this fate.

GR- CHANGE2 AC DOM PART Tape - articulate students tend to dominate talk-time in each group - distribute these students in different groups as well as men and women; section on 'why classify' yielded most variety - open-ended? - generally the topic was appropriate for CL; AC - check 'air plant' with colleague, characteristic = group name!

GR-CHANGE  
EVNOTE  
LANG

Redistributed groups - 2 men and 2 women per group - prefaced it by (jokingly) saying that the women were working too well together; students were amenable to the change; resulted in one English first language speaker per group; groups were:  
Group A - S1, S2, S3, S4; group B - S5, S6, S7, S8; group C - S9, S10, S11, S12.

LROLE

I felt that the activity was worthwhile - students may begin to realise that knowledge about classification is constantly in a state of flux; they felt 'good' when they themselves figured out that a third kingdom was required - I congratulated them in that they took approximately 10 minutes to work out something that took taxonomists years. One person / group reported; each group generated ideas - some group conflict and consensus.

PART1

I need to stress the tentative nature of science knowledge, at the beginning of the next session; I had mentioned the 6 K system - I should give the separation of Monera in Archaeobacteria and Eubacteria next session, which is to focus on plant classification - the course for the semester focusses on plants - as designed by my colleague.

AR

I did not tape the group talk of this first activity - groups handed in the columns they drew up in moving through the stages of 2 to 3 to 4 kingdoms. This combination of group and class interaction during the session is appropriate for some CL - all were seen to participate.

FORMAT  
PART2  
STIND1

I think that my instructions were clearer in this session. Students seemed to enjoy the first activity - showed excitement, asked some good (critical) questions like 'what is so different about bacteria?'.  
The poster production activity 'what is a plant', took about 15 minutes and group talk was taped. Groups worked on-task in the allocated time - produced fairly good posters (better than the previous ones); sharing of ideas in the class occurred during the display. The evaluation of each group's poster by other groups was exciting for students, the colleague and myself; I guided the evaluation by encouraging comment and making comment on criteria: eg., awarding 1-5 marks for appearance (negotiated) - this was discussed in each group before scoring; content - I gave guidance in identifying and discussing some alternative concepts on the posters. Students seemed to be more conservative than my colleague and in allocating marks - I would have graded as follows:  
Group A:  $2,5 + 3 = 5,5$  ; thus 6  
Group B:  $4 + 3 = 7$   
Group C:  $4 + 4 = 8$

TIME

PART3  
ASSESS  
STIND2

AC

ASSESS AC STIND The content of posters were better than previous ones - showing the learning and alternative concepts - this should be reinforced by the article on 'plantness' given for week-end reading.

ASSESS MOTIV Students cooperated in evaluating themselves - each wrote a paragraph on what was learnt about classification, awarded a self-evaluation on evaluating their input during CL and 'least-liked' and 'best-liked' (on CL) lists. I am to score the paragraphs (1-5) and add the self-evaluation mark - this, together with the poster mark would give a total maximum mark of 20 / student - a combination of peer, self and lecturer assessment - which I think is fair enough - the student response assured me so - they were seen to enjoy the assessment process!

LROLE In the same vein, I feel that the session was well managed by me and that it was enjoyable, with learning taking place. I wonder what my colleague felt about it - I had requested that she refrain from making comment before I reflected in my diary - or what the students wrote!

AR My focus for the next session (without analysing the tapes or student and colleague reflections) would be:  
\* Continue with 'clear' instructions  
\* Continue with poster evaluation and the combination of evaluation

GR RULE ASSESS2 MONIT TIME \* CL rules may be needed to be generated by the groups  
\* Discuss group dynamics at the beginning - allocate enough time to review (students indicated that they would like such information - novelty? - seem to want to be involved in the research itself - should I ask them to edit written thoughts or is verbal confirmation sufficient?)  
Hand-outs distributed: 'CL', 'plantness'.  
Ended with individual writing of paragraphs, self-evaluation and lists - to help with subsequent action

- 16.02.95  
RN Analysis of tapes: 3 sets of tapes (side A of each - sessions 1 and 2) - should it be transcribed or should I just listen and pick out 'threads'? Do I analyse how each group is working together or should I go for overall impressions? Do I categorise 'events'?
- 18.02.95  
AR1 Worked on tapes until 15h00 this afternoon - see analysis and reflection (loose sheets in files, session 1 and session 2) -  
CL found it very difficult - especially S3's voice, and distinguishing between S1 and S6 in session 1 tape and between S5 and S6 in the session 2 tape - I suppose it would become easier with practice; wider range of input in CL; alternative  
PART concepts that were not seen on posters were detected. There  
AC1 more positive inputs in student lists; dislikes were on  
MOTIV identified constraints.  
ASSESS Should focus on alternative concepts, criteria for assessment of posters, time.
- 19.02.95  
AR2 Completed reviewing the tapes. This type of focussed observation is so important in evaluating one's lessons; developed 3 transcripts of alternative ideas (students call them 'misconceptions - I wonder if I should use the term!) that were 'ignored' by others in each group:  
AC2 Group A: about the endoskeleton (from session 1)  
Group B: about 'lazy' plants (from session 2)  
Group C: about 'carbon dioxide for plant respiration' (from session 2).  
Each group is to discuss one alternative concept - to be aware that such ideas may go unnoticed and to develop some strategy to minimise such 'ignoring' of certain inputs during the development of ideas. I will begin by using this next session; give some feedback on other alternative ideas; get groups to develop some ground rules - they were given a hand-out about some ideas on this at the end of the last session; then an  
GR RULE activity on classifying 10 plants from the Edgewood garden using a hand-out on plant classification.

AC1 Transcripts were analysed by students - illuminated how alternative concepts (AC) can be ignored in a group: group A was assisted by the colleague - detected; I looked at groups B and C; S7 raised the problem of language in detecting AC's - when I probed into a student's idea of plants being 'fed with water' by animals, he said that in siZulu 'watering' was regarded as 'feeding' ("In Zulu we say feed the plant with water"); but, I feel that S8 who is not Zulu speaking, should have picked up the AC and, furthermore S7, who identified this subtlety, should have made some input during the discussion in session 2. S8 commented that if I am "to write a book on this" I must include this language aspect! I asked them "are plants really inactive?" and they agreed that it 'lazy' and 'inactive' were unsuitable words to describe plants.

LANG1

AC2 Group C did not pick up the AC (carbon dioxide...for respiration) but instead focussed on the debate of 'night and day gaseous exchange' of plants. Perhaps it was too ambitious to expect students to detect AC's that they have 'ignored' in their talk - it is, however, a critical thinking activity which should be developed. I pointed out the AC for this group - members recognised this once it was brought to their notice - and that they had ignored it.

