

COLLABORATIVE TEACHER PARTICIPATION

IN CURRICULUM DEVELOPMENT:

A CASE STUDY IN JUNIOR SECONDARY GENERAL SCIENCE

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THESIS

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ABSTRACT

This research report describes an investigation that involved the collaborative participation of teachers in the redevelopment of parts of the Junior Secondary General Science syllabus. The redevelopment tried to implement environmental education as an innovation.

There are two central assumptions that the investigation has made.

The first assumption is that the the present Junior Secondary General Science syllabus lacks environmental relevance and therefore the pupils are inadequately prepared to deal with environmental problems. The introduction of a curriculum innovation like environmental education has the potential to bring greater environmental relevance to the syllabus.

The second is that such an innovation can be more successfully implemented at schools if it involves the collaborative participation of teachers in the redevelopment of the syllabus. This assumption is made since evidence suggests that curriculum change can be a process of social reconstructive process when it takes place in situ and where teachers and pupils reshape the curriculum in the classroom as the teaching and learning progresses.

An action research approach was selected since it is compatible with collaborative teacher participation in curriculum development. The research design involved three parallel case studies:

1. Clermont Zone
2. Durban Teachers Centre
3. Edgewood College

The research confirmed that the Junior Secondary General Science syllabus is perceived by teachers to lack environmental relevance; that teachers, while initially resisting participation in the curriculum development process, were willing to participate if it revolved around their curriculum problems. Significant features of collaborative teacher participation in curriculum development seem to be the co-creation of context by the teachers, the need for institutional support, the production of curriculum materials and the need for networking and intercontextual dialogue. Teachers initially had limited curriculum development skills which needed to be developed.

This research process has implications for practical actions 'to enable' the transformation of existing curriculums, and assisting the development of a more democratic and effective education system.

TO...

my mother who taught me my first and enduring lessons
dealing with collaboration and its significance.

AND TO...

Symmie, Jaya, Michelle, my two daughters, family and
friends who endured my long absences and supported my
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C O N T E N T S

PAGE NO:

CHAPTER ONE: AN OVERVIEW OF THE PROJECT

1.1	INTRODUCTION	1
1.2	CENTRAL ASSUMPTION	1
1.3	AIMS OF THE RESEARCH	2
1.4	RESEARCH METHODOLOGY	3

CHAPTER TWO: ENVIRONMENTAL EDUCATION AND CURRICULUM CHANGE

2.1	INTRODUCTION	6
2.2	THE NEED FOR CURRICULUM CHANGE IN SOUTH AFRICA	6
2.3	ENVIRONMENTAL EDUCATION AS AN INNOVATION	10
2.4	PERCEIVED FAILURES OF THE INNOVATION	11
2.4.1	RDDA Model and Curriculum Innovation	11
2.4.2	Examining Underlying Causes	12
2.5	CHALLENGING THE PERCEIVED FAILURES	13
2.5.1	Curriculum Development of Environmental Education as a Process of Social Transformation	13
2.5.2	The Conception of the Curriculum	16
2.5.2.1	The "Product Conception" of Curriculum	17
2.5.2.2	The "Process Conception" of Curriculum	20
2.5.2.3	Curriculum as a Reconstructive Process	21

CHAPTER THREE: ACTION RESEARCH AND COLLABORATIVE TEACHER PARTICIPATION IN CURRICULUM DEVELOPMENT

3.1	INTRODUCTION	26
3.2	RATIONALE FOR RESEARCH APPROACH	26
3.3	ACTION RESEARCH	27
3.4	"WEAKNESSES" OF ACTION RESEARCH	30
3.5	THE INTENDED WORKGROUP AND ITS OPERATIONAL PARAMETERS	32

3.5.1	Composition	32
3.5.2	Modus Operandi	32
3.5.3	Operational Context	33
3.6	DATA COLLECTION	34
3.7	EVALUATION OF PROCESSES AND PRODUCTS OF THE WORKGROUP	34
3.7.1	Internal Evaluation	35
3.7.2	External Evaluation	35
3.7.3	Research Diary	36
3.7.4	Minutes	36
3.8	CASE STUDY	37
3.9	SETTING UP THE WORKGROUPS	37
3.9.1	The Original Intention	37
3.9.2	The Revised Position	38

CHAPTER FOUR: CASE STUDY - CLERMONT ZONE

4.1	THE SCIENCE EDUCATION PROJECT (SEP)	40
4.2	THE "WORKING PHILOSOPHY" IN SEP	40
4.3	SETTING UP THE WORKGROUP	41
4.4	THE CLERMONT ZONE	42
4.4.1	Clermont, The Township	42
4.4.2	The Zone Itself	42
4.5	THE FIRST MEETING	45
4.6	WORKSHOP	45
4.7	VISIT TO UMQHUELE JUNIOR SECONDARY	46
4.8	THE FIRST WORK SESSION OF THE WORKGROUP	47
4.8.1	Problems with General Science Curriculum	48
4.8.2	The Metric System	49
4.8.3	Practical Work	51

4.9	VISIT TO UNIVERSITY OF DURBAN-WESTVILLE	57
4.10	BOOKLET PRODUCTION	58
4.11	EMERGING POSITIONS	60

CHAPTER FIVE: CASE STUDY - EDGEWOOD

5.1	THE CONTEXT	63
5.1.1	Establishing the Edgewood Workgroup	63
5.1.2	The F.D.E. Course	63
5.1.3	Constraints	64
5.1.4	Edgewood College	65
5.2	THE WORK PROCEDURE	66
5.3	ESTABLISHING A WORKING RELATIONSHIP WITH THE WORKGROUP	67
5.3.1	Why were the Teachers doing the F.D.E. Course	68
5.3.2	Problems in the Standard 6 and 7 General Science Curriculum	69
5.4	DEVELOPING CURRICULUM DEVELOPERS	74
5.4.1	Workshop Strategy	74
5.4.2	Module on Water Quality and Water Borne Diseases	75
5.4.3	Designing a Curriculum Package	80
5.5	EMERGING POSITIONS	83

CHAPTER SIX: CASE STUDY - DURBAN TEACHERS CENTRE WORKGROUP

6.1	SETTING UP THE WORKGROUP	86
6.2	CONTEXT OF PARTICIPANTS	87
6.2.1	Teachers	87
6.2.2	Superintendents	88

6.3	WORKSESSIONS	91
6.3.1	The First Worksession	91
6.3.2	Intercontextual Dialogue	98
6.3.3	Tasks	99
6.3.4	Second Worksession	100
6.3.5	Subsequent Worksession	102
6.3.6	Workshop	108
6.4	EMERGING POSITIONS	113
6.4.1	Changes in the General Science Curriculum and its Implication for Environmental Education	113
6.4.2	Resistance to Participation	
6.4.3	Challenging the Resistance	113
6.4.4	Participating in Curriculum Development	114
6.4.5	Model for Collaborative Teacher Participation in Curriculum Development	115
 <u>CHAPTER SEVEN: EMERGING POSITIONS</u>		
7.1	DESIGN PROBLEMS WITH EXISTING GENERAL SCIENCE CURRICULUM	118
7.2	IMPLEMENTATION PROBLEMS OF THE GENERAL SCIENCE CURRICULUM	118
7.2.1	Language Problem	118
7.2.2	Large Classes	119
7.2.3	Lack of Facilities and Resources	120
7.3	COLLABORATIVE TEACHER PARTICIPATION IN CURRICULUM DEVELOPMENT	120
7.3.1	Culture of Non-Participation	120
7.3.2	Generating the Culture of Participation	123

7.4	COLLEGES OF EDUCATION AND CURRICULUM DEVELOPMENT	125
7.5	ENVIRONMENTAL EDUCATION AS A CURRICULUM INNOVATION	127

CHAPTER EIGHT: IN CONCLUSION

8.1	LIMITATIONS OF THE RESEARCH	130
8.2	TASKS TO COMPLETE	131
8.3	COLLABORATIVE TEACHER PARTICIPATION IN CURRICULUM DEVELOPMENT	132
8.4	ENVIRONMENTAL EDUCATION AS A CURRICULUM INNOVATION	133
8.5	FURTHER RESEARCH	134

FIGURES

Figure 1	The Action Research Spiral	29
Figure 2	The Network of Institutions	108

TABLES

Table 1	Departmental Affiliation of Teachers	66
Table 2	Teachers Experience in Teaching General Science	67

LIST OF APPENDICES

A. DECLARATIONS

i) Tiblisi Declaration	Appendix 2	184
------------------------	------------	-----

B. QUESTIONNAIRES

i) Teacher Background	Appendix 5	195
ii) Problems with the present General Science Curriculum	Appendix 6	197
iii) Evaluation of Course Module on Water	Appendix 10	206
iv) Water Supply and Problems	Appendix 9	204

C. RESPONSES ON GENERAL SCIENCE CURRICULUM

i) Clermont Zone	Appendix 12	211
ii) Durban Teachers Centre	Appendix 11	208
iii) Edgewood College	Appendix 7	199

D. RECORD OF RESEARCH

i) Research Diary	Appendix 1	142
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E. PRODUCTS OF RESEARCH PROCESS

i) Progress Report	Appendix 3	191
ii) Papers	Appendix 3	
iii) Curriculum Materials	Appendix 3	
iv) Curriculum Questionnaire	Appendix 3	

F. WORKSHOPS

i) Processes in Science	Appendix 8	202
ii) Dancing Moth Ball	Appendix 4	193

C H A P T E R O N E

AN OVERVIEW OF THE PROJECT

1.1 INTRODUCTION

This thesis describes a curriculum development project that involved the collaborative participation of teachers in the redevelopment of sections of the Junior Secondary General Science curriculum by using an environmental education approach, as outlined by the IUCN (defined in Chapter 2).

The people of South Africa are currently faced with many environmental problems, examples of which include poverty (Ramphela and Wilson, 1989), soil erosion and shortage of clean water (Sunter, et al., 1989). It is widely held that the present curriculum in schools does not prepare pupils to respond to environmental problems (SCISA, 1989; EEASA, 1989). In the above researchers' view, which is shared by others in the field (Degenaar, 1988; O'Donoghue, 1989), a curriculum innovation in the form of environmental education is needed to prepare pupils to deal with environmental problems.

1.2 CENTRAL ASSUMPTION

Present curriculum development in South Africa is a diluted form of the RDDA model (R-Research, D-Development, D-Dissemination and A-Adoption) since the research (R) component has seldom been significant. Moreover, this model is held to be weak for bringing about curriculum innovation because it generally results in a low rate of adoption by teachers (Papagiannis et al., 1982; Popkewitz, 1984). The repeated failures of the RDDA model are usually ascribed to weak communication between the curriculum developer and the teacher, insufficient or poor evaluation and a lack of teacher participation (Olson, 1982; Eisner, 1985).

It is further argued in Chapter Two that the real failing of the model seems to be its assumption of social change i.e. it assumes that social change is a rational management procedure which takes place as an event rather than as a process. It assumes that teachers will adopt the curriculum innovation once they are exposed to it.

Many social theorists like Mead (1934), Berger & Luckman (1967), Schutz (1973), and Giddens (1990) argue that social change is a reconstructive process that takes place in a social context during the course of one's actions. Recent research by O'Donoghue (1989) in Natal suggests that curriculum change can contribute to a process of social reconstruction and can be fairly successful if it involves collaborative teacher participation.

In light of the above, the central assumption that this thesis makes, is that, the process of curriculum development and change contributes to a process of social reconstruction and fundamental to it is collaborative teacher participation. Thus the researcher and the teachers worked together to develop/redevelop the existing section/s of the Junior Secondary General Science core syllabus in light of issues that the participants brought from their own praxis.

Junior Secondary General Science was selected because very little research has been done in this area (SCISA, 1989).

1.3 AIMS OF THE RESEARCH

The aims of the research were:

- (a) to collate insights from teachers about their problems in the Junior Secondary General Science core syllabus;

- (b) to use the above (a) to develop a section or sections from the Junior Secondary General Science core syllabus as part of a collaborative, curriculum development process between the researcher and participating teachers;
- (c) to establish guidelines for collaborative teacher participation in curriculum development in General Science by adopting an environmental education approach to the topics;

1.4 RESEARCH METHODOLOGY

The research design is a case study based on action research (Cohen and Manion, 1985). The teacher-participants were initially intended to be ten General Science teachers selected by locality (Durban) and willingness to participate. For reasons outlined in Chapter 3 however, it was changed to involve approximately 60 teachers from three different areas around Durban. Essentially, the investigation sets out to "illuminate" and "describe" rather than to "test" and "prove".

An action research design is compatible with the participant approach to curriculum development (Cohen and Manion, 1985), since it links reflection and action and offer teachers a way of becoming aware of how those aspects of the social order which frustrate innovation can be overcome (Carr and Kemmis, 1986; Grundy, 1987).

The actual method used for the enquiry process was to:

- (a) negotiate a modus operandi through problems and discourse around existing curriculum and its development and implementation;
- (b) develop the selected syllabus topics through a process of reflective discussion, writing and revision;

- (c) internally evaluate the work by encouraging a reflective discussion process using audio-recordings and word processors;
- (d) externally evaluate the work by conducting workshops with other teachers, by using a committee of consultants, comprised of people with differing views and experiences in the areas of science education, environmental education, curriculum development and action research; and by dissemination of the research results to concerned organisations such as Science Curriculum Initiative of South Africa (SCISA), Association of Science Teacher Educators (ASTE), South African Association of Teachers of Biology (SAATB), South African Association of Teachers of Physical Science (SAATPS), Environmental Educators Association of Southern Africa (EEASA) and interested individuals for comment and feedback;
- (e) keep a research journal (Appendix 1) in order to establish an accurate portrayal of the research process both individually for each case study and collectively for the research process as a whole.

The thesis is structured into 7 chapters and appropriate appendices. It sets out to portray the enquiry process and attempts to generate 'grounded' theory from this process.

Chapter 2: argues the need for an environmental education approach being implemented into the Junior Secondary General Science Curriculum by using collaborative teacher participation.

Chapter 3: outlines the rationale for choosing an action research framework for the curriculum development project and outlines the research design.

Chapter 4, 5: outline respectively the collaborative
and 6: participation of teachers in curriculum
development projects in each of the
following individual case studies:

1. the Clermont Zone
2. the Edgewood College of Education
3. the Durban Teachers Centre.

Chapter 7: attempts to portray the common emerging
positions asserting a collective "grounded
theory" from the research as a whole.

Chapter 8: concludes the study with a summary of the
main findings of the research, an evaluation
of its strengths and limitations, and points
to further research potential.

C H A P T E R T W O

ENVIRONMENTAL EDUCATION AND CURRICULUM CHANGE

2.1 INTRODUCTION

In this chapter an attempt is made to analyse the nature of the present South African curriculum in schools. It is suggested that this curriculum is irrelevant and an innovation such as environmental education has the potential to overcome the problem of irrelevance.

Further, in this chapter, environmental education as an innovation is analysed and it is suggested that its past implementations have two main weaknesses viz. its adoption of the RDDA model and its view of social change. To overcome these weaknesses, it is suggested that change in general and curriculum change in particular be viewed as a process of social reconstruction.

Therefore, the implementation of an innovation like environmental education needs to be done using a collaborative teacher participation mechanism.

2.2 THE NEED FOR CURRICULUM CHANGE IN SOUTH AFRICA

Education systems primarily serve the purpose of cultural reproduction (Bourdieu and Passeron, 1977; Aronowitz and Giroux, 1985). Cultural reproduction in this sense refers to ways in which schools, in conjunction with other social institutions, help perpetuate social and economic inequalities across the generations (Giddens, 1990). The South African education system is a good example of cultural reproduction.

The current situation in South Africa has been analysed from a variety of perspectives and ideological frameworks. There is a deep economic, political and social crisis in our

society which is reflected in the education crisis (Kruss, 1988). Black education in particular, is plagued by many problems (Van den Berg, 1986). These problems can be attributed mainly to the apartheid ideology of the state which has been described by Hartshorne (1986, p1) as follows:

"where education has been used so obviously as an instrument of control, where it has been used to protect power and privilege, to divide and segregate according to a hierarchy of provision, financing, resources and quality from white down to black."

The manifestations of this ideology are represented by per capita expenditure, the proportion of qualified teachers, the qualitative and quantitative provision of facilities such as buildings, equipment, sports facilities, and many other facets amongst the varying economic, racial and cultural groupings in South Africa.

In the researcher's opinion it is not only Black education which is experiencing a crisis. It is the entire educational system of South Africa which is experiencing a crisis in form and content. O'Donoghue (1987) described the present educational form in South Africa as suffering from Educational AIDS i.e. it is Autocratic, Instructional, Deterministic and Scientific. He is of the view that the present system of education is bringing about change in individuals by manipulating their behaviour using uncritical transmissive teacher practices, textbooks and rote learning. Further the content of education does not prepare pupils effectively for the future (SCISA, 1989; EEASA, 1989).

In recent times, the state in both the Educational Renewal Strategies, 1991 and the New Model for Education, 1991 has seemingly "acknowledged" that the education system is unjust and irrelevant. The 'new' education dispensation

proposes a unitary education system (seemingly to overcome the unjust past), with a strong leaning to science, technology and vocationalism (seemingly to overcome the irrelevance of "academic" education). The shift of relevance is in accordance with the "new economic order" that is dominated by science and technology. Thus, in the words of Aronowitz and Giroux (1985, p3):

"schools are considered producers of human capital."

They further argue that the production of human capital falls within the economic reproduction model i.e. aligning the curriculum of school to the workplace. They argue further that this model is weak since:

"it does not develop critical thought that can become the economy that can resolve the health issues, labour conflicts, race and sex discrimination, etc." (p54).

The above implies that critical thought is central to overcoming and solving environmental problems such as health issues.

South Africa is faced with wide ranging environmental problems within the political, social, economic and biophysical spheres, examples of which include poverty (Ramphela and Wilson, 1989), soil erosion and clean water shortage (Sunter et al., 1989). These problems have led to wide spread environmental degradation which in turn leads to decline of environmental quality and health.

The environmental degradation might be sufficiently overturned by appropriately transformed policy and practices in the areas of state governance, economy, material resource usage, education and others. Irwin (1990, p6) states that

"Sound management of our environment along with the careful husbanding of our economy and development and the entrenching of human rights are the major challenges facing us as a society as we approach the twenty-first century. Environmental education links these concerns and provides one support structure for us to heal ourselves as a nation, environmentally, socially and politically."

Further, he alludes that environmental education should be integral to any "transformed" education system in South Africa, such that it can sufficiently address environmental degradation. The call for environmental education is supported by authors Clayton (1980), Irwin (1988), Degenaar (1988) and more recently by the "White Paper on environmental education" (1989).

The most widely accepted definition of environmental education, which is known as the IUCN definition is as follows:

"Environmental education is the process of recognising values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relations among man, his culture and his biophysical surroundings. Environmental education also entails practice in decision making and self-evaluation of a code of behaviour, about issues concerning environmental quality." (IUCN 1977, P17)

Therefore, environmental education (as defined by IUCN in 1971 and further endorsed by the Tblisi principles in 1977-see Appendix 2) is seen as an innovation that could transform both the form and content of the present education system (Brookes et al., 1990). It provides relevant environmental content (Hank, 1985) while the

environmental approach which is critical and integrative provides opportunities to transform the form of education away from its present "Educational AIDS" as expressed by O'Donoghue (1987).

2.3 ENVIRONMENTAL EDUCATION AS AN INNOVATION

Authors such as Leopold (1949), Carsons (1962), Marshall (1968) and Ehrlich and Ehrlich (1972) brought the threat of environmental degradation to the attention of the general public. Internationally, the potential impact of problems such as overpopulation, soil erosion and pesticide poisoning, amongst others, elicited calls for sustainable development. Environmental education can be seen as one of the strategies in response to these problems.

The 1975 Belgrade Charter acted as an influential policy statement which advocated the implementation of environmental education as a subject in schools. The Tblisi Declaration (UNESCO-UNEP, 1978) provided a set of guidelines for an environmental education approach in the formal, non-formal and informal education communities. The declaration aimed for people to acquire the knowledge, values, attitudes and practical skills which would help solve environmental problems. It was advocated that this could be done through holistic education in the "total environment".

Fixed curriculum packages (eg. teaching guidelines and resource packages dealing with particular environmental problems) were developed for "undoing" the obvious degradation of the environment and the corresponding decline in the quality of life (Brookes, et al., 1990). This was done largely by external experts using structured processes of intervention (O'Donoghue, 1989). The RDDA model of curriculum design and implementation was utilised widely in this regard (Greenall, 1987; Robottom, 1987).

2.4 PERCEIVED FAILURES OF THE INNOVATION

Environmental education as an innovation was perceived by Stevenson (1987) and Greenall (1987) to fail when the intended improvement in the environment seemed not to materialise. They hypothesised that this failure could be due to many causes. Two predominant hypothesised reasons for this failure could be the RDDA model itself as a means of curriculum innovation (see Stevenson, 1987) and the lack of attention paid to the root causes of the environmental problems (see Greenall, 1987; Gough, 1987).

2.4.1 The RDDA Model and Curriculum Innovation

The RDDA model of curriculum development entailed research (R) by experts. These experts researched around the form and content of curriculums for schools and then they developed the curriculum for schools. The development (D) involved pilot testing of the developed curriculum, after which the curriculum was disseminated (D) to schools. The curriculum may have been disseminated in the form of syllabi, resource packages for teachers and pupils or most commonly in the form of textbooks. The dissemination may have been facilitated via workshops and orientation courses. Teachers were then expected to adopt (A) and teach according to this predesigned curriculum.

The procedural steps of the RDDA model suggest that they are discrete components which have a linear sequence that can produce a coherent curriculum. The procedures are intended to provide efficient management and control of the development of curriculum. The model assumes a rationalist, objectives-based view of educational change (Brookes *et al.*, 1990; Cornbleth, 1990). In the view of Popkewitz (1984) this model of educational change is

bureaucratic, technicist and fails to bring about change. Some major weaknesses of the model which have been identified by various writers are:

- it views social change and change of natural phenomena in a similar way as one of control and manipulation (Popkewitz, 1989) via the rational process of external management and innovation diffusion (O'Donoghue, 1989);
- it does not account for the context variation of users (teachers) (Papagiannis et al., 1982);
- there often exists a communication breakdown between the central planners (experts) of the curriculum innovation and the implementors (teachers) of the innovation (Olson, 1982);
- there is a lack of user (teacher) participation in designing curriculum innovation (Eisner, 1985) as it views teachers as technicians or implementors. (Aronowitz and Giroux, 1985; Robottom, 1987).

2.4.2 Examining Underlying Causes

One of the popular strategies used in environmental education is problem solving. Pupils and students are given local environmental problems to solve (Stapp, 1988). Stevenson (1987) noted that often these problems were addressed at the symptomatic level i.e. the symptoms of the problems were being addressed, not

the underlying causes. An example of this would be the prevention of top soil loss by dredging the river mouth before it could enter the sea; while the cause of the erosion of the soil were farmers with poor farming methods, up river. If environmental education was meant to be effective, it then needed to address the causes of environmental problems (Stevenson 1987). Capra (1982) pointed out that the underlying causes of environmental problems are overconsumption and materialism which needed to be addressed in order to overcome environmental degradation.

2.5 CHALLENGING THE PERCEIVED FAILURES

Both these hypothesised reasons underlying the failures of environmental education do not significantly examine the underlying assumptions of environmental education (Brookes et al., 1990). The researcher is of the view that the possible hypothesised failing of environmental education is not only with the RDDA model and its failure to examine the underlying causes of environmental problems rooted in "materialism and overconsumption" (Capra, 1982). This curriculum model also fails to bring about realistic change since it ignores the process of curriculum development as a process of social reconstruction and transformation.

2.5.1 Curriculum Development of Environmental Education as a Process of Social Transformation

It was felt by authors like Clayton (1980) and Degenaar (1988) that the increase in environmental degradation could be overcome by environmental education which would:

"make people aware by communicating what was going wrong. If this was done well, they would get the message, become aware and change

their behaviour, thus, restoring the world to its former splendour." (O'Donoghue, 1989, p43).

This implied that behaviour of individuals could be rationally altered by using strategies that communicate environmental messages. These strategies presume that social change is viewed as a rational behaviour modification event, a cumulative effect of altering individuals thinking and actions with respect to environmental issues.

According to O'Donoghue (1989) the above assumption of social change seems to have wide currency in environmental education amongst conservation agencies in South Africa. Some agencies use rational planning and objective communication approaches to make people aware of the environment so that the environmental problems are solved and people change their attitudes and behaviour (Fourie, 1977; Fuggle and Rabie, 1983; Odendaal, 1986).

Popkewitz (1984, p139) examines the rational model of social change which views change as that which:

"becomes the implementation of procedures to make established procedures more efficient. Motion and activity become a substitute for change."

This model implies that change becomes more effective if one communicates environmental problems clearly in a well organised manner. It is suggested that if this view of change was true then environmental education would have produced a number of environmental improvements. This may not be the case (Brookes, 1990), illustrating that this view of social change is simplistic as it does not consider the dynamics of

interactions of individuals and institutions and their values, politics, power relationships, needs, amongst other factors (Popkewitz, 1984). These "complexities" arise out of individual's lived experiences within highly contextual social worlds.

Our worldviews and actions are socially constructed (Berger and Luckmann, 1967) within social contexts that both enable and constrain these worldviews and actions (Giddens, 1990). As an individual one is simultaneously an agent and a product of our social reality.

"For instance, as a businessman I know that it pays to be inconsiderate of others. I may laugh at a joke in which this maxim leads to failure, I may be moved by an actor or a preacher extolling the virtues of consideration and I may concede in a philosophical mood that all social relations should be governed by the Golden Rule. Having laughed, having been moved and having philosophized, I return to the "serious" world of business, once more recognize the logic of its maxims, and act accordingly. Only when my maxim fails "to deliver the goods" in the world to which they are intended to apply are they likely to become problematic to me "in earnest"."

(Berger and Luckman, 1967, p58).

This suggests that it is social factors that inhibit change. It seems that in order for change to be effective individuals themselves need to examine critically the social factors that inhibit change and act on them in order to bring about change (Freire, 1970). Freire and Shor (1987) are of the view that

individuals need to participate within a critical consciousness in order to bring about change which leads to improvement and empowerment. This critical consciousness enables individuals to illuminate the conditions of the dominant ideology that have conditioned them so that they can overcome this conditioning thus leading to transformation (Freire and Shor, 1987).

Berger and Luckman (1967) are of the view that effecting social change is a process of reconstruction of one's reality i.e. a redefinition of the way the person thinks, feels and acts on something or someone. This reconstruction becomes possible if the person participates consciously (Freire, 1970), via dialogue, reflection (critical evaluation of past actions) and action. A critical dialogue takes place internally through self-reflection yet is enhanced if the person is working collaboratively (O'Donoghue and McNaught, 1990) with other people. Working collaboratively provides opportunities for inter subjective dialogue which enhances the quality of reflection and action (Wildermeesch, 1985).

Therefore, social transformation may be viewed as a reconstructive process involving participation via dialogue, reflection and action which is further enhanced when done collaboratively (O'Donoghue and McNaught, 1990).

2.5.2 The Conception of the Curriculum

Our conceptions about curriculum reflect and shape how we see, think and talk, study and act on the education that is made available to pupils in schools (Stenhouse, 1975). These conceptions are not "merely theoretical", they emerge and enter into practice (Cornbleth, 1990). Generally, the conceptions of curriculum seem to be categorized into two, "the

product conception" and "the process conception" (Grundy, 1987; Hopkins, 1989; Cornbleth, 1990). The "product conception" is also referred to as the "technocratic conception" (Cornbleth, 1990). Both these conceptions have variations within them.

