THE INTEGRATION OF ENVIRONMENTAL EDUCATION WITH TECHNOLOGY EDUCATION: AN INVESTIGATION INTO TEACHER TRAINING AND TEACHER PRACTICE

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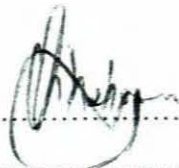
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SEPTEMBER 2003

DECLARATION

I declare that

THE INTEGRATION OF ENVIRONMENTAL EDUCATION WITH TECHNOLOGY EDUCATION: AN INVESTIGATION INTO TEACHER TRAINING AND TEACHER PRACTICE

is my own work, that all the sources I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not previously in its entirety or in part been submitted at any other higher education institution for a degree.

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ABSTRACT

This research study is mainly based on the third learning outcome for Technology Education which requires the learners to be able to demonstrate an understanding of interrelationships between science, technology, society and the environment. The purpose of the study is to investigate how Technology Teacher Training Programmes incorporate environmental aspects into technology education and how Technology educators facilitate learning in order to meet environmental requirements that are expressed as learning outcome 3 for Technology Education. In this study an attempt is made to encourage efforts that could lead to the development of new learning frameworks, integrated activities and learning programmes for the technology education curriculum.

The study is set against the literature on integrated programmes for curriculum development in general and for environmental and technology education in particular. It also draws on literature that calls for partnerships and closer co-operation between institutions of higher learning and the world of work, on evaluation research and programme evaluation and on the role that could be played by service-learning in promoting attitudes and values that are necessary for the integration of environmental aspects into technology education.

Using the naturalistic or qualitative evaluation approach and narrative data production methods in the context of teaching and learning, the lecturers in teacher education institutions and technology educators in schools were interviewed in order to find out how technology teacher education prepared

technology educators for the workplace and how technology educators designed learning activities and facilitated learning in their technology classrooms. The curriculum documents for technology teacher education programmes were consulted and classroom observations also made.

The research findings have indicated that technology educators find it difficult to integrate environmental education with technology education when teaching technology education and that technology teacher education programmes do not entirely prepare technology educators for the integration process that is required by the Revised National Curriculum documents of the Department of Education and Training. The study therefore calls for partnerships and collaborative efforts of higher education institutions, the Department of Education and Training and various environmental organizations in order to develop work integrated curricula that could enable technology educators to assist their learners to demonstrate an understanding of interrelationships between science, technology, society and the environment.

THIS THESIS IS DEDICATED

TO

MY LATE FATHER

HLALELE ABEDNEGO KHABELE

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DEFINITION OF TERMS

Integration:

A key design principle of the Revised National Curriculum Statement Grade R – 9 (Schools), which requires learners to apply their knowledge, skills, values and attitudes gained from one learning area to other learning areas.

Learning Outcome:

A description of what learners should know, demonstrate and be able to do at the end of the General Education and Training band in terms of knowledge, skills and values. (A set of learning outcomes should ensure integration and progression in the development of concepts, skills and values through the assessment standards).

Learning Programmes

Are the vehicles through which the curriculum is implemented at the various sites of learning. They are sets of facilitation methods and learning activities in which the learner will be involved while working towards the achievement of one or more specific outcomes.

Environment:

All physical, social, economic, political and biological factors that affect or make up an organism's surroundings.

Environmental Education:

An educational process that seeks to develop the necessary knowledge, understanding, values, skills and commitment to allow people to be pro-active in securing a healthy and properly functioning environment that is sustainable. It is made up of five elements: Awareness, knowledge, attitudes, values and participation.

Technology:

Is the use of knowledge, skills and resources to meet human needs and wants and to recognize and solve problems by investigating, designing, developing and evaluating products, processes and systems.

Technology education:

Is a planned process designed to develop learner's competence and confidence in understanding and using technologies and in creating solutions to technological problems.

Outcome Based Education

A process and achievement –oriented, activity based and learner centred education process that promotes critical thinking, skills development and lifelong learning.

Outcomes-based curriculum development

Curriculum development which starts with the formulation of the purposes of learning and teaching and uses these as the criteria for further curriculum development.

Service-learning

An involvement of students in organised community service that addresses local needs, while developing their academic skills and commitment to the community. Community service is combined with academic teaching, learning and assessment practices that promote critical, reflective thinking and civic responsibility of students.

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CHAPTER 1

INTRODUCTION

1.1 RESEARCH CONTEXT

The importance of environmental education has been stressed in many parts of the world and environmental education is recognised internationally as an important response to the emerging environmental crisis (Bones 1994).

> Increasingly, environmental education practitioners are recognising the need to link environmental education processes to the social, economic and political dimensions of environmental issues in ways that move beyond narrow orientations to awareness raising and information communication.(Swedish International Development Agency, 2002).

However, there has been a lack of clear focus on environmental issues in the previous South African education system. Most efforts to make school children aware of the environment and to encourage in them a sense of responsibility towards the environment have taken place primarily outside the formal education sector. Since the 1980s there has been increased pressure on education authorities to accept responsibility for assimilating the principles of environmental education into South African school curricula (Irwin 1990; UNESCO 1980).

In response to this pressure environmental education in South Africa has been seen as "necessary at all levels and programmes of the education and training

system"(Government Gazette No 196 of 1995:22).Other pronouncements of support for environmental education are documented in the Interim Constitution where a defense is made for fundamental rights of citizens to "an environment that is not detrimental to his/her health or well-being" (Bill of Rights 1996:10) and in the RDP document where it is stated that environmental education programmes should be developed to "rekindle our people's love for the land, to increase environmental consciousness amongst our youth, co-ordinate environmental education policy at all levels, and empower communities to act on environmental issues and to promote environmental ethics" (ANC 1994:40).

South Africa, as part of the International arena and the host of the World Summit on Sustainable Development has shown its interest and support in finding sustainable solutions to the challenges of Environmental Education and the reduction of poverty and inequality. Education is widely recognised as a major priority in ensuring improvements in the quality of life and eradication of poverty thereby placing the African continent on a path of social and economic development and environmental protection which can only be achieved if the learners grasp both the scale of environmental problems and the role they have to play in the solutions (Bird Life South Africa 2002a).