LANG2

AC3 The CL group rules generation activity (given partly to minimise constraints like 'dominance') - the discussion was taped, inadvertently - students routinely 'switched on' here - I thought that

LROLE

GR RULE

DOM

AR

AR the taping would interfere with their 'candidness' here - perhaps, on listening to the tapes this aspect would be illuminated. Students commented that it was a "positive" (constructive) activity. I did not collect their lists of rules - I asked students to keep them - I thought there was insufficient time to discuss them and, furthermore I mentioned to them that they could continue reflecting on the rules - I felt that a time be scheduled for more 'reflections' and constructions in the near future.

GR RULE

REFL

TIME

TIME1

RESTIME

TIME2

PART

LROLE

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LROLE feel that I have developed a habit of personal 'excitement' during lessons - I want to know what's going on in every minute of a lesson - it was difficult for me to refrain from 'interfering' with group ideas!

AR I will 'analyse' the tapes tomorrow - I find this a good idea -

RES TIME I am tired now and I may lose some subtleties; immediate analysis could mean also the loss of these subtleties - found that on re-listening to the tapes of session 1 and 2 I uncovered and learnt more.

AC There was a short discussion after the transcript analysis - emphasising that mistakes/AC's may be reinforced at times when members do not respond by 'clarifying' them (eg., in group A), that members are unable to detect these (eg., in group C), at times and that idiosyncratic language may prevent detection (everyday language as opposed to science language) at other times (eg., in group B).

LANG

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SESSION 4

WED 22.02.95

ASSESS I revealed and discussed the errors made on the classification task responses. Assessment process was discussed - students consented to methods employed thus far.

TIME The keying activity - I started with an introduction to keys - use etc. - using 5 flowering plant specimens from the garden (*Hibiscus teleasus*, mayflower, *Agapanthus sp*, hen-and-chicken and *Ricinus sp* [yellow-flowered] - developed a spider key on OHT using paired phrases.

TIME Student group activity - keyed 10 leaves (5 dicots - 2 compound leaved, 5 monocots). This took 30 minutes - all members were sen to be participating and groups were on-task.

Note: The second period of the double - the colleague conducted a 'classification game' to introduce students to concepts of 'advanced' and 'primitive' organisms - using a BSCS work sheet.

LROLE1 I used the time when students worked in CL groups to observe individual members working in their groups - participation was good all round, judging from the talk. I walked around to each group reminding them about their 'rules', especially about

MONIT 'dominance' - my perception (which I did not share with

GR RULE students) was that S2 in group A, S8 in group B and S10 in

DOM1 group C tended to dominate talk - these students are English first language speakers - could this be the reason for their

LANG dominance - or is it dominance? - S10's may be just

DOM2 articulating and summarising and the same may apply to S2; but in S8's case it seems that it's his nature to dominate - this was brought to his notice by other group members during the

LROLE2 rule generation activity! I will not intervene (for a while, at least) and I may not have to intervene (incidentally, he had mentioned in the interview, that the teacher should intervene and he may expect me to!). S2 and S10 are not perceived as

RN being really dominant by me - is explaining, clarifying the topic a sign of dominance generally?

ASSESS I showed students their assessment marks thus far - they seemed to be happy with them - some, eg., S8, commented that they were fair.

UTIL Students worked in their groups to focus on designing an activity in a lesson for a standard 5 class, on classification and to consider the context of the activity in the lesson -

FORMAT they were given approximately 50 minutes of discussion time and 20 minutes of reporting to other groups. S4 presented for group A, S8 for group B and S10 for group C. Some reference books were made available - these were not used! - why? - were students confident enough with their own ideas/pooling of ideas?.

AC I referred to the general ACs that I gathered on listening to the tapes, as far as the classification exercise was concerned, eg., that non-Plantae plants were classified in appropriate kingdoms, but were then placed into Plantae divisions (like, Kingdom - Protista, Division - Bryophyta, or non-anthophyte plants being given monocot and dicot class names!)

TOPIC I gave an advance planner pertaining to tests, a seminar (on alien plants given by the colleague) and a group research seminar on germination; I also reminded them about the deadlines for the project given by the colleague on 'trench gardens'.

PART The colleague made some input in reinforcing my instructions during the introduction to the CL activity of the session. S10 - a JP student - was very amenable - she went along with the idea of developing an SP activity, although she was given the choice of working with a JP activity - her group decided that they would help her develop JP one or develop activities for both SP and JP, if such an occasion arose in a subsequent session.

GR PRES Each group generated ideas on activities - the reports were made for the purposes of sharing; no formal assessments were made - but I



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RN collected their written ideas - perhaps as data.  
During the discussion group B again asked for clarification on the issue of the 'classification-grouping' question.

UTIL Group A - idea of grouping foods; group B - idea of grouping cutlery; group C - idea of using leaves collected by children to group.

GR SIZE The comments from students were brief. I urged students to build a 'bank of ideas' which may help them in the field.

PART Group B's idea of working with 5 pupils/group in a class of 35-40 - I should ask for feedback on group size.

TOPIC Students were on-task for the activity - much discussion - perhaps the nature of the task, its open-endedness had contributed to this - not taped!

UTIL S8 attempted to walk across to group A at one stage - he was stopped by the colleague and he returned to his group; did the colleague feel that his input was needed only in his group? - perhaps he needed to clarify something; I did not intervene here, but commented that S8 tended to walk around like in visiting the toilet during the last session; I should look into this aspect of intergroup contact during CL, however - collaboration here may have an impact on collaboration on curricular matters in the field. Do students want to change their groups? - a broader range of ideas could emerge; one reason for changing could be to eliminate intergroup competition - I should speak to students about this, especially since most felt, at the interviews, that intergroup competition is a motivating factor; another reason for changing groups may perhaps be 'boredom' or 'saturation of ideas' within a group!

UTIL  
GR  
CHANGE

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AC Handed out an extract from an article on AC - *Young Peoples Ideas about Plants* - to each student for reading.

RN I need to appraise with students:  
\* the sessions that were conducive/not conducive to CL?  
\* the sessions in which each participated most/least  
\* ideas for enhancing the CL  
\* what was learnt about facilitating CL

UTIL \* discuss how they could try any strategies learnt

AC \* discuss the 'AC' article - resistance after formal instruction

Note: Monday - meet students and colleague at Botanic Gardens

RN I had started the cycle by focussing on constraints and other aspects were revealed - AC's, assessment, etc. - probably the AR approach?? - other approaches may not obtain this (one aspect at a time)!