2.5.2.1 The "Product Conception" of Curriculum

The prevailing, mainstream conception views curriculum as a tangible product, usually a document or plan for instruction in a particular subject (Cornbleth, 1990). The specificity and detail of the curriculum product can range from a brief outline of topics to be taught and learned, such as a syllabus or course of study, to an elaborate outline accompanied by teacher and student materials eg. readings, textbook, worksheets and a teacher-guide including directions for testing and teaching.

Cornbleth (1990) suggests that curriculum construction is technocratic when it is seen by curriculum developers as presumably objective, where the development of curriculum is separate from policy-making and implementation. The policy-making is undertaken by bureaucrats or ministries of education, the development of curriculum by experts generally outside the school and the implementation by teachers. This view of curriculum construction coincides with the RDDA model discussed in 1.2 above. Curriculum change is seen as implementing a new product which involves the constructing and implementing of a different document or package. Change is implemented using set procedural steps which will then produce a predetermined end state (Stenhouse, 1975), the "curriculum product". Curriculum change is viewed as a rational management and control procedure.

South African school education is generally predicated on this "product conception" of curriculum. The following official definition of curriculum illustrates this:

"A curriculum is a scientifically based written programme for teaching and learning, comprising the aims, relevant and organized content selected for the purpose , as well as didactical guidelines."

(Transvaal Education Department,
1988, in Jolly, 1990 p3).

Environmental education also seems widely to be predicated on this conception. This suggestion is made based on the writings of environmental educationists, Gough, 1987; Stapp 1988; Robottom, 1987 from different countries. Curriculum documents from USA, Israel, Sweden and Australia have also been examined. This suggestion is made acknowledging the possible limited exposure of the writer to other readings and curriculum documents.

The product conception of curriculum makes the following assumptions:

- Curriculum is consensual;
- Change is a rational management and control procedure.

These assumptions are interrelated, but will be treated separately.

Curriculum is consensual

The product conception assumes that the curriculum that is planned by the experts is the curriculum "needed" by all schools irrespective of the local

conditions prevailing at the school (House, 1979). Also it assumes it will be taught the same way as it was planned (intended). Since all school pupils will have common curriculums this then makes the curriculum consensual (House, 1979). In reality the curriculum products do not seem to be widely used as intended by their developers (Hamilton, 1973; Fullam and Pomfret, 1977).

Further, the consensual assumption often decontextualizes the curriculum from its local contexts. These local contexts have different structural and socio-cultural contexts prevailing which influence the shaping of the intended curriculum product to a different reality (Stenhouse, 1975).

Change is a rational management and control procedure

The consensual approach generally views education as a function to reproduce culture (Bourdien and Parseron, 1977). It is believed that to bring about changes in culture all one needs is to change the structure and form of education by changing the curriculum (House, 1979). Environmental education within this framework of curriculum change is valued as it has the potential to influence a cultural change i.e. produce individuals that are more responsive to their environment.

This new curriculum will then presumably bring about controlled new, intended changes in school pupils. The RDDA model is used to bring about a change in curriculum which then changes pupils. This model of change is viewed as a rational management and control procedure, and therefore change of curriculum and people is predeterminable and achievable by systematic implementation steps. This rational model of change

is suggested to be too weak (Popkewitz, 1989) to bring about change as illustrated in the earlier discussions under social change and the RDDA model (1.2).

2.5.2.2 The "Process Conception" of Curriculum

Schwab (1978) argues that the planned product of curriculum is reshaped by teacher and pupil interactions. He calls this reshaped curriculum "the actual curriculum". The actual curriculum alludes to the process conception of curriculum construction, which is described by Cornbleth (1990, p24) as:

"an ongoing social activity, by various contextual influences within and beyond the classroom and accomplished primarily by teachers and students."

Cornbleth (1990) suggests that this alternative shifts the conception of curriculum from intention to realization, from plan to practice, from consensual to contestation and from decontextualized to a contextualized reality. Also importantly, curriculum construction is seen as a shared responsibility and is integrated. Curriculum policy making, construction and implementation dynamically interact with each other and are integrated with their structural and socio-cultural contexts implying that curriculum is constructed and reconstructed in a situated practice. Context both shapes and situates curriculum (Grundy, 1987).

Further, Stenhouse (1975) argues that curriculum change is not a rational exercise but is complex and problematic. Change involves an interplay of personal and professional, structural and socio-cultural factors over time. Curriculum change is context bound and involves the participation of stakeholders (of

that context) via dialogue, reflection and action within that context. The stakeholders could be teacher, pupils, parents, and researchers amongst others. Grundy (1987, p77) states:

"When we talk about process approach to the curriculum, we place deliberation, judgement and meaning-making as central."

This quotation will be explored by an analysis of Grundy's concept of curriculum as praxis which she sees linked to curriculum as a reconstructive process. This concept is largely informed by the work of Freire who initially formulated the concept of praxis.

2.5.2.3 Curriculum as a Reconstructive Process

Grundy (1987) describes the concept of curriculum as praxis as follows:

1. The contributive elements of praxis are action and reflection. Curriculum develops through the dynamic interaction of action and reflection. That is, the curriculum is an active process in which planning and evaluating are reciprocally related and integrated into the process;
2. Praxis takes place in the real, not the natural world. Curriculum construction must be constituted with real, not hypothetical learning situations and with actual, not imaginary pupils;
3. The world of praxis is the constructed, not the natural world - knowledge is socially constructed via an active process. This knowledge is not the truth and one must critique it when one engages with it;

4. Praxis assumes a process of meaning-making which recognises meaning as a social construction; implying that meaning-making and interpretation originates via dialogue. During this dialogue, conflicting meanings arise, thus, creating a critical orientation.

Cornbleth (1990) and Grundy (1987) view:

- curriculum construction and implementation interacting dynamically; these are also integrative with each other and with the structural and socio-cultural contexts;
- curriculum change as a process of social reconstruction which is participatory i.e. change is accompanied by the active participation of the stakeholders (of that context in which change is desired) via the processes of action and reflection in their context;
- curriculum reconstruction as being emancipatory in that it involves reflection which Gadamer (1977) acknowledges has the power of bringing to consciousness that which is implicitly and unquestioningly accepted. Emancipation:

"inform(s) one's practice in a transformation of consciousness, that is, a transformation in the way in which one perceives and acts in the world." (Grundy, 1987, p99)

It seems that reflection is an essential prerequisite for emancipation. Since curriculum reconstruction revolves around reflection as one of the components then curriculum reconstruction should lead to emancipation. O'Donoghue and McNaught (1990, p22) view curriculum change as consisting of "inter-subjective

critical processes of dialogic transformation". The kind of curriculum change they propose is collaborative "grass roots" reconstructive action. By "grass roots" is meant teachers at local schools.

Cornbleth (1990), Grundy (1987), O'Donoghue and McNaught (1990), suggest that curriculum change as a process of social reconstruction which involves collaboration and participation of various stakeholders should occur at the site of educational practice. This view of curriculum change is different to the RDDA model but is in keeping with the rationale of social change as a reconstructive process discussed earlier.

Since teachers are located at the site of educational practice (the classroom) they are central stakeholders that influence the practice (Stenhouse, 1975; Olson, 1982). Collaborative teacher participation is therefore essential during curriculum reconstruction and change (O'Donoghue and McNaught, 1990). This is further supported by Hoyle, 1972 in Stenhouse (1975, p24) who states that:

"Ultimately, it is the teacher who has to operationalize on innovations at the classroom level. He can act as a 'champion' of an innovation among his colleagues."

The collaborative teacher participation approach to curriculum development has both strengths and weaknesses. Stenhouse (1975) outlines the following weaknesses:

- practising teachers have fair work loads at schools and may face a time constraint;

- teachers may find this exercise personally threatening as they need to reflect on their own practices and criticize these practices in "public" i.e. within the collaborative teacher group.

He further argues that these weakness can be sufficiently overcome by providing adequate support structures such as researchers. These researchers could work with teachers and support their work.

He is also of the view that the strengths of collaborative teacher participation in curriculum development and change outweighs its weaknesses. The strengths are:

- since teachers are participating in the development, they are more familiar with the innovation and confident in implementing and sustaining the innovation (Olson, 1982);
- since teachers "own the innovation" they have a greater sense of commitment in implementing the innovation (Naidoo and Pillay, 1991);
- that it leads to the development of more appropriate innovations which are realistic and are in tune with the context in which teachers work (Naidoo and Pillay, 1991);
- that it promotes professional development of teachers (Stenhouse, 1975).

In conclusion it seems safe to say:

- (1) that environmental education has the potential to offer curriculum change within present educational school environments provided that it is reconceptualized not within the RDDA model of curriculum change, but rather within an emancipatory, social reconstruction praxis model of curriculum innovation;
- (2) that crucial to the above is the collaborative participatory role of the teachers within schools.

C H A P T E R T H R E E

ACTION RESEARCH AND COLLABORATIVE TEACHER PARTICIPATION IN CURRICULUM DEVELOPMENT

3.1. INTRODUCTION

In this chapter it is argued that action research is compatible with collaborative teacher participation. The research was therefore guided by an action research framework.

Further, the weaknesses of action research are analysed to show how they were partially counteracted by using appropriate mechanisms in the research design. Also, the research design used is outlined in detail.

The initial attempt to recruit teacher participants for the research seemed to fail and a renewed strategy was used. This is outlined in the latter part of the chapter.

3.2 RATIONALE FOR RESEARCH APPROACH

Ideally the rationale a research approach or methodology adopts should be compatible with the rationale operating within what is to be researched (Popkewitz, 1984). The researcher had to be careful in selecting the research approach as each approach makes different assumptions about curriculum development and change. The chosen research approach had to be compatible with the collaborative teacher participation approach to curriculum development and change.

The underlying rationale for collaborative teacher participation in curriculum development as outlined in Chapter 2 demands that the research:

- takes place within the unique contexts of each of the educational practices;
- be undertaken collaboratively by the teachers;
- integrates investigation, education and actions;
- tries to centre around involvement and improvement.

3.3 ACTION RESEARCH

The essential elements of action research seem to be compatible with the demands made on the research. Some essential elements of action research are listed below.

- 3.3.1 "Action research is educational - it is concerned with diagnosing a problem in a specific context and attempting to solve it in that context; it is usually (though not inevitably) collaborative - teams of researchers and practitioners work together on a project; it is participatory - team members themselves take part directly or indirectly in implementing the research; and it is self-evaluative - modifications are continuously evaluated within the ongoing situation, the ultimate objective being to improve practice in some way or other". (Cohen and Manion, 1989, p217).
- 3.3.2 "Action research integrates investigation, evaluation and action". (Walters, 1989, p13)
- 3.3.3 "Action research creates opportunities for teachers to work together, to share experiences and problems and to collaborate in their own growth as they attempt alternative ways of teaching. It potentially recasts teaching as intellectual work, engaging teachers and partners with university researchers in classroom research." (Walker, 1990, p62)
- 3.3.4 "Action research is grounded in two essential principles:improvement and involvement." (Grundy, 1987, p142)

From the above it seems that the rationale of collaborative teacher participation in curriculum development and change is compatible with action research. Further, Carr and Kemmis (1986, p156) state that:

"educational reforms must be participatory and collaborative; it envisages a form of educational research which is conducted by those involved in the education themselves."

Therefore, the research was guided by an action research framework.

Briefly, action research in education acknowledges that learning takes place in a context. Its method involves recurrent processes of acting, observing, reflecting and planning. A widely accepted definition of action research by Carr and Kemmis (1986, p164) reads as follows:

"Action Research is a form of self-reflective enquiry undertaken by participants (eg. teachers and pupils) 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 these practices are carried out."

Grundy (1987, p145) states that the process of action research consists of a number of "moments" which constitute four types ie. observing, acting, planning and reflection. Action and reflection are concerned with developing understanding and carrying out action. These moments are

both retrospectively and prospectively related to each other through two organizational moments: *planning* and *observation*. Reflection and planning take place in the realm of discourse, whereas action and observation belong in the realm of practice. Reflection looks back to previous action through methods of observation which reconstruct practice so that it can be recollected, analyzed and judged at a later time. Reflection also looks forward to future action through the moment of planning.

She explains further that this continuous retrospectivity and prospectivity of the action research process means that it is not a linear methodology, beginning with plans and ending with the evaluation of actions taken along the way. It is, rather, a cyclical process in which participants act strategically in the light of developing understandings. Thus, those involved in work of this kind tend to speak of an action research "spiral" with each cycle leading naturally to the next through the relationship of moments. Discourse and practice (in the one dimension) and construction and reconstruction (in the other) are brought together so that improvements in practice and in understanding can be made systematically, responsively and reflectively. This spiralling aspect of action research is depicted in Figure 1.

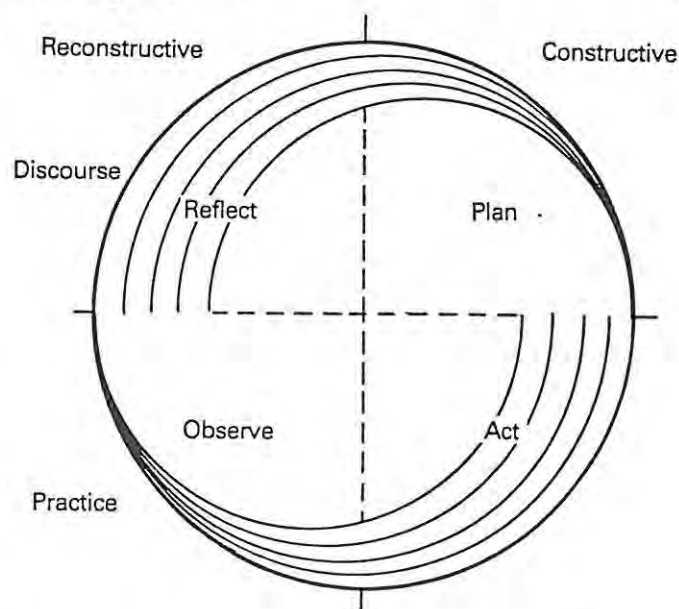


Figure 1. The Action Research Spiral (Grundy, 1987, p147)

Besides being participatory, action research is also collaborative and democratic (Carr and Kemmis, 1986; Grundy, 1987). Collaboration creates opportunities for teachers to work together to share experiences and problems, (Walker, 1990) via dialogue. The dialogue provides opportunities for greater reflection and self criticism (Brown, 1991), thus, potentially leading to better observing, action, planning and reflecting within the action research spiral.

The democratic nature of action research means that the research was guided by the following democratic principle: participants are able to influence and determine the conditions of the research collaboratively (Carr and Kemmis, 1986, Brigley, 1990). This principle has two implications for the research. Firstly, the researcher and teachers must work collaboratively as equal partners, as researchers (Kyle and McCutchoen, 1984). Secondly, it espouses an emancipatory interest (dealt with in detail later in this chapter) since participants have the control of the research process (Grundy, 1987) and the participants work with freedom and fairness.

3.4 "WEAKNESSES" OF ACTION RESEARCH

Walker, (1989) suggests that positivist researchers will see action research as lacking in rigour since the research process is not underpinned by its rationalist research procedures. On the contrary, both Walker (1989) and Winter (1989) argue the need for rigour, but using an alternative framework. Winter (1989, p36) argues that:

"the procedures of action research helps us to 'go beyond' our opinions, beliefs, assumptions and ideologies, so that at the end our understanding and our practices are more securely based (and in that sense more "valid") than we set out." (Winter, 1989, p36)

Therefore, the researcher needed to acknowledge, understand and act on these weaknesses of action research by using appropriate strategies to ensure that the research strives toward rigour and validity. This process is not without difficulty:

- 3.4.1 Cohen and Manion (1989) suggest that there will always be tension between the teachers and researcher in the collaborative situation. The tensions arise due to difference in purpose and orientations of the two participants: the teacher is orientated by teaching and implementing, while the researcher is guided by research, precision and control. Further, they suggest that this tension can be minimized if the researcher has a negotiated clear purpose which is constant.
- 3.4.2 Hutchinson and Whitehouse (1986) suggest that it is difficult for teachers to work collaboratively as they find it difficult to scrutinize individual and social practices in a group because of the threatening and revealing nature of the process. They further suggest that the researcher needs to create a climate in which the group feels comfortable to work.
- 3.4.3 Winter (1982) suggests that the major weakness is validity. The subjective nature of action research poses this validity problem. The subjective nature arises due to the research tending to be consensual and reliant on interpretations made by the researcher.

By consensual in the above context it is meant that the collaborative group outcomes may be treated as "unchanging truths". Because of a long process of contestation within a group after, it comes to believe that those can no longer be contested. O'Donoghue and McNaught (1990) suggest that this could be overcome to an extent by using an external moderating

mechanism i.e. the use of "expert" consultants to contest or verify these consensual outcomes. This has been outlined later in 3.7.2.

The interpretations the researcher makes of the data may be subjective. It is suggested that these interpretations of data could be overcome by means of "triangulation" (Baird *et al.* 1991), i.e. checking the researcher's data and interpretation via comparison with other sources (other than the researcher); for example, the teachers within the research process.

3.5 THE INTENDED WORKGROUP AND ITS OPERATIONAL PARAMETERS

The research process intended using the following:

3.5.1 Composition

Ten General Science teachers selected by locality (Durban) and willingness to participate formed part of the collaborative work group involved in the research (Stenhouse, 1975). By "locality" is meant that teachers were restricted to Durban since it is the area in which the researcher lives and works thus saving on transport costs and time. Ten teachers were considered a manageable number for the scope of this research. The work group represented a "convenience sample" (Cohen and Manion, 1989).

3.5.2 Modus Operandi

The workgroup of 10 teachers plus the researcher:

- negotiate a modus operandi through needs/problems, discourse around current curriculum and its development and implementation;

- choose a section from the Standard 6 or 7 syllabus for curriculum development;
- in subsequent work sessions develop/redraft/expand/modify... this section of syllabus through a process of reflection and action.

3.5.3 Operational Context

The curriculum in South African schools is generally planned by experts who are often only remotely connected with the unique contexts of educational stages. These experts may have a political agenda, informed directly or indirectly by the apartheid ideology. Also, the schools seem to be generally governed by bureaucratic departments which could retard the flexible implementation of curricula or the bringing about of changes in the curricula such as an environmental approach. Participants in research, therefore, need to recognise these constraints and address them in order to bring about curriculum changes (Walker, 1990). Such a process of recognition engages a workgroup in an emancipatory action research framework.

According to Walker (1990) an emancipatory action research spiral both arises out of and allows for the development of authentic insights about the construction of the practices under investigation. When the action research process also embodies reflection in the light of critical insights, the emancipatory interest becomes even more evident. The possibility then exists for the development of a critical understanding of social interactions and contexts. Such understandings will enable participants to recognize the constraints imposed upon their practices by social structures and interactions which are informed by interests in domination and control.

These understandings will facilitate the recognition that their own social practices, springing from unreflective habits or being sanctioned by the traditions of the social group, also represent and perpetuate unequal social relations.

When such understandings, borne of reflection, both upon critical insights of society and upon the immediate social context, are reflexively related to curriculum directed towards changing the unfree or unequal relationships existing in the curriculum, then an emancipatory form of action research may be recognized as being in operation. Emancipatory action research will always be characterized by a critical focus and a willingness to encompass the social context of action within the field of investigation. In this way, emancipatory action research is intrinsically political since the quality of any social context, notably in the South African apartheid constructed society, is indirectly a consequence of political actions which have contributed towards shaping it.

3.6 DATA COLLECTION

Techniques used to collect data had to be in keeping with action research and naturalistic interpretative research (Baird et al. 1991). The researcher kept a research diary while the work group kept minutes of all work sessions. The teachers completed periodic written evaluations and questionnaires. Also the researcher entered into regular interviews and discussions with the teachers.

3.7 EVALUATION OF PROCESSES AND PRODUCTS OF THE WORKGROUP

As outlined earlier the major weaknesses of action research is the reliability because of its subjective nature. Therefore, all processes and products of the workgroup were

constantly evaluated by suitable mechanisms in order not to compromise the validity of the research. The mechanisms were:

3.7.1 Internal Evaluation

To minimise subjective interpretations (made by the researcher) of the workgroups functioning, the researcher's interpretations were triangulated with the minutes of each work session and with the teachers themselves.

3.7.2 External Evaluation

As referred to in 3.4 a major problem in inter-subjective situations is that the consensual outcomes of group interactions may appear as a new and unchangeable truth to the participants (O'Donoghue, and McNaught 1990). The clarification of ideas may, however, have been inhibited by a lack of grounded critical reflection on the teacher's part or by the dominance of influence of prevailing ideology shaping teachers' thinking. It is for this reason that an external moderating mechanism (use of consultants and workshops) was established to ensure that the concepts constructed, techniques used and materials development were well situated in a philosophical framework that was appropriate for environmental education and curriculum development.

(i) Consultants:

The researcher periodically engaged with consultants who have extensive experience and could be critical, ensuring rigour in the areas related to this research. The consultants and areas of "expertise" were:

Dr Anand Naicker - Qualitative Research
Dr D S Rajah - Curriculum Theory
Rob O'Donoghue - Action research, Environmental
Jim Taylor - Education and materials
development
David Brookes - Science Education.

(ii) Workshops:

Workshops were convened so that other teachers outside the work group could evaluate the products of the curriculum development of the work group.

3.7.3 Research Diary

A research diary (Appendix 1) containing the case records and the researchers reflections was kept by the researcher. This record helped to establish an accurate portrayal of the research (Carr and Kemmis 1986; Grundy, 1987). Also the record would be used to facilitate self-reflection during the process (Carr and Kemmis, 1986) and sharpen the analysis and synthesis of this thesis.

Part of the research diary consisted of the writing of progress reports (Appendix 3) that reflected the interpretations of the research. These reports were intended for two types of audience: firstly the supervisors and the consultants of the research and secondly the general professional body of educators (see Appendix 3).

3.7.4 Minutes

Minutes were kept of each work session by a person elected by the work group. The minutes served two purposes. Firstly, it was a record for the workgroup in terms of clarifying tasks and secondly, provided

direction against the researcher's research diary to ensure that there were no misinterpretations on the part of the researcher.

3.8 CASE STUDY

Both the number of teachers participating and the nature of research orientated the research design towards a case study (Cohen and Manion, 1985). The investigation essentially sets out to "describe" and "illuminate" rather than to "test" or "prove". The thesis, therefore, will be characterised by a descriptive analysis. The description will be essentially of critical moments i.e. instances/occasions that either enabled or constrained collaborative teacher participation and curriculum development during the research and the working of the work group. Also, importantly, as advocated by Glaser and Strauss (1967), the research will try to seek for the development of "grounded theory", meaning the use of qualitative data in an attempt to derive categories and concepts.

3.9 SETTING UP THE WORK GROUP

3.9.1 The Original Intention

At the July 1990 conference of Science teachers, at the University of Natal, the researcher announced the research with the view to attract teachers that were willing to participate. Although approximately 10 teachers expressed an interest only 2 teachers were from the Durban area. The researcher then visited schools around the University of Durban-Westville (workplace of researcher) with the intention of creating the workgroup. It became apparent that the researcher could not attract 10 teachers to participate due to the following reasons:

- the project would be time consuming;
- the volunteer group could not meet at a given time because of differences of availability to meet;
- teachers felt they would not effectively participate in such research as they did not have the skills;
- teachers were concerned about working with other totally strange teachers.

The researcher also realized that even if 10 teachers did participate it would be difficult as it would be a time consuming process as it requires time for teachers to learn to work collaboratively with each other. The research would have taken more than the year and would be in conflict to the research degree regulations.

3.9.2 The Revised Position

To overcome the problems in trying to establish the workgroup the researcher then approached institutions that had teachers working collaboratively, who met on a regular basis at a common time and who were supportive of the research initiative. The following three institutions were approached:

- Science Education Project : Clermont Zone;
- General Science Subject Committee : House of Delegates;
- Science teacher upgrading : Edgewood College of Education.

All three institutions wanted to participate in the research creating a joint pool of approximately 60 teachers; more than the envisaged number of 10. The researcher decided to work with all three institutions separately as it would be difficult to work with such a large number of teachers. Therefore, three separate workgroups based on institutional affiliation were formed i.e. Clermont Zone, Durban Teachers Centre and Edgewood College and they worked parallel to each other.

Each of these three institutions were treated as separate workgroups and therefore, will be reported as separate case studies in chapters 4, 5, and 6, respectively. These chapters describe and explain the investigation in each of these workgroups. Each chapter attempts to outline the context of each workgroup, the investigation itself and the discussion of the key findings. Also it must be noted that since each workgroup worked parallel to the others they tended to inform each other via the researcher. This informing of each workgroup by the others contributed along with the use of consultants and workshops, to the avoidance of making the research consensual.

CHAPTER FOUR

CASE STUDY - CLERMONT ZONE

4.1 THE SCIENCE EDUCATION PROJECT (SEP)

Science Education Project is a non-governmental national organisation which is attempting to improve the quality of secondary school science teaching in the subject areas of Biology, General Science and Physical Science. It focuses mainly on "disadvantaged" schools. Science Education Project operates in all the provinces of South Africa and most of the "homelands".

In the Natal region Science Education Project is organised into zones that constitute an aggregate of secondary schools in a township such as Clermont. All the science teachers from these schools within a particular township, together with a Science Education Project implementor (a person employed by Science Education Project to support and facilitate the work in 3 to 4 zones), constitute a zone. Each zone nominates one of the teachers as the co-ordinator. This person organises workshops and meetings for the zone, serves as the link to the Science Education Project office and represents this zone at meetings, which involve all the other zone co-ordinators.

4.2 THE "WORKING PHILOSOPHY" IN SEP

The "philosophy" that seems to inform SEP in the Natal region was outlined by the manager of this region as:

"the teachers own the project and run the project collaboratively with each other".

It followed that, if the above "working philosophy" really prevailed, it would facilitate the research process since both SEP and the researcher seem to be driven by the same modus operandi of democratic, collaborative teacher participation.

4.3 SETTING UP THE WORKGROUP

The researcher approached the Science Education Project's regional manager for Natal with a proposal for developing one or more sections of the Junior Secondary General Science curriculum using collaborative teacher participation and environmental education as an innovation. The SEP regional manager was enthusiastic about the proposal as he thought this research would benefit both the SEP as an organisation and the teachers of SEP of the Clermont zone in particular since this zone was barely functioning. The reasons for the problems will be outlined later.

Thereafter, the regional manager put forward the researcher's proposal at a meeting of zone co-ordinators, where it was discussed and forwarded to each zone for discussion. This process of consultation indicated the democratic "spirit" in which the zones seem to function and it was important for the researcher to be mindful of this at all times during the research project.

The Clermont Zone expressed interest in the proposal and the researcher was invited to put the proposal to all the teachers of the Clermont Zone.

4.4 THE CLERMONT ZONE

4.4.1 Clermont The Township

The residents are black Africans who face an insurmountable number of problems such as poverty, unemployment and lack of communal facilities. The housing ranges from largely squatter settlements to a few "ownership" type homes.

The township falls under the jurisdiction of the KwaZulu "homeland" which many residents have vehemently opposed. There is a high level of political activism amongst the residents rejecting both the KwaZulu Government and the apartheid state. This has engendered a degree of militance in the pupils, similar to the 1976 Soweto uprising. Since both schools and teachers are seen as part of apartheid state they have become victims of this militance. Some teachers and pupils have been killed in the past years.