In order to achieve and ensure these improvements, we need to develop and improve our curriculum by integrating environmental education with different learning areas including Technology so that the learners can be able to acquire

environmental and technological skills to improve their lives. The Minister of Education shares the same view when he states that the new South African curriculum aims at "promoting human rights, social justice and a healthy environment, thus providing us with a platform to develop environmentally literate and active citizens" (Asmal 2002). He also stresses the need for environmental learning support material that could enable learners to explore and seek solutions to complex environmental issues. This is a real challenge to the transformation of our education system and means that as a curriculum development strategy, environmental education should be integrated with technology education so that environmental problems could be realized in a technological way.

Recently the need for integrating environmental education with technology education has been realized by the National Department of Education. This department has produced the Revised National Curriculum Statement for Technology Education (Grades R - 9) that requires the learners to achieve the following 3 learning outcomes:

The learner will be able to:

1. *Apply technological processes and skills ethically and responsibly using appropriate information and communication technologies.*

2. *The learner will be able to understand and apply relevant technological knowledge ethically and responsibly.*

3. *The learner will be able to demonstrate an understanding of the interrelationships between science, technology, society and the environment.*

1.2 PROBLEM STATEMENT AND JUSTIFICATION

Technology education is a new learning area that has been introduced to schools through Curriculum 2005 (Department of Education 1997a). This learning area was neither offered in schools that were attended by some of the teachers nor in teacher education institutions. The fact that the third learning outcome for technology education expects the learner to demonstrate an understanding of the interrelationship between technology, society and the environment means that the teachers are faced with the challenge of facilitating learning by linking environmental education with technology education through the integration process.

The focus of this research is the integration of environmental education with technology education as required by the Revised National Curriculum Statement of the National Department of Education. This view of the need for integration is also expressed in other documents of the department of education and training:

> Education and training are each essential elements of human
> Resource development and as envisaged in the White Paper

on Education and Training (1995), new, flexible and appropriate
curricula which cut across traditional divisions of skills and
knowledge are needed. An integrated approach to learning
rejects the rigid division between theory and practice and between
knowledge and skills (Department of Education, 1997:11).

There are few studies that focus on the integration of environmental and

technology education. Such studies are necessary because technology

educators need guidance with regard to curriculum development issues that are

related to outcomes-based education in South Africa. It was against this

background that an attempt was made to investigate how technology educators

integrate environmental aspects with technology education in order to assist their

learners to achieve learning outcome 3 of the Revised National Curriculum

Statement.

1.3 THE RESEARCH OBJECTIVES

The purpose of the study was to investigate how Technology Teacher Training

Programmes incorporate environmental aspects into Technology education and

how Technology educators facilitate learning in order to meet environmental

requirements that are expressed as learning outcome 3 in Technology

Education. Another objective was to highlight the need for guidelines for the

integration of environmental education with technology education. An attempt to

achieve these objectives was made through the use of the following research

questions:

- How did technology teacher education programmes prepare technology educators to facilitate learning towards the achievement of learning outcome 3?
- How did technology educators design learning activities that integrate environmental education with technology education?
- How did technology educators facilitate learning in their technology classrooms?

In achieving the above objectives this study could assist curriculum planners of teacher training institutions to consider restructuring learning programmes in a way that could enable teachers learn to integrate environmental education with technology education in the classroom. Thus, the development of teacher training programmes that integrate environmental education with technological education could be encouraged.

The learners may also learn technological skills and knowledge that could enable them to design and make products for the benefit of their own environment. The teachers, learners and the community at large could benefit, in the sense that environmental education could promote sustainable development and improve the capacity of the people to address their environmental and developmental issues. The research could also contribute in developing "a critical understanding of the interrelationship between technology, society, and the environment" (Department of Education 2002).

1.4 DELIMITATION OF THE STUDY

Technology educators for grades 4-7 at one primary school in Gugulethu as well as educators for grades 8-9 in one high school in Gugulethu were selected for the purpose of the study. In addition, teacher-training programmes in three tertiary institutions were examined. The two schools and three institutions chosen for this study are purposive samples of different communities with different political, cultural and educational backgrounds. They have been selected in order to compare educational experiences relating to the integration of environmental awareness with technology education, both in teacher education and classroom practice.

1.5 THE STRUCTURE OF THE STUDY

This research report is set out in five chapters. Chapter one is the introduction which portrays the importance of environmental education from an international perspective. It also highlights pronouncements of support for environmental education in the constitution of South Africa as well in other documents that relate to educational transformation. The need for environmental education in South African schools is stressed since the learners are expected to explore and seek solutions to complex environmental issues. Emphasis is also placed on the

importance to link environmental education with technology education through the integration process.

The second chapter provides a concise and clear description of the educational research literature that deals with best practices in facilitating learning and assessing technology and environmental education. The literature that stresses the importance and the need for the integration of environmental education with technology, as required by the Revised National Curriculum Statement, is also cited. In addition the plight of the learner in terms of what is envisaged in the society in which he or she lives is highlighted. Case studies that integrate different subjects or learning areas together with their problems and successes have also been documented in this chapter.

Following the literature review, is Chapter 3 which presents the methodology and the procedures that were followed in this study. The debate on paradigms that relate to educational research is examined and the paradigm that informed the researcher's study is described. This chapter also analyses and reflects upon the methodology used for collecting data. Research approaches, techniques, philosophies and traditions that have been used by various social researchers are highlighted. The researchers position is discussed so as to locate the study within a particular research tradition. The role of the participants and limitations of the study also form the subject of this chapter.

After the data were collected from the technology educators and lecturers, it was captured, analysed and interpreted. The fourth chapter presents the findings that are derived from the responses of the teachers and lecturers to the integration of environmental education with technology education. The research findings relating to the perusal of curriculum documents for the technology teacher training programme are also portrayed in Chapter 4.