REFL I gave a brief exposé of where the research was, using an OHT  
 RN (showing the cycles of reflecting, planning and action) and of  
 ETHIC where they were in the context of the course. I spoke about  
 REFL reflection in practice as a subconscious and conscious action;  
 DOM about the methodological implications of reconnaissance and the  
 LANG need to for it if we were to practise CL effectively. Students  
 TIME1 agreed with the idea of using the session for this. I had given  
 AC a memo about this plan to the colleague on Monday - she also  
 GR agreed to it.  
 SIZE I started by focussing on ideas I had isolated from the  
 RULE analyses of 5 sessions of the first cycle - including ideas  
 TOPIC given by students on: 'dominance', 'language', 'time  
 constraint', 'alternative concepts', 'group size', 'group  
 rules', 'appropriateness of topic' and 'changing groups'.  
 TIME2 These aspects were summarised in a hand-out, given to each  
 student, highlighting the dilemmas involved. They spent 40  
 minutes (approximately 5 minutes/aspect) in group discussions  
 of the aspects and to make a poster outlining statements made  
 on each aspect - these were presented in the class report back.  
 AR Group A's discussion on 'language', group B's on 'dominance'  
 and group C's on 'ACs' were taped.  
 PART All members of each group were observed to be participating in  
 TIME the discussions. I prompted them with reminders of time and it  
 LROLE was difficult

TIME for them to round off in the allotted time - some extension  
 LROLE (about 5 minutes) was given - a few students indicated that  
 PART there was much to discuss - students were perceived to be on-  
 task. S9 in group C was quiet, however - but was listening.  
 The colleague seemed very excited and she voiced the feeling  
 that "this is so good for students" and that it will help them  
 in their practice - something that we spoke about in an earlier  
 conversation. I responded by suggesting that she move around or  
 stay with one group to get a general 'feel' of the discussions  
 - it seemed as though she wanted to join the discussions, but  
 she held back here. I perceived this resistance to intervene an  
 AR-DATA a positive light. She also apologised for not observing all the  
 sessions and I assured her that the observation notes that she  
 had made thus far were a 'tremendous' help - I later showed her  
 some of the cross-referencing I had made using her notes, my  
 observations and other data - I perceived that she felt good  
 about her contributions!  
 LANG I found out that S5's home language is siSuthu and not siZulu  
 as indicated in the records; other students are Zulu speakers  
 (except for S2, S8 and S10 who are English speakers). I moved  
 LROLE around among the groups, not spending too much time at each  
 group for fear of interfering, but as a general 'check' of on-  
 PART task behaviour (which was positive); reminded them about the  
 posters;

PART I heard 'snatches' of talk - vis-a-vis, explanations, debate,  
TIME1 consensus making.  
The report back occurred after about 45 minutes of CL - each  
LANG1 group was given 5 minutes to report.  
TIME2 Group B: S5 reported (for the first time); the poster was clear  
and 'good'; she was articulate; the main ideas were those on  
AC1 the poster; mentioned that second language students took longer  
to express ideas; requested S7's input on AC and it seemed that  
she had not internalise this - she found it difficult to  
express it; mentioned that as 'students' level' increased the  
ACs were taken care of; with help from members she indicated  
FORMAT that an appropriate format would be a class introduction by the  
teacher followed by group discussions (S8's input) to allow for  
'some knowledge' that learners have, i.e. not to pre-empt such  
knowledge (S& added that teachers may be 'surprised at the  
GR views from children'; felt that 'new' views from others are a  
CHANGE1 plus when groups change, that group rules were necessary and  
GR SIZE1 that they opted for a group size of about 6 members.  
LANG2 Group A: S3 presented (for the first time); articulate and  
DOM1 fluent; presented the idea of 'intentional' and 'unintentional'  
LANG dominance - sometimes necessary for progress; that ideas were  
difficult to express by second language speakers - S4  
AC2 elaborated here; that time was limited in the sessions; that  
report back helps clarify 'misconception' (sic) and that  
teachers should guide here; S2's input on group size - depends  
GR SIZE2 on the size of the class - if large, then opt for larger  
GR RULE groups; that group rules are necessary; that CL is appropriate  
TOPIC for problem-solving; that changing groups is a good idea in  
GR that it develops the skill of working with different types of  
CHANGE2 people.  
LANG3 Group C: S12 presented (second time); expresses ideas clearly  
TIME3 but slowly (I expected the allotted time to be extended  
LANG somewhat - this happened!); said that group work helps with  
DOM2 language proficiency; that no member should be dominant - this

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TIME1 could be facilitated by delegating work; that time should be  
GR RULE determined by the way in which it is used; that rules were  
GR necessary; that the sessions were appropriate for CL; that they  
CHANGE1 felt that changing groups was not a good idea because people  
GR SIZE1 'bond' in a group; that they opted for a group size of up to 8.  
TIME2 There was not much time left after the reports; my input at  
LROLE this stage was limited to questions that I posed - to encourage  
REFL reflection:  
DOM \* on what strategies could we use to limit dominance  
TIME3 (intentional or unintentional) - how can talk-time be limited;  
what if what is said is perceived as worthwhile!  
LANG \* agreed that language proficiency may be enhanced by talking -  
how should this be encouraged?  
TIME4 \* time may be a constraint almost in all cases - a topic may  
engender many ideas - how do we manage this?  
AC \* ACs may be reinforced instead of being 'clarified' -  
especially those that remain undetected - I have detected some  
because of playback of tapes - how can a teacher detect as many  
as possible in the event of many groups at one time?  
GR SIZE \* size - posed the idea that even where 4 members are working  
together, some people's ideas may not be taken, heard etc. - if  
groups are larger, what then (students agreed that it should  
remain as 4)  
GR RULE \* group rules may be necessary - helps unpack problems  
TOPIC \* topics - are all appropriate for CL?  
GR \* agreed with the idea that changing groups exposes a range of  
CHANGE2 other ideas; and that the report-back helped with this sharing  
of ideas - what if members are 'bored'; what about intergroup  
contact during group CL; what about whole groups 'connecting'  
at times?

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TIME I need to reinforce the idea of keeping to allotted times  
MONIT I introduced the idea of member observation - one person in a  
group observes during CL - as a type of monitoring (as a  
AR response to the group rules) and as part of the research (to  
RN obtain data); and the idea of students writing reflective notes  
(in keeping with the idea of how it has helped me and how  
important my observations and reflections were in the planning  
of action) - the class seemed amenable to these suggestions - I  
gave each student a hand-out with some guidelines on  
observations and reflective writing; member observation was to  
be done on a rotating basis.  
GR I asked students if they wanted to change groups - all wanted  
CHANGE the groups to remain as they were.