4.4.2 The Zone Itself

It consists of 13 science teachers drawn from 3 secondary schools in the township.

4.4.2.1 Schools

The three schools are:

S'thengile Junior Secondary School

This school is the most "chaotic" and neglected school in the zone. The average class size is approximately 60 with very poor facilities. Textbooks, library and laboratories are non-existent in the school, the laboratory having been burnt down during the

educational boycott in the 1980's. The toilets, which are in the centre of the school and close to the classes stopped functioning properly 3 years ago. The pupils and teachers are forced to continue using toilets and the waste from these toilets overflows into the classrooms. There is a constant stench in this school. The department has not yet done anything about it.

The pupils in this school seemed to control the school. They walked in at anytime of the day and walked out of lessons anytime they pleased. Also some teachers have reported that some pupils sometimes tell them when to teach and when not to teach.

It therefore, seems safe to say that there was a lack of a "learning culture" and teachers have had to work under incredibly difficult and intimidating circumstances.

S'thokozile Junior Secondary

This school seems to be reasonably better off than S'thengile Junior Secondary in terms of pupil attitudes. It had an average class size of approximately 55 pupils and originally had a reasonable amount of equipment. Recently, however, a squatter settlement "sprouted" up around the school and the squatters stripped the school of facilities such as windows, doors, desks, parts of the roof, charts and so forth.

Umqhele Junior Secondary

This school is the best equipped school in the zone. However it has a library with no books, a laboratory with few pieces of equipment and an average class size of approximately 50 pupils. The school seems to be well organised and runs reasonably well.

All the schools were overcrowded and lacked facilities. These schools were under the control of the Department of Education and Culture - KwaZulu but in April 1991, after community protests, control was transferred to the Department of Education and Training (DET). According to the teachers this transfer holds promise for better provision of facilities.

4.4.2.2 Teachers

The 13 science teachers in the zone are poorly qualified to teach science. Only one teacher has a science degree while four others were trained science teachers at colleges of education. The highest formal science qualifications for most of the teachers were either mainly standard 10 Biology or Physical Science. The teachers were frequently required to teach different subjects each year irrespective of their abilities or qualifications to teach the subject.

According to the Science Education Project manager this zone barely functioned over the past three years due to the school boycotts and the low teacher morale. Thus, unlike other SEP zones, the Clermont zone did not have a well established collaborative and participatory ethos around improving science education.

4.5 THE FIRST MEETING

At this meeting the researcher was introduced by the regional manager and was allowed to sit in the meeting. The meeting was conducted by the zone co-ordinator (a science teacher from Umqhele Junior Secondary) who also kept minutes of the meeting. The meeting agenda is normally set in advance by the teachers of the zone.

This meeting dealt with the planning of zone activities for the year. The researcher was allowed to put forward the research proposal. The zone members agreed to notify the researcher a week later on whether they would participate in the research or not.

During the meeting the researcher felt uneasy, viewing himself as an intruder. The researcher knew none of the teachers prior to this first meeting.

A week later the researcher was informed that the zone was unwilling to participate in the research project but that they would like to maintain contact with the researcher. No reasons were furnished as to why the zone did not want to participate in the research.

4.6 WORKSHOP

The researcher was requested by the zone to organise a workshop for them on the teaching of science. The workshop was planned by the zone for one full school day and focused on various aspects of teaching science. As one part of the workshop, the researcher was requested to deal with the use of practical demonstrations in science that arouse pupils' interest.

The researcher participated in the entire workshop. The workshop seemed to have been reasonably well received by the teachers. Also the teachers had begun relating much

more easily with the researcher. The science teacher from Umqhele Junior Secondary asked the researcher to lend them microscopes from the university, which the researcher promised to do.

4.7 VISIT TO UMQHELE JUNIOR SECONDARY

The researcher organised the loan of a microscope from the University of Durban-Westville. The microscope was taken to Umqhele school. Owing to the fact that the four teachers from this school were better acquainted with the researcher, the researcher managed to discuss informally with them their reasons for refusal to participate in the research project. The following reasons were given:

- the teachers felt that they were unable to carry out research on curriculum problems and curriculum development because unlike "experts", they are ordinary teachers and felt they lacked "special research skills";
- research on curriculum development is time consuming;
- these teachers did not want to contribute to the development of the "apartheid curriculum" since the school and its curriculum are seen as the expression of the apartheid policy.

The discussion then turned to the problems in the existing General Science curriculum, which were readily outlined. They also acknowledged that nothing was being done about these curriculum problems by the experts. It was postulated that maybe the experts were unaware of these problems or that they could not solve them. One teacher made the following remark:

"The one that makes the shoe does not know the problems experienced by the one who wears the shoe".

This was the turning point in the discussion. The teachers realized that they were in the best position to identify and solve problems in the practice of teaching. Thus, they acknowledged that teachers have a right to and should participate in curriculum development.

These four teachers expressed renewed interest in the research project and said that they were willing to participate in the project if it focused specifically on problems which they faced directly during their curriculum practice. They then, at the next zone meeting, encouraged the whole group to participate. It must be noted that this would be an extension of the work SEP was doing but was different in that it focussed on a particular problem over a sustained period of time.

4.8 THE FIRST WORK SESSION OF THE WORKGROUP

All the teachers in the zone agreed to participate in the research project and set the date for the first work-session. The workgroup met on this day and affirmed their participation in the research but insisted that it should focus on problems of their curriculum practice.

During this worksession the workgroup focussed on:

- general problems in the Junior Secondary General Science syllabus;
- specific problems they wished to work on;
- a future working strategy.

4.8.1

Problems with the General Science Curriculum

The teachers felt that this curriculum did not adequately equip pupils for "life" i.e. to be functional in the work place or at home. They, therefore, felt that this curriculum was irrelevant. Also, the textbooks prescribed for this curriculum were inappropriate since authorities prescribing them did not take a number of factor into account:

- the difficulties experienced by English second language speakers;
- the ability and performance levels of the pupils; and
- the everyday life experiences of pupils not being reflected in problems and examples in the textbook.

The teachers readily acknowledged their own inability to teach some sections and the pupils' inability to cope with many sections. Some of the problem sections that were highlighted were mass, weight, pressure, metric system, measurement, ratio, proportion and calculations. Practical work was another major problem area.

The workgroup decided that, in subsequent worksessions it would focus on two particular problem areas: the metric system and practical work. It was agreed to gather information for the next worksession about the way people have addressed these problems. It was also decided by the workgroup that the use of workshops was a good mechanism to deal with these problems in subsequent worksessions.

The original intention of the researcher to introduce an environmental approach into the curriculum, was to be set aside because of the democratic decision of the workgroup to focus on the above two problem areas. More importantly, the teachers wanted to pursue which had immediate impact on their teaching. From this, it must be noted that collaborative curriculum development in a particular direction (e.g. environmental education) could not be a unilateral decision by the researcher but rather a collaborative one with the participants.

4.8.2 The Metric System

All the teachers in the workgroup agreed that the majority of pupils they teach had problems with this section. A teacher related the following incident which many teachers immediately identified as a problem within their own classes. The teacher asked the pupil to illustrate the magnitude of one metre. In response the pupil walked all round the classroom.

The initial analysis by the workgroup revealed that pupils:

- cannot convert from one metric unit to another e.g. centimetres to metres;
- do not understand the concept of magnification;
- have difficulty in working with ratio and proportion;
- have an insufficient repertoire of everyday experiences which hinder conceptualization of and application of the metric system. An example of this

was outlined by many of the teachers: pupils buy meat according to the amount of money in their pocket and not by the standard mass system of kilograms. This illustrates how socio-economic conditions and everyday life experiences mitigate against the learning of some topics in school;

- have many problems in understanding the basics and these problems originate from the primary schools where this section was first introduced. The workgroup postulated that it was possible that it was poorly taught at this level. The secondary school seemed to "inherit" these problems. The workgroup decided to initiate contact with neighbouring primary schools and to talk to the teachers of these schools about these problems. During the meeting with primary school maths and science teachers, it was soon realized that additional factors affecting poor learning of this mathematical concept included the difficulty that some primary school teachers had in understanding the section themselves, resulting in their mainly using the transmission method of teaching this section. This method does not give pupils any opportunity for experiential learning i.e. the use of appropriate activities as a means of learning from practical involvement. Instead, pupils use rote learning and cannot understand and apply what they have learnt.

The workgroup soon realized that this problem with the metric system was a big problem and solving it would require much work. The work would involve the collaboration of both secondary and primary school teachers in the areas of Science, Mathematics and English. It would also required extensive analysis of the way pupils both at the primary and secondary schools learn and the impact of teaching methodologies on their learning.

Lecturers of Science Education, Maths Education and English Second Language at the University of Durban-Westville confirmed the workgroup's realizations and acknowledged that this could be a substantive multidisciplinary research task. They also agreed to participate when such a project was undertaken. Due to the magnitude of the task the workgroup decided to undertake such a task at a later date possibly early in 1992.

4.8.3 Practical Work

All the teachers in the workgroup agreed that practical work was an essential and integral part of science teaching, but that pupils had been exposed to only a minimal amount of practical work, because of their experience of the following problems when attempting to conduct practical work:

- both S'thengile and S'thokozile did not have laboratories;
- all schools were desperately short of laboratory equipment. Some teachers reported that their pupils have not even seen a test tube;

- the classes were too large (approximately 55 pupils) to conduct meaningful practical work;
- teachers themselves had not experienced some of these practicals, which meant that they found it difficult to teach them when they did not know what to expect;
- the teachers could not understand some practicals;

These problems forced the teachers into what one teacher called

"doing textbook practicals or doing practicals theoretically"

By this it was meant that pupils used textbooks to copy apparatus and methods into their practical books while the teacher "made up" the results of the practical work which pupils had to analyse. A further illustration of this point was the experience of Science Education Project implementor performing an experiment on osmosis during a Biology practicals workshop. A teacher who witnessed the experiment made the following remark to the researcher:

"I started believing that practical work happens in textbooks until I saw this practical on osmosis. It was magic and I must do it with my pupils".

An analysis of this statement suggests that teachers are incapacitated with respect to practical work because of their belief that they cannot change this situation. The teachers seemed to think that

practical work can be done only if one has the relevant equipment and skills. The teachers however, did not see that one can be innovative and improvise by using "home made" equipment when attempting to perform the practical. Such attempts could provide valuable experience that could start developing skills in performing, planning and teaching practical work. These innovative abilities seemed to be lacking within the teachers for the following reasons:

- teachers seem to conceive practical work as being performed in a particular way i.e. in a laboratory using sophisticated laboratory equipment, thus giving it a "scientific look". Since the schools lack laboratories and equipment the teachers seem to feel that they cannot conduct scientific research;
- teachers view themselves as implementors of curriculum i.e. the practicals need to be clearly outlined in textbooks or teachers' manuals and fully equipped laboratories should be available, so that these teachers could implement the practical. This is analagous to a technician implementing a plan and design of an engineer.

These conceptions of practical work (the "scientific look" and teachers as implementors) had to be challenged since the workgroup remarked that they were incapable of making systems changes, such as building a fully equipped laboratory. They became "victims" of these conceptions and not agents of change. The researcher, attempted to overcome these conceptions by running a workshop on the creative use of practical work at the next worksession of the workgroup. It

must be noted that the researcher was in no way suggesting that changes are brought about purely by change of conceptions only, but also by systems changes like the provision of adequate facilities by the education departments.

4.8.3.1 Workshop on Creative use of Practical Work

The researcher conducted a workshop that engaged and contested the view that some teachers had on practical work and their inability to do something about the problems associated with it. The workshop revolved around the demonstration of the "Dancing Mothball" (Appendix 4) which involved the teachers in tasks like improvisation of equipment, finding alternative ways of setting up the demonstration, using equivalent chemicals that are found in the kitchen, listing the number of concepts that could be taught using this demonstration, and employing appropriate teaching methods that could be employed during these demonstrations to illustrate the different concepts. This workshop seemed to be a success and one teacher made the following comment:

"This is science - to remind pupils of their environments but getting them to relate their own everyday experiences".

Also some teachers in later worksessions started sharing their own "creative" practical demonstrations with the group, while others modified the "Dancing Mothball" demonstration and used it in their teaching.

The workshop seemed to challenge the teachers' past conceptions and alluded to possible new conceptions for example:

- practical work need not happen in a laboratory. It can happen anywhere in the environment. In this regard, environmental education will be accepted favourably by teachers since one does not need sophisticated laboratory equipment and a laboratory but rather that one's local environment can be a laboratory. Also doing "practical work" in the environment, as advocated by environmental education, may be an effective strategy to challenge teachers' conceptions of practical work;
- one needs to be innovative and attempt to find alternative ways to perform practicals which puts teachers in the role of curriculum developers rather than of implementors of curriculum;
- one needs to find ways of using one practical in many different ways by modifying it slightly to illustrate different principles and concepts, or use one practical to illustrate many different principles and concepts.

After this worksession the workgroup decided that, in the future, ideas on practical work should be shared and that other people who could perform workshops on practical work should be invited.

4.8.3.2 Workshops on Practical Work

Workshops were organised by the workgroup for themselves by inviting people with "expertise" in the following areas of practical work;

- improvisation - how to make your own equipment using materials found at home, for example, an electroscope could be made by using a small glass bottle;
- laboratory safety;
- laboratory management;
- performing some difficult syllabus practicals to gain understanding of them.

As the workshops progressed the teachers seemed to become more confident about performing practicals. This increase in confidence is alluded to in the following remark made by one teacher:

"The discussions and practical work we have done have improved our science attitudes".

The workshop process was also possible because of the institutional support of SEP who provided expertise as well as help in the workgroup.

Some teachers began "networking" with this expertise and invited the SEP implementor to their classes to team teach practical work. An example of such a lesson was one in which a teacher borrowed dissecting microscopes from the University of Durban-Westville and invited a SEP implementor to team teach a practical lesson on the use of the dissecting microscope. The teacher reported this experience to the workgroup and argued strongly that practical work can be done in large classes if one used groupwork. She noted:

"scholastic performance is achieved by group method when doing practicals".

4.9 VISIT TO THE UNIVERSITY OF DURBAN-WESTVILLE

During one worksession the teachers expressed interest in visiting the university to see the laboratories. The workgroup decided to spend one full working day at university to visit some laboratories and then continue the work of the workgroup.

On the day of the visit, besides touring the laboratories of the university, the workgroup decided to produce a booklet on practical work. This booklet was written so that it would serve as a guide to other teachers and encourage them to design practicals themselves and to be innovative.

The visit seemed to be a success judging from the teachers written evaluations. Some comments included:

"The climax of our working together was the workshop we had at the university. On this day we made a great stride putting our ideas and discussions onto paper".

"What I learned viz. electron microscopy; compiling a book; is an experience of a lifetime".

4.10 BOOKLET PRODUCTION

The workgroup decided jointly on the contents of each chapter for the booklet. Each chapter was assigned to either a person or two people from the workgroup. The workgroup produced the booklet by drawing on their past experiences (as individuals and from the workgroup's workshops) and referring to books on practical work from the university. They were assisted by academic and technical staff at the university. The academic staff

members helped some teachers to clarify their ideas and to express them clearly in writing, as illustrated by one teacher's comment:

"Thanks to Mr Brookes for helping disentangle some of our ambiguous statements".

On the other hand the university technical staff gave technical guidance dealing with book production.

Many of the teachers found this writing process challenging and difficult and some members expressed the following:

"I was quite amazed to discover that it was one thing to teach using a method peculiar to you and which you found successful with pupils... and quite another to put on paper the same method for others to read, understand and benefit. It was a struggle".

"It was difficult to write".

As the draft chapters were completed they were handed in to the SEP for typing. Once all were typed, copies were circulated to the workgroup. The workgroup decided to refine the draft chapters using a workgroup process. When each teacher received the draft copy of the booklet there was much excitement and the teachers felt a sense of achievement. One teacher said:

"When I apply for a job I will say I wrote a book".

The teachers were enthusiastic about the completion of the booklet and wanted it done by early December 1991 so that it could be taken to the national SEP conference for teachers.

One teacher remarked:

"we will show them our book from the Clermont Zone".

During the workshop that dealt with the refinement of the draft booklet, each chapter was criticized for its accuracy of content and language usage. The group seemed to be comfortable with one another and felt free to either support or criticize the writing.

The booklet was printed by the university and it was planned to circulate it to all SEP zones. It was also planned to distribute it to the approximately 300 teachers on the SCISA mailing list.

The following seemed to emerge during the writing of the booklet:

- the past experiences that the workgroup gained on practical work helped to provide a "capital" of ideas for the writing of the booklet. This "capital" of ideas was necessary to effect the commencement of the production of the booklet since it seemed to "empower" the workgroup to produce the booklet;
- teachers found it difficult to produce the book, initially because they lacked writing skills and technical skills on booklet production. These skills were to be developed during the production of the booklet but the teachers needed assistance in the form of both human and technical resources;

- the success of the production of the booklet was dependent on institutional support, such as access to information, technical assistance, guidance on writing skills, and printing of materials. Thus, the institutions of SEP and the University with their relevant human and physical resources made the production of the booklet a reality;
- the teachers developed a sense of "ownership" and fulfilment when the booklet was partially completed. The production of materials by teachers is important as it creates a sense of "ownership" that seems to "empower", enhancing confidence and motivating them to perceive themselves as "curriculum developers";
- the production of the booklet encouraged the teachers to work together i.e. it promoted a spirit of collaboration.

4.11 EMERGING POSITIONS

The following seems to emerge from this case study:

- 4.11.1 Teachers resisted participating in curriculum development because they felt that they were not "experts", since they did not have the relevant skills. Also such work was seen as time consuming. From this it seems that disempowered teachers perceive themselves as merely implementors of curriculum.
- 4.11.2 Institutional support is important in promoting the collaborative curriculum development process. Institutions can provide access to both human and physical resources that help develop skills needed for curriculum development within the workgroup and enable

the implementation of the workgroup's plans. Further it must be noted that working with SEP which initially formed the Clermont zone, established the earlier sense of collaborative participation within teachers and thus enabled the research process.

- 4.11.3 It is also necessary to develop technical skills like writing, use of library resources and organisation of written material. Development of such skills is part of the process of developing curriculum developers. It is equally important to develop the skills of collaborative groupwork and co-operative negotiation among teachers as potential curriculum developers.
- 4.11.4 Production of materials like a booklet may be an important aspect of curriculum development. The products give the teachers a sense of ownership, achievement and confidence.
- 4.11.5 The confidence of the members of the workgroup who engaged in curriculum development seemed to increase. They felt that they were at the early stages of becoming curriculum developers. Therefore, with time and continuity their abilities as curriculum developers will improve.
- 4.11.6 Teachers are prepared to participate in curriculum development if it directly addresses their problems as experienced in curriculum practice. Common problems also promoted collaboration as the teachers all tried to resolve the problem.
- 4.11.7 Teachers teaching in "disadvantaged" schools seem to face a multitude of problems that adversely affect their curriculum practices. Some of these problems are large classes, lack of facilities (textbooks, laboratories and so forth) and pupils who lack a "learning culture" partly due to political activism.

- 4.11.8 The disempowered teachers feel incapable of changing these problems. These teachers can bring about some changes if they want to, but they do not. This may be due to the teachers' poor science qualifications, their poor training at teacher training colleges, or that they have become "victims" of the system where they feel totally disempowered. Once teachers are initiated into role of curriculum developers they are more likely to contribute collaboratively to address the contextual problems, hence reversing their disempowerment.
- 4.11.9 The current General Science syllabus is seen as irrelevant and inadequate for preparing pupils for "life". This problem of irrelevance may be adequately addressed by an innovation like environmental education which deals with the total environment and aims to equip a person for "life".
- 4.11.10 The direction a collaborative workgroup takes in curriculum development is essentially negotiated within the workgroup and is not necessarily predetermined by an external researcher's "agenda". Thus, if the workgroup is essentially made up of teachers, the curriculum development will revolve around their needs and problems located within the practice of their teaching.

C H A P T E R F I V E

CASE STUDY - EDGEWOOD COLLEGE OF EDUCATION

5.1 THE CONTEXT

5.1.1 Establishing the Edgewood Workgroup

The researcher met with the Head of Department of Science Education and the senior lecturer in charge of the Further Diploma of Education (F.D.E.) and discussed the possibility of establishing a workgroup at Edgewood College. The lecturers were enthusiastic about the idea and they felt it was appropriate to establish the workgroup by using the teachers who were part time students upgrading their qualifications and engaged in the first year of F.D.E. However, both the lecturers felt strongly that the work proposed for the workgroup should not interfere with the teachers' ability to complete the F.D.E. course.

5.1.2 The F.D.E. Course

This course was established at Edgewood College in 1991 to upgrade the qualifications of secondary science teachers. It was financially sponsored by ESKOM, with the provision that it provided mainly for Black teachers.

The course is a two year part time one which requires students to attend lectures from 15h30 to 20h30, once a week. In the first year the teachers are required to complete the following courses: Chemistry Part I, Biology Part I and Didactics Part I.

These courses were structured so as to improve the teachers' understanding of content, and the teaching skills designing and managing of practical work.

5.1.3 Constraints

The lecturer dealing with the Biology course agreed to work collaboratively with the researcher and to allow the researcher to work with the teachers/students during the Biology lectures. Although this provision was useful it posed a time constraint since:

- besides engaging the workgroup in the proposed research. The lecturer had to complete the curriculum set by the college for the teachers;
- approximately 8 teachers taught at schools about 150 km from Edgewood College. This meant that the teachers travelled considerable distances to reach lectures. It followed that worksessions for the research were to be restricted to the biology lectures.

The timetable was arranged in such a way that the Biology lecturer met the teachers for one 5 hour lecture every 3 or 4 weeks. This posed a problem of continuity, particularly for the students.

5.1.4 Edgewood College

The college is responsible for training both primary and secondary teachers. In the past it only catered for the training of white teachers as dictated by the apartheid policy. This policy meant that the college:

- was well equipped with a good supply of both human and physical resources;
- had previously dealt only with students who had experienced a better standard of education and were therefore better able to cope with the demands of the college.

In addition, the medium of communication at the college was English and dealt primarily, with students whose first language was English.

(i) Lecturer

The lecturer of the Biology course is highly qualified having a Master's degree in Science. He was well organised and systematic. The course materials were always prepared in advance of the respective sections.

(ii) Teachers

The twenty seven teachers busy with the F.D.E. course came from the departments of education listed in Table 1.

TABLE 1: DEPARTMENTAL AFFILIATION OF TEACHERS

DEPARTMENTS OF EDUCATION	NUMBER OF TEACHERS
HOUSE OF ASSEMBLY	1
HOUSE OF DELEGATES	2
DEPARTMENT OF EDUCATION AND TRAINING	10
DEPARTMENT OF EDUCATION AND CULTURE (KWAZULU)	13
SCIENCE EDUCATION PROJECT	1

All of the teachers obtained their first teacher qualification diplomas from colleges of education. Approximately two thirds of them had no formal science courses from the colleges of education and were not trained to teach science.

The following table represents the range of General Science teaching experience:

TABLE 2: GENERAL SCIENCE TEACHING EXPERIENCE

GENERAL SCIENCE TEACHING	NUMBER OF TEACHERS
TEACHING GENERAL SCIENCE STD 6 & 7 PRESENTLY	10
TAUGHT GENERAL SCIENCE IN THE PAST	8
NO TEACHING EXPERIENCE	5
TEACHING EXPERIENCE OF PRIMARY SCHOOL	4

Twenty three of these teachers taught in schools that had poor facilities i.e. no textbooks, no libraries, a lack of furniture and classrooms, no laboratories and so forth. These teachers had to deal with class sizes ranging between 40 - 80 pupils with an average of approximately 50 pupils. These pupils generally came from impoverished socio-economic backgrounds. The context of operation for these teachers was similar to the disadvantaged conditions described in the Clermont schools (see 4.3). The above information was obtained via a questionnaire (Appendix 5).

5.2 THE WORK PROCEDURE

Having to confine some of the work procedures and all the contact with the workgroup to part of the biology lecture period (see 5.1.3) posed the following constraints on the research process:

- the time was insufficient to establish a reasonable relationship between the researcher and the workgroup. Establishing a reasonable relationship is vitally important as shown in the Clermont case study (see 4.6 and 4.7);
- the workgroup had insufficient time to complete the tasks which they had identified as needing to be undertaken for the research.

The above problems were partly overcome by the researcher:

- agreeing to team teach with the biology lecturer. This meant that the researcher could work with the workgroup throughout the biology lecture thus enabling a reasonable work relationship to be established. Also, the researcher had access to joint planning of the biology lectures and later the biology sections;
- getting the biology lecturer to plan a module on water and environmental education as part of the biology curriculum. This enabled the "proper" establishment of the research around environmental education. This will be outlined in detail later (see 5.4.2 and 5.4.3).

5.3 ESTABLISHING A WORKING RELATIONSHIP WITH THE WORKGROUP

The relationship between the biology lecturer and the teachers that made up the workgroup was very formal. These teachers offered the following explanations of this relationship:

- They as teachers had generally experienced past college education which created this precedent of formality between students and lecturers. Many of them during their first college diploma attended colleges that insisted they wear uniforms and in some cases they even experienced corporal punishment;
- The biology lecturer did not necessarily want a formal relationship between himself and the students, but on the other hand he did not deliberately try to address this problem of formality.

The researcher was introduced to the students as a lecturer from a "sister" institution. Thus, the students initially responded with the same formality to the researcher as to the biology lecturer. Such a formal relationship tends to mitigate against establishing a good working relationship, thus restricting the flow of information and true feelings of the workgroup.

The first problem the researcher had to overcome with the workgroup was this high degree of formality. Fortunately, the researcher knew one of the students, a Science Education Project implementor. During the lecture students worked in groups. The researcher used this opportunity to work closely with the implementor's group. Gradually the members of this group started "opening" up and accepted the researcher. Soon the other groups also began to accept the researcher. This helped establish a reasonable working relationship in which collaborative endeavour developed as an accepted way of operating.

During the period the researcher managed to gather information from the workgroup by interviews, discussions and questionnaires dealing with the reasons for the teachers doing the F.D.E. course and what they perceived as the problems with the current General Science curriculum (See Appendix 6). These issues will be examined separately. It is clear that these teachers could more readily verbalise their criticisms of their school situations given the context of academic reflections provided by the inservice course.

5.3.1 Why were the Teachers doing the F.D.E. Course?

Most teachers in the group had poor science education qualifications but were teaching science. The only formal science qualifications these teachers had were high school biology or General Science.

These teachers stated that they had to rely on the school textbook in order to teach science. Therefore, when these teachers were asked why they were doing this course, they said that they hoped this course would help them understand the science content and develop an ability to conduct practical work thereby improving their teaching of science. Interestingly, these teachers also seemed to think that the only role of the college was to improve their abilities as implementors of the science curriculum at schools, indicating that they seem to view themselves as technicians or implementors of curriculum. This view is similar to that expressed in Chapter 4.

The way the F.D.E. course was structured was such that it seemed to address only the improvement of the implementation skills of the teachers, thereby reinforcing the notion of teachers as technicians. By this it is meant that teachers improved their abilities in implementing an externally designed syllabus.

5.3.2 Problems in the Standard 6 and 7 General Science Curriculum

Only the problems having relevance to environmental education as an innovation will be discussed. For a complete list of problems refer to Appendix 7.