Chapter 5 focuses on the summary of the research findings and puts forward some recommendations regarding the implementation of an integrated approach to technology education. The conclusion is also set out in this chapter to motivate technology teachers to deal with the challenges of integrating environmental aspects into technology teaching with great vigour and enthusiasm.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

One feature of the current reform initiatives in the South African education system is the introduction of the Revised National Curriculum Statements that outline learning outcomes for different learning areas in schools. Technology Education is the learning area that has three learning outcomes mentioned in the previous chapter.

The current research is based on the third learning outcome that requires the learner to demonstrate an understanding of the interrelationships between science, technology, society and the environment. The research is set against the general literature on curriculum development which promotes integration in general and on the integration of environmental and technology education in particular. The research also draws on literature that relates to knowledge production and transfer between institutions of higher learning and the world of work as technology teacher education programmes are examined in the light of the practice of technology educators in schools. Reference is also made to the literature on programme evaluation since the research also attempts to evaluate technology teacher education programmes in terms of their conceptualization, design, implementation and impact.

2.2 LINKS BETWEEN HIGHER EDUCATION AND THE WORKPLACE

There is a growing interest around the world for curriculum renewal in order to ensure that teaching and learning programmes enable graduates to be effective in the world of work and society (Teichler 2000; Foster and Stephenson 1998; Garrick and Kirkpatrick 1998; Teichler 1998). This interest has created the need for greater co-operation between the world of work, the society and the higher education sector in order to develop representative work integrated curricula (WIC). In South Africa this growing interest has been highlighted in the National Commission on Higher Education Report of 1993, Education White Paper of 1997 and the National Plan for Higher Education in 2001. The calls for links between higher education, the society and the workplace seem appropriate for the purpose of this research since the integration of environmental education with technology education requires collaborative efforts of the lecturers in teacher education institutions, the schools and environmental organizations.

2.3 PROGRAMME EVALUATION

Programme evaluation has been regarded as a crucial process that could lead to the development of learning programmes that are responsive to the needs of the society and the workplace. According to Asher (1976) most of the evaluation models now used grew out of the formative and summative, process and product evaluation models. He claims that the CIPP model name comes from the initial letters of the following four types of evaluation functions that constitute the evaluation method: "Context, input, process and product" (Asher 1976: 206).

Rossi and Freeman (1993) distinguish the following three classes of evaluation studies:

- Analysis related to the conceptualization and design of interventions
- Monitoring of programme implementation, and
- Assessment of programme effectiveness and efficiency

Posavac and Carey (1992) also distinguish between the following four types of evaluation:

- The evaluation of need
- The evaluation of process
- The evaluation of outcome, and
- The evaluation of efficiency

Similarly, Babbie and Mouton's (2001) logic model suggests that an educational programme that is intended to have a relationship to its workplace needs is evaluated according to conceptualization, programme design, implementation and impact of the programme. Babbie and Mouton (2001:337) claim that the purposes of programme evaluation are "programme management, improvement and refinement, financial accountability on public demand, to meet accreditation requirements, for purposes of quality assurance and control, and various other reasons". This research study is based on Babbie and Mouton's (2001) logic model of evaluation for the purpose of improvement and refinement.

2.4 INTEGRATING DIFFERENT SUBJECTS OR LEARNING AREAS

Integrated approaches towards education and training are now a major international trend in curriculum development and the reform of qualification structures (Department of education: 1997a). Several studies support the idea of integrating different subjects or learning areas. Crane (1980: 1) states: "What is needed is total human awareness – concern and democratic input coupled by co-ordination of control programs." Rothman (1998: 153) also writes:

> The more obvious societal needs in South Africa include creating sustainable development, improving the education system, alleviating poverty and addressing environmental problems. In the classroom activities for technology learners should provide opportunities for designing and making technology products that contribute to the solution of environmental problems.

Also in support of integration, Deshields (1995: 1) says:

> The science, society and America's Nuclear Waste curriculum provides information and background on energy and waste – management issues. It is suitable for use in technology, environmental science and social studies classes in middle high schools... Its content and focus are consistent with national goals to strengthen and update technology and science curriculum.

According to Tsang (1998:14) service learning is one way of integrating different subjects. He further argues that service learning is a powerful pedagogy for integration and has the potential to use technology to meet societal needs.

2.5 THE IMPORTANCE OF INTEGRATING ENVIRONMENTAL EDUCATION WITH TECHNOLOGY EDUCATION

One of the key outcomes of the Earth Summit (UNCED) Conference for educators that took place in Rio de Janeiro on 3-4 June 1992 is the recommendation that:

> Environmental and development education should be incorporated as an essential part of learning, within both formal and non-formal education sectors. A proposal is made that Governments should strive to update or prepare strategies aimed at integrating environment and development as a cross- cutting issue into education at all levels within the next three years
> (Palmer and Neal 1994:15)

Bones (1994:16) also stresses the importance of integrating environmental education into curricula: "Environmental education can be integrated into existing curricula. It is an excellent way to engage student interest and motivate student learning"

Integration with special reference to environmental education and technology education is documented in the Government Gazette,2002 (Act no. 27 of 1966).

> Economic and environmental factors and a wide range of attitudes and values need to be taken into account when developing technological solutions. It is in this context that technology is defined as: The use of knowledge, skills and resources to meet people's needs and wants by developing practical solutions to problems while considering social and environmental factors. (Government Gazette, 2002 Vol. 443:37)

Buchanan (1997: 17) also highlights the importance of integrating environmental education with technology education:

> reform mechanisms must not only look at technology but also at the surrounding environments. He further suggests that technology must be understood as a composite of social forces, cultural influence and values, as well as the technical mechanisms.

These calls for the integration of environmental aspects with technology education result from the realization that all technological development takes place in an economic, political, social and environmental context (Department of Education 2002).

2.6   SOCIAL JUSTICE ISSUES

Abu-Shakra and Nyein (1995: 64) highlight the need for an education that strives for social justice. They claim that there is an immediate need to enhance health and wellness in communities that are most afflicted by environmental pollution and its harmful effects. It is believed that through integrating classroom learning and community experience the students could perform tasks that aim at achieving environmental and social justice while developing students' social responsibility.