MONIT1 I gave guidelines on member observations - and that it be  
LANG rotated; clarified procedure for all 3 observers (S3, S8, S10)  
- idiosyncratic language. S3 decided to observe and not give  
any input, S8 and S10 gave input and observed; S8 was seen to  
MONIT2 give more input than S10 did in the group. Posters were drawn  
TIME by S1 in group A, S7 in group B and S12 in group C.  
The first set of posters were displayed on time (within the  
AC1 allotted 10 minutes) - showed some ACs, eg., group A did not  
identify the 'grass stem' and when questioned about this the  
members could not explain (I had expected them to say 'because  
it was hidden'), group B's types of roots.  
The 3 major parts of the anthophyte plant were reinforced as  
AC2 the 'root', 'stem' and 'leaf' in the class discussion. I  
deliberately ignored the AC on types of roots (I explained this  
strategy to the colleague) so as not to pre-empt the subsequent  
discussion. Groups chose the part they wanted to discuss in the  
next CL activity: A - stem; B - root; C - leaf. I spoke about  
ASSESS assessment procedure. The 'participating' members all gave  
PART input - there was much discussion and members helped with  
LROLE posters. Group A appealed for my help with distinguishing  
between 'trunk and stem' - I responded by asking if members had  
tried to answer; asked S3 who did not respond at first  
(apparently since he was observing)

but who said that he did not know on prompting; I proceeded to  
guide them by asking about the 'stem' of a young tree and about  
what happened to this 'stem' as the tree grew - the group  
TIME agreed that the term 'trunk' is really a mature stem in some  
plants. I also clarified their idea of distinguishing between a  
PART 'plant' and 'tree'.  
I gave time prompts - the allotted time was used; the last 1/2  
hour was used for the report back using posters.  
Group C - S9 presented (first time) - she seemed to be at ease  
and she was fluent; gave a working definition of the leaf -  
somewhat incomplete (part that manufactures food); functions  
AC1 included 'respiratory organ'; monocot leaves do not have  
midribs; dicot leaves have petioles; S10 added - shapes differ,  
succulent etc.; S7 questioned the 'use of sunlight for food'  
and commented that it does not mean that we can manufacture  
food - good explanation given by S12 here; questions were  
AC2 directed to the whole group. S8's question on the 'midrib' led  
LROLE to my guidance in identifying the AC and clarification of the  
AC (on ascertaining that there were no more questions); I  
highlighted the distinction between gaseous exchange and  
respiration (after S7 mentioned that the stem may also be  
regarded as a respiratory organ because it has lenticels); I  
mentioned that many dicots have sessile leaves. The appearance  
ASSESS of the poster was good. I encouraged them to modify their  
working definition and to try to get the technical definition.  
I expanded on the concept of modified leaves in buds. I  
mentioned that the topic for the next session would be  
'modifications'.

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PART Group A - presented by S2 (first time) who asked for input on 'hairy' stems from S3 and on another aspect from S4; poor poster appearance - was a list of ideas, not organised into sections asked for and not in the order asked for; working definition - it is 'central' between roots and leaves; ACs included 'some stems have nodes and internodes, some bear flowers (perhaps based on their observation which they mentioned about flowers growing directly on the trunk of a tree at Botanic Gardens); S5's question on the definition - S7 responded and I elaborated on the idea of a working definition; S12 asked about 'hairy' - S4 explained. S7 spoke about 'certain' cells that are involved in 'directing leaves to the sun' - I mentioned that the aspect of 'phototropism' involved plant hormones - will be discussed at a later stage by the colleague. I asked them to find a technical definition; clarified the ACs.

TIME1 Group B - S7 presented ; somewhat rushed - time problem (that is why we decided to rotate the order of presentation); 'Definition' on poster; working definition using functions; types - adventitious and tap; 'root hairs' instead of fine lateral roots; no responses because of time. I clarified ACs and asked them to find a technical definition.

AC2

TIME2 Managing time was strictly controlled by me, although the LROLE questions raised during class discussion took up time - I found that I had to stop and summarise at times! The colleague observed; questioned me about the strategy at the beginning on why I did not expand ideas during the First poster presentations.

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TIME The session ended abruptly - peer group assessment was FORMAT postponed to Wednesday. I spoke about the general plan for the next session - asked students to gather information on modification of the plant part that their groups chose so that ideas may be pooled in the next session. I reminded them about MONIT reflective notes on the session - urged them to do these as soon as possible, preferably today.

AR The colleague commented on the 'good constructivist' nature of RN the session. I commented on the value of AR. I also explained the ideas of working and technical definition - she had asked me about what was acceptable - and the relevance of each type for the level of schooling and everyday life.

PART Students had shared and pooled ideas - I perceived that much learning had occurred.

MONIT Student observations on dominance, language, ACs, rules, participation and evaluation were handed in - to be analysed. The group talk in the second activity was taped - about 20 minutes.

DOM It would be interesting to listen to group B since S8, perceived to be potentially dominant, was observing;; and group C since S10, the explainer and clarifier was observing!

GR RULE Groups seem to be rotating role - at least those of presenter and recorder.

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ASSESS My tentative assessment:  
appearance(5)+content(5)+presentation, response(5)+  
productivity(10) (25 max):  
A: 2 + 2,5 + 3 + 7 = 14,5  
B: 4 + 2,5 + 3 + 4 = 13,5  
C: 4 + 2,5 + 4 + 5 = 15,5

REFL I started with a review:  
 RN monitoring - explained member observation, reminded students about their reflective notes since none were forthcoming; gave some feedback on classification; asked students to reflect about group size - that it should be decided not merely on the basis of convenience, but on the anticipated participation level as well; asked them to reflect on the aspect of appropriateness of all topics; suggested that if individuals would like to change groups they should indicate this to me (at which stage the colleague expressed the idea that they were 'old enough' to be open and let all know).

TIME We negotiated that questions during class discussions be limited to 1 per group. I asked if each group decided who was to present before or after the CL activity (I wanted to find out if there was a link between this and participation of the presenter) - A: after, B: before, C: after - I then indicated the basis of my curiosity (so S9's perceived increase in participation may not have been due to her anticipated presentation, but on the other hand, groups were rotating roles and perhaps she knew that it was her turn to present).

PART I shared that not all ACs were revealed by the posters and other products, although I found that students had suggested that products adequately revealed them, that group C had felt that clarification of an AC be given immediately and other groups felt that 'hindsight' shifted ACs. I suggested that such ACs may be more difficult to shift partly because of the social approval (peer approval) aspect in a CL group and may even be reinforced - asked students to reflect on this.

AC Peer group assessments of the posters of session 7 were made (appearance[5]+content[5]):  
 A was given 2 = 3 = 5; B 3 + 2 = 5; C 3 + 2 = 5, by the two other groups in each case.  
 The colleague commented on this -

ASSESS she suggested to students that they need to substantiate their assessment since she could not understand why group A had 3 for content whereas others had 2! I suggested that I expected

LROLE students to be careful in awarding marks especially since I had guided them at assessing the content of a poster during our first experience of such assessment and that I did not expect to continue with such guidance by me! Furthermore I had circled the problem areas on the posters of session 7, prior to this session! Perhaps students are not assessing carefully and fairly - they needed to be made aware of this (as was done by the colleague and myself).