(a) Language Problem

Most pupils are English second language speakers and experience many problems with:

- communicating in English;
- understanding the language;

- relying on literal translations which cause problems e.g. cell in biology and cell in electricity seem to the pupils as referring to the same thing;
- interpreting the textbook language i.e. the English used in textbooks pose many problems for understanding. For further analysis of this problem see 4.7.1.

Using English as the medium of instruction obviously poses a problem for an English second language speaker, adversely affecting the learning outcome. Solutions to this problem will be explored during the curriculum package development phase of this case study.

(b) Class sizes and Facilities

This has been outlined previously for the Clermont schools (see 4.3) where the class sizes are large and poor facilities prevail. Again, these teachers like their Clermont colleagues, felt that environmental education could not succeed without sophisticated laboratory equipment. They too felt thwarted by their "disadvantaged" state.

(c) Teachers

These teachers readily acknowledged their inability to understand some of the textbooks and scientific knowledge which in turn adversely affected their ability to teach science.

Since the teachers seemed to lack the basic scientific knowledge needed for environmental education they would have experienced problems in teaching it effectively. Some teachers said that

their scientific knowledge and teaching skills could be improved by attending inservice courses at colleges of education.

(d) Time

Generally, it was felt that the syllabus is long and therefore, difficult to complete. Where teachers have completed the syllabus they have had to "rush" through it, at the expense of pupils' understanding of sections. Therefore, introducing additional environmentally relevant sections would compound the problem of syllabus length. If environmental education is to be advocated then the environmental approach to the syllabus should be introduced with the replacement of some irrelevant sections with relevant environmental sections.

(e) Content of Curriculum

The teachers teaching in rural areas in particular felt that there were no sections in the syllabus that really addressed the rural context. Most teachers also felt that most sections were fragmented and lacked a context since these sections did not relate to pupils everyday lives. It seems that the innovation of environmental education could address all the above problems i.e. rural neglect, fragmentation and lack of context. Environmental education deals with the total environment, thus including the rural environment; its approach is interdisciplinary, thus potentially overcoming fragmentation and it emphasizes the person's environment (local environment), thus giving context.

In further discussions with the workgroup it became apparent that they felt that they could not change the curriculum but were interested in trying to overcome the problems of "actual" curriculum i.e. coping with large classes and inadequate facilities, gaining more knowledge in science, and learning to perform practical work. This meant that the workgroup did not feel the need for them to be involved in curriculum development, other than improving the actual curriculum practice. They also perceived environmental education as a means of improving the existing irrelevant curriculum.

These discussions seemed to indicate a sense of "disempowerment" of teachers with respect to participation in curriculum development and innovation. It seems the need to improve the teaching of the prescribed syllabus should be taken into account by both inservice courses and teacher upgrading courses such as the F.D.E. This need can be addressed if these inservice and upgrading courses consciously work within the context of school reality. An example of this practice would be to address - how a teacher can cope with 70 pupils in the class. These courses need to get teachers to explore teaching methods, to try them out in schools and evaluate the success of such teaching methods.

The F.D.E. course that the workgroup was busy with was not, in the considered view of the researcher, working with the teachers' actual curriculum problems. During discussions with members of the workgroups, they said that they definitely benefitted by gaining more scientific knowledge and practical skills but were not dealing with their everyday curricular problems, like the problems of the language medium and large class sizes. Another example that

illustrated this "disconnection" between the college experience and school was the use of the microscope. During the course at the college, the teachers worked with microscopes that they did not have in the school. They, were therefore not able to transfer skills learned at college to school. On the other hand, if at college they were to deal with this microscope and the established principles on which such microscopes function, then the teachers could use the principles to improvise by building a "homemade" microscope. This "homemade" microscope could then be used in schools, which would constitute a transference to school of skills learnt at college.

The above discussion is in no way intended to imply that inservice and upgrading courses should be based exclusively on dealing with actual curriculum problems, but the researcher is of the opinion that such courses should have a balance of developing:

- curriculum implementors - both within the real and ideal school contexts; and
- curriculum developers who are skilled at criticizing existing curricula and who bring about and implement curricular change.

The F.D.E. course seems to try to develop curriculum implementors for the "ideal" school context. Thus, the workgroup remained incapable of bringing about effective changes to the prescribed syllabus. Also, during the course, when lecturers did suggest useful methods that could be used in school the workgroup resisted these changes since they felt that these methods could only be applied to "ideal" schools. In

a sense the workgroup became victims of the school system since they could not see themselves bringing about changes at school. It became obvious to the researcher that this "victim mentality" had to be challenged and that this might be done by workshops in which the workgroup would have to analyse the implementation of new curriculum practices within their school contexts and engage in curriculum development projects. This meant that the biology curriculum in the F.D.E. course had to be altered.

The researcher together with the biology lecturer changed the biology course by using workshops that addressed curriculum practices, introducing the workgroup to a module on Water Quality and Water Borne diseases which focussed on curriculum development and change.

5.4 DEVELOPING CURRICULUM DEVELOPERS

5.4.1 Workshop Strategy

Workshops were run within the allotted lecture periods on different areas of curriculum practice and implementation. One such workshop will be discussed.

One of the early sections in the biology lectures, that the workgroup experienced before the workshop strategy was used was the "nature of science". Various aspects of the nature of science and its relevance to the teaching of science were outlined by the biology lecturer during lectures. The workgroup felt that these aspects, especially the processes of science, could not be implemented in their schools because their schools lacked laboratories, equipment and so forth.

The researcher designed a workshop on the processes of science (Appendix 8) and their applicability to a "disadvantaged" school context. The workshop enabled

the workgroup to analyse each process of science, what equipment was needed to develop each process, and how each process could be implemented in teaching. The workgroup soon realized that one does not need a laboratory or laboratory equipment in order for pupils to engage in many of the processes of science. Soon the workgroup realized this "process" oriented teaching, i.e. getting pupils to engage in the process of science, could be implemented in any school irrespective of facilities available.

The workshop strategy provided a useful way for the workgroup to analyse new curriculum practices and for realising the feasibility of implementation of such practices into existing school contexts. Importantly these new curriculum practices had the potential to improve the quality of teaching and learning.

The workshop served as a "terrain of contestation" between the teachers' old curriculum practices and the proposed new practices. During these workshops the teachers' dialogue with each other reflected on past actions and the feasibility of new actions. They were also given opportunities to plan the implementation of the new action.

Although this workshop strategy was useful it had one major weakness since there was no follow-up evaluation of the teachers' implementation of the proposed actions. The proposed actions should be tried at school followed by an analysis at college of the failures and successes of such actions.

5.4.2 Module on Water Quality and Water-Borne Diseases

Originally this module was intended to cover parasitology but was redesigned so that it could expose the workgroup to curriculum development and change. It was decided to focus on water quality and water borne diseases for the following reasons since:

- this would give parasitology a meaningful context that it otherwise lacks. Diseases do occur in people within their "real" environments and not only in textbooks;
- such a module could address the problem that many people face in their everyday lives. It was also topical in the newspapers, in Natal, with headlines such as

"Umgeni river contaminated"

"River water hazard"

and so forth;

- with the above problem not being adequately addressed at school, opportunities exist for the teachers to engage in developing a curriculum package on this section for school;
- the teachers would experience environmental education and implement it at school as an innovation that addresses the curriculum irrelevance problem.

The above reasons also provided a guide to the planning of the module on Water Quality and Water-Borne Diseases that was implemented as part of the biology course. This module was designed so that it put the workgroup through the "learning situation" during which they experienced practical "actions" in their own environment, gathering and gaining knowledge on water quality and water-borne diseases. Essentially the module's design was guided by an environmental education approach. Further, the workgroup were given opportunities to design such a module for schools.

Before the module could be started as part of the F.D.E. course work the workgroup was given a questionnaire (see Appendix 9) to complete. The questions attempted to establish the respondents source of water, the quality of their water and problems with water. The actions respondents would take in order to solve such problems was also investigated. The questionnaire further tried to determine which aspects of this module were appropriate as an innovation that could be included in the General Science curriculum.

The analysis of the questionnaires suggests that:

- the teachers who came from areas where clean water was not "piped", experienced for themselves or their pupils diseases due to poor water quality. They seemed to be well-informed about some issues like the purification of water for themselves and the types of water-borne diseases but not about other aspects like how these diseases are treated and so forth. They also realized the importance of clean water;
- the teachers with "piped" clean water did not seem to think that water was an important issue and were ill-informed about water borne-diseases;
- all the teachers felt that the junior secondary General Science curriculum did not pay enough attention to water. The teachers who had "piped", clean water suggested very technical curriculum inclusions (e.g.. chemistry of water, filtration and distillation techniques) while the teachers who did not have "piped" water wanted aspects dealing with water quality and water-borne diseases included in the curriculum.

The understanding and the amount of information by the teachers without clean "piped" water about water quality was restricted since, although they knew names and symptoms of diseases, and about the use of bleaches and boiling water to kill "disease", they did not know the nature of these diseases. This limited their "actions" in dealing with contaminated water and in preventing the contamination of water. It seemed that these teachers needed more information and other learning experiences that could "demystify" the concept of water quality so that they become "empowered" to act, and attain good water quality.

During the module the workgroup were exposed to various experiences on water quality and water-borne diseases by using videos, lectures, practical work and seminars. Two experiences will be highlighted since the researcher considers them significant. Also the responses to the questionnaire (Appendix 10) verify this because of their attempt to demystify the scientific knowledge about water quality.

EXPERIENCE 1: LECTURE AND PRACTICAL WORK ON BILHARZIA

During the regular class meetings two medical researchers from the Medical Research Council were invited to discuss their research on bilharzia in the rural areas of Natal. They dealt with the occurrence of bilharzia, its incidence, transmission, the health problems it produces and the snails that carry it. They also gave the workgroup the opportunity to examine the snails and the worms of bilharzia under the microscope. The workgroup found this experience most profitable, as expressed by this comment by one member of the workgroup:

"The speakers were very informative and gave us in-depth details about the bilharzia parasite. The bilharzia specimens were very important as they made us more aware of the parasite in a practical manner".

The above experience seemed to demystify bilharzia by making the information about bilharzia accessible to the workgroup. Also the practical made the learning of this information "real".

EXPERIENCE 2: WATER TESTING KIT

Steve Camp from Umgeni Water Board was invited to discuss project water and demonstrated practically how water quality is tested. Each member of the workgroup was given a water testing kit with which they had to test the quality of water in the area they lived. This experience proved to be valuable to the workgroup as expressed by one member:

"Testing the water quality with Mr Camp's pack aroused my interest. My home is situated next to the stream which we thought was not very polluted. With the help of Mr Camp's pack we all have to guard ourselves from polluting it".

The above illustrated that "action" (e.g. testing of water) in the local environment was important as it made most members more aware that environmental problems exist in their neighbourhood. The access to information about the environmental problem gives the person a sense of "empowerment" as does being able to do something about the problem.

The above experience also promoted the workgroup to seek more information about diseases caused by contaminated water and about quality of water in general. Some teachers also encouraged their pupils to undertake water testing themselves.

By this time the workgroup felt strongly that such a section on Water Quality and Water-Borne diseases should be included in the Junior Secondary General Science syllabus. At this point therefore, it was decided by the biology

lecturer and the researcher to introduce the workgroup to curriculum development. Each member was given the task to design a curriculum package for Junior Secondary General Science. The package was to be on Water-Borne Diseases with the requirement, that it could be implemented in their schools.

5.4.3 Designing a Curriculum Package

The members of the workgroup produced poorly constructed curriculum packages. Some produced one chart, others 2 or 3 posters, while one person produced a reasonable package. During one worksession the workgroup gave the following reasons for the poor attempt at producing a curriculum package:

- Some did not know what was meant by a curriculum package;
- Most members said that they could not produce a package simply because they did not know how to do this. They said that they had never done this before, either at school as teachers or while they were at colleges of education training to become teachers.

It was obvious that teachers lacked curriculum development skills some of which included the writing and simplifying of information that was needed for the development of this package.

During this worksession the researcher discussed what was meant by a curriculum package. Then members were given an opportunity to look at each other's curriculum packages. The workgroup then worked collaboratively and selected pieces of material from each member's curriculum package that could form one reasonable curriculum package. After this exercise

the workgroup assembled a reasonable curriculum package. This process brought about a realization of the importance of working collaboratively.

At subsequent worksessions the workgroup focussed on the assembled curriculum package, analysed its appropriateness for schools and began redesigning it.

Some of the areas which were considered when dealing with appropriateness and design of the curriculum package, were the appropriateness of content, accuracy of information, form of presentation and language. Although all these areas were important, the language area seemed the most significant. The curriculum package used English as a means of communication but was meant for English second language speakers who had many difficulties communicating and understanding English.

The following actions emerged as helping communication and comprehension:

- use of diagrams to give a "pictorial" interpretation of the words, thus enabling easier understanding of the information e.g. a diagram of a pit latrine next to the words "pit latrine";
- simplifying the word or phrase. e.g. Transmission - to move from one to another. Also, the constant repetition of this translation wherever the word transmission appears in the text. This reinforced the learning of this term;
- use of a glossary that is bilingual i.e. English words (that are difficult to explore the meaning of) are translated into the mother tongue. It was felt that this glossary should be used to

help pupils gain conceptual understanding rather than literal translation. The workgroup stated that pupils found it difficult to understand the concept of a parasite when explained in English as follows:

Parasite: an organism living in or on another and drawing nutrients directly from it thereby causing harm to it.

However when using a common everyday Zulu phrase "Ukutana umbungulu", pupils understood the concept well. This expression has immediate associations which pupils use to describe a person acting like a parasite. In translating this from Zulu into English one can see why:

ukutana: is like
umbugulu: bed bug

"ukutana umbugulu" = is like a bed bug
= parasite

The above illustrates two points. Firstly, that there is a need for mother tongue translations of concepts and secondly, the translation must try to use the everyday context of the mother tongue speaker. Thus the teacher needs to be familiar with the social context and the language of the second language speaker to facilitate better communications.

The curriculum package is still being developed and is likely to be produced professionally by Umgeni Water. This curriculum package is seen as potentially supporting Project Water of Umgeni Water and will be used in schools. It must also be recognised that the college provided useful institutional support (e.g. Umgeni Water, Medical Research Council) in helping the workgroup develop skills needed for curriculum development and access to information and resources needed to develop this curriculum package. Such support is important. Further it must be stated that the teachers in the workgroup were by no means accomplished as curriculum developers but were beginners who were developing.

5.5 EMERGING POSITIONS

The following seems to emerge from this case study:

- 5.5.1 Teachers from "disadvantaged" schools in particular could be made to see inservice and upgrading courses as potential vehicles to improve their curriculum practices.
- 5.5.2 The nature and form of the curriculum of inservice courses (like the F.D.E. course) may foster teachers' notions of being merely implementors rather than developers of curriculum.
- 5.5.3 New curriculum practices suggested by the college should be related to teachers' school contexts' in order for teachers to implement such new practices. If new practices are not related to teachers' contexts then teachers seem to reject these innovations. Also, the workshop strategy seemed to be a useful form to discuss the implementation of such practices.

- 5.5.4 Teachers feel incapable of participating in curriculum development if they lack the skills. The colleges themselves do not seem to attempt to equip teachers with such skills but rather focus on curriculum implementation skills.
- 5.5.5 Colleges of education should refocus their role so that they prepare teachers who:
- (i) can implement new curriculum practices in both advantaged and disadvantaged schools;
 - (ii) seek to improve their curriculum practices continuously; and
 - (iii) act as curriculum developers that can change curriculum and implement the changes.
- 5.5.6 The Junior Secondary General Science curriculum is too long and seems to be irrelevant. This relevance may be effectively addressed by introducing an investigating innovation like environmental education. This should be done by advocating the use of the environmental approach to the teaching of all the sections by using more environmentally relevant ones like Water Quality and Water-Borne Diseases.
- 5.5.7 A college of education may be used effectively to introduce an innovation like environmental education during pre- and inservice courses. These colleges sustain the interest in the innovation by providing support in the form of human and physical resources which help the teachers develop the needed curriculum development skills.
- 5.5.8 Developing appropriate curriculum materials that are related to environmental education is important. By appropriate, it is meant that materials must be suited to the local context i.e. these materials must relate

to the problems and needs of the users of the material
e.g. language usage for second language speakers and
so forth.

5.5.9 Environmental education as an innovation in
"disadvantaged" schools will "face" problems such as:

- (i) teachers with poor knowledge background and lack
curriculum development skills;
- (ii) language problems;
- (iii) and large classes.

It follows that, further research in this area needs to be
undertaken, in order to facilitate the implementation of
this innovation, in schools. If the research is not done,
useful innovations may be rejected.

C H A P T E R S I X

CASE STUDY - DURBAN TEACHERS CENTRE WORKGROUP

6.1 SETTING UP THE WORKGROUP

Each subject, at schools under the control of the House of Delegates, has a subject committee, that comprises teachers, lecturers and superintendents. The General Science subject committee of which the researcher has been a member since 1988, is one such subject committee. The functions of such a committee are to deal with curricular matters like improving the teaching of science, selection of textbooks, promoting the subject via quizzes and fairs; curriculum development and to facilitate better communication between the teachers and the superintendents. However, in the researcher's experience this committee dealt purely with technical (example, organising science fairs) and administrative (example, choosing textbooks) issues of science education at schools.

At one meeting of the committee the researcher put forward the proposal of Curriculum Development for Std 6 or 7 General Science which would involve the collaborative participation of General Science teachers. The proposal was met with enthusiasm and was supported by all members of the committee as they felt that it would improve the General Science curriculum. A week later the researcher addressed all the different subject superintendents of the House of Delegates (H.O.D.) on curriculum change and teacher participation in curriculum development. Again this proposal was widely supported. This created an ideal climate for the project. The researcher was given permission to work with approximately ten teachers at the Durban Teachers Centre (D.T.C.), during school hours. The provision of time and venue was important institutional support provided by the House of Delegates.

Members of the General Science subject committee volunteered to locate willing participants for the workgroup. Five volunteer schools were located, with each school nominating two General Science teachers to participate. Besides these 10 teachers, 4 superintendents (responsible for science education at schools) and the researcher formed the workgroup at Durban Teachers Centre. The researcher personally knew all the superintendents and three teachers from the workgroup. This helped to establish a reasonable relationship between the workgroup and the researcher.

6.2 CONTEXT OF THE PARTICIPANTS

6.2.1 Teachers

All teachers were qualified to teach General Science and were initially trained at a college of education. Subsequently some teachers had upgraded their qualifications by studying further by correspondence through a university or college. The upgrading of qualifications was not in the direction of science, with the exception of two teachers.

All all these teachers taught in fairly well organised schools that have laboratories, libraries, free textbooks for pupils and other teaching aids like overhead projectors and so forth.

The pupils of these schools generally seemed to come from a reasonable socio-economic background with English regularly used as a means of communication. There were very few, (approximately 2 per class) English second language speakers. According to the teachers the class size ranged between 28-34 pupils per class.

6.2.2 Superintendents

All four superintendents were highly qualified with a minimum of a Bachelors degree in Science and a professional qualification. They had both teaching and lecturing experience of science and science education.

These superintendents were responsible for the functioning of the subjects of Biology, Physical Science and General Science at secondary schools. Their functions mainly dealt with:

- supervision of the subjects of General Science, Biology and Physical Science;
- advising teachers and promoting teacher development;
- evaluating progress of teachers;
- assessing and promotion of science teachers;
- confirmation of new science teachers into permanent positions.

Teachers see the main function of these superintendents as "crit masters" i.e. as evaluators and "watchdogs". They also view the superintendents as bureaucrats of the House of Delegates (viewed as an illegitimate body created by the apartheid state) who implement the policy of an illegitimate body. In short, these superintendents were viewed suspiciously by teachers.

Before the research could proceed the Teachers Association of South Africa (an association which was strongly supported by teachers who work for the House of Delegates) took a decision not to allow any superintendent to evaluate teachers. This decision

was supported by most teachers including the teachers of the workgroup. It followed that, the relationship between the teachers and superintendents was one of tension, though there still seemed to be a satisfactory level of cordiality within the workgroup.

To overcome some of the tension and suspicion between teachers and superintendents the researcher stressed that all the participants within this project were "equals", having equal responsibility and ownership of the project. Also, actions that the workgroup decided to pursue, were not to be carried by teachers only, but by all within the capability of each person. This principle of democracy was accepted by all and did seem to overcome some of the tension and suspicion.

The researcher was employed by the House of Delegates (H.O.D.) a teacher during the years 1982 - 1986, during which time he learnt the H.O.D. school context reasonably well. The researcher also had informal links with some teachers of the H.O.D. even after leaving the school context of the teaching profession, therefore, keeping abreast of developments within this context.

6.3 WORKSESSIONS

6.3.1 The First Worksession

The researcher visited each participating school to clarify any misconceptions of the research project and gain popular support for the research project. This was done by speaking to the principal, the head of department of science and participating teachers. Some heads of departments were enthusiastic and wanted their entire department to participate, while other heads of departments saw the need for only "weak" teachers to participate in the workgroup.

Popular support was gained for the research project since it offered the potential to improve science teaching.

During the visit the head of department was given a questionnaire (Appendix 6) which was then discussed by all the science teachers before the participants from each school attended the first worksession. The questionnaire tried to determine the issues and problems that the teachers experienced with the General Science curriculum when they implemented it at school. These issues and problems were to be presented at the first workgroup meeting. The strategy of involving all the science teachers at the five different schools to discuss the questionnaire before the worksession rather than at the worksession was employed because:

- the participants of the workgroup would have completed the questionnaire before rather than at the worksession, which would save time at the worksession;
- with all the science teachers of that school making an input the problems highlighted would tend to be more "representative" of what was happening in each school. Also in this way approximately 30 teachers (6 science teachers at each school i.e. $6 \times 5 = 30$) would have participated as opposed to 10 at the worksession;
- the strategy promoted feedback and supported change. The two teachers acted as representatives of all the science teachers of their schools by bringing the ideas of these teachers to the worksession and feeding the ideas of the worksession back to them at the

schools. These representatives were "accountable" to the other teachers thereby facilitating feedback. Since the other teachers were indirectly part of the project they supported changes that were brought about by the workgroup and tried them at school. This helped to provide support and contextualized the curriculum changes.

At the first worksession (refer to pages 19-23 of research diary) the aims of the project were outlined and clarified by the researcher. The democratic nature of the project was also stressed for reasons given earlier (see 6.2.2.). During this session the workgroup focussed mainly on the problems of the existing General Science curriculum. Only the problems related to environmental education and collaborative teacher participation will be outlined since they have a direct bearing on the aims of this research. See Appendix 11 for a complete outline and assessment of problems as stated by teachers. Some responses were:

Responses Outlining Perceived Curriculum Problems in Science Education

1. Std 7 syllabus too long.
2. Lack of facilities for junior classes.
3. Lack of preparation time for practical work.
4. Large classes - having 30 pupils poses organisational problems for practical work.
5. Science is irrelevant in terms of the environment and pupils' experiences; also the sections in the syllabus fragment it.

6. Problem sections -
 1. Electricity
 2. Particle Model
 3. Chemistry
 4. Ecology
7. Teacher training - too much emphasis on theoretical principles of educational academic work and not on the practical teaching situation. Trainee teachers are therefore inadequately prepared for teaching.
8. Inservice courses for teachers are lacking. Teachers are therefore not in touch with developments in education which could help improve their teaching.
9. Teachers find it difficult to initiate change themselves by trying new teaching ideas. Instead they let the system dictate change to them.

Response 5 supports the earlier assessment of SCISA, EEASA and others in terms of a lack of environmental relevance of the General Science curriculum. Clearly this problem cannot be overcome by simply adding environmentally relevant sections to the existing curriculum since:

- the std 7 syllabus is too long (Response 1);
- it would not overcome the existing fragmentary nature of the syllabus (Response 5) but rather reinforce it.

Ideally the use of the environmental approach, as advocated by those interested in environmental education, was seen as capable of overcoming these problems, since:

- it linked the pupils' experiences with the curriculum;
- it linked the environment to the syllabus by dealing at an integrative level with relevant environmental problems;
- pupils worked in their environments in order to solve these problems (exercises in problem solving);
- it encouraged pupils to gain hands on experience in the natural environment. This experiential learning tended to promote the understanding and application of ecological concepts and principles. The hands on experience in the natural environment had the potential to overcome the problem of understanding ecology (Response 4). According to the teachers the pupils seem to have a problem understanding ecology. During this discussion teachers indicated that they tended to use the textbook or laboratory to teach ecology. This approach to teaching did not give pupils the opportunity to experience the natural environment and reduced the amount of "experiential learning", thus, posing learning difficulties for them.

Although all this was discussed, it was not followed through since the group decided to focus on other tasks. Also the section on ecology had been completed by most schools by the time of the meeting of the worksessions.

Responses 7,8 and 9 suggested that teachers saw themselves as technicians that implemented curriculum only. Thus they aspired to improving their abilities as technicians or as implementors of curriculum. Further, they saw themselves as "victims" of the system and were incapable of changing the system since they did not see themselves acting as agents of change.

The problems raised by teachers (in responses 2,3,4,5) seemed to suggest that they did not reflect with depth. They did not express any critical analysis as to why and how these problems arose and continued to exist. The teachers therefore, suggested mainly technicist changes like asking for more laboratories.

Further, these teachers tended to externalize the problems i.e. all the problems were due to the "system" and they themselves did not in any way contribute to causing problems or the solving of these problems. An example of such an attitude to a problem was their response to the insufficient number of laboratories. The teachers suggested that the increase in the number of laboratories would increase the quality of teaching and learning. The researcher pointed out that this was not necessarily true. It would depend entirely on how effectively the teacher uses these facilities - "the computer is as good as the person who used it". The solving of such a problem, according to teachers (the provision of more laboratories), would be the "system's" responsibility. Accordingly, the solutions for most problems seemed to be placed in the "system's hands", promoting the appearance that teachers were "victims" of problems as well as change thus having a "victim mentality". Teachers seemed to see themselves as victims of the system and incapable of bringing about change, thus reinforcing a "victim mentality".

This "victim mentality" which teachers seemed to project unwittingly about themselves, limits the amount of improvement and change that can be brought about in the curriculum. Ideally, teachers should be seeking to bring about improvement and change to the curriculum. Stenhouse (1975) is of the view that this can be done if teachers view themselves as curriculum developers. Curriculum developers attempt to improve the curriculum by bringing about changes in it.

As it turned out, by practising curriculum development in the workgroup; the teachers started to engage and contest the "victim mentality" and with time started seeing themselves as confident "doers and thinkers" of curriculum development. It must be noted that at the beginning of the project the teachers could not participate meaningfully in curriculum development. This could have been due to their limited technicist reflective ability and the way they viewed themselves i.e. as technicians and victims of change. Also the contestation between the role of teachers as technicians/curriculum implementors and their role as curriculum developers was potentially threatening to some of them and therefore, some teachers might not want to participate in curriculum development.

The nature of the problems raised by teachers from the five schools were similar as they came from very similar contexts. The similarity of the problems seemed to establish immediate dialogue between teachers, resulting in co-operation and a sense of "comradeship". In a sense these common problems helped the workgroup co-create context around common objectives thus a collaborative working relationship was established easily in a short period of time. It also seemed to launch the teachers into "action" by starting to engage in curriculum development. Since these problems were pertinent to the teachers they continued to participate in the curriculum development process despite the internal contradictions between

their perceptions of themselves as technicians and their actions which suggest their role as curriculum developers.