In the Revised National Curriculum Statement for Technology Education the kind of learner that is envisaged is one who will:

act in the interests of a society that is based on respect for democracy,equality,human dignity,life and social justice.The curriculum seeks to create a lifelong learner who is confident and independent,literate,numerate, multi-skilled,compassionate … with the ability to participate in a society as a critical and active citizen (Department of Education 2002: 3).

The achievement of Learning Outcome 3 for Technology Education will ensure that learners are aware of the impacts of technology, i.e. how technology has benefited or been detrimental to society. The consideration of the issues that relate to social justice when integrating environmental education with technology education could be beneficial in shaping the kind of a learner that will contribute positively to the entire society. This involves participating in any project that will change the lives of the people and improve their living conditions. Pretorious (1998:32) shares this view of striving for social justice through the learner's understanding of technology:

> The understanding of technology should contribute to the development of learners' capability to perform effectively in their changing environment and stimulate them to contribute towards its improvement.

2.7 BEST PRACTICES FOR FACILITATING AND ASSESSING INTEGRATION

Service learning is regarded as one of the best practices for facilitating learning.

Decker (1998:9) claims that "service learning has become a powerful pedagogy"

in that the quality of teaching/learning environment is improved while students' sense of civic responsibility and agency is enhanced. Rothman (1998: 11) argues that:

> if the students engage in a service project through which they identify and work closely with a local community agency, learning is not only enhanced but a recognized community need is also met. The students use the experience to reflect on the ways that their interactions with people and the environment relate to technology when they go back to the technology classroom.

With regard to assessment Bradley (1996: 24) states that the best way to assess student performance is to use students' writing about their experience and evaluate the writing by assessing the level of the reflective process expressed in the writing. Troppe (1996: 6 –11) suggests the following assessment practices for service learning:

- An assignment or activity, such as a reflective journal, is needed to provide evidence of how the student connects the service to the course content.

- Assessment should require the students to transform service experiences into learning experiences by distinguishing between description and analysis and between emotional reactions and cognitive observations.

- To preserve the academic integrity of service learning, credit should not be awarded for hours of service but rather for demonstrated learning based on the service.

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2.8 CASE STUDIES OF INTEGRATED COURSES

The following is an example of a case study that integrates environmental education with technology education.

According to Rothman (1998:153) an attempt was made to create a disaster warning system for communities near flood areas that signaled the onset of localized floods or debris flow. The students worked with communities in two areas particularly vulnerable to such disasters in Utah and Chile. The system provides a warning that affords neighbourhood residents and maintenance workers between twelve seconds and twelve minutes to escape the hazardous zone.

Other cases studies have been documented in different fields such as architecture where students designed low-cost houses, business education where students turned their business skills towards the project that benefits the community, education where prospective teachers who enroll in the Teacher Service Internship Programme are given a fellowship to live and study in the low-income neighbourhood served by the Community Based Learning Project (CBLP) and interact with children and their families. In the health fields students spend time with the community gaining greater insight into public health issues (Rothman 1998: 150).

2.9 PROBLEMS AND SUCCESSES OF INTEGRATED PROGRAMMES

2.9.1 Successes

Successes of similar integration have been documented. To highlight some of

the successes achieved, Chick (1995:5) made the following statement:

> I look for self-motivated students with a sincere interest in
> environmental improvement...and the response to this
> opportunity to research and solve problems has been extremely
> positive (Chick 1995:5)

She claims that the environmental service course in Florida Community College

has enabled students to learn about the global environmental problems and work

to solve local environmental problems.

In other successful case studies of integration the students focused on the

environmental issue of recycling and networked with the recycling coordinators of

the city waste hauler and the restaurant area in order to raise awareness and

community commitment of recycling issues. This effort has resulted into the city

officials agreeing to install a recycling drop-off center on the Central Florida

Community College campus (Chick 1995:5).

Through the environmental science course that Chick (1995) developed, the

following were accomplished: Curriculum development, completion of the pilot

programme and permanent implementation of the course.

Mackay, Young and Beynon (1991:13) raise another hope for success in technology education when they state that:

> Of all the changes required by the national curriculum, technology is perhaps the most dramatic. Technology's rise in recent years – culminating in its status as one of the seven foundation subjects in the national curriculum – provides exciting possibilities for changing educational practices and resolving some key educational dilemmas. As technology is finding its way into national curriculum, it is hopefully, becoming redefined.

2.9.2 Problems

Several studies indicate that all the problems that are related to the planning and implementation of integrated programmes revolve around time needed for proper co-ordination of activities. Johnson (1995) points out that organizing and implementing her integrated course was much more time-consuming and labour-intensive than she had originally anticipated. Zlotkowski (1995) also states that the students reported that integrated courses required a much greater commitment of time than they had originally planned. Although the students were initially cautioned about the significant amount of time to successfully complete the course, many became overwhelmed by time commitments and consequently, requested more administrative coordination on the part of the instructors, such as assistance with setting up interviews and transportation. Other problems mentioned include funding, lack of efficient administration and communication on issues relating to curriculum planning and assessment (Perusek 1995)

2.10   CHALLENGES FOR TEACHER EDUCATION

If learning outcome 3 expects the learner to demonstrate an understanding of the interrelationship between technology, society and the environment the teachers are faced with the challenge of facilitating learning by linking environmental education with technology education through the integration process.

To achieve the goals of both environmental and technology education requires the preparation of good quality technology educators:

> It is important for teachers to understand and help learners to be aware of how knowledge, skills, attitudes and values are interconnected" (Bird Life South Africa 2002b: 5).

Since teachers are regarded as key persons and agents of change several studies have stressed the importance of their pre-and in-service education. Beeby (1986:37) states that "Teachers are the frontline troops of change, and progress depends on their own education, motivation and freedom to innovate". This idea is supported by Watson (1991:96):

> For the sake of our youth, our country, and our society, leaders must care and recognize that they do have a responsibility. The rudderless ship drifting about without the traditional moral anchors and moral compass must be retrofitted. Individuals in leadership positions can make it happen. At the very least, they can toss the first pebble in the pond to cause the ripples to occur.