RN I pointed out also what I had learnt from listening to the  
 AR tapes of the discussion related to the posters: that group A seemed to be the most productive but that their poster did not reveal this - I gave examples of the ideas that were not used and I posed the implication for classroom practice. I shared the realisation that assessment of group work required that the teacher needed information on how the group worked in producing a product - but how can this be done, apart from the teacher actually observing the group (a dilemma similar to the one on ACs). I proposed that we look at ways to accomplish such assessment and suggested my idea which was to be used in this session - that groups draw up 2 columns and enter ideas that were used and others that were not used in their products - suggested that in the classroom they could draw a light bulb in one column and a bin in the other (laughter). I suggested that

AC this may also help in the detection of ACs.

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RN PART1 I requested that the colleague focus on students that I perceived as fluctuating in their participation (bordering on the least participative in their groups) viz., S1 in group A, S6 in group B and S9 in group C. She concurred that these students were perceived as such by her, but I think she did not comply with my request!

FORMAT Students had been asked to research 'modification' of the relevant chosen plant part and information gathered and ideas were pooled, at the end of which posters each displaying modifications were made (taped activity). The observers - S2 in A, S5 in B, S12 in C.

TIME1 I decided not to give time prompts - but at the end of the  
TIME2 allotted 15 minutes I asked them to stop and display their posters. Group C managed to display 3 out of the requested 4 modifications - cactus spines, cabbage leaves and leaf tendrils (garden pea); group A had 4 modifications but they not clear and did not give relevant plant examples - tuber, bulb (did not indicate the stem), runner and vine; group B did not understand what was required - produced poor examples, were 'off the topic' - 'metaphore' instead of pneumatophore, primary root, 'sinkers', fibrous root. I discussed some ACs - the ones on A's and C's posters (omitted B's inadvertently - time?).

AC1 Student participation was good during the CL activity. I  
TOPIC suggested that each group make their lists of 'used' and  
AC2 'discarded' ideas (so that I could correlate these with the tapes). I had indicated that I would evaluate participation and that I would not include such evaluation of the previous session.

PART2 Students were given the last 25 minutes of the session to  
AC3 prepare for their 'teach' presentations on the modifications scheduled for Wednesday - each group needed to prepare a 20 minute activity and relevant notes.

ASSESS I find the AR approach satisfying and revealing much that I would have 'missed' in implementing CL.

AR

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PART Although they were free to visit the library, nobody did this; they consulted the books I had made available, some students were chatting (not on-task), some spoke with the colleague about a field trip that was scheduled, some asked about the planned test. I handed out the advance planner which scheduled the remaining sessions.

ASSESS I requested that each group plan a 10 mark question on modifications for inclusion in the forthcoming test. I handed out possible topics for the presentation of experimental work on germination - groups were requested to indicate their choice of topic.

ASSESS The posters of the session were to be regarded as outlines to be built on for a chart to be used during the 'teach session'. I indicated that the 'teach' presentation, the chart and the notes were to be assessed.

Note:

RN \* the colleague's notes were somewhat procedural in nature in  
AR that they represent a record of what occurred during sessions.  
\* I will do the tape analysis tomorrow  
\* discuss report 1 with the supervisor - Friday 13h00  
\* next reconnaissance - 22.03.95



Students continued with planning the 'teach' session scheduled for Wednesday.

I discussed the concept of 'modification' with group B. I asked the students about their biology background - S11 did not do matric biology (attended school under a previous system whereby a choice was made at standard seven entry - he chose physical science).

AC I reminded student about the columns of 'used' and 'discarded' ideas. Groups were observed to be on-task - participation seemed high with much collaboration. Group A asked if a lesson plan was required - I responded by saying that a brief description would suffice and that the focus for me was to observe how the lesson was taught since it would give me an idea of the learning that occurred about CL and about modifications. I mentioned the link between teaching each other and cognitive rehearsal, especially for second language speakers - I shared this with the other groups as well.

LANG I mentioned 'shy' people in conversation with group C and asked SHY S9 whether group work helped her with this - they suggested that in the peer situation shyness may be overcome - I agreed with them and said that we should exploit such situations to develop confidence.

PART3 With group B I mentioned that I did not think that anybody was LROLE shy in the group - they agreed; spoke about what I perceived as constructive use of conflict in their group - S5 suggested that people learnt with conflict - I agreed that I did; I shared that S6 may have not entered the conflict situation to which S8 responded "she sides with us" (meaning S7 and S8). With group A ideas were sounded off me - it seemed that they were looking for confirmation; I threw ideas back to them; they were 'bogged down' with 2 types of modification (storage and reproduction in the rhizome corm and runner) and could not think of more - I guided them to 'photosynthetic' stems as another type and asked them to generate one type more.

REFL I also discussed the exploitation of some individual skills that people had, eg., drawing, conflict resolution ones, understand meeting procedure - S11 is conversant with conflict resolution and procedural skills in that he had experienced being a 'shop steward' and a chair of a paper union, S7 has recently become involved in an education forum. Note: such sessions may help a teacher to get to know more about students - by chatting to with groups who seek help and by sharing what other groups have been doing. S4 and S11 borrowed books from me.

PART The colleague did not write observation notes - but she mentioned that the groups were working well in 'delegating'.

UTIL Presentations - teach sessions by each group - observed and  
ASSESS assessed by the colleague and myself - rescheduled for today  
instead of Wednesday (because the field trip was rescheduled).  
I requested that 'ideas columns' be handed in.  
Group C: S10 and S11 presented (leaves); S11, the 'teacher' -  
brief introduction then activity - 'pupils' to discuss and  
record on paper, agree on what is to be reported; 'pupil'  
groups discussed for 5 minutes (time was not stipulated; S10  
the 'assistant' summarised reports on chalkboard; S10 was  
'teacher' for the subsequent explanations. In my comments -  
some positive feedback - use of constructivism, use of chart  
during explanations; some negative aspects - all features were  
requested from one group, other groups were not asked, the  
onion leaves were not located by the teacher.  
Group B: S7 was 'teacher' (roots); pictures were distributed to  
2 'pupil' groups - each discussed for two minutes; developed  
idea of modification; gave topic 'roots'; used chart - revealed  
1 modification at a time - asked each group for the main  
function of the part; explained what a root and the modified  
root and listed functions; completed in 11 minutes. My comments  
- some positive - good use of chart; some negative aspects -  
incorrect spelling of pneumatophore; pictures were discussed  
while 'teacher' stood in front; self-appointed reporters; AC  
that prop root was for 'protection'; 'telling' method for most  
of the period.  
Group A: S1 presented (stems); distributed specimens - did not  
instruct that 'pupils' discuss; 'teacher' asked questions. My  
feedback - a positive aspect- questions led to idea of a  
modified stem; negative - nodes and internodes were not  
mentioned, incorrect spelling of 'tuber', some poor questioning  
(eg., what is it?), individual answers and not group consensus,  
no discussion of incorrect responses runner 'for protection of  
soil').