Although working with teachers of a similar context helped establish collaborative participation around solving common problems, the new actions and the reflections of the workgroup could become unchanging truths since they are not exposed to other contexts (examples of this are seen in responses 2,3 and 4). Teachers demanded idealistic teaching conditions which could not be attained due to the poor socio-economic conditions that currently exist in the country. Ironically, the teachers of the Clermont case study wanted the very conditions that the D.T.C. workgroup had since it seemed ideal to them, whereas the D.T.C. workgroup found them inadequate.

The researcher pointed out that these unchanging truths are problematic and need to be challenged and overcome. The researcher could challenge some of them since he had experienced a "wider picture", having come from a different context and having worked with teachers outside the H.O.D. during the research. This alluded to the need for the workgroups from different contexts to interact with each other from time to time so as to promote an intercontextual dialogue. Such an intercontextual dialogue acts as a useful way of challenging the unchanging truths. Since each context is different intercontextual dialogue created an external moderating mechanism.

6.3.2 Intercontextual Dialogue

The external moderating mechanism as described in Chapter 3 was modified to include intercontextual dialogue between the three workgroups. This intercontextual dialogue was arranged towards the completion of each workgroup's task. The meeting had the potential to provide an external moderating

influence which could encourage the sharing of resources, promote future net-working and improvement of past curriculum development efforts.

The meeting between the different workgroups was set late in the the research process because:

- the teachers needed time to establish a collaborative spirit by first working in a non-threatening context i.e. by first working on a set of common problems which helped establish a sense of collaboration and allowed the teachers to become confident amongst themselves. Experiencing dialogue (before gaining confidence) with other teachers from different contexts was seen as capable of creating a situation which would destroy the teachers' developing confidence.
- the teachers needed to have developed sufficient ideas and materials for reconstructing the curriculum which they could then share with other teachers.

6.3.3 Tasks

During the first worksession the workgroup identified the following tasks which they wanted to undertake:

1. It was felt that pupils, parents and teachers should be surveyed on their views of the current General Science syllabi.
2. The Std 7 syllabus was too long, indicating a need to find ways of shortening it.

3. Lack of facilities - it was recognised that the provision of facilities would not improve due to economic constraints. Therefore, it was felt that the workgroup needed to improvise and increase efficiency.
4. Large classes - this problem will become worse in the future. Therefore, the workgroup needed to find new teaching strategies to work around this problem.
5. Particle nature of matter - it was felt that this module was foundational to subsequent science sections. Therefore, the workgroup needed to redevelop this module to facilitate meaningful learning in pupils.

6.3.4 Second Worksession

After the first worksession the researcher visited all of the participating schools to check on work progress and offer relevant support. During one such visit the researcher felt a sense of dissatisfaction about the research project. The researcher made sure that this dissatisfaction was discussed at the second worksession.

The teachers put forward the following reasons for the dissatisfaction:

- they felt that they were being used by the researcher so that the researcher would gain his Masters Degree;
- there was no use participating since no curriculum changes would be instituted by the H.O.D. no matter what recommendations the research project made.

On further discussion teachers pointed out that they had in the past been subjected to research surveys by researchers (who were working on post graduate degrees) and pilot studies that did not materialize any gains for the teachers or the pupils. They felt like "test objects" that were "acted on" by pilot studies that did not improve the practice of education. Their primary rejection of research interventions (and not the obtaining of degrees) was that the interventions did not seem to hold any promise for improving their education practice.

The researcher had to emphasise clearly that he had no intention of "acting on" the teachers as "test objects" but rather of working collaboratively with them to find ways to bring about curriculum changes that would be implemented in educational practice. The researcher also pointed out that it was totally undemocratic for the workgroup to impose changes on other teachers based on the workgroup's findings. Rather, these findings should be presented to the other teachers outside the workgroup so that they could interact with the findings and decide on their implementation. After extensive discussion these points were accepted.

An analysis of the above situation suggests that:

- traditionally, research conducted at schools seems to have used teachers as information gatherers who were not integrally involved in the research process; and
- this research created, within teachers, the expectations for curriculum change.

Further, this suggests that teachers saw researchers as "experts" who prescribe the curriculum changes which they had to implement. This further supported

their view that teachers were technicians who have no power to bring about change since change is brought about by outside agents like researchers.

The progress of each task within the schools was also assessed during this worksession and it was discovered that hardly any work had been done on each of the tasks. The reasons for the poor progress of tasks was the lack of time i.e. teachers said that they were over-committed at school with various other duties. On further discussion it was established that although time constraints were a problem, teachers also lacked skills needed for curriculum development. Therefore, they found it difficult to carry out the tasks.

The workgroup decided to reduce the number of tasks and clarify each task carefully in order to effect the completion of the tasks. Two tasks were adopted based on their urgency and need. These were Task 1 and Task 5.

6.3.5 Subsequent Worksessions

Task 1

This entailed the designing of questionnaires that would survey teachers, parents, pupils and the wider community like industrialists and others. This survey would try to gather information about the present General Science curriculum for Std 6 and 7 and propose future curriculum changes.

The Science superintendents in the workgroup proposed that the information gathered by the questionnaires would in future be used to guide curriculum changes for std 6 and 7 General Science in the H.O.D. This proposal was received favourably by the workgroup and in particular by the teachers since it meant that they could really effect changes.

Early during the process of designing the questionnaires the workgroup found it difficult to work since they were not familiar with designing questionnaires. The workgroup overcame this problem by looking at other questionnaires, reading articles on designing questionnaires and talking to people who designed questionnaires. Importantly, during this process the workgroup became more critical about the nature of curriculum and its content. There was a "rich" dialogue about what type of science curriculum was needed and why. It was felt strongly by the workgroup that, General Science should, amongst other objectives enhance the development of environmental literacy.

During this task the participants in the workgroup became more reflective which was essentially what set up the "rich" dialogue situations.

Task 5

The task entailed the development of a module in the section dealing with the particle nature of matter.

(i) Problems

The workgroup decided to focus on what the problems were with regard to the teaching and learning of the module. Essentially they knew that this section was a problem as it was abstract to pupils. However, the teachers did not know why and how the problem arose. That teachers did not reflect deeply enough on the context of the problem was shown by the very superficial solutions (e.g.. repeat the lesson so that pupils can understand) they suggested. The workgroup realized that they did not know much about the context of the problem and therefore, could not immediately to solve it. It was decided to interview pupils and talk to other

teachers about what the problems might be. They also suggested that the information gathered should be presented at the next session together with the researcher making an input on this problem. The researcher was asked to make an input about this since he had previously run a workshop on this section.

(ii) Designing A Module

In the subsequent worksession the problem was explored in fair detail, which suggested that the participants were becoming more reflective about their analysis of problems.

Further, it was decided that a module could be designed to improve the teaching and learning of this section by taking account of the problems.

Interestingly the designing of the module, encouraged participants to analyse:

- the learning process i.e. rote learning vs constructivism;
- the teaching methodology i.e. chalk and talk vs creative involvement of pupils;
- the nature of science and its link to teaching and learning.

Also, during the development of this module the participants tried to develop alternative practical activities which would be simple and facilitate meaningful learning for pupils. They became innovative and excited about the work, thus promoting more collaborative partnerships. Two examples from the workgroup will be used to illustrate these points:

EXAMPLE ONE: DIFFUSION OF A SOLID IN A SOLID

The work group brainstormed to develop a practical activity that illustrated a solid diffusing within a solid. During this there was sharing of past experiences and ideas which were supported or contested and then refined by dialogue. Ultimately some provisional ideas were developed which different groups of teachers volunteered to attempt.

One group placed KMnO_4 crystals in gelatine and observe the KMnO_4 spread through the gelatine, effectively illustrating a solid diffusing in a solid. This created a great sense of achievement and excitement amongst the participants. Also it strengthened the collaboration between all the participants in the group, especially between teachers and superintendents thus to an extent overcoming the earlier tension.

EXAMPLE TWO: DETERMINING THE MASS OF AIR

Again the workgroup brainstormed and developed various ideas which could be tried out at school, with pupils. One teacher decided to give pupils a project - to design a practical demonstration that illustrated air has a mass. Ultimately the workgroup accepted the practical designed by the pupils since it worked the best.

This example illustrates that increasing partnership and collaboration among teachers, and also between teachers and pupils encouraged curriculum development. This illustrated that pupils are important partners in curriculum development. This is captured by the following comments made by the teacher:

"I was amazed at what the pupils came up with. Their designs were much better than our ideas".

(iii) Materials Production

The workgroup decided to produce a booklet which would act as a guide to the teaching of the particle nature of matter. This booklet was to include the problems encountered during the teaching of the section, suggested solutions and all the practical investigations and demonstrations that the workgroup had developed.

During the developing and writing of the booklet the following emerged:

- it was not easy to write materials which pupils and teacher would understand. The workgroups grappled with this problem but realized the need for clear and simple written language communication in order to facilitate understanding. Also simple diagrams enhanced the communication;
- physical resources such as a computer and photocopier, as well as technical expertise enhanced the production of materials. The workgroup worked at Durban Teachers Centre (a resource centre) which provided this technical back-up; showing that institutional support of this kind is important to effect the completion of materials production;

- there is a need to refer to other written materials in the syllabus content area in order to facilitate the writing and production of materials. This is important since the workgroup had not produced materials before and the reference to other materials helped this process. Also, the reference to other materials helped the workgroup with ideas of presentation, language use, and so forth.

Besides the institutional support of the H.O.D. access to other facilities outside H.O.D. seemed to be important. Materials production was dependent on both human and physical resources. Without either one material production was not possible. It seemed that each workgroup would need their own elaborate physical resources to be successful in its materials production. However, within the present socio-economic climate the provision of elaborate physical resources for each workgroup would be impossible. On the other hand, if a network of different institutions is created which facilitates the access and support of individuals to resources among institutions (Figure 2), then there would be no need for each institution to have its own elaborate physical resources.

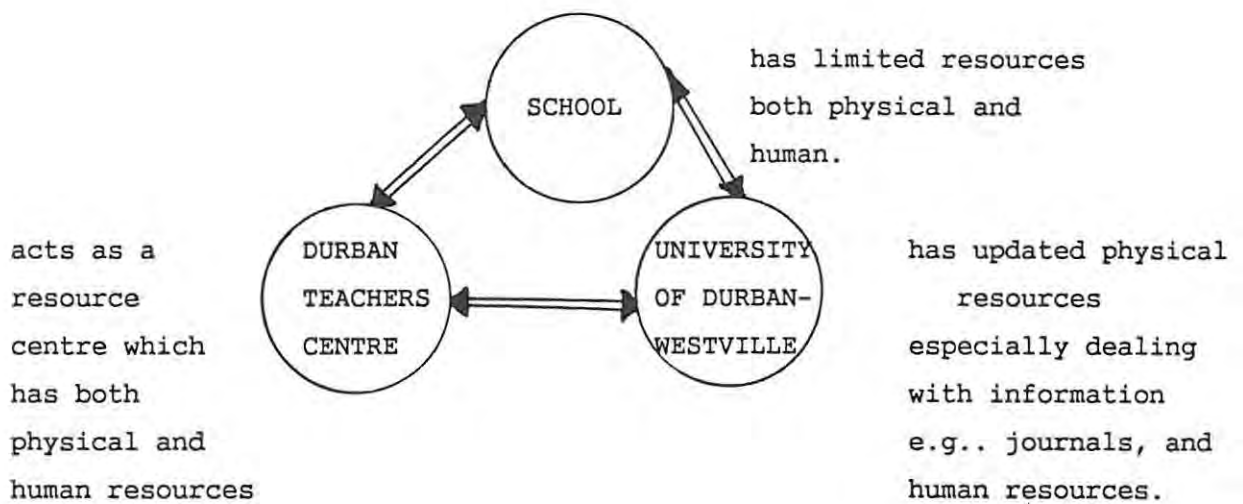


Figure 2 - The Network of Institutions

Each institution had a different degree of resource development and was limited if it worked separately. Working collaboratively, via networking, they increased the availability of resources thereby enhancing work efficiency.

6.3.6 Workshop

Once the module on the particle nature of matter was in a reasonable state of completion the workgroup argued whether the module should be disseminated to other teachers (outside the workgroup) or invite criticisms of the module by other teachers before dissemination. The workgroup felt the latter should be done via a workshop since the other teachers would provide:

- criticisms that would help improve the module;

- provide guidance about their "gut feeling" about the appropriateness (to their school context) and the "workability" of the module.

During the planning of the workshop the following emerged:

- the workgroup agreed that every one of its members should participate in the presentation and facilitation of the workshop. However, many members expressed reservations about presenting or facilitating since it would be the first time most of them were doing something like this. They felt that they lacked the confidence and skills to do this;
- all the members recognised the importance of this workshop. Therefore, they took this task seriously and planned thoroughly. It was important since they felt that their work (products) was on the "line". There was a high degree of collaboration, thus, galvanizing the workgroup further and creating a sense of "ownership" through having to defend their products.

The members were supportive of each other and a "mock" workshop was "staged" amongst themselves. This helped them develop confidence and skills needed for the workshop.

During the presentation workshop:

- some members of the workgroup were initially very nervous about their presentations. As the workshop

progressed these members became more confident as they sensed a feeling of admiration for their work by teachers outside the workgroup. This reinforced the importance of "ownership" i.e. the members of the workgroup "showed" other teachers what they produced;

- the participant teachers criticized the time allocation for the module. They felt that it needed twice the amount of than normally used in completing this module. This excessive demand for time by the module could pose problems in terms of syllabus completion. Also, other useful changes were suggested, such as the use of a "black box" exercise which could help develop the abstraction ability in pupils;
- some teachers rejected the new methods based on constructivist learning. These teachers did not give reasons why they rejected this methodology. The researcher suspected that these teachers were resisting change in a very similar way to that which the members of the group experienced earlier in the project i.e. the problems are not with the teachers but with "the system";
- some of the participant teachers volunteered to participate in the workgroup in the future. These teachers also suggested that this

type of work (curriculum development) be widened to include more teachers who would then develop different modules.

Immediately after the workshop the workgroup evaluated the workshop and decided that:

- the workshop was a useful learning experience for many of the members of the workgroup;
- importantly, the workshop should be used as a mechanism in the dissemination of the module. It was felt that if non-workgroup teachers had just been presented with the module many would have resisted the use of the module. The workshop would provide a forum for clarification of the module, and could support and guide new teachers in its implementation. Also, the participant teachers when contesting the module made changes to it by, adapting it to their own context. These teachers seemed to assume part "ownership" of the module because of their suggested changes, and hence became more amenable to its implementation;
- the work group should first plan to revise the module in the light of suggested changes and then use the workshop to disseminate the module. The module must be seen as a draft as it would be further revised by teachers.

An analysis of the workshop, from the researcher's point of view seemed to indicate that it was important as:

- it promoted collaborative work before and after the workshop. Before, the workgroup seemed to galvanize and prepare for the presentation. Afterwards, the participant teachers became interested and wanted to participate with the workgroup;
- it promoted a sense of "empowerment" i.e. the members of the workgroup gained confidence and had a sense of "ownership" of the module;
- it provided a forum of contestation and change. Contestation refers to the criticisms levelled by other teachers at the workgroup's efforts, which forced the workgroup to rethink what they thought was an unchanging truth. This mobilized new changes for the workgroup. Also, during the contestation the other teachers' ideas were challenged forcing them also to rethink their ideas, thus mobilizing change. This process consequently promoted curriculum reconstruction.

At the time of writing of this thesis the workgroup were still busy with the reworking and the dissemination of Tasks 1 and 5. It is envisaged that these tasks will be completed in 1992.

6.4 EMERGING POSITIONS

The following seem to emerge from this case study:

6.4.1 Changes in the General Science Curriculum and its Implication for Environmental Education.

The General Science curriculum is too long, and has irrelevant sections which do not relate to the pupils' environment nor prepare them for the future interactions with it. Irrelevant sections can be replaced with more relevant environmental issues. An environmental education approach can be used to teach these relevant environmental sections.

6.4.2 Resistance to Participation

The teachers resist participating in curriculum development since:

- they feel that it is a time consuming process;
- some feel that changes can only be brought by the "system" i.e. by decision-makers and "experts";
- they seem to see themselves as "technicians" that implement curriculum and not as curriculum developers.

There seems to be an entrenched "culture of non-participation" amongst teachers.

6.4.3 Challenging the Resistance

This "culture of non-participation" can be challenged by:

- getting teachers to highlight the problems they experience in the curriculum. Teachers must be encouraged to analyse the problems which are generated by the "system" and by themselves. This can be done by an intercontextual dialogue i.e. individuals from outside the teachers' context "painting the whole picture" which challenges the teachers to see curricular problems more than "system" problems;
- getting teachers to work on curriculum problems which they can solve.

6.4.4 Participating in Curriculum Development

Teachers seem to be willing to participate when:

- the curriculum development revolves around the solving of their own problems;
- there is adequate institutional support. For example, the H.O.D. provided time and a venue for the teachers to work on the project;
- there is adequate access to human and physical resources. This need not be effectively provided by one institution alone, but by the networking of institutions;
- a sense of "ownership" is created by the teachers producing curriculum materials that they can acknowledge as their own work yet which could be shared by other teachers;

- their confidence increases.

Teachers experience problems which could affect their quality of participation. These problems are:

- inadequate time to complete tasks; making it important for teachers to have institutional support, choose reasonable task sizes and work collaboratively on different aspects of a task so as to shorten the time needed for completion;
- limited technicist reflective ability, i.e. teachers who cannot reflect deeply on the problems do not effectively address the problem. However, with time this reflective ability seems to improve. Therefore, continuous involvement in curriculum development projects will improve reflective ability;
- lack of curriculum development skills like writing, analysis of problem, ability to access latest information on curriculum innovations and so forth. These skills can be developed as the project proceeds, with further institutional support and networking.

6.4.5 Model for Collaborative Teacher Participation in Curriculum Development

The following model seems to emerge from collaborative teacher participation in curriculum development.

Firstly, the workgroup needs to co-create a working context i.e. they need to share and discuss their curriculum problems and identify common problems. If the teachers come from similar contexts this

co-creation of context seems to be established quickly because of the similarity of the problems. Also this co-creation of context seems to help the workgroup become cohesive and collaborate to find a solution.

Secondly, the workgroup needs to focus on one or two problems so that it is manageable and can be performed within the time commitment of the workgroup.

Thirdly, the workgroup needs to divide the task and collaborate to complete the task. During this time the workgroup needs to reflect, act and dialogue at school and within the workgroup.

Fourthly, the workgroup needs to produce curriculum materials. During this phase in particular, institutional support and networking is important so as to promote the development of the materials and skills needed by the teachers for curriculum development.

Fifthly, the workgroup needs to share these materials with other teachers via workshops. At these workshops the curriculum materials are contested and supported; thus, helping the development of the materials and their wider dissemination. In the process the workgroup develops further in terms of the skills and confidence needed for curriculum development.

C H A P T E R S E V E N

EMERGING POSITIONS

The teachers who participated in each workgroup were either located at schools or in a college of education where they were involved in upgrading their qualifications. These teachers examined and highlighted problems both with the design and implementation of the current General Science curriculum. Collaboratively teachers within each workgroup developed innovations which could overcome some of these problems. While working with each workgroup the following information and overlapping positions were emerging in the areas of:

- 7.1 Design problems with existing General Science Curriculum;
- 7.2 Problems experienced with implementing the General Science Curriculum;
- 7.3 Collaborative Teacher Participation in Curriculum Development;
- 7.4 Colleges of Education and Curriculum Development;
- 7.5 Environmental Education as a Curriculum Innovation.

The information gained for 7.1 and 7.2 was via a questionnaire (Appendix 6) and discussion within each workgroup. Only the problems which are related to environmental education will be discussed in 7.1 and 7.2 (See Appendix 7, 11 and 12 for detailed information and other areas beside environmental education). The advantages of collaborative teacher participation within curriculum development 7.3 unfolded itself to the researcher as a consequence of the process of the research. This process is discussed at some length. 7.4 and 7.5 will be dealt with in detail as they have various implications for environmental education.

7.1 DESIGN PROBLEMS WITH THE EXISTING GENERAL SCIENCE CURRICULUM

Generally the teachers felt that the current curriculum lacked environmental relevance, although there are some sections which are perceived to have direct environmental relevance. These sections however tend to be reduced to specific's e.g. only dealing with the parts of the fish, therefore not generating a greater understanding how the fish lives in its environment, its impact on the environment and vice versa. Teachers began to agree that there is a need to include environmentally relevant sections as well as the need to use an environmental approach in teaching relevant sections. Using the environmental approach in teaching of sections may result in a greater understanding of the sections in a holistic manner. Also the teachers felt that there was a disconnection of curriculum from the life experiences of their pupils. Pupils were not made conscious of their impact on and interconnection with the environment. Environmentally-oriented sections in the curriculum could foster more positive relationships between pupils and their environment.

7.2 IMPLEMENTATION PROBLEMS OF THE GENERAL SCIENCE CURRICULUM

7.2.1 Language Problem

The scientific register (terminology of science) has always presented a problem. In a sense it can be regarded as a language of its own. The language of the science classroom tends to be couched in this scientific register. This poses a problem for those initiated into this register thus hindering conceptual understanding because it is not the language of thought. Further the problem is compounded by textbooks that are:

- written in this scientific register which is not the language of everyday use of the pupils;

- written for a target English first language audience although the pupils are second language speakers of English (e.g. Black schools);
- poorly structured and have inadequately documented content.

The teachers suggested that these problems could be overcome to an extent by the following strategies:

- using models; hands on experiences; using kits; use of diagrams; use of analogies; use of illustrations; bilingual translations developing appropriate materials that relate to pupils life experiences.

These strategies, according to teachers tend to allow pupils to develop a pictorial understanding which facilitates better conceptual grasp and communication.

7.2.2 Large Classes

Most teachers taught classes that had between 50 to 60 pupils. This posed an enormous problem for communication with and individual attention for pupils. Many teachers suggested the following strategies which could be used to overcome this problem:

- using groupwork, within which peer teaching can be encouraged; use of kits which pupils could use on their own; and use of instructional materials which guided pupils through self-learning exercises.

The above guidelines are equally applicable for developing efficient learnings in smaller classes e.g. in the H.O.D. schools.

7.2.3 Lack of Facilities and Resources

It must be argued that while many schools face shortages of textbooks, finances, laboratory facilities, laboratories and other curriculum materials, the mere provision of these facilities will not automatically result in better teaching and learning. In some schools which have all these facilities the teachers do not use these resources effectively or at all. Often the teachers argue that these resources are inappropriate to develop conceptual learning amongst their pupils. The solution lies largely in the developing of appropriate skills within teachers who then can work in any situation irrespective of lack or inappropriateness of facilities. This development of skills seem to be realized when teachers start working collaboratively on curriculum development. One useful exercise is for teachers to develop materials which are cost effective and context-suited. In this way teachers become more independent of the "experts" and instead rely on themselves.

7.3 COLLABORATIVE TEACHER PARTICIPATION IN CURRICULUM DEVELOPMENT

7.3.1 The Culture of Non-Participation

The teachers initially seem to resist the participation in the curriculum development projects since they experience various problems. The common problems seem to be:

Time Restriction: teachers have a large work load thus imposing a time restriction;

- General Apathy:* some teachers are apathetic about participating due to reasons ranging from authoritative school administration to a lack of professional and personal commitment by teachers;
- Lack of Skills:* teacher education programmes, both preservice and inservice, do not deliberately develop skills required for curriculum development in teachers;
- Lack of Information:* teachers do not have access to latest information and research findings in Science education or education in general;
- Disempowerment:* systematically over a period of time teachers become deskilled and disempowered as a result of:
- the lack of or limited participation by teachers within the RDDA model;
 - the imposed centralized bureaucratic control;
- Victim Mentality:* teachers see themselves as victims to curriculum changes rather than as actors initiating these changes. This results from the following notions:
- change is brought about by systems or authority and not by individuals;

7.3.2 Generating a Culture of Participation

The culture of teacher non-participation had to be challenged and replaced by a culture of teacher participation in curriculum development. This participatory culture was generated by the researcher recognising the following:

- 7.3.2.1 Generally teachers came to acknowledge the merits of working collaboratively with teachers of the same or similar context, within institutional frames. An institutional frame is defined as an agency that brings teachers together and provides a working context around common purposes. (Examples: Science Education Project, inservice courses, departmental Science committees etc.). These institutional frames then provide a support system that allows participation;
- 7.3.2.2 Teachers will want to participate in curriculum development if it encompasses their needs, problems and experience. It must be noted the needs and problems are context-bound hence generally dictating the need for teachers of the same/similar context working together. They tend to support each other since they can identify with each other's problems;
- 7.3.2.3 It is important for teachers to identify what they wish to work on since:
 - (a) they see a possibility to produce tangible solution/s to their problem/s. This helps commit teachers to participate in the curriculum development process;
 - (b) they are familiar with the problem therefore they can use their experiences to attempt to solve the problem. This seems to make the teachers confident and encourages their participation.

Also they seem eventually to acknowledge their role in contributing to solve these problems with or without "experts";

- (c) it seems to help co-create a collaborative working context around a democratically decided set of purposes for the curriculum development project. Once this is established the teachers find it easy to share experiences, problems and ideas via dialogue and by reflecting on past actions. This then promotes further action, dialogue, reflection and sharing, continuously challenging and promoting the reconstructive curriculum process. This leads to developing appropriate curricular and improved curricular practices.

7.3.2.4 Generally teachers suggested very technical and practical curriculum innovations and not transformative innovations. However, as the project continued these teachers suggested changes and actions (active solutions to bring about and try improvements) which were becoming more sophisticated e.g. the Durban Teachers Centre workgroup started challenging underlying assumptions of learning (rote learning vs constructivism). This happened due to deeper reflection and gaining access to new information. Hence in the view of the researcher, with time and support these teachers may embark on transformative innovations.

7.3.2.5 It seems that the workgroup needs to focus on only one or two problems which they have identified. They need to work collaboratively using action research to overcome this problem. During this process the production of materials (e.g. reports, teaching modules etc.) by the workgroup needs to address their problem, is fundamental to their growth as confident curriculum developers. These materials create a sense of ownership and this builds confidence.

7.3.2.6 Improving the workgroup's action research can be accomplished by widening the participation by inviting more interested persons. This was done by means of workshops. The workgroup organised a workshop on the problem area with other science educators. This provided a good platform for intercontextual dialogue i.e. science educators whose contexts were different from the workgroup dialogued with the workgroup and vice versa. This intercontextual dialogue set up a dialectical discourse which caused both the workgroup and other science educators to reflect more deeply on the problems and solutions which the workgroup raised. This also provided a good external moderating mechanism which challenged the workgroup's problems and solutions. During this dialogue the other science educators generated ideas in the workshop which they later tried in schools. They started linking with the workgroup, hence widening the workgroup into a network. The network is important as it supports the exchange and sharing of materials, ideas and intercontextual dialogue, thereby sustaining and widening the reconstructive curriculum development process.

7.4 COLLEGES OF EDUCATION AND CURRICULUM DEVELOPMENT

In the view of the researcher it ought to be the task of Colleges of Education to extend their role beyond merely training teachers for certification. Colleges of Education should contribute to the process of curriculum innovation. The teachers both at Durban Teachers Centre and Clermont however indicated that these institutions did not help them gain skills for curriculum development while training to become teachers. Also the teachers at Edgewood saw the role of colleges as merely producing teachers who could handle the subject content adequately and teach confidently. Usually this was interpreted within the framework of training teachers to be implementors of already constructed curriculum packages, rather than to be developers of their own curriculum.