2.10.1 An integrated approach to the teaching/learning processes

The paradigm shift to Lifelong Learning through a National Curriculum Framework has resulted into all learning areas being viewed as part of the larger whole. The interaction between and among the learning areas is seen as greater than the sum of those parts (Department of Education 2002)

The new national curriculum and its policies has been a real challenge to many educators in terms of integrating learning areas and complying with the standards set for the implementation of Outcome Based Education.

The teachers are faced with a daunting task of keeping themselves informed and to acquire new knowledge, educational skills, strategies and concepts such as integration of learning areas, learner assessment, classroom management and implementation so as to keep up with the demands of the Revised National Curriculum Statement.

The problems of integrating learning areas are highlighted by Crane (1980:1): "Environmental problems are reported with increasing frequency and reveal intrinsic weaknesses in programmes designed to alleviate them".

Meakin (1992:26) points out some of the shortcomings related to integration and technology education:

Most technology teaching seems to stop short of educating
for a technological society by focusing merely on physical
technology. This is perhaps the most visible part of
technology when we look in the mirror, but it is certainly not
not the whole picture. Ask people what comes to mind when the
word technology is mentioned, and many will say 'computers'...

2.10.2   Environmental awareness in teacher education

Although environmental education is encouraged by official documents its current

status in teacher education remains at an unsatisfactory level. According to

Wilke, Peyton and Hungerford:

> Few, if any, teacher training programmes adequately prepare
> teachers to effectively achieve the goals of environmental
> education in their classrooms. Wilke, Peyton and Hungerford
> (1987:1)

In order to facilitate the integration of environmental education, technology

educators need to mediate learning in a way that is sensitive to the needs of the

learners,They are expected to construct and utilise learning opportunities that

are appropriately contextualised and inspirational.

2.10.3 The teaching of values

In an attempt to highlight the importance of teaching values, Cross and

McCormick (1986: 87) poses the following questions:

> Should we equip children with the necessary specialized skills
> and knowledge to enable them to gain employment in industry
> and commerce when they leave school or should we prepare
> children in ways which will ensure that they are technologically
> socialized and able to make informed decisions in their own lives
> about technological choices?

The teaching and integration of technology education with environment is

influenced by the teacher's interest, perceptions, values and beliefs. This implies

that educators should consider and view these factors as influential to learners

when designing their technology curriculum. Advocating for the teaching of

values Rusnak (1992: 5) portrays the principles of integrated character education

as follows:

> Teaching is driven by goals, and values are an intrinsic part
> of goals. When a teacher selects materials, develops curriculum,
> asks questions, teaches a lesson, sets standards, or manages a
> classroom, to name only a few routine duties, the teacher is
> modelling a specific set of values, such as responsibility,
> co-operation, trust. respect and caring. Teachers are always
> influencing the character of each student.

Page (1987: 316) claims that such integration shapes the future direction of

school children and

develop in all pupils an understanding and appreciation of technological and industrial development, so that the ordinary citizen of the future will exercise some control over these developments, as well as recognize that his or her standard of living depends on them.

The kind of learner that is envisaged in technology education is explained in the

National Education Policy, 1996 (Act no. 27 of 1966):

> The curriculum aims to develop the full potential of each learner as a citizen of a democratic South Africa. It seeks to create a lifelong learner who is confident and independent, literate, numerate and multi – skilled, compassionate with a respect for the environment and the ability to participate in society as a critical and active citizen."
> (Government Gazette 2002 Vol. 443:17)

Environmental Education also aims at environmental protection and

improvement. Chapter 36 of Agenda 21 on Education, Awareness and Training

states that:

> education is critical for achieving environmental and ethical awareness,values and attitudes,skills and behaviour consistent with sustainable development.
> (UNESCO 2002)

Palmer and Neal (1994:21) support this idea when they document the aims of

environmental education as:

> The need to develop attitudes of care, curiosity and concern for the environment in such a way as to develop a sense of responsibility towards home, school and community; to demonstrate to children the complex interrelationships between humanity and the environment, and to give pupils the necessary skills to do these things

In the light of the learning outcomes that learners need to achieve, technological practice takes place within the learner's needs, and is influenced by social, moral and environmental contexts. The role of educators is vital since the influence educators can have on the learners' perspectives on environmental and technological issues is partly dependent upon the educators' own knowledge, skills, values and attitudes. It is against this background that the conceptualization, planning and implementation of technology teacher education programmes as well as teacher practice in technology education classrooms were investigated. The manner in which the investigation was conducted will be discussed in Chapter 3.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

As stated in the first chapter, the primary purpose of the study was to investigate the manner in which technology educators integrate environmental education with technology education in the process of assisting their learners to achieve one of the learning outcomes for technology education. Another objective of the study was to investigate how the pre-service teacher-training programme prepared technology educators to incorporate environmental aspects when teaching technology education in their classrooms. In order to achieve the objectives mentioned above, a variety of data generating methods were used. This chapter analyses and reflects upon these methods. Data analysis and interpretation as well as the limitations of the study are also examined.

Before data production methods are analyzed, it seems appropriate to start by reflecting on debate about evaluation research since it played a major role in shaping my own evaluation of the pre-service teacher-training programme for technology educators.

3.2 DEBATE ON EVALUATION RESEARCH

A key element of evaluation studies is the intervention or programme that is being evaluated. According to Rutman (1984: 10) programme evaluation entails the "use of scientific methods to measure the implementation and outcomes of programmes for decision-making purposes". He further explains that the term "programme" is any intervention or set of activities that attempt to meet some recognized social need or to solve an identified problem. Rossie and Freeman (1993: 5) also see evaluation research as reflecting social scientists' increasing "desire to make an actual difference in the world". This desire to change things is also clear in their definition when they define evaluation research as "... the systematic application of social research procedures for assessing the conceptualization, design, implementation and utility of social intervention programmes". Debates on evaluation research clearly indicate that programme evaluation research has become an area of specialization within the broader terrain of applied social research.