AC

ASSESS Presentations were mediocre generally. I tentatively awarded  
group A 11/20, B 10/20 and C 13/20. I conferred with the  
colleague who agreed on the lessons being 'mediocre' - made  
assessment reports for each group (chart[10] + notes[10] +  
lesson[20], max 40: A: 6 + 6 + 11 = 23; B: 6 + 5 + 10 = 21; C:  
4 + 7 + 13 = 26.

PART The overall ranking seems to reflect the participation in each  
group. Group B seemed to recover from their initial AC of  
'modification' - but seem to be confused about types of root  
systems and types of roots. Generally the notes compiled by  
groups had many errors - reference handouts were given.

MONIT I ended the session with some housekeeping eg., reminded  
students about reflective notes, group generated items for the  
test, arrangements for the field trip, ideas columns,  
germination research.  
Made arrangements for interviews.

RES Interviewed S3 at 10h40 - only one interview was possible. I  
TIME planned these interviews to focus on participation - S1, S3,  
S6, S7, S9, S11.  
Field trip (conducted by colleague) - Palmiet Nature Reserve -  
on alien plants (project given to each group); successful in  
promoting cooperation and understanding the context of alien  
plants; students were shown how to remove these plants;  
students helped remove some...

PART Research session - alien plants  
I helped the colleague here...It was encouraging to see students work in their groups; self-responsibility noted; on-task; some students gave me their reflective notes - I reminded others about these; lists of ideas handed in by groups A and C; organised interview times with S1, S6, S7, S9 and S11.

RES TIME

RES TIME DOM  
RN  
AR

Interviewed S1, S6, S9 and S11. All seemed more comfortable than the last set of interviews, good rapport, not self-conscious; used a checklist for aspects of participation like dominance; S3 (yesterday's) and S11 seemed to understand the questions better than others; S1 and S9 were cheerful - I needed to rephrase some questions for them; S6 - responded to what was asked, not much elaboration.

I explained why I needed to interview them - that 2 from each group were selected to 'check' on perceptions and to focus on participation; they seemed to be honest and open in their responses - it was not as though they were trying to give what they perceived I wanted - I was slightly concerned about this aspect, especially since I had to rephrase questions (where I consciously tried not to 'lead' their responses).  
I felt good after the interviews and am excited about what I am doing. Action-research is really illuminative! So much that we take as 'for granted' is revealed!

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PART1 Some of my perceptions seem alternative to their ones - eg., S9 sees herself as participating well - but I see this as in the technical sense (not in that her cognitive participation is high), and S6's input that she is always participating; while others were affirming - eg., in the cases of S1, S3 and S11. I've realised another perspective to S11's help given to S9 -

PART it may be that his past experience at negotiating as a shop steward etc. may have equipped him in this respect and that it is not the kind of 'patronising' help that I had thought about.

SELF- Self-confidence seems to have increased all round and ESTEEM dominating patterns somewhat resolved (not as well in group A DOM as alluded to by S1). Topics that seem to have priority in evidencing good participation seem to ones in reconnaissance. The session involving the first modifications poster seemed to be rated low in participation (as confirmed by the tapes for TOPIC groups B and C). The way the topic was interpreted by these groups seems to be a problem - perhaps if this is considered and certain strategies (like allowing each member to give an example) participation in such a discussion would be enhanced.

PART2 All agreed that the conceptual base of a member, partly TOPIC determined participation levels and that clarification of ACs enhanced participation; that language proficiency was not a significant factor for CL participation (although time and PART3- language proficiency were linked); science language seemed to COG be the 'leveller'; giving and receiving help were seen to LANG benefit members generally.

RN S7 did not present himself for the interview - no apology sent. I should listen to the tapes (about 20 minutes each) to construct a report by Monday; prepare test.

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ASSESS At the interview I mentioned the idea of pair responses to certain test questions to S11 - he did not find it suitable at first. After the interview I probed this aspect with him - gave my experience of developing such items in an 'energy' package I had developed - he found it interesting and thought it was

LROLE worth trying out in the test - I am tempted to do just that! I wonder what types of questions groups will submit on Monday morning - what if I find them unsuitable - hope not - perhaps I should have added that the questions were subject to editing! It seemed that students were generally motivated to give information at the interviews - perhaps they feel that they are helping improve the CL practice.

RES TIME I will not be able to schedule an interview with S7 before the next session.

AR I find that this way of teaching reveals much that would have eluded me before - how did I ever cope with evaluating my lectures before! I need to write these reflections - part of my research question.

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SESSION 11  
Test Session

THURS 20.03.95

ASSESS Items 1-5 were constructed by me; items 6 and 7 by the groups - group C submitted early, but groups A and B at the start of the session - the colleague kindly made copies.  
Queries during the test: from S1, S4 and S7 on the 'key' - I explained this to the class; from S11 on the word 'critique'; S3 asked the colleague whether he should answer the question on stems (item 3).

TIME Students were given a time prompt when 1/2 hour remained - so that item 5 (the pair work question requiring 10-20 minutes) could be done - they completed this in 10 minutes. Some extension of time was given to students in order to complete other parts of the test; S12 was the last to complete - needed about 6 minutes beyond the time.

REFL S5 submitted a reflective note.

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21.03.95

AC Marked the test scripts - disappointing results - still ACs even on items requiring just recall!  
It seems that students are not familiar with 'critique' type responses; collaborative work in test situations.  
Keying activity - not well done.  
Group generated items - A's question was not clear.  
Need to review test - perhaps on Thursday.

REFL Reconnaissance hand-out - to be prepared - may have to explain some terms.

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SESSION 12

WED 22.03.95

Reconnaissance III - Participation

The colleague excused herself - went to Umgeni Valley; distributed the booklets on trench gardening for the colleague. We used another room for the session - stocktaking by the lab assistant in my room.

MONIT Distributed and read through the hand-out with students - expanded and explained at places, eg., the meaning of 'cognitive', 'reflect'; used the OHT (on cycles) to contextualise the activity; gave the emphasis for the reconnaissance as 'participation and equity'.

TIME CL activity began at 13h52; students seemed on-task, much discussion observed. Step 1 ended at 13h58 (adequate time allocated); spot check on order of inputs - in A S3, S2 then S1, S4; in B S7, S8, S5 then S6, in C S11, S12, S10 then S9.

PART1 Step 2 by 13h58, stopped at 14h03 - much writing and group talk; S1 in A, S6 in B and S9 in C seem to be least participative in their groups; spot check - S7 and S8 seem to be 'chatting' to each other - I asked if they had completed and I suggested that they move to step 3 if they wanted to.