In the view of the researcher, these institutions need to refocus their curricula so that they produce teachers who are curriculum developers as well. This can then help both the generation of the culture of participation in curriculum development and developing skills needed for curriculum development within trainee teachers. Therefore it is important to engage the trainee teachers in curriculum development projects during the course of their study. These curriculum development projects might enact the following:

- critique the present curriculum at schools and highlight the problems with it. Examine problems beyond technical ones (e.g. resource shortage) and analyse both the symptoms and causes of each problem. This helps develop the critical abilities needed for curriculum development among trainee teachers;
- decide on a curriculum innovation which will address some of the problems exposed. This innovation should be developed collaboratively by the trainee teachers with the teachers (at school) for the school;
- training institutions should provide information access to other resources by inviting specialists on areas from other institutions who can present seminars and so forth. This helps the trainee teachers shape, and challenge their ideas about the innovation; it provides opportunities for experiencing innovation; and supports the trainee teachers so that they can successfully develop the innovation. During this time the institution ought to help the trainee teachers develop the skills such as networking, accessing resources both human and physical, writing skills, materials

production, working collaboratively, and the ability to critique that are needed for curriculum development;

- the trainee teachers should try these innovations at school. This is important as any curriculum development project should be linked to the reality of school and not work hypothetically or abstracted from school. However there may be practical constraints like the timetable requirements of the college that do not suit the school, transport cost and so forth;
- the trainee teachers should produce materials e.g. charts and information books, that could be used to support the innovation. Also these materials must be developed collaboratively as they may generate a wealth of good quality material and must be tested in schools. These materials could be shared via a network of teachers who could adapt them for their needs.

7.5 ENVIRONMENTAL EDUCATION AS A CURRICULUM INNOVATION

Although all three workgroups considered that the current General Science Curriculum is not environmentally relevant, only one workgroup (Edgewood) developed a module of environmental relevance. The researcher attributes this to the following possible reasons:

- the democratic nature of action research allowed teachers to address curricular innovations as they wished;
- the teachers developed curricular materials that overcame the problem which they saw as urgent and which they could handle. This was

important to allow in order to generate the culture of participation in curriculum development.

- the Edgewood group worked on environmental relevance as the course structure (at Edgewood) provided adequate support to help teachers work in this direction.

The above has the following implications for environmental education as a curriculum innovation:

- teachers see it as a needed innovation but they preferred to work on other innovations because these link directly to some problems they experienced at school and which they felt they could use their experience and resources to solve. Teachers generally also lack information on the environmental education approach and therefore do not know how to develop the innovation;
- it is easier to introduce environmental education as an innovation at institutions which train teachers because it can be made a compulsory part of their training course. This can be done by involving the trainee teachers in curriculum development projects as part of their course;
- these institutions need to provide adequate support, (example, techniques for developing materials) and access to information about environmental education. This helps trainee teachers develop modules for environmental education, thereby developing the skills needed for developing further environmental education modules;

- although the two other workgroups did not directly work on environmental education as an innovation, they can engage in it after intercontextual dialogue i.e. when each workgroup meets to share their resources and experiences later in the project. This illustrates the importance of the network in generating and sustaining environmental education as an innovation.

CHAPTER EIGHT

IN CONCLUSION

The main aim of the investigation has been to describe and explain the curriculum development project that involved the collaborative participation of teachers in the redevelopment of sections of the Junior Secondary General Science curriculum using an environmental education approach. The investigation essentially sets out to describe and illuminate rather than to test and prove. Therefore the investigation seeks to establish a grounded theory.

The nature of the chosen research process involves that it will not subscribe to traditional empirical research methods, since it would not be compatible with naturalistic inquiry of collaborative teacher participation in curriculum development. Although the strengths of research process are compatible with collaborative teacher participation, the research process may be perceived to have limitations.

8.1 LIMITATIONS OF THE RESEARCH

This investigation has been circumscribed for the purpose of this thesis. It therefore has certain inherent limitations. Some of the limitations are:

1. There seems to be lack of coherent body of literature which could provide a solid and specific theoretical base for the investigation. This limitation may be due to the researcher's own inability to access such theoretical information;
2. This study has primarily been of a descriptive and explanatory nature. It has not attempted to evaluate the effectiveness of the curriculum development project which involved the collaborative participation of teachers in the development/redevelopment of sections of the Junior Secondary General Science curriculum

using an environmental education approach. Such evaluative study involving monitoring the impact of redesigned curriculum materials by teachers on the quality of classroom learning could provide an important additional perspective;

3. The collaborative teacher participation in curriculum development has the limited ability to affect system changes i.e. provide schools with new facilities and overcome injustices of the apartheid education system. On the other hand positive macro changes to the system together with micro changes such as the collaborative teacher participation in curriculum development, have the potential to transform the current unjust authoritarian education system into a more democratic and just one with a relevant curriculum;
4. The tasks engaged in the research process seem to be "incomplete" and changing. This is dealt with 8.2.

8.2 TASKS TO COMPLETE

A critically important point is that the investigation has an "ongoing" nature. Therefore the process of collaborative teacher participation in curriculum development seems to be ongoing and moving into new directions. The following tasks have still to be completed by the workgroups:

1. , Clermont Zone

- (a) Dissemination of material generated on practical work.
- (b) Developing a module on teaching of the Metric System at Primary and Junior Secondary Schools.

2. Durban Teachers Centre

- (a) Dissemination of module on particle nature of matter.
- (b) Completion, dissemination and analysis of questionnaires that focused on suggested changes for the Junior Secondary General Science.

3. Edgewood College

- (a) Completion and dissemination of module on water.

8.3 COLLABORATIVE TEACHER PARTICIPATION IN CURRICULUM DEVELOPMENT

On the other hand the strengths of such research approach made it possible to establish a democratic collaborative teacher participation in curriculum development. Further this research approach made it possible for other valuable variables about collaborative teacher participation to emerge. These seem to be:

- 1. That there seems to be a culture of non-participation in curriculum development amongst teachers. This culture seems to cause teachers to resist the participation in curriculum development projects;
- 2. That the culture of non-participation can be challenged and overturned if the curriculum development revolves around the teachers curriculum problems.

To ensure the process of collaborative teacher participation in curriculum development succeeds the following features seem significant:

- the co-creation of context;

- working on manageable curriculum problems;
- production of materials to address these problems;
- the need for institutional support and networking so that it promotes the curriculum development process;
- workshops are useful as a mechanism to disseminate the curriculum materials because it improves the collaborative action of the workgroup and generates interest amongst other teachers to participate;
- the need for intercontextual dialogue;
- the teachers have limited curriculum development skills but these develop progressively during the curriculum development project;
- the colleges should refocus from training of curriculum implementors to producing of curriculum developers. This may be done by getting the trainee teachers to engage in curriculum development projects at schools.

8.4 ENVIRONMENTAL EDUCATION AS A CURRICULUM INNOVATION

The study suggests the following:

1. That the current Junior Secondary General Science curriculum is too long and irrelevant i.e. it is not linked to the pupils' experiences. The present

curriculum does not foster pupils' understanding of the interrelatedness within the environment, nor especially their own interconnectedness with environmental problems. An environmental education innovation has the potential to overcome the problems in the General Science curriculum;

2. That the implementation of environmental education in the General Science curriculum will face practical difficulties in disadvantaged contexts in particular. These practical difficulties are large classes, English as a second language of communication and lack of facilities like textbooks, equipment, facilities and so forth.

8.5 FURTHER RESEARCH

This investigation is one of few pieces of research done on collaborative teacher participation in curriculum development in South Africa. It has therefore opened many possibilities for further research. Such possibilities are:

1. What skills, provisions and policies are needed to empower teachers to become curriculum developers?
2. How can the colleges of education realize the aim of producing teachers that are curriculum developers?
3. How can colleges of education play a role in introducing trainee teachers to environmental education so that they can develop environmentally relevant curriculum and practise this curriculum at schools?

4. What sections in the General Science curriculum need to be replaced by which environmentally relevant sections and how to use the environmental education approach to teach other appropriate sections?
5. What are the practical implications like English second language, lack of resource materials, large classes for the implementation of environmental education in schools?

Opening up of further research investigations is important to generate the transformative process within the developing South African education system. Teachers acting as curriculum developers and participating collaboratively have the potential to continually develop relevant curriculum in relationship to different times and contexts.

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APPENDIX 1

RESEARCH DIARY

KEY

A. SETTING UP RESEARCH

A1 PROPOSAL

A1.1 Planning

A1.2 Draft Proposal

A2. FUNDING

A3. CONSULTANTS

A4. SETTING UP TEACHER GROUPS

B. RESEARCH

B1. CASE STUDIES

B1.1 Clermont

B1.2 Edgewood

B1.3 Durban Teachers Centre

B2. Tensions

B3. Emerging Positions

B3.1 Research Methodology

B3.2 Analysis

B4. Consultations

B4.1 Rob O'Donoghue and Jim Taylor

B4.2 Anand Naicker

B4.3 D.S. Rajah

B4.4 David Brookes

B5. Supervision

B5.1 Carmel

B5.2 Pat

B6. Writing up the Thesis

B6.1 General tips

B6.2 Chapter 1 : Introduction

B6.3 Chapter 2 : Culture of Participation

B6.4 Chapter 3 : Relevance

B6.5 Chapter 4 : Case Studies - General

B6.6 Chapter 5 : Clermont - Case study

B6.7 Chapter 6 : Edgewood - Case study

B6.8 Chapter 7 : Durban Teachers Centre - Case study

C7. PROGRESS REPORT

C7.1 Progress Report No. 1

A. SETTING UP RESEARCH

A2. FUNDING

15 FEBRUARY 1991

- (1) Phone Dianne - set up a meeting backing from SCISA and (R) seen as a SCISA initiative ==> further meeting with Dianne also needs proposal and anticipated budget.

SCISA FUNDING PROPOSAL

1. FIELD OF RESEARCH

The field of research is Curriculum Development in Environmental Education. The provisional title is:

A PARTICIPATORY APPROACH TO CURRICULUM DEVELOPMENT: A CASE STUDY IN SECONDARY SCHOOL GENERAL SCIENCE.

2. CONTEXT OF RESEARCH

Presently the people of South Africa are faced with many environmental problems, of which some involve political change (Ramphela and Wilson, 1989) soil erosion and water shortage (Sunter, 1989). The present curriculum in schools does not prepare pupils to tackle these problems. (SCISA 1988, EEASSA, 1989). A curriculum innovation (environmental education) is needed to prepare the people to tackle environmental problems (Shane, 1974). Shane sees environmental education as a reactionary solution to the environmental crisis. On the other hand O'Donoghue (1989) sees environmental education both as a needed curriculum change and as an approach that brings about reconstructive change in an individual through a social process of critical dialogue and reflection.

In the above views of Shane and O'Donoghue both have agreed that there is a need for curriculum innovation although each sees the innovation differently. A new curriculum needs to be developed in South African schools. Present curriculum development uses scientific approach of an RDDA model. (R - Research D - development D - dissemination A - adoption). This model is proven to be weak for bringing about innovation (Papagiannis et al. 1982, Popkewitz, 1984) because of the low rate of adoption by teachers. The repeated failures of this model have most often been ascribed to communication weakness, insufficient or poor evaluation and lack of teacher participation. (Olson, 1982, Eisner, 1985).

A radical change in outlook may be required. An alternative approach would be the over-running of a centre-to-periphery outlook to a participatory involvement of teachers in curriculum development. This participatory approach to curriculum development would need to be done in a way that enables the participants to take a large share of the initiative and to become confident thinkers and doers (McNaught, et al. 1990). From this perspective, teachers are partners in the process of innovation and accept this

innovation (Verduin, 1967, Taylor and O'Donoghue, 1990). This should lead to better implementation of innovation (Olson, 1982), by gaining greater commitment from the teachers involved.

This research project will use the participatory approach to curriculum development. The researcher and General Science teachers will work together and develop an existing section of the Standard 6 or 7 General Science syllabus in the light of issues that participants bring from their praxis and theoretical frameworks.

3. AIMS OF RESEARCH

- 3.1 Examine issues related to curriculum development in general.
- 3.2 Establish guidelines for participatory approach to curriculum development in particular.
- 3.3 Evaluate the participatory approach to curriculum development.
- 3.4 Examine collaborative research (teachers and researchers) and establish guidelines for this type of research in particular.
- 3.5 Develop an exemplars section/topic for Std 6 or 7 General Science.

4. RESEARCH DESIGN

This research project is designed to be collaborative as the researcher and teachers act as both participants and facilitators co-operatively (Kyle and McCutcheon, 1984). The investigation is essentially setting out to illuminate and describe rather than to "test" or "prove". It is for this reason that a case study is appropriate. An action research design is selected as it is most compatible with the participant approach to curriculum development (Cohen and Manion, 1985). Action research also links reflection to action, offers teachers a way of becoming aware of how those aspects of the social order, which frustrate innovation, can be overcome (Kemmis and Carr, 1986, Grundy 1987). The research design involves the following.

4.1 WORK GROUP

Three work groups each with approximately 20 General Science teachers will be convened and a work group of teachers of General Science will be convened. Clermont, Edgewood and D.T.C. will be convened. The selection of teachers will be based on theoretical and selective sampling procedures (Denzin, 1970). The work group will:

- negotiate a modus operandi through needs/problems, discourse around current curriculum and its development and implementation.

- choose a section from the Standard 6 or 7 syllabus for curriculum development.
- in subsequent work sessions develop/redraft/expand/modify this section of syllabus through a process of reflection and action.

4.2 EVALUATION OF PROCESSES AND PRODUCTS GROUP

4.2.1 Internal Evaluation

This will be encouraged as a reflective discursive process backed by relevant audio recording technique & a word processor.

4.2.2 External Evaluation

This will be done in the following manner:

- 4.2.2.1 Workshops with other teachers - workshops will be convened to evaluate the products of the curriculum development of the work group.
- 4.2.2.2 Committee of Consultants - a committee of consultants will be established based on expertise in field of research. This committee will provide expertise and an external moderating effect on the research project. The committee will be made up of people of deferring views and experiences in the areas of Science Education, Curriculum Development and Action Research.
- 4.2.2.3 General Dissemination - dissemination of products of the research project to various organisations (SCISA, ASTE, SAATB, SAATP) and interested people for further evaluation and feedback.

4.3 RESEARCH DIARY

Will be kept using a word processor. This record will help establish an accurate portrayal of the research.

5. BUDGET

1..	Transport	a) Researcher	R 700-00
		b) Teachers	750-00
2.	Software		300-00
3.	Printing		500-00
4.	Workshops		1 000-00
			<u>R3 150-00</u>

/6 MARCH 1991/

SCISA prepared to fund - need to write a proposal

A3. CONSULTANTS

- 3.1 David Brookes - Science Education
- 3.2 Anand Naicker - Qualitative Research and Foundations of Education
- 3.3 D S Rajah - Curriculum
- 3.4 Rob O' Donoghue and Jim Taylor - Action Research, Environmental Education and Materials Production

A4. SETTING UP TEACHER GROUPS

/15 FEBRUARY 1991/

- (a) Phone Jeremy and set up meeting for 18 February at 12 O' clock.
- Clermont SEP Zone
- (b) Meeting with Krish at Reservoir Hills Secondary (R.H.S) Meet G.Sc Teachers on Wednesday 20 February at 3 O' Clock to address them.

Clermont Zone (Refer to B3.1)

/18 FEBRUARY 1991/

Met Jeremy at 12h30 at Durban Campus and Pumalani
Use of at zone for (R)?

- (i) need to meet - Wednesday 27 February 1h30 pm to visit teachers
 - (ii) write a proposal for consultative teachers meeting on 9 March - to be developed in conjunction with teachers of Clermont.
==> this will enable clarity of ownership of (R) and institute democratic procedures.
- (R) is emerging as a joint venture

W.B.H.

R.H.S

CLAREMONT

SEP

MYSELF

Besides individual reports SEP as an organisation to generate any other research eg. to present research findings as a report/workshop for next SEP national conference by Clermont zone.

Need to contact Westville Boys High (W.B.H) and gain consent.

- (b) Meeting with Krish at Reservoir Hills (R.H.S) Meet G.Sc Teachers on Wednesday 20 February at 3 O' Clock to address them.

Phoned Edgewood

/25 FEBRUARY 1991/

- tap into M4 upgrading course for G.Sc Guy N expressed interest
Tentative meeting with Guy and Anne Early March.

/26 FEBRUARY/

Phoned Springfield - for contact teachers.
Met Patrick on Monday 4 March 1991.

/27 FEBRUARY 1991/

Phone Richard Potgieter at W.B.H. - no reply

/28 FEBRUARY 1991/

Spoke to Krish at R.H.S

Schedule to meet teachers next week during lunch time
==> arrange with Krish.

/1 MARCH 1991/

Spoke once more with Guy - still keen ? linked to Edgewood.

/11 MARCH 1991/

Meeting with Guy Nicholson Monday 18 March at 3h30.

/18 MARCH 1991/

1. Meeting with Guy Nicolson on Monday at 3h30

A4. TEACHER GROUPS (Refer to B3.2) /21 MARCH 1991/

Emerging Principles

1. Need to meet teachers at their starting points - this is determined by their teaching contexts and their ideas of empowerment etc. also what are their immediate needs. eg. Clermont teachers needs were dictated by poor facilities and lack of science background. Hence, they felt they were not in a position to address the changes in curriculum but rather learn how to survive by improving their teaching abilities by developing materials. LACK OF EMPOWERMENT.
2. Need to work with teachers needs - Hence this A.R research has a practical interest. This gives rise to a tension with emancipatory Action Research (A.R) as the practical interest would be said to be reformist and not transformative as emancipatory A.R.

3. Tension between practical A.R. and emancipatory A.R.
 4. In order to deal with emancipatory A.R. the research needs to inform teachers of about the ideological problems with the curriculum (as teachers do not see them) and then work collaboratively and transform this curriculum - is this strategy emancipatory ???
 5. I suspect that in addressing the practical problems around curricula - with time teachers by themselves will ask questions that require transformation of the curriculum ie. they will progress from practical interests to emancipatory ones.
-

B. RESEARCH

/18 FEBRUARY 1991/

B1. Case Studies

B1.1 CLERMONT (Refer to A4.)

Clermont Zone

Met Jeremy at 12h30 at Durban Campus and Pumalani

Use Clermont zone for (R)

- (i) need to meet - Wednesday 27 February
1h30 pm to visit teachers
 - (ii) write a proposal for consultative teachers meeting on
9 March - to be developed in conjunction with teachers
of Clermont.
==> this will enable clarity of ownership of (R) and
institute democratic procedures.
- (R) is emerging a joint venture

W.B.H

R.H.S

CLERMONT

SEP

MYSELF

/5 MARCH 1991/

Meeting with Clermont Zone at 8/03

What should the Zone do?

1. meet monthly and discuss problems
2. share resources
3. decide upon the place for venues
4. elect zone leaders and deputy
5. share teaching skills/child centred
6. programme of the year
7. Problem solving day
8. Resource centre develop
9. Organise audio visual aids
10. share with other zones

Input

Teaching skills

ADVANTAGES

1. Schools ==> DET
2. Link with UDW and other teachers

TEACHERS PRESENT

Umqhele J/S

Purity Kondive	7072726
Thohnle Mchiza	7071430
M.D. Makhatini	7079403
S.H. Gcabashe	

Siltele J/S

N.Y.Z. Shinga	
M. Ntshali	7075238

Sthokozile J/S (Lab burnt down)

Miss N.P. Mncachi	9074380
Squash Gumede	7071498
E.T. Shezi	9075960

Each teacher has an average of 60 pupils per class

UDW

- needs to set up workshops for Sc. Teachers
- address immediate needs teaching

Need to bring in a sense of cohesion by focusing on teachers immediate problems - by focusing a common set of problem/s.

PURPOSES:

1. get researcher in touch with problems of teachers in a
Used this as a pilot for research used to:
disadvantaged situation.
2. What are the teachers views on present curriculum?
Teachers saw curriculum as inappropriate in terms of
 - (a) does not prepare individuals for work situation
 - (b) no link to real life
 - (c) no technical resources that we needed to cover curriculum.
 - (d) language in textbooks problematic (1st vs 2nd language)
 - (e) examples in textbooks does not link with real life experience
 - (f) too packed syllabus
3. workshop was used to challenge victim ideology,
- meet group on 10 April

Research Methodology (Refer to B3.1)

Rationale - difficulty working with schools
lack of time, travelling to Clermont.
therefore move to Edgewood and link to
curriculum - group that meets on a regular
basis. Use this Clermont as pilot for
actual research at Edgewood.

Emerging Framework - Research Plan & Methodology

Use Clermont as pilot and external moderating mechanism for
research at Edgewood and Durban Teachers Centre

ANALYSIS

General Analysis (Refer to B3.2)

Teachers blamed outside problems eg. lack of resources etc.
to poor teaching - however after reflecting and discussion,
teachers realized it was a personal problem ie. need to be
creative and imaginative in their own teaching - the lack
of this was due to timetable constraints, poor teacher
education programmes - etc. lack of exposure to alter ways
of teaching.

/10 APRIL 1991/

SEP Clermont meeting with teachers and report on research.

All the teachers did not turn up - workshop postponed to 17 April

Used this opportunity to talk to Dorris, Siphon and Toka with regard

- a) which are the problem sections in Gen. Science?
- b) why did teachers not want to participate in research.
- c) Siphon and Dorris felt that both teachers and pupils have problems with concepts mass, density, volume, area. This problem is compounded by inappropriately written texts and pupils having certain real life experiences eg. Buy meat for R5,00 and not bought by mass. All three felt that there was a need to address these specific problems by having workshops directed to address these problems.
- d) Toka felt that research is done by people that are specially trained and skilled - ordinary teachers could not do this research on curriculum development as they were not trained researchers.
Dorris felt that this type of research was demanding - hence she distanced herself from it. She saw that there are many problems in the existing syllabus but felt that these problems will be resolved by experts.

"The one that makes the shoe does not know the problems of the person who wears the shoe" Toka.

On further discussion both Dorris and Toka acknowledged that teachers are in the best position in identifying problems in the practice of teaching - and they are the appropriate persons to solve them.

They also acknowledged that curriculum development was not as necessarily addressing changing the official curriculum only - but solving problems and improving the actual curriculum. Hence they felt they should participate in trying to solve actual curriculum problems - there was no need to feel incapable about contributing to curriculum development.

/25 APRIL 1991/

Meeting at Clermont Zone

1. Based on the meeting on 10 April ==> put forward that we look at a problem area in Gen. Science syllabus.
2. Teachers identified many problem areas in terms of teaching and learning for pupils eg. Force, Density, Pressure, Mass and Weight, the metric system, measurement, calculations.
3. Teachers agreed that we look at the metric system and develop materials to improve their teaching and pupils learning.
4. Teachers were open about admitting to experiencing difficulty in teaching sections.
5. Suggested that they work in the following way:

TASK 1

Identify the problems that:

- a) teachers having in teaching this section
- b) pupils have in learning this section
- c) each teacher put forward his/her methods of teaching this section
- d) share existing resources that teachers used when teaching this section.

TASK II

Try out strategies that each teacher gained from the sharing Process ==> give feedback on the success of these strategies.

TASK III

Meet over a period of 1-2 days and using the experiences gained by task I and II develop a curriculum package that will enhance the teaching of and learning of the metric system.

Also teachers identified the need to improve their practical techniques and learn to improvise - set a workshop date for the 25 May 1991.

During all these tasks they use to co-ordinate activities.

/3 JUNE 1991/

Clermont Zone

Planned the workshop on practical work - with teachers and SEP implementers

Workshop Programme

- 1) Use of SEP kits
 - performing practicals
 - laboratory management
- 2) Improvisation
- 3) Meaningful use of practical work.

/5 JUNE 1991/

Clermont Zone

NOM T. SHEZI 811257
 814684

a) Workshops

- 1) Assessment Workshop 29 July - 2 August
Visit from Leeds.
- 2) Ecology Workshop 11& 12 July - Peter Towse

b) Zone plan of Action

- 1) Visit to UDW
- 2) Metric System
- 3) Projects - Expo
- 4) Planning something that this Zone could perform at next SEP teachers Workshop

Projects

- Visit at UDW
- plan project
- SEP organize transport

Analysis

The workshop was quite useful-

- (a) initially some teachers were quite disinterested.
- (b) however when these teachers become actively involved to explore, their enthusiasm increased.

/9 AUGUST 1991/

Clermont Zone - 9'0 Clock - Practical work

Initial contacts with research group - 23

- Guy works in a structured way with the group - well organised
 - bombarded teachers with readings - teachers not too happy about this.
 - These people get tired from about 7pm - need to work with them in a relaxed and interesting way.
 - Obtained background information of students - why are they doing this course?
 - and how the course must be structured
- Provide valuable insight into the way individuals view curriculum - see 18/03 Edgewood - Questionnaire.

At Edgewood and Guy

- This course must be handled based on flexibility i.e. ability to respond to where students are and work on actual needs - one cannot work on fixed past perceptions.
- They may have some difficulty at Edgewood: i.e. of fixed ideas.

Need to introduce research

- can use Guys and Irwins periods
- must introduce on 15/4 by getting people to focus on G.Sc syllabus and take home --> get people to think about syllabus in personnel level and reflect
==> at next meeting get people to share
==> ask people specific questions about relevance of G.Sc syllabus.

Problems envisaged with research group

1. lack of continuity - need to talk to Mariam about use of time.
2. Need to establish how many teachers have experience in G.Sc teaching - some lack experience.
3. Course meetings time possible are 15/4, 22/4, 13/5, 20/5 and 17/5, 17/6, 24/6
==> need to work on Saturdays with this group.
4. People will be tired out because of long hours - need to get people interested and motivated.

G.Sc Teaching Experience

No. teaching G.Sc 6 & 7 presently	7
No. taught G.Sc in the past	7
No. that would like to teach G.Sc.	5
No. teaching G.Sc in Primary School	3

Analysis (Refer to B3.2)

Survey Teachers

This was used to establish starting points of people and not to measure changes of people at the end of programme.

Need to use a questionnaire or to establish

- (a) Background Information - Qualifications, teaching experience.
- (b) Ideas Teachers have about teaching
- (c) To gauge teachers sense of empowerment/or resourcefulness.
- (d) the context in which teachers are teaching.

WORKSHOP

/15 APRIL 1991/

A. The teaching of living and non - living

Got teachers to think about teaching these concepts by involving as much processes of science - reason for focussing on processes - is wherever teachers talk about science they seem to reflect the nature of science - is purely a body of facts.

B. Survey on Science Curriculum

Given to teachers to complete in consultation with colleagues and report back on the 29 April 1991.

/29 APRIL 1991/

CURRICULUM DEVELOPMENT PROJECT - GENERAL SCIENCE

SURVEY QUESTIONS

Please complete this questionnaire in consultation with all teachers of General Science (past & present) in your school.

1. What are some of the problems you and your colleagues face at your school when you teach science?
2. From your experience of teaching General Science what are the problems
 - 2.1 in the current General Science syllabus (Std 6 & 7);
 - 2.2 you face in teaching this syllabus.
3. Which section/topic of this syllabus (Std 6 & 7) is the most problematic in
 - 3.1 its design;
 - 3.2 teaching.