Evaluation research has, over the years, witnessed a wide range of approaches, philosophies and traditions which are summarized in the following section.

3.2.1 Evaluation Research Traditions

Babbie and Mouton (2001) distinguishes the following three main research traditions in evaluation research.

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- The experimental tradition which finds its philosophical roots in positivism

- The naturalistic or qualitative tradition which has its roots in the interpretivist paradigm.

- The participatory / empowerment tradition which has clear affinities with the critical metatheory.

3.2.1.1 The experimental tradition

During the 1960s and 1970s evaluation research was dominated by the experimental approach which is associated with natural sciences. The researchers used a variety of experimental designs in studying social life. Basically experiments involve taking action and observing the consequences of that action. A group of subjects is selected and something is done to them. The effect of what has been done to them is then observed. One purpose of the experiment and evaluation might be to determine how long it actually takes for the therapy to be effective.

The following are the three major pairs of components that are used in the experimental tradition.

- Independent and dependent variables
- Pre-testing and post-testing
- Experimental and control groups

3.2.1.1.1 Independent and dependent variables

The experiment is used to examine the effect of an independent variable on a dependent variable. Babbie and Mouton (2001: 209) give an example of prejudice against Black South Africans. In their example, the researcher's hypothesis suggests that prejudice depends on a lack of knowledge of black South African history. The dependent variable is prejudice and exposure to black South African history is the independent variable. The purpose of the experiment is to test the validity of the hypothesis. Watching a film on black South African history might be seen as causing a change in prejudice or reduced prejudice can be seen as an effect of watching the film.

3.2.1.1.2 Pre-testing and post-testing

In this experimental design, researchers measure the subjects in terms of a dependent variable (pre-tested), exposed to a stimulus representing an independent variable, and then remeasured in terms of the dependent variable (post-tested). If we use Babbie and Mouton's (2001) example of prejudice and exposure to black South African history the researcher would begin by pre-testing the extent of prejudice among experimental subjects using a questionnaire, then expose the subjects to the black South African history film and measure the extent of prejudice again using the same questionnaire. If a

lower level of prejudice is discovered during the second administration of the

questionnaire it might be concluded that the film had reduced prejudice.

3.2.1.1.3 Experimental and control groups

Researchers detect the effects of the experiment by using a control group that

does not receive the experimental stimulus. In the example of prejudice and

exposure to black South African history, two groups of subjects might be given a

pre-test. The film is shown to the experimental group only and a post-test of

prejudice is administered to both groups. If prejudice were reduced only in the

experimental group such reduction would be seen as a consequence of the

exposure to the film.

The main purpose of evaluation research in the experimental tradition is to

determine whether the programme under review succeeded or failed and the

positivist tradition includes all those philosophers of social science who support

the idea that social sciences should emulate the methodology or logic of the

natural sciences. According to Babbie and Mouton (2001: 225) "the greatest

weakness of laboratory experiments lies in their artificiality. Social processes that

occur in a laboratory setting might not necessarily occur in more natural social

settings". Towards the middle-seventies a number of studies began to question

the usefulness of experimental approaches in evaluation research and called for

more responsive and participatory forms of evaluation research which are discussed in the section below.

3.2.1.2   The naturalistic / qualitative evaluation tradition

Several theorists have used the naturalistic or qualitative evaluation approach as an alternative to the dominant experimental tradition. Each of the theorists gave this paradigm a different name. Patton (1990) labeled this tradition as qualitative evaluation. Williams (1986) labeled it as a naturalistic evaluation, and Guba and Lincoln (1981) called it a fourth generation evaluation.

It is argued that qualitative or naturalistic evaluation approaches share all the fundamental epistemological and methodological principles of qualitative research (Babbie and Mouton 2001: 357). It is suggested that in a useful approach to naturalistic evaluation, one asks a number of questions about the evaluation project to be conducted. The responses to the answers will determine whether a naturalistic approach or a traditional experimental approach will be most appropriate (Williams 1986).

Babbie and Mouton (2001: 357) claim that naturalistic evaluation is best under the following conditions:

- When it is important and desirable that the insider perspectives, values and knowledge of programme recipients need to be integrated into an evaluation design.

- When the focus is more on describing the implementation process rather than on the outcomes or impacts of an intervention.

- When the purpose of an evaluation is formative and developmental in nature (improvement-oriented) rather than summative (judgement-oriented).

- When it is important to study the intervention in its natural setting and preferably through its entire life cycle.

- When it is possible to use unobtrusive measures, including simple observations and the analysis of documents, in an ethically acceptable manner.

- When the ultimate quality of the evaluation is produced through a triangulation of data sources and the use of multiple methods.

The following are some of the key ways that are viewed as distinguishing qualitative evaluation studies from quantitative evaluation studies.

- Research is conducted in the natural setting of social actors

- Qualitative evaluation research emphasizes process rather than outcone

- The actor's perspective (the "insider" view) is emphasized.

- The primary aim is in-depth descriptions and understanding of actions and events.

- Understanding social action in terms of its specific context is more important than attempting to generalize to some theoretical population.

- The research process is often inductive in its approach, resulting in the generation of new hypotheses and theories (Babbie and Mouton 2001:309).