PART2 Step 3 - B started at 14h06, completed at 14h13; A from 14h07 to 14h13; C from 14h08 to 14h14.

PART3 Step 4 - poster - stopped at 14h25 - much discussion; S1, S5 and S12 wrote on posters.

FORMAT Presentation - A presented, then class discussion; B and C presented followed by a combined discussion.

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PART1 Group A: S2 presented; poster title 'CL Session'; some explanation. Recommendations made by the group included -  
TOPIC question be clarified for the whole group for CL - lecturer important here eg.. in S4's understanding of 'experiment' in  
GR RULE1 step 1 (noticed by me); a member's talk should not be disturbed - because idea may 'disappear' (I said that this was often noticed by me); every member should be given a chance to talk;  
PART2 share work to save time (I suggested that roles, eg., scribe, could limit participation); every member should 'pay attention'; 'listen to instructions'.  
PART3 Group C: S9 presented - read the poster; poster title  
GR RULE2 'Participation Equity'. Recommendations - each be given an equal chance to express views (I commented that deliberate 'rounds' may ensure this); all members must participate in a discussion; put a statement to the group to clarify before a conclusion is reached; all members should listen; statements made should be 'to the point'.  
DOM  
GR RULE3 Group B: S5 presented - with explanations; poster title 'Future Strategies'. Recommendations - all members must understand the question; all members be given an opportunity to contribute; points or ideas given must be clarified; members should be given the opportunity to say what they think of the question - whether it is right or wrong; conclusion should be reached ( I asked 'even if more than one' - they agreed).  
I brought to their notice the different titles of the posters, that each group had developed their own strategies, that each group was unique in this.  
Questions: from S5 about a person generating an idea and not clarifying - S12 responded that it is important to clarify, as a strategy to obviate domination; from S4 about the omission of a diagram in step one - my response was that it was a deliberate ploy to enable students interpretation and for groups to develop strategies if member(s) could not understand the question - S7 spoke about this as a good strategy in a class situation.  
MONIT I spoke about 'listening time' and a strategy employing the 'timing' of this, especially if a group had a problem with it; commented on the usefulness of reflection, even with children; commented on a reflective note about 'free-riding' and its  
PART4 implication for participation;

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ASSESS emphasised the idea of equity.  
MONIT I mentioned that the test scripts would be given back to them tomorrow after a poster session; reminded some students about reflective notes and the reports on the 'germination' project.  
PART I must speak more about 'listening' strategies.

I reviewed parts of plants and their functions; posed function of flower as question. Introduced activity - to discuss ideas on how anthophytes reproduce and to present a poster. The colleague arrived at this point.

PART1  
MONIT I reminded students about their group ideas on participation in the last session and the strategies that they had decided on; the colleague asked students if they found the reconnaissance session worthwhile - S2 said that it made them aware of certain interactions and that with practice participation in each session was an improvement of the last.

AC1 Group C: S12 presented - explained poster well; said 'floral plant' instead of 'flower' (clarified during question time); concept map showing dichotomy of asexual and sexual with some drawings - asexual as part of plant that produces a new plant, sexual as ovum + male gamete, then pollination by wind, water, insects or self, then fertilisation, then seed, then new plant.

AC2 Group B: S7 presented; explained well, but 'seeds' instead of 'ovary' - discussed sexual reproduction only - said that they had discussed asexual reproduction; questions - I asked about 'flower of same plant', 'seeds in ovary', 'corollas'; S2 asked about how children could be made aware that the fruit develops from the flower; good poster - 'flow' diagrams from flower to seed.

AC3 Group A: S3 presented - with explanation, fluent; poster with illustrations of parts of plant involved in asexual reproduction and of flower representing sexual reproduction; said that seed is both male and female - brought up by S11 during questioning that 'seed is part male and part female - I explained this); mentioned ovule (I used this to focus on B's idea of seeds in ovary). I intervened during the CL activity - students were drawing a flower under 'asexual reproduction'; colleague asked why - response was that another student was writing the headings.

PART2  
PART3  
LROLE Groups used term 'gamete' correctly; S7 spoke about the paw-paw plant - what his granny told him about them ('wives' of the one) - I responded by speaking about integrating 'folk' wisdom with 'science' knowledge; S8 spoke about hybrids that they discussed in their group - I responded by giving further examples of hybrids and spoke about hybrid sterility; S11 spoke about 'folk wisdom' - melon seeds that germinate to develop into 'hybrid' plant if they 'enter the mouth'- discussed the 'rationale' behind different types of 'folk wisdom' - that it should not be ignored if brought to the classroom - link with increase in participation and self-esteem.

SELF-  
ESTEEM  
PART4 Participation seems to have improved all round - all were seen to be involved, some expressed their 'enjoyment' of the session.

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REFL I reminded students about 'reflective notes' - S11 gave me one  
MONIT about session 12. Some students promised to hand in these.  
ASSESS I gave students their test scripts - suggested that they re-  
write the same test as suggested by the colleague and said that  
we should review the test after this was done - students  
amenable. I reminded students about the 'germination' report,  
and referred to the 'planner' in further reminders. I suggested  
ASSESS that further discussion on plant reproduction would occur  
during following pract sessions on sexual and asexual  
reproduction.  
The colleague gave feedback on the test - about it being  
different to what students were accustomed to (including her  
course in their first year) - different in the CL assessment  
and 'nature' of the questions (?? - she referred to them as not  
'recall type'. She then spoke about preparations required for  
the 'trench garden' project that she had assigned them.  
AC Note: AC - 'seed' in flower; S11's 'bisexual' seed - clarified  
by focussing on when the term is used, eg., although a person  
has genes of both parents the person is not regarded as  
bisexual, that the term is used to refer to the ability to  
produce gametes of both types in the case of bisexual and one  
type in the case of unisexual...

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SESSION 14

THURS 30.03.95

Sexual Reproduction - flower structure and pollination. The  
colleague was not at the session - a problem for the research.  
PART1 I outlined the steps - in the hand-out - partly individual  
(participation!) and partly cooperative work.  
TIME1 Students spent some time filling in the table - I helped many  
LROLE students to locate floral parts - I spoke about the calyx of  
*Cassia*; I explained (briefly) the concept of carpels.  
I gave guidance to S11 - a reference guide (he did not have  
PART2 high school biology background and was unsure about the floral  
LROLE parts.  
Demonstrated the use of the dissecting microscope.  
TIME2 CL: discussion on the distinction between dicot and monocot  
flowers and functions of parts - about 3 minutes, on fruit,  
pollination and dispersal - about 5 minutes, poster making and  
display - about 15 minutes.  
ASSESS Posters were assessed by peer-groups on negotiation - I had  
asked students to choose the type of assessment - compromise  
reached as partly lecturer and partly peer-group.  
Group A's poster - very good, but illustrated leaves not as in  
*Agapanthus* and 'fly' pollinated; B awarded 3,5 on 5 marks, C  
gave 4 and I gave 4 - rounded to 8/10.  
Group B's poster - good, but unsuitable fruit shape, incorrect  
spelling of pollination; A gave 3, C gave 3 and I gave 3 -  
rounded to 6/10.  
Group C's poster - good, but unsuitable fruit and seed shape; A  
gave 3, B gave 2,5 and I gave 3 - rounded to 6/10.  
Students seemed to grasped the concept of sexual reproduction  
in anthophytes.  
Evaluation of work sheets - all groups need to: revisit  
'carpels' - 'locules' as rough indication of number of carpels;  
use 'perianth' instead of 'perigone' (especially groups B and  
C); distinguish between the floral features of dicots and  
RN monocots. I need to prepare a note on this. S11 has done well  
in his observations.