Substantiate in each case.

RESPONSES

Question 1

1. Facilities

- lack of apparatus
- no laboratories
- no textbooks
- lack of chemicals and resources

2. Class size

- too large classes - approximately \pm 70 pupils/class

3. Pupils

- negative attitudes
- pupils experiences are limited, knowledge also limited
- lack scientific skills
- can't see things in 3 - dimension
- language problem - with English
- understanding the textbook.

4.. Language Problems

- medium of instruction problematic
- textbooks language
- language usage and communication
- language comprehension
- literal understanding and concepts eg. cell in biology and cell in electricity pupils see them as the same thing

5. Textbooks

- pupils and teachers find it difficult to understand the textbook
- lack of textbooks
- textbooks tend to give definitions rather than explain concepts
- the concepts are not linked with reality
- language in textbooks
- teachers have no choice in choosing textbooks

6. Time

- insufficient time allocated for science periods
- periods are short
- experiments time consuming

7. Teachers

- inexperienced in teaching science
- do not understand the textbooks

8. Content

- too much emphasis on theory

Question 2.1

- Length of syllabus
- Std 6 is not clearly linked to Std 7
- time allocated by official syllabus is too little, eg. 7 periods for a topic ends up, using 10 periods
- some topics are time consuming
- the task of completion of syllabus tends to dictate racing through syllabus, irrespective of pupils understanding
- insufficient inservice courses
- shortage of sections that are related to rural areas

Question 2.2

- no link between Std 6 & 7
- completion of syllabus dominates over good teaching practices
- lack of enough material for practical work
- cannot give pupils individual attention.

Question 3

1. Particle nature of matter - too much of information which is confusing, difficult to demonstrate, pupils cannot envisage spaces between solid and liquid matter - hence do not believe this, difficult to understand and teach.
2. Density - difficult to teach
3. Electrolysis - difficult to teach and explain what is an ion.
4. No logical sequence in the topic of plants eg. Std 6 - Reproduction --> Std 7 external structure
5. No microscopes - tend to theorize about the cell structure and this leads to problems eg. pupils develop misconceptions.
6. Lack of apparatus for electricity and light. This results in problems (ref. 5) - also the general teaching of these sections pose problems.
7. Reproduction - difficult to teach because it conflicts with cultural outlook to reproduction - seen as taboo.
8. Chemical change, bonding, reactions and equations.

9. Difficult to teach some concepts egs. valency, differences between mass and weight

ANALYSIS

1. Teachers face an overwhelming no. of problems related to the actual curriculum - again these problems are context bound.
2. Teachers admitted to their own inability to teach certain sections.
3. Curriculum development should tend to focus on the problems that the teachers face --> rather than looking for a change in the official curriculum.
4. The intensity of language problem is incredible - needs to be addressed at a serious level.
5. Inservice programmes and teacher education programmes for science teachers cannot work with purely with improving the teachers skills and content in science, and improving science teaching hypothetically - needs to operate within a CONTEXT OF REALITY ie. should revolve around these teachers real school contexts eg. large classes, 2nd language problems etc.

Edgewood

/14 MAY 1991/

Meeting with Guy

- Water - Decided to develop materials around water quality
- collaboratively with Umgeni Board, WLS & NPB, Guy, Myself and teachers.
 - need to establish a working relationship with Umgeni Board WLS & NPB
 - enables the course of action.

Edgewood

/4 JUNE 1991/

Met with Guy Nicholson

Clarified work procedure with students

Step 1

Guy to deal with Water Quality and Water Borne Disease

- give students the background to knowledge.

Step 2

Students in groups or individual to develop a curriculum package for Std 6 or 7.

Step 3

Entire group to be involved in General Development

Step 4

Production of materials

/9 SEPTEMBER 1991/

Locust Demonstration - making model
evaluate the water course.

B1.3 DURBAN TEACHERS CENTRE

/26 MARCH 1991/

Meeting with Gen Science Sub-Committee

- talk about the research project see if teachers are interested.
 - suggest that a workshop be held with teachers on a Saturday.
- a) the relevance and the problems of present curriculum
 - b) focus on one section and get teachers to state problems with section and the way they will change it.

New research Model ie. at different levels.

1. different groups eg. Clermont to discern problems and another group to start curriculum development.
2. Each group work independent and complete the research process Edgewood/separate from the H.O.D.

Suggest that work in the following way. /27 MARCH 1991/

1. Survey all G.Sc teachers in terms of curriculum development.
2. Work with a selected group around the Durban Teachers Centre.

ACTUAL MEETING DEPARTMENT ACCEPTED THE PROPOSAL

/28 MARCH 1991/

Meeting with General Science Subject Committee House of Delegates

What is the department doing?

Department Gen.Sc curriculum Development

1. 2nd language problem marking at senior primary level
Develop support material,
New testing, New pract work.

* Multicultural Context

FINDINGS

Use

1. Extensive pract. experience
audio-visual aids base
pictorial
2. Group work - Co-operative work

Umkomaas Drift

129 - (91 are black)

Meeting 10 April 1991

ACTION RESEARCH FRAMEWORK

Ask Ari Naidoo

Use of Language Laboratory?

/2 APRIL 1991/

Meeting with Juggie Govender (Home) 411988

- He will set up teacher groups at Durban Teachers Centre
- Suggested the first workshop introduce the prac. on the Mothball ==> gain teachers ideas in terms of possible use in school syllabus.
- 1st workshop 20 April at 8pm
- also meet (Chatsworth teachers on Thursday 18 April at 1h30pm

/22 APRIL 1991/

Visited the participants of the Durban Group - Clarehills, Overport, Reservoir Hills, Burnwood and Centenary.

- spoke to each H.O.D. and outlined the ideas of the project and how each school H.O.D and his science team were part of this project.
- also handed survey questionnaire to each group to think about in advance and come up with the schools view on the science curricular, rather than the individuals view on science curriculum.

- the purpose of these visits were also to get a greater sense of commitment and participation within each school.
- some H.O.D's responded favourably, others saw this as this as an exercise needed by the weak teacher.

/24 APRIL 1991/

CURRICULUM DEVELOPMENT PROJECT - GENERAL SCIENCE

Durban Teachers Centre

Participating Schools

- | | | |
|-----|---------------------------|-------------------------------------|
| 1. | Overport Secondary | S.B.S Ismail
G Samuels |
| 2. | Clarehills Secondary | G.D Bhairaparsad
S.E. Thandroyen |
| 3. | Burnwood Secondary | V.G Moodley
C.M. Thomas |
| 4. | Centenary Secondary | Y Veerasamy
R Chandarman |
| 5.. | Reservoir Hills Secondary | N Ebrahim
S Laljeeth |

24-04-91 Workshop - Durban Teachers Centre

SESSION 1

Objective - To focus on the problems in the current General Science syllabi - Stds 6 & 7

The following survey questionnaire was used to generate discussion around this objective.

1. What are some of the problems you and your colleagues face at your school when you teach science?
2. From your experience of teaching General Science what are the problems:
 - 2.1 in the current General Science syllabi?
 - 2.2 you face in teaching this syllabi?
3. Which section/topic of this syllabi is the most problematic in:-
 - 3.1 its design?
 - 3.2 teaching?

RESPONSES

Centenary Secondary

1. Lack of facilities
Class units too large
No consideration given to extra time for lab organisation.
- 2.1 Time - volume too great.
- 2.2 Teachers leave out last sections of syllabi - due to lack of time. As a result problems arise the following year. Teachers do not formally achieve general aims and objectives of science.
3. Electricity/circuits - cannot relate to applications.

Reservoir Hills Secondary

1. Syllabus - too long.
2. Depth of syllabus - very little guidance given.
3. Animal adaptations - over emphasised.
4. Electricity - pract. work.
5. Preparation and teaching time/too little.
6. No double period for pract. work.
7. Inadequate specialist facilities.
8. Large classes
9. Difficult to trace equipment - due to use by too many teachers.
10. Chemicals - not enough ventilation in classrooms.

Overport Secondary

1. Inadequate facilities - no access to lab for junior classes.
Too few periods - not much time for pupils to handle apparatus.
Practicles - large nos. in class.
Syllabus - too long.
Pupils - live in flats - no knowledge of plants, soil and animals.
- 2.1 Practicles not in keeping with experience of pupils - too long.
- 2.2 Black pupils - communication problems.
Too little preparation for pract work.
- 3.1 Std 6: Gases - why hydrogen?
Phase changes - absorption and release of energy too abstract.
Concept of weight.

Std 7: Electricity - concept of potential difference.
Pressure - Concept of liquid pressure and gaseous pressure.
Chemistry - Balancing of equations/purpose?
- 3.2 As above

Clarehills Secondary

1. No proper equipment
2. General Science - lab needed
3. Std 7 syllabus - too long
4. Very large classes - problems for pract work.
5. Std 6 - section on the fruit - pupils find it confusing

Burnwood Secondary

1. General Science lessons cannot be accommodated in labs - therefore equipment has to be carried to classrooms.
2. Insufficient teaching time and preparation for practs
3. Equipment
4. Syllabus too long.
5. Irrelevant sections eg. vegetative reproduction in roots, stems and leaves - fragmented

SECTION 2

Objective - to formulate a group position in terms of common problems in the General Science syllabi-via general discussion.

RESPONSES

1. Std 7 syllabus too long.
2. Lack of facilities for junior classes.
3. Lack of preparation time for practical work.
4. large classes - 30 - poses problems for pract work.
5. Science is irrelevant in terms of - the environment
pupils experiences
fragmented sections
4. Problem sections -
 1. Electricity
 2. Particle model
 3. Chemistry
 4. Ecology
7. Teacher training - too much of stress on academic work and not on the practical teaching situation. Hence trainee teachers inadequately prepared for teaching.
8. Inservice courses for teachers are lacking. Hence teachers are not in touch with developments in education which could help improve their teaching.
9. Teachers find it difficult to change themselves by trying new teaching ideas but they let the system dictate change on them.

SESSION 3

Objective - to identify problems that could be solved by the group on a relative level.

TASKS

1. Survey - it was felt that pupils, parents and teachers be surveyed on their views of the current General Science syllabi.
2. Std 7 syllabus too long. Hence we need to find ways of shortening it.

Lack of facilities - it was recognised that the provision of facilities would not improve due to economic constraints. Hence it was felt that we need to improvise and increase our efficiency.

4. Large classes - this problem will be aggravated in the future. Hence we need to find new teaching strategies to work around this problem.
5. Particle nature of matter - it was felt that this module is foundational to subsequent science sections. Hence we need to develop it to facilitate meaningful learning in pupils.

Session 4

Objectives -
1. To clarify each task.
2. To appoint co-operators for each task.
3. To set up working procedures.

TASK 1 - Design of survey questionnaires.

Co-ordinator - Burnwood Secondary

To design questionnaires for pupils, teachers and parents to obtain their views on the current General Science syllabus.

TASK 2

Improvise and improve the efficiency of use of present facilities and equipment.

Co-ordinator - Clarehills Secondary

To find new strategies that will help the teacher to manage and teach large classes.

TASK 3

Improvise and improve the efficiency of use of present facilities and equipment.

Co-ordinator - Centenary Secondary

To identify ways and methods to improvise and improve efficiency of present facilities and equipment.

TASK 4

Find new strategies to cope with large classes.

Co-Ordinator - Clarehills Secondary

To find new strategies that will help the teacher to manage and teach large classes.

TASK 5

Particle nature of matter.

Co-ordinator - Reservoir Hills Secondary

To develop a package on the particle nature of matter that will facilitate meaningful learning in pupils. this package will be designed in such a way so as to facilitate process orientated science in a large class within the existing framework of facilities and equipment.

WORKING PROCEDURE

1. Rotating chairperson of facilitator - Mr J Govender will chair the next meeting.
2. All members in the science department of each school will consider all tasks and make inputs.
3. Next meeting - 13/05/91
Time - 13h00 - 15h00

AGENDA

1. Task 1 - Survey
2. Task 5 - Particle nature of matter.

REFLECTIONS ON WORKSHOP

1. Teachers concerned that changes must be implemented ==> almost demanded a guarantee about the change.
2. Teachers tended to externalize the problems in curricular ie. all the problem were due to the outside factors and the system.
3. Teachers failed to reflect on their own teaching and how it contributes to problems
4. They saw that the system had to change and the change must be implemented from the 'top'
5. They failed to see that they could be agents of change who could challenge the system.
6. They could not see that this project could help benefit them personally in terms of learning.
 - 6.1 research techniques
 - 6.2 help improve their own teaching
 - 6.3 reflecting more deeply on their practices in school.
7. Teachers continued to work because it had institutional framework ie. approval of the subject of superintendents and the department.

/25 APRIL 1991/

1. Visited Reservoir Hills high and spoke to Nizaam and H.O.D. about project ==> H.O.D. gave full support and was enthusiastic.
2. Also by talking to other teachers sensed a feeling of dissatisfaction - some teachers in research group seem to feel that they were used ==> need to address at the next meeting of teachers.

/13 MAY 1991/

Durban Teachers Centre - Meeting with Juggie & Burnwood

- teachers were having difficulty in drawing questionnaire - TASK 1
- Reservoir Hills Centenary & Burnwood attempted questionnaire
- Generally teachers had difficulty drawing up questionnaires for parents
- Spent time clarifying the purpose of the ==> this helped Burnwood in establishing a clearer picture for complication of questionnaires
- meeting of Durban Teachers Centre was postponed from 13 May to 21 May - as teachers could tasks - lack of time and "know how "

1. RESEARCHERS

/23 MAY 1991/

Tensions

2. Clarify

3. CHANGE

Process

Design Teachers

/13 JUNE 1991/

Review

Questionair - Parent

Pupil

Parent Questionnaire

1. Centering - outline the objectives Questions.
 - attitudes of parents
 - relevance

only discussed parent questionnaire

/27 JUNE 1991/

Durban Teachers Centre- putting the package together.

/15 JULY 1991/

Durban Teachers Centre- Meet at Lab - UDW

/13 AUGUST 1991/

Durban Teachers Centre - meet Juggie and prepare book

/19 AUGUST 1991/

Meeting teachers - ask them about their experiences

/26 AUGUST 1991/

Met with Juggie

/4 SEPTEMBER 1991/

Plan workshop

/14 SEPTEMBER 1991/

Workshop in Parricle Nature of Matter

B2. EMERGING TENSIONS

/27 MARCH 1991/

1. Is this research process seen in terms of a part of something bigger or stands as the whole address the requirements of the Masters.
2. Teachers have different starting points - most of the time these are dictated by the context in which teachers operate ==> this will pose two problems.

Major one being - seeing themselves as contributing significantly to curriculum change if especially they are from a disadvantages context ==> yet could significantly contribute if we work progressively from the teachers starting points and slowly moving towards curriculum change ==> time constraint in terms of Masters.
3. Should teachers be surveyed by interviews etc. ==> to determine starting points of people?
4. Positivism vs Interpretative positions? eg. workshop ==> smaller group ==> wider dissemination.
5. The research is dictating a new direction from original proposal ie. from curriculum innovation in terms of environmental relevance to problems with teachers particiapting in curriculum development.

6. Emancipatory A.R. vs A.R with a practical interest.
7. Although initially it was important to work with each context separately ie. Clermont separately from Durban Teachers Centre etc., in the long term the curriculum initiative is going to be problematic for the following reasons:
 - a) it becomes to context specific and becomes difficult to adapt to another context.
 - b) it lacks an external moderating influence
 - c) it calls for changes that are not in keeping with reality of national or regional changes eg. House of Delegates want teachers lab assistants while Clermont does not even have labs.

A way to overcome this context specific problems is for the teachers of different contexts to meet and exchange ideas, materials developed on curriculum. This I hope to set in about early August. Also this may enable the formation of "SHARE NET" among the teachers of different contexts.

B3. EMERGING POSITIONS , /13 MARCH 1991/

B3.1 Research Methodology (Refer to B1.1)

Rationale - difficulty working with schools
 lack of time, travelling to Clermont.
 therefore move to Edgewood and link to
 curriculum - group that meets on a regular
 basis.

Emerging Framework - Research Plan & Methodology

Use Clermont as the pilot and external moderating mechanism for research at Edgewood and Durban Teachers Centre.

B3.2 ANALYSIS /13 MARCH 1991/

General Analysis (Refer to B1.1)

Teachers blamed outside problems eg. lack of resources etc. to poor teaching - however after reflecting and discussion, teachers realized it was a personal problem ie. need to be creative and imaginative in their own teaching - the lack of this was due to timetable constraints, poor teacher education programmes - etc. lack of exposure to alter ways of teaching.

Survey Teachers (Refer to B1.2) /18 MARCH 1991/

This used to establish starting points of people and not to measure changes of people at the end of programme.

Need to use a questionnaire or to establish

- (a) Background Information - Qualifications, teaching experience.
- (b) Ideas Teachers have about teaching
- (c) To gauge teachers sense of empowerment/or resourcefulness.
- (d) the context in which teachers are teaching.

TEACHER GROUPS (Refer to A4) /18 MARCH 1991/

Emerging Principles

1. Need to deal with teachers at their starting points -this is determined by their teaching contexts and their ideas of empowerment etc. also what are their immediate needs. eg. Clermont teachers needs were dictated by poor faculties and lack of science background they felt they were not in a position to address the changes in curriculum but rather learn to survive by improving their teaching abilities by developing materials. LACK OF EMPOWERMENT.
** Also easier to work on emancipatory A.R if one works with teachers needs - this strategy is an imposition
==> How else can one introduce this?

/23 MARCH 1991/

CHANGES IN SOUTH AFRICA (Political) Global issues

What is curriculum

1. teacher participation
2. relevance
3. curriculum design

Literature Survey - Chapter 2

- 1) Curriculum Relevance
 - pupils ideas
 - content
 - 2) Curriculum Design
 - 3) Teacher Participation
 - major areas of concern in South Africa
 - a) Getting them to participate
 - b) Implications of participation
- 4) Content of South Africa and the changes ==> empow

/26 MARCH 1991/

Teacher Groups (Refer to A2)

See 22 March 1991

Suspicion that lack of empowerment puts teachers off from participating in research - also time commitment etc. Hence need to survey this ==> Use a Questionnaire or workshop this at 10 April - Ask Jeremy if this is possible.

Paradigm Shift?

Need to redirect the research

2 possible options

OPTION ONE

To recognise that people have different needs and different levels of commitment ==> based on these differences need to work with people that are at the point that they want to change the curriculum. Hence this makes the Edgewood group or HOD the possibilities - especially the HOD - as the Edgewood group have the course work problems in terms of their readiness for this kind of work ==> more appropriate in their second year of study rather than the first year ==> this research could advance the actual upgrading programme and cause problems.

Use HOD group as prime research group and use the Clermont and Edgewood group for

- a) Piloting
- b) Acting moderating influence

Hence can call a joint workshop of all the groups. Clear ideas and problems of present curriculum - for the following purposes.

- (i) establishing the context of different teacher groups
 - thereby sensitising each group to other context
 - curriculum must be developed in terms of context
- (ii) establishing problems with teachers in encountering in teaching science - general and specific
- (iii) establishing the relevance and problems of present curriculum ==> what directions of change we need to take.
- (iv) which sections in std 6, Or 7 is the most problematic in terms of relevance. ==> What directions of change we need to take bearing in mind (i), (ii) and (iii)

With this data gleaned ==> teacher group at HOD develop ideas could use to test in Edgewood and Clermont - more especially in Edgewood and take further development.

* Getting teachers to participate in curriculum development can pose a problem if:

- (i) not used to curriculum development
external eg. time
- (ii) context difficulties
internal eg. empowerment

How we get teachers to participate?

- let teachers start at their starting points
(SURVEY, TECH. CAN ESTABLISH THIS) and then continue from there.
- a researcher with a fixed agenda will find it difficult to intervene and participate with teachers if their agenda is different.

OPTION TWO

Use Edgewood and HOD as main groups to work independently and collaboratively at times and develop curricular materials let each one act as the external moderating mechanism ==> problem would be the continuity at Edgewood therefore HOD may progress more rapidly.

In both it has become clear that need to work with research group and establish the context, their perceptions etc. in terms of teaching and Sc. teaching before proceeding with actual curriculum development ==> this enables

- i) to me to start at the context of teacher
- ii) to monitor development of teachers in terms of teaching science and empowerment over the period of research.

/28 MARCH 1991/

CULTURE OF PARTICIPATION (Refer to B4.1)

co-creating context

- 1. Problems
- 2. Experience

Community (Stenhouse)

Showed Action
Dialogue
Reflection

/29 MARCH 1991/

MODEL FOR RESEARCH

MODEL

PARTICIPATION

PROCESS

RELEVANCE

PRODUCT

Problem
needs

dialogue
reflect

Adaptation
writing

intercontextual

ownership represent

/8 MAY 1991/

(refer to C7)

1. Teachers find it difficult to see themselves contributing to curriculum debate and change. They see themselves as implementers of curriculum for reasons stated before.
2. Teachers see change being governed by systems and do not see themselves as agents that could bring about change
3. Hence teachers find it difficult to participate in initiatives that are linked to curriculum development.
4. Teacher DISEMPOWERMENT results in non participation of teachers in curriculum development ==> CULTURE OF NON PARTICIPATION is institutionalized for various resources as discussed before.
5. The challenge is to overcome the culture of non participation ==> CULTURE OF PARTICIPATION.
6. In trying to reconstruct culture of participation the following is emerging:
 - a) individual teachers find it hard to participate

- b) need to work with institutional frames and encourage them to support teacher participation in curriculum development.
- these institutional frames then provide a support system that allows their teachers to be involved in curriculum development.
- c) the context in which the teacher works will determine the teachers problems and needs around curriculum development - each context needs to work separately initially.
- d) teachers will want to participate in curriculum development if the development encompasses the teachers needs, problems and experience. Also it must be non threatening and have a climate to encourage the teachers to participate.
- e) Teachers problems and needs more focus on different levels of curriculum ie. official, actual and hidden --> hence teachers needs will dictate the level/s of curriculum that the project will work on.
- f) Teachers need to co-create context around their problems, experience and needs via dialogue this helps to establish community among teachers.
- g) Once community is established teachers will identify a particular aspect they want to work on.
- h) The particular aspect will rotate around action, dialogue, reflection and sharing.

B4. CONSULTATION

/11 MARCH 1991/

B4.1 Rob O'Donoghue and Jim Taylor

Spoke to Jim and Rob 8/03

- guard against Edgewoods functional - structure view of curriculum.

/28 MARCH 1991/

Consultation with Rob and Jim

1. Is it right to assume people have different starting points? No, this is problematic need to create Community via shared experiences are the key and not starting points.

STARTING POINT ? ?	CULTURE OF NON PARTICIPATION
--------------------	------------------------------------

shared experience	Contextually relevant granted in issues that concern teachers as a starting point
-------------------	---

establish

References see symbolic interactionism

community could lead to shared action

2. Need to distinguish between the way people are involved in the curriculum at different levels eg. although the present curriculum is fairly prescriptive - teachers still make some choices about the way they want to teach - allowed micro manipulate and not macro planning.
3. Chapter 2 needs to start to answer -: what is curriculum? in its existing form. (Refer to B6.3)

ideology of

- CNE

Teaching and learning

practiced

reality - see 2.

Ref. Fadila Fouche and Fundamental pedagogics

need to change the ideology from man participation

PARTICIPATION

CULTURE OF PARTICIPATION

Co-creating context

1. Problems

Dialogue

2. Experience

Community (Stenhouse)

Showed Action

Dialogue

Reflection

Culture of sharing

Clermont

Problem

is that you having a
fixed context ==>

problematic needs to
be evaluated in different
contexts

EDGEWOOD

HOD

needs to be inter contex-
tual by trying it in a new
context.

Getting networks (Refer to B3.2)

- ==> establishing culture of sharing
- establishes intercontextual dialogue
- disseminates information
- growing pool of resources

1. What are the most significant things that create community?
how does it lead to networks

the other idea of ownership --> comes if people present to others.

Participation as the key focus on

the
process

Productive

Relevance

Model for Curriculum development (Refer to B3.2)

Working within a Reconstruction process

reconstruction of ideology of participation at the grassroots.

Paradgm shift (Refer to B3.2)

Non participation

Participation

What process enable this shift?

- also look at Melani Walkers article contest her notions
- people need to move through a series of reforms to transform therefore people are conservative by nature and change is difficult.

B4.2 ANAND NAICKER

/26 MARCH 1991/

Curriculum Development

26/03 Spoke to Anand Naicker

- consulted on research Methodology and Tensions he recommended that:
 - i) I describe the setting up teacher groups fully as part of the methodology of research ==> this indicates the true spirit of qualitative research.
 - ii) the research methodology responds to the context and must be creative and will move between "positivists" and qualitative positions.

- iii) because of this responding to context I should not see myself as researcher rather as a participant and report as "I"
- (iv) the context of teachers and the establishment of teacher groups as part of locating and identifying the problem.
- (v) Although Claremont teachers have the problem of coping with the present curriculum - this could indirectly turned to address changing the curriculum.
- (vi) See the research at operating at two levels
 - ie. (a) Describing the research Methodology
 - (b) Describing the process of curriculum development.

/26 MARCH 1991/

- (i) Pat
- (ii) Carmel
- (iii) Rob and Jim
- (iv) David
- (v) D S Rajah
- (vi) Anand Naicker

What are the problems?

1. How to get teachers to participate? - cope with differences of agendas.
2. Chapter 2 literature Review? Carmel, David and Pat.
3. Which option to follow - in terms of research design?

B4.4 DAVID BROOKES

/8 APRIL 1991/

Problem with the masters are getting bigger than half thesis?

- need to report on a page or paragraph on all factors that impact on research eg.
- culture of participation
- relevance
- perceptions on curriculum
- levels of participation of
- teachers in curricula
- fragmentation between action and thinking

B5. SUPERVISION

/27 MARCH 1991/

B5.1 Carmel

Phoned Carmel on 27/03 - suggested to write up materials and send for her to look out.

/17 MAY 1991/

Meeting with Carmel McNaught

1. Focus ==> of write up should be descriptive & interpretive
2. Teachers were engaged in practical A.R. - need to see this project in terms of Teacher Development so as to help teachers to reach a point of emancipatory/genuine A.R. now only will teachers actually reach the point of transformative Curriculum Development.
3. This fundamentally shows that:
 - (a) all teachers are not necessarily capable of Transformative Curriculum Development (T.C.D)
 - (b) teachers are at different developmental points in terms of actually transformative curriculum development.
 - (c) teacher development actions will facilitate the preparation of teachers for Teachers Curriculum Development.
4. See the masters help facilitating the development of teachers towards Teacher Curriculum Development.

|
Facilitating the induction period by
developing - skills
 - prof. development
 - self esteem in teachers
5. Hence the write up should:

- emphasise the growth period
- concentrate on the people and their growth
- model of curriculum development, teachers need to go through process before they start
 |
 genuine Action Research
6. Curriculum development model for teachers
 - A. Teachers with practical Action Research - Researcher Support
 - B. | |
 Action - Teachers
7. Masters should be about creating the base support for

(b) Chapter 7

Since the research has "sort of" drifted away from environmental education need to reroot by talking about how this model could be implemented in environmental education.