Strauss and Corbin, 1990:24) share the same view when they define a grounded theory (another concept used in qualitative research) as a "qualitative research method that uses a systematic set of procedures to develop an inductively derived theory about a phenomenon" Qualitative researchers are also described by both Harper 1987:9 and Schwandt 1997:10 -11) as "bricoleurs: They learn to be adept at doing many things, drawing on a variety of sources, and making do with whatever is at hand"

3.2.1.3 The participatory / empowerment evaluation tradition (Metatheory)

Participatory and empowerment evaluation approaches share the basic principles and assumptions of the participatory action research paradigm. According to McTaggart (1991: 169) the conception of participatory action research is a "convergence and coalescence" of theoretical and practical traditions in many fields which include agriculture, social work, education, health, housing and community development. This kind of research originated in all these fields as a response to the realization that the knowledge production aspirations of the academics did not inform social practice and the fight for social justice (Fals-Borda 1988: 97). This led to the development of so-called liberationalist research methodologies that had political goals and commitments of liberating and empowering those who were being studied. People were encouraged to conduct research on the practices that affect their lives in their own contexts. Reflection with and by those whom research was intended to help

was required to inform social practice (Babbie and Mouton: 2001: 59). The key differences between participatory action research and other research traditions (quantitative and qualitative) lie in the location of power in the research process. People who are being studied play a role in setting the agendas, participate in data gathering and analysis and control the use of outcomes. In other words these people share ownership of the research enterprise (Maclure and Bassey 1991).

The participatory evaluation tradition also came as a response to the criticism that evaluation results were not being used optimally and that a key problem was the lack of involvement and participation of all stakeholders in the evaluation design as well as in the implementation of the evaluation study. Referring to Brunner and Guzman (1989: 9), Babbie and Mouton (2001) write: " ...These evaluations reflected the worldview and priorities of the sponsoring agencies and denied any meaningful input from the main actors in the development projects". Responding to the " imperialist" and "colonial" forms of evaluation studies undertaken in Third World countries, various scholars developed an alternative evaluation approach that made local project directors, facilitators and beneficiaries not feel victimized by evaluators who were sent out by sponsoring agencies to assess either the viability of proposed projects or the results of ongoing ones.

In this participatory evaluation tradition the intended beneficiaries of the intervention, together with the evaluators, decide when an evaluation should take place, what should be evaluated, how the evaluation should be carried out, and what should be done with the results. The evaluation is an educational process through which social groups produce action-oriented knowledge about their reality and reach consensus about action to be taken. The evaluation is also a learning process that allows the facilitators and professional evaluators to coach other members of the evaluation team until they become knowledgeable, efficient and autonomous as the project matures. In other words participatory and empowerment evaluations involve all the participants who are involved in the programme in a collaborative manner as co-evaluators. The idea is that through this involvement more empowered and emancipated communities could be produced.

3.3   THE RESEARCHER'S POSITION

For the purpose of my study, I have decided to use the naturalistic or qualitative evaluation approach to evaluate teacher technology education programmes in teacher training institutions with regard to the integration of environmental education with technology education in schools. This included an inquiry into technology educators' practice in their attempt to assist the learners to achieve the third learning outcome that focuses on values and attitudes necessary to understand the relationship between science, technology and the environment.

The choice of qualitative evaluation approach was more appropriate for this study, since the research was conducted in the natural setting of technology educators with the aim of describing and understanding their practice in relation to their technology teacher training (education) programme. This evaluation approach also made it possible for me to evaluate the teaching process of technology educators as well as the planning and implementation process of their teacher training programme. In other words the emphasis was more on the evaluation of the process rather than on the outcome.

3.4   THE RESEARCH GROUP

According to Cohen and Manion (1989), a sample is the population upon which the study focuses attention. The research group or sample used in this study consisted six technology educators and three lecturers at three different teacher education institutions. This sample size was appropriate for the purpose of the study (purposive sample) which was to investigate the extent to which environmental issues are considered when technology educators conduct their classes. The aim of this research was not to generalise the findings and the small sample used served the purpose of the study.

3.5   THE RESEARCH DESIGN

As mentioned earlier in the study the naturalistic or qualitative evaluation approach was used to evaluate technology teacher education programmes in teacher training institutions with regard to the need for the integration of environmental education with technology education in schools. In designing my research, I decided to follow Mouton's (2001) logic model which is based on Rossie and Freeman's (1993) evaluation framework. This model distinguishes the following steps in programme evaluation:

- Analysis related to the conceptualization and design of interventions
- Monitoring of programme implementation.
- Assessment of programme effectiveness and efficiency

Giving an explanation for the term 'logic model' Posavac and Carey (1992:11) claim that there is a logical sequence in the evaluation questions: "Without measuring need, programs cannot be planned rationally; without effective implementation successful outcomes cannot result from the program; and without valued outcomes, there is no reason to worry about cost effectiveness".

The following section gives a brief description of the steps in the logic model of evaluation and aligns them with the activities of the present study.

3.5.1 Analysis related to the conceptualization and design of interventions

Attention here is focused on programme objectives. An attempt is made to find out whether a programme is designed in such a way that it addresses identified social needs adequately (Rossi and Freeman 1993:35). A social problem is defined and specified in such a way that the conceptualization and design of appropriate interventions is maximized.

In this study the focal point of evaluation was on how the technology teacher education programme was conceptualized to meet environmental, societal and work needs and who was involved in the conceptualization of the programme. The lecturers in teacher training institutions were interviewed (Appendix 1).

The teacher technology education programme was also evaluated in terms of its design in integrating environmental education with technology education. In addition to the interviews of the lecturers the curriculum documents for the teacher education programme were also consulted (Appendix 4) in order to establish how the exit level outcomes relate to the societal, environmental and work needs and whether assessments of prospective technology educators require environmental issues to be taken into account or not. The design of the programme was also evaluated in terms of how the programme was structured and whether there was sufficient time allocated to visit environmental sites or not.

3.5.2 Monitoring of programme implementation

According to Babbie and Mouton (2001:341) a programme is implemented in a certain context or setting once its design and development has been completed. The questions that are usually raised include the following: Is the programme being implemented as designed? Are services delivered as originally intended? Rossi and Freeman (1993: 56-36) mention the following three reasons for conducting programme monitoring studies:

- To properly manage and administer programmes, programme managers need to conduct their day-to-day activities as efficiently as possible. (Programme monitoring as a management tool).

- Programme sponsors and other stakeholders require evidence that what was paid for and deemed desirable actually took place. (Programme monitoring as providing evidence within the context of accountability).

- To establish the necessary conditions for the assessment of programme outcome or impact.