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FORMAT The 'individual' sections were included to enhance  
PART participation in subsequent discussion.



Asexual Reproduction in Anthophytes:

FORMAT I distributed the work sheets - each group was given a different set of specimens: A - 'rooting' violet leaf, sprouting ginger, radish plant; B - 'rooting' stem of 'queen-of-the-night', 'hen-and-chicken' plants, turnip plant; C - onion plant, water hyacinth plant, beetroot plant. Students had been asked to bring specimens - group B complied by bringing a sweet potato.

MONIT Observations of cognitive aspects were done by a member in each group: A - S10, B - S7, C - S12. S3 and S4 were absent in group A - S10 of group C joined them; so A had 3 members (S1, S2, S10), B had the usual 4 members (S5, S6, S7, S8) and C had 3 members (S9, S11, S12). The discussions of specimen 2 in each group were; reports (using posters) on the identification of each plant part that was modified with reasons and how each reproduces, were done.

AC Group A - S2 presented; not sure about the radish - I responded with an explanation - followed by requesting a reason from them for the identification; reporting was good; they had decided that the swollen part of the radish was the root by a process of elimination. Group B - S8 presented - reported well; I asked for reasons for their decisions; incorrect selling of turnip. Group C - S11 reported - good, organised, explained well; not sure about 'onion leaf' Posters were illustrated well - not assessed! Class discussion involved a brief overview of asexual reproduction by me using an OHT. I returned the work sheets on the flower - I reviewed the problems encountered in the structure of the flower.

PART The class went out to inspect and work on their trench gardens after which we spoke about 'folk wisdom' while standing around a well laid out trench garden - I found that students were enthusiastic in their responses about what people had told them about propagating plants, eg., S7 - spoke about his granny's knowledge about how wattle is planted - seeds are planted in a trench, covered with grass and burned - we related this to 'science' in that heat from the fire may be required to stimulate germination - and about his observation as a child that a banana plant that grew alongside a drain grew faster than others - perhaps stimulated by substances related to decomposing matter;

S1 - her mother had told her about how sugar cane is planted - that a piece of stem is placed horizontally in the soil - we discussed the wisdom of this;

S11 - the response he got from two people about how strawberry is planted - that the stem is planted - we discussed propagation by runners;

S2 - her childhood belief that if a banana plant was close to a paw-paw plant the banana will bear small paw-paws instead of seeds - discussed the possibility of a 'taboo' against the practice of planting crops too close to each other to eliminate competition for raw materials like soil nutrients and sunlight. I commented that much is learnt around campfires - perhaps the outdoor situation is conducive to learning as we were doing in a circle around the trench garden - I had perceived an all-round 'good' feeling during this informal discussion.

LENV

AR The colleague commented to me that she felt that much planning had gone into the sessions I had taken and that the session was good - I think this is partly to do with the AR aspect! I gave students the specimens we studied to plant in their gardens.

GR CHANGE In her reflective note S10 had indicated that she would like a change of group - the opportunity had arisen in this session - group A seemed to work well together - members are friends and had worked together in session 1 - they were happy - perhaps

GR SIZE group size was a factor here since there were 3 members in the group.

PART TIME Generally students participated well; group C was cautioned about time management - they took a long time in discussing their first specimen - S10 did say (in her note) that S11 and S12 'like to talk'.

SESSION 16

THURS 06.04.95

ASSESS Germination Project Reports:  
Group C - S12 presented; used maize, bean and pumpkin - planted at same time; descriptive data - observations on progressive days; conclusions given; noticed that pumpkin seed started germinating today; [7/10].  
Group B - S8 presented; attempted to determine the origin of the root, stem and leaves; experimental work seemed unrelated - specimen back up poor evidence; gave theoretical background (see comments); [5/10].  
Group A - S2 presented; two types of germination - hypogeal and epigeal; mentioned that conclusions were not evidenced - bean did not germinate; [7/10].  
We reviewed the test.

ASSESS Specimens were submitted for assessment - I did this after the session:  
A - 7/10, B - 5/10, C- 7/10  
Written reports assessed:  
A - 5/10, B - 4/10, C - 7/10  
Overall assessment [max 30]:  
A: 7 + 7 + 5 = 19  
B: 5 + 5 + 4 = 14  
C: 7 + 7 + 7 = 21

ASSESS Test:  
Instructions were given.  
S9 and S7 were a few minutes late at arriving.  
I laid out specimen A with equipment needed.

FORMAT Students chose partners for pair responses to Q 6:  
S2 and S10, S5 and S12, S6 and S11, S1 and S4 (S1 wanted S5 who had chosen already), S3 and S8, S7 and S9 (both late - no choice).

AR Conversation with the colleague; I showed her the handout that was to be used as a guide for the reflective essays; she commented on what she perceived as 'a lot of work' I put in, on what she perceived as much being learnt by students; I

RN requested that she write down some reflections that she had made during the experience; I outlined the breakdown of marks

ASSESS of the germination report; she thought that the test questions were good; we discussed the types of questions for the semester exams; she shared her curiosity of the students' choice of partners for Q 6 - that she would like to ask them for the bases of the choices.

TIME Students began writing the test at 13h45. They were asked to complete Q 5 by 14h30 so that Q6 may be attempted; some queries - 'critique' by S6 and S12, 'pistil' by S8; S7 asked what was meant by 'lily'; S8 asked about the soil level on the diagram. Specimen A (Petunia flower) for Q 1 - 2 flowers per student - set out prior to test session.  
I distributed specimen B for Q 6 to pairs.

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REFL I distributed the hand-out for Wednesday and the marks-sheets to each student.  
I commented on group C's trench garden being water-logged and suggested that they dig channels to lead the water away.  
Students worked on the trench gardens.  
S2 and S10 completed the test first - helped with group C's garden; all helped later; S12 completed last.

11.03.95

ASSESS I marked the test - a general improvement on the last test: range 58% (S7) to 94% (S10).