5. Highlight environmental education relevance in main discussion - teacher problems but other problems are in appendix.

B6. WRITING UP THE THESIS

/30 MAY 1991/

B6.1 CHAPTER ONE

| CHAPTER TWO

| CHAPTER THREE

Introduction

- set the context of research in general
- specifically outline the problem and modes of operation
- State the original problem and briefly describe how the research was to proceed.
- State the new re-define problem - outline working procedure.
- => teacher participation in curriculum development

curriculum development and Innovation

- general conception of curriculum
- describe models of curriculum development.
- describe the S.A. context of curriculum development. Analysis and discuss problem around it.

need to shift to new position => reinforced by various organisations <=

teacher participation (genuine) in terms of curriculum development

- what are some of the problems around realizing this

- time
- RDDA
- Teacher Education
- Political
- personnel

Setting up the Teaching Group and The Methodology

- the compatibility between A.R. and teacher participation
- the type of A.R. visualized for genuine curriculum development.
- describe the problem are the use of individual teachers.
- shift to institutional frames
- describe how each institutional frame was set up.

genuine participation in curriculum development.

8. Write the need to describe the process of teacher development hence, explore critical events eg. people (Thoko) for each case study.
9. Write the case studies with a map - which illustrates the critical events.
10. a) Centrally to explore the chapter after the case studies to explore:
 - The process of teacher development towards their readiness for genuine curriculum development
- b) Also this chapter to produce a model of curriculum development.
11. The teachers reflective abilities improves if the teachers admit to their own problems ie. internalizers while externalizers do not have stronger reflective abilities ==> good reflective abilities central to emancipatory Action Research.

B5.2 Pat

Pat phoned 26/03 - wants to meet with me on the 15 April 1991.

- see if I could set up a teacher workshop - Edgewood is a possibility
- need to confirm with Guy

/10 JUNE 1991/

1. Clarify conceptions
2. Model (Chapter 7) - proces and praxis
 - suggests potential directions for reader
 - suggests a direction
 - potential imple-mentation in gen.
 - in particular for environmental education
3. Conclusion
 - needs to be reflective and show weaknesses and strengths
4. Rooting of environmental education and not drifting into Science Education.

(a) Chapter 1

- need to root science education in terms of Environmental approach - see proposal.

CHAPTER FOUR

Case Study - Clermont

- describe the context of each institutional frame.
- Outline significant events in terms of curriculum development

==>

CHAPTER FIVE

Case Study - Edgewood

- use a map to show significant work
- the workshop report should they be placed as appendices

CHAPTER SIX

Case Study - D.T.C

What should go into the work up of each case study??

CHAPTER SEVEN

Synthesis - An Emerging Model for C.D by Teacher Participation

- a) TEACHER DEVELOPMENT

GENUINE
C.D.

- b) SETTING UP PARTICIPATION

- c) USE OF INSTITUTIONAL FRAMES.

CHAPTER EIGHT

Conclusion

References Needed

- a) A.R.
- b) Curriculum Development
- c) Teacher Development
- d) Teacher Empowerment

Chapter 1 : Introduction

- Should provide an historical picture and setting the scene for the research.

B6.3 Chapter 2 : Culture of Participation

- Must address the question - why do teachers "feeled threatened" by participatory in curriculum development.

Chapter 2 : needs to start to answer -: (Refer to B4.1)

what is curriculum?

- in its existing form

ideology of

- CNE

Teaching and learning

practiced

reality - see 2.

Ref. Fadilu Fouche and Fundamental pedagogics

need to change the ideology, from man participation

P A R T I C I P A T I O N

B6.4 Chapter 3 : Relevance

SETTING UP RESEARCH

- Participation & A.R.
- individual teachers
- move to institutional frames
- how each institutional frame was set
- the context of each institutional frame and the working within each institutional frame

B6.5 Chapter 4 : Case Studies - General

B6.6 Chapter 5 : Clermont - Case study

B6.7 Chapter 6 : Edgewood - Case study

B6.8 Chapter 7 : Durban Teachers Centre - Case study

C7.1 Progress Report No. 1

I decided to research the existing General Science syllabus as I noticed problems with it. One such problem was it was not environmentally relevant and could not prepare pupils to understand their environments. The urgency of increasing threat of global problems such as ozone depletion, greenhouse effect and others, as well as national problems such as political changes called for relevant changes in the General Science Curriculum.

After studying research findings about the problem of environmental relevance, approaches to teaching, and designing of the General Science curriculum; I noticed that the problems with existing General Science syllabus was the way it was developed (RDDA model) and the way in which it was taught at schools. The current syllabus does not have sections that address some global environmental problems. Also the teaching lacked an environmental approach. Although experts (central planners) could add in environmentally relevant sections teachers would not be fully in touch with this innovation since they were not part of developing it; also they would not teach these sections using an environmental approach since they are not familiar with it. On further reading I noticed that this problem could be addressed more appropriately by working collaboratively with teachers. It is for this reason it was felt that teachers needed to be part of developing the curriculum innovation - hence the participatory approach to curriculum development is to be used.

The above defined the research project into being collaborative, participatory and using an Action Research (A.R) framework. Since the project was addressing changes beyond being reformist it attempted to adopt an emancipatory A.R.

Approximately 15 teachers and myself were to work collaboratively. These teachers were to be drawn from the neighbouring townships of UDW for practical reasons of transport. The research group would meet on a rotating basis in individual schools that teachers are from and at the university. This method of rotating venues was considered important as it could sensitize individual teachers of other contexts beside their own context.

In approaching individual teachers from the neighbouring schools outside UDW it became apparent that it would be difficult to interest approximately 15 teachers. I needed to redress my approach and look for institutional frameworks that supported this kind of work. Hence I identified the following institutional frames - Edgewood - the upgrading science teachers course; SEP - Claremont Zone; and Durban Teachers Centre - House of Delegates. Teachers from these institutional frames were to work collaboratively on the research project by meeting at rotating venues as described previously.

On establishing contact and gaining permission from all the institutional frames I decided to visit each of them so as to become familiar with the context of each. This proved to be valuable as it allowed me to become sensitive to the some needs and spirit within each context but at the same time I felt this one visit was inadequate. At the first workshop I decided to work with each institutional frame separately for the following reasons:

- i) needed to get to know each context better
- ii) each context was totally different made different demands hence it would become difficult to meet immediately.

The subsequent sessions were used to determine the problems teachers identified in the existing General Science Syllabus. During these sessions teachers identified some relevant common problems but also identified different problems dealing with the official and actual curriculum. These different problems related to the actual curriculum were context bound hence different. Also teachers expressed different needs based on context, to change the curriculum on either official level and actual level, on actual level only or an official level only. The hidden level was neglected totally.

CLERMONT

The teachers highlighted problems both with the official and the actual curriculum. They felt there was a desperate need for curriculum change. However they could not see themselves in contributing meaningfully to changing the curriculum for the following reasons:

- i) they are not qualified science teachers
- ii) they have experienced poor teacher education programmes which did not help them develop strategies for involvement in curriculum development.
- iii) changes in curriculum are brought about by experts.
- iv) they are incapable of research.

Generally the above reasons indicate a sense of disempowerment of the teachers which has been systematically entrenched over a period time by

- i) not letting teachers participate in curriculum development (use the RDDA model)

- ii) the mechanistic training and education which the teachers received during their teacher training courses - very skills and content based
- iii) the teacher education programmes did not actively promote curriculum development as part of their curricula
- iv) the amount of choice that teachers had in terms of the actual curriculum was limited by the existence of textbooks which they became reliant on because of the lack of adequate science background.
- v) Also the existing political system of protest and confrontation - the extra parliamentary organisations over the past years were calling for the dismantling of Bantu Education and hence did not advocate active constructive participation but rather for teachers to participate at the level of protest and political confrontation to rebel against Bantu Education. Also they called for the development of alternative curricular which teachers found hard to develop.

The above factors have led to a sense of disempowerment among teachers, hence makes participation in curricular issues difficult. The immediate challenge is to get teachers to participate in curriculum development ==> to build a culture of participation ==> sense of empowerment.

Although they did not want to participate in the research project they still wanted to maintain contact with me. They suggested that I facilitate a few workshops on Science Teaching. During the subsequent workshops and discussions teachers realized that curriculum development did not mean the changing of the official curricular but it also involves the problems around the actual curricular. They highlighted many problem sections for teaching and pupils learning. They decided that we should address the following:

- * Practical work and improvisation
- * Metric System - to develop a curriculum package to facilitate meaningful learning and teaching.

a) Practical Work and Improvisation

Teachers felt the need to

- i) improve their practical skills
- ii) develop strategies to deal with large nos.
- iii) develop strategies to deal with insufficient facilities and equipment.

Teachers have undertaken to think about this and later have set aside a one day workshop (15:05:91) where they can address these problems.

b) Metric System

Pupils have problems understanding this section for various reasons. Some reasons identified by the teachers were the following -pupils have a limited experience due to their context, poor mathematical background and poor teaching.

It was decided that we work in the following manner in developing a curriculum package that may address some of the problems pupils have. Firstly, teachers will exchange existing teaching strategies and resource etc. so that other teachers could try them out and develop these existing resources further.

Secondly, try out new ideas with pupils and see how they respond.

Thirdly, meet over a one day period and develop the curriculum the actual curriculum package - note although this was planned the school still remained the site for curriculum development.

Generally my role in both (a) and (b) was one of facilitator and resource person.

DURBAN TEACHERS CENTRE

I was approached by the Science Superintendent from the House of Delegates to set up a curriculum development project at the Durban Teachers Centre. Five schools volunteered to participate in the project

See Workshop report P17 - 21

Again my role was one of facilitator and resource person.

EDGEWOOD

See Workshop Report P11 - 14

EMERGING PRINCIPLES

1. Teachers find it difficult to see themselves contributing to curriculum debate and change. They see themselves as implementers of curriculum for reasons stated before as well practical reasons such as time constraints, heavy workload etc; and general apathy in some cases.
2. Teachers see change being governed by systems and do not see themselves as agents that could bring about change
3. Hence teachers find it difficult to participate in initiatives that are linked to curriculum development.

4. Teacher DISEMPOWERMENT results in non participation of teachers in curriculum development ==> CULTURE OF NON PARTICIPATION is institutionalized for various reasons as discussed before.
5. The challenge is to overcome the culture of non participation ==> CULTURE OF PARTICIPATION.
6. In trying to reconstruct culture of participation the following is emerging:
 - a) individual teachers find it hard to participate
 - b) need to work with institutional frames and encourage them to support teacher participation in curriculum development.
 - these institutional frames then provide a support system that allows their teachers to be involved in curriculum development.
 - c) the context in which the teacher works will determine the teachers problems and needs around curriculum development - each context needs to work separately initially.
 - d) teachers will want to participate in curriculum development if the development encompasses the teachers needs, problems and experience. Also it must be non threatening and have a climate to encourage the teachers to participate.
 - e) Teachers problems and needs many focus on different levels of curriculum ie. official, actual and hidden --> hence teachers needs will dictate the level/s of curriculum development that the project will work on.
 - f) Teachers need to co-create context around their problems, experience and needs via dialogue this helps to establish community among teachers.
 - g) Once community is established teachers will identify a particular aspect they want to work on.
 - h) The particular aspect will rotate around action, dialogue, reflection and sharing.

EMERGING PROBLEMS AND TENSIONS

1. Is this research process seen in terms of a part of something bigger or stands as the whole that addresses the requirements of the Masters.

2. Teachers have different starting points - most of the time these are dictated by the context in which teachers operate ==> this will pose two problems.

Major one being - seeing themselves as contributing significantly to curriculum change if especially they are from a disadvantages context ==> yet could significantly contribute if we work progressively from the teachers starting points and slowly moving towards curriculum change ==> time constraint in terms of Masters.

3. Should teachers be surveyed by interviews etc. ==> to determine starting points of people?
4. Positivism vs Interpretative positions? eg. workshop ==> smaller group ==> wider dissemination.
5. The research is dictating a new direction from original proposal ie. from curriculum innovation in terms of environmental relevance to problems with teachers participating in curriculum development.
6. Emancipatory A.R. vs A.R with a practical interest.
7. Although initially it was important to work with each context separately ie. Clermont separately from Durban Teachers Centre etc., in the long term the curriculum initiative is going to be problematic for the following reasons:
 - a) it becomes too context specific and becomes difficult to adapt to another context.
 - b) it lacks an external moderating influence
 - c) it calls for changes that are not in keeping with reality of national or regional changes eg. House of Delegates want teachers lab assistants while Clermont does not even have labs.

A way to overcome these context specific problems is for the teachers of different contexts to meet and exchange ideas, materials they developed on curriculum. This I hope to set in about early August. Also this may enable the formation of "SHARE NET" among the teachers of different contexts.

APPENDIX 2

TBILISI DECLARATION

GUIDING PRINCIPLES FOR EFFECTIVE ENVIRONMENTAL EDUCATION AS
ADOPTED AT THE 1977 INTERGOVERNMENTAL EDUCATION HELD AT TBILISI,
USSR.

Environmental education should"

- * consider the environment in its totality - natural and built, technological and social (economic, political, cultural-historical, moral, aesthetic);
- * be a continuous life-long process, beginning at the pre-school level and continuing through all formal and nonformal stages;
- * be interdisciplinary in its approach, drawing on the specific content of each discipline in making possible a holistic and balanced perspective;
- * examine major environmental issue from local, national, regional and international points of view so that students receive insights into environmental conditions in other geographical areas;
- * focus on current and potential environmental situations while taking into account the historical perspective;
- * promote the value and necessity of local, national and international cooperation in the prevention and solution of environmental problems;
- * explicitly consider environmental aspects in plans for development and growth;
- * enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences;
- * relate environmental sensitivity, knowledge, problem solving skills and values clarification to every age, but with special emphasis on environmental sensitivity to the learner's own community in the early years;
- * help learners discover the symptoms and real causes of environmental problems;
- * emphasize the complexity of environmental problems and thus the need to develop critical thinking and problem solving skills;
- * utilize diverse learning environments and a broad array of educational approaches to teaching/learning about and from the environment with due stress on practical activities and first-hand experience.

APPENDIX 3

PRODUCTS OF RESEARCH PROCESS:

**Progress Reports, Papers
and Curriculum Materials
Produced**

A) PROGRESS REPORTS

i. Progress Report No. 1

A report submitted to SCISA (part funder of the research) in April 1991.

ii. Progress Report No. 2

Submitted to SCISA in July 1992.

B) PAPERS

1. **TEACHER PARTICIPATION IN GENERAL SCIENCE CURRICULUM DEVELOPMENT**

P. Naidoo and S. Pillay, presented at the 14th National Conference of Maths and Science Teachers, 2 - 6 July 1991, UCT, Cape Town.

2. **ENVIRONMENTAL EDUCATION AS CURRICULUM INNOVATION FOR SCHOOL**

P. Naidoo, presented at the symposium on: The Role of the Primary Science Teacher as a Curriculum Developer in Future South Africa, 27 May 1992, Springfield College of Education, DURBAN.

3. **PRINCIPLES OF ENVIRONMENTAL EDUCATION AND CURRICULUM INNOVATION**

P. Naidoo, presented at the: Convention for a Natal Science Teachers, 13 - 14 July 1992, University of Natal, DURBAN.

4. **PARTICIPATORY CURRICULUM RECONSTRUCTION - A CASE STUDY WITH CLERMONT SCIENCE TEACHERS**

P. Naidoo, C. Suransky, M.A. Samuel, KENTON CONFERENCE, 30 - 31 October 1992, BROEDERSTROOM.

5. "PARADIGM SHIFT: FROM TEACHER NON-PARTICIPATION TO TEACHER PARTICIPATION IN CURRICULUM DEVELOPMENT. A CASE STUDY IN SOUTH AFRICAN SCIENCE EDUCATION".

International Conference on Science Education in Developing countries : From Theory to Practice. 3 - 8 January 1993, Jerusalem, ISRAEL.

C. CURRICULUM MATERIAL PRODUCED

i. Particle Nature of Matter

An example module on the particle nature of matter produced for Std 6 General Science by D.T.C. This has been disseminated to all H.O.D. schools throughout South Africa.

ii. Handbook on Practical Work for Science Teachers

This handbook was produced by the Clermont workgroup and is to be disseminate by SCISA and SEP.

iii. Water Quality and Health

This module is partially complete and was produced by the Edgewood workgroup.

APPENDIX 4

DANCING MOTH BALL

THE DANCING MOTHBALL

METHOD 1

1. Dissolve 30g of NaCl to 400 ml of tap water
2. Place ~ 20g of Zinc granules in a 500 ml measuring cylinder
3. Now pour the 400 ml of the salt solution into the measuring cylinder.
4. Place one mothball into the measuring cylinder
5. Add 25 ml of a 2 ml/HCl into the measuring cylinder.

Exercise One

1. What do you observe?
2. Explain why this happens?

Exercise Two

What if you do not have the equipment or the chemicals - suggest alternative way/s you could perform this.

Exercise Three

What concepts could such a demonstration be used to teach different standards of science pupils?

Exercise Four

What are some of the skills and attitudes such an exercise could develop in pupils.

Exercise Five

Choose a concept and skill/s (that you have listed in EX 3 & 4 respectively) and now design a lesson plan so that you could help your pupils develop the chosen concept and skills.

APPENDIX 5

QUESTIONNAIRE:

Teacher Background

QUESTIONNAIRE

TEACHER BACKGROUND

1. NAME: _____
2. NO. OF YEARS TEACHING: _____
3. NO. OF YEARS TEACHING SCIENCE: _____
4. LIST YOUR QUALIFICATIONS: _____

5. STATE YOUR HIGHEST SCIENCE QUALIFICATION: _____

6. WERE YOU SPECIFICALLY TRAINED TO TEACH SCIENCE. IF NO, WHAT
WERE YOU TRAINED FOR?: _____

7. NAME THE SCHOOL YOU PRESENTLY TEACH AT: _____

8. LIST THE STANDARDS YOU TEACH SCIENCE IN: _____

9. BRIEFLY DESCRIBE THE CONDITIONS UNDER WHICH YOU TEACH
(Average number of pupils per class, Faculties
available, supervision etc.)

APPENDIX 6

QUESTIONNAIRE:

**Problems with the Present
General Science Curriculum**

CURRICULUM DEVELOPMENT PROJECT -
GENERAL SCIENCE

SURVEY QUESTIONS

Please complete this questionnaire in consultation with all teachers of General Science (past & present) in your school.

1. What are some of the problems you and your colleagues face at your school when you teach science?
2. From your experience of teaching General Science what are the problems
 - 2.1 in the current General Science syllabus (Std 6 & 7);
 - 2.2 you face in teaching this syllabus.
3. Which section/topic of this syllabus (Std 6 & 7) is the most problematic in
 - 3.1 its design;
 - 3.2 teaching.

substantiate in each case.

APPENDIX 7

RESPONSES ON GENERAL SCIENCE CURRICULUM:

Edgewood College

EDGEWOOD COLLEGE OF EDUCATION

RESPONSES

Question 1

1. Facilities

- lack of apparatus
- no laboratories
- no textbooks
- lack of chemicals and resources

2. Class size

- too large classes - approximately \pm 70 pupils/class

3. Pupils

- negative attitudes
- pupils experiences are limited, knowledge also limited
- lack scientific skills
- can't see things in 3 - dimension
- language problem - with English
- understanding the textbook.

4. Language Problems

- medium of instruction problematic
- textbooks language
- language usage and communication
- language comprehension
- literal understanding and concepts eg. cell in biology and cell in electricity pupils see them as the same thing

5. Textbooks

- pupils and teachers find it difficult to understand the textbook
- lack of textbooks
- textbooks tend to give definitions rather than explain concepts
- the concepts are not linked with reality
- language in textbooks
- teachers have no choice in choosing textbooks

6. Time

- insufficient time allocated for science periods
- periods are short
- experiments time consuming

7. Teachers

- inexperienced in teaching science
- do not understand the textbooks

8. Content

- too much emphasis on theory

Question 2.1

- Length of syllabus
- Std 6 is not clearly linked to Std 7
- time allocated by official syllabus is too little, eg. 7 periods for a topic ends up, using 10 periods
- some topics are time consuming
- the task of completion of syllabus tends to dictate racing through syllabus, irrespective of pupils understanding
- insufficient inservice courses
- shortage of sections that are related to rural areas

Question 2.2

- no link between Std 6 & 7
- completion of syllabus dominates over good teaching practices
- lack of enough material for practical work
- cannot give pupils individual attention.

Question 3

1. Particle nature of matter - too much of information which is confusing, difficult to demonstrate, pupils cannot envisage spaces between solid and liquid matter - hence do not believe this, difficult to understand and teach.
2. Density - difficult to teach
3. Electrolysis - difficult to teach and explain what is an ion.
4. No logical sequence in the topic of plants eg. Std 6 - Reproduction --> Std 7 external structure
5. No microscopes - tend to theorize about the cell structure and this leads to problems eg. pupils develop misconceptions.
6. Lack of apparatus for electricity and light. This results in problems (ref. 5) - also the general teaching of these sections pose problems.
7. Reproduction - difficult to teach because it conflicts with cultural outlook to reproduction - seen as taboo.
8. Chemical change, bonding, reactions and equations.
9. Difficult to teach some concepts egs. valency, differences between mass and weight

APPENDIX 8

WORKSHOP:

Processes in Science

WORKSHOP: PROCESSES IN SCIENCE WITHIN A DISADVANTAGED
CONTEXT

Purposes:

- i. Explore some processes in Science and its relevance to teaching science.
- ii. Working with the processes within the context of large class and the lack of appropriate technical resources.
- iii. Explore the teaching within (i) and (ii).

PLAN

PART 1

- i. Working in pairs identify the different processes in science.
- ii. Do you think that children learning science should experience some/all these processes of science? If some list them and justify.
- iii. Which of these processes (listed in ii) your pupils cannot experience due to constraints at school. List them and state constraints that affect them.

iv. Discussion

[30 min.]

PART 2

- i. Plan a lesson that you teach pupils the concepts living and non living. In your lesson you must engage pupils in as many processes of science as possible.

ii. Discussion

[30 min]

PART 3

The way I would plan the lesson

Discussion

APPENDIX 9

QUESTIONNAIRE:

Water Supply and Problems

WATER SUPPLY AND PROBLEMS

1. Home Water Supply and Waste Water Disposal

- (a) Where do you live? Describe the area.
- (b) What type of water supply do you have at home? (tap, river etc)
- (c) What are the difficulties you experience in obtaining your water.
- (d) How is waste water and sewerage disposed off?
- (e) Do you or the community experience problems with the quality of water? If yes, state the problems.

2. Water-Borne Diseases and Prevention

- (a) Name some water borne diseases? Where and How did you learn about them?
- (b) What are some precautions a person can take in order to avoid getting these diseases?

3. Relevance of Water in the General Science Curriculum

- (a) Do you think aspects on water should be included in the curriculum? If yes, which aspects and why?
- (b) Do you think that the current curriculum addresses these aspects adequately?

APPENDIX 10

QUESTIONNAIRE:

Evaluation of Course Module on Water

EVALUATION OF COURSE MODULE ON WATER

1. WHAT WERE THE STRENGTHS AND WEAKNESSES OF THE MODULE?
2. EVALUATE THE VISITING LECTURERS INPUT
 - 2a Medical Research Council - DR OPITZ
 - 2b Umgeni Water Board - STEVE CAMP
3. EVALUATE THE PRACTICAL COMPONENTS, BOTH IN THE LAB AND AT THE RIVER.
4. WHAT WERE SOME OF YOUR SIGNIFICANT LEARNINGS OR EXPERIENCES DURING THIS MODULE?
WHY?
5. WHAT ARE SOME OF THE THINGS YOU LEARN DURING THIS MODULE, THAT YOU COULD USE IN SCHOOL?
6. WATER IS AN IMPORTANT RESOURCE. DO NOT THINK THAT WE PLACE ENOUGH EMPHASIS ON THIS IN THE EXISTING STANDARD 6 AND 7 GENERAL SCIENCE SYLLABUS?
7. WHAT ARE SOME ISSUES (ABOUT WATER) YOU WOULD LIKE TO INCLUDE IN THE STANDARD 6 AND 7 GENERAL SCIENCE SYLLABUS?
8. IF YOU WERE ASKED TO INTRODUCE THESE ISSUES (NO. 7) IN SCHOOL, DO YOU THINK YOU WOULD BE ABLE TO DEVELOP CURRICULUM MATERIALS? ALSO INDICATE THE PROBLEMS YOU MAY ENCOUNTER OR NEED TO ACCOUNT FOR WHILE TRYING TO DEVELOP THESE CURRICULUM MATERIALS. - WATER BORNE DISEASES.
9. WHAT SKILLS DO YOU THINK YOU NEED TO DEVELOP CURRICULUM?
10. DO YOU THINK THAT COLLEAGUES SHOULD HELP YOU DEVELOP THESE SKILLS? IF YES, SUGGEST HOW.
11. WHAT TYPES OF CURRICULUM MATERIALS WOULD BE MOST USEFUL FOR SCHOOL. (THAT ADDRESSES NO. 8)

APPENDIX 11

RESPONSES ON GENERAL SCIENCE CURRICULUM:

Durban Teachers Centre

DURBAN TEACHERS CENTRE

Centenary Secondary

1. Lack of facilities
Class units too large
No consideration given to extra time for lab organisation.
- 2.1 Time - volume too great.
- 2.2 Teachers leave out last sections of syllabi - due to lack of time. As a result problems arise the following year. Teachers do not formally achieve general aims and objectives of science.
3. Electricity/circuits - cannot relate to applications.

Reservoir Hills Secondary

1. Syllabus - too long.
2. Depth of syllabus - very little guidance given.
3. Animal adaptations - over emphasised.
4. Electricity - pract. work.
5. Preparation and teaching time/too little.
6. No double period for pract. work.
7. Inadequate specialist facilities.
8. Large classes
9. Difficult to trace equipment - due to use by too many teachers.
10. Chemicals - not enough ventilation in classrooms.

Overport Secondary

1. Inadequate facilities - no access to lab for junior classes.
Too few periods - not much time for pupils to handle apparatus.
Practicles - large nos. in class.
Syllabus - too long.
Pupils - live in flats - no knowledge of plants, soil and animals.

- 2.1 Practicles not in keeping with experience of pupils - too long.
- 2.2 Black pupils - communication problems.
Too little preparation for pract work.
- 3.1 Std 6: Gases - why hydrogen?
Phase changes - absorption and release of energy too abstract.
Concept of weight.

Std 7: Electricity - concept of potential difference.
Pressure - Concept of liquid pressure and gaseous pressure.
Chemistry - Balancing of equations/purpose?
- 3.2 As above

Clarehills Secondary

- 1. No proper equipment
- 2. General Science - lab needed
- 3. Std 7 syllabus - too long
- 4. Very large classes - problems for pract work.
- 5. Std 6 - section on the fruit - pupils find it confusing

Burnwood Secondary

- 1. General Science lessons cannot be accommodated in labs - therefore equipment has to be carried to classrooms.
- 2. Insufficient teaching time and preparation for practs
- 3. Equipment
- 4. Syllabus too long.
- 5. Irrelevant sections eg. vegetative reproduction in roots, stems and leaves - fragmented

APPENDIX 12

RESPONSES ON GENERAL SCIENCE CURRICULUM:

Clermont Zone

CLERMONT ZONE

What are the teachers views on present curriculum?

Teachers saw curriculum as inappropriate in terms of

- (a) does not prepare individuals for work situation
- (b) no link to real life
- (c) no technical resources that we needed to cover curriculum.
- (d) language in textbooks problematic (1st vs 2nd language)
- (e) examples in textbooks does not link with real life experience
- (f) too packed syllabus