In this study the most important reason was to get evidence that what was deemed desirable and crucial for the learners (learning outcome for technology education) formed part of the technology teacher education programme. Both the lecturers (Appendix 1) and technology educators who are currently teaching at schools (Appendix 2) were interviewed in order to find out how the technology teacher education programme was implemented to meet societal, environmental and work needs. The interview questions also aimed at finding out the extent to

which the lecturers were interested in environmental issues and the manner in which environmental issues were included and assessed in teaching practice.

3.5.3 Assessment of programme effectiveness and efficiency

Attention usually shifts to the outcomes of the programme once it has been established that a programme has been implemented according to plan. Babbie and Mouton (2001:341) point out that the outcomes could entail behavioural changes (more knowledgeable students), attitudinal changes and better services. These authors further claim that programme outcome studies aim to establish the relative success of an intervention by investigating whether the intended outcomes of the programme materialized or not.

Although it was not established whether technology teacher education programmes were implemented according to plan, an attempt was made to evaluate their impact. Technology educators were interviewed to find out how they designed their technology activities to assist the learners to achieve the third learning outcome for technology education (Appendix 2) and whether they thought that their teacher education programme helped them to be able to design activities that integrate environmental issues with technology education or not. An observation schedule (Appendix 3) was also used to gather information related to the practice of technology educators with regard to the third learning outcome of technology education. I observed some of the technology classes

with the aim of collecting evidence of environmental awareness in the classrooms and in learner portfolios.

3.6 DATA PRODUCTION METHODS AND THE RESEARCH PROCEDURE

Before the interviews and observations took place I sought permission from the Research Unit of the Western Cape Education Department, school principals and rectors of teacher education institutions to execute the investigation.

Permission was granted subject to the following conditions:

* No disruption of the normal academic programme.
* No use of any material that is the intellectual property of the WCED without a written request (Appendix 5).

I made use of data narrative production methods in the context of teaching and learning. To find out how technology teacher-education programmes prepared technology educators for the workplace I interviewed three lecturers in three technology teacher-education institutions of the Western Cape. One lecturer from each training Institution was interviewed. Six technology educators from two schools were also interviewed. Three of them were from a primary school in Gugulethu. One educator was selected from each phase (i.e. junior, intermediate and senior). Other three technology educators were from a high school also in Gugulethu. All the interviews were conducted during May and June 2003.

The total number of interviews was nine and the interviews were both narrative and semi structured. The following section explains why I decided to use narrative and semi-structured interviews.

3.6.1 Narrative interviews

There have been arguments in support of narrative inquiry (Gough 1998; Klausner 1998). The reconstructed stories are not only regarded as a fundamental educational tool but are also seen as having the potential to encourage self- reflection. Basch (1987: 11) states that the narrative interview has several advantages in comparison to other qualitative techniques of collecting data because it offers researchers an opportunity to:

> ...deal with complicated subject matter; gather a deal of in depth information... in a relatively short time, obtain reactions from respondents... clarify responses; and improvise to pursue unexpected but potentially valuable lines of questioning.

In this study technology educators were asked to narrate how they designed their technology activities to meet environmental needs.

3.6.2 Semi-structured interviews

According to Cohen and Manion (1989) semi-structured interviews are less formal and make the interviewer free to modify the sequence of the questions, change wording, explain questions and add to the questions. They also make it easy for the interviewer to probe for more specific answers to clarify misunderstandings. Elliot (1991) recommends that a semi-structured interview should begin with the unstructured part in order to establish a climate in which the interviewee could feel comfortable and respond more freely to the questions.

3.6.3 Observations

Two positions on a continuum of participant observation techniques have been identified and described as "an observer-as-participant in which the researcher is known as the researcher, but does not participate in the events, and a "participant-as-observer", in which a researcher participates as fully as possible in the on-going activities (Fien 1992: 9). I did not take the role of full participant as the intention of this study was an evaluation rather than an engagement in emancipatory action research.

The technique of observation was used to supplement my other sources of data and to gain a deeper insight into the practice of technology educators. My observations were centred around technology activities in and outside the classroom. I hoped to relate the practice of technology educators to the way they

were educated in their teacher education institutions. I observed classes that were conducted by the same six technology educators who were interviewed. Observations also took place from May to June 2003.

3.6.4   Curriculum documents

The curriculum documents for technology teacher education programmes were requested from three different technology teacher education institutions and consulted with the intention of establishing the way in which the programmes were planned or designed and to find out if there were any similarities or differences in the planning and the implementation of the programmes. I hoped that the information gathered from these documents would also reflect the exit level outcomes that would possibly include the ability of the educators to integrate technology education with environmental education.

3.7 ANALYSIS AND INTERPRETATION OF DATA

It is argued that collected data mean very little until they are captured, recorded, analyzed and interpreted (Bell 1993). Since the naturalistic or qualitative evaluation approach was selected for the purpose of this study, data analysis and interpretation aimed at producing research findings that were not derived from statistical procedures or other means of quantification. Strauss and Corbin (1998:11) point out that some researchers use techniques associated with

qualitative methods (e.g. interviews and observation schedules) but code the data in a manner that allows them to be statistically analyzed. These authors refer to such analysis as "quantifying of qualitative data".

In this research qualitative analysis was not the "quantification of qualitative data" but was rather a "nonmathematical process of interpretation, carried out for the purpose of discovering concepts and relationships in raw data and then organizing these into a theoretical explanatory scheme" (Strauss and Corbin 1998:11). The reason for choosing qualitative data analysis methods was the nature of my research problem. My research attempted to understand the nature of experience and the coping mechanisms of technology educators when faced with a new and challenging learning outcome for technology education which would be difficult to learn about through quantitative research methods. The responses of the lecturers and technology educators to the interviews were recorded and summarized. Open coding that was used included conceptualizing, classification and discovering of categories that helped me to see emerging patterns from the raw data.

3.8 DATA VERIFICATION

Whatever procedure for collecting data is selected, it should always be examined critically to assess to what extent it is likely to be reliable and valid (Bell 1993). In this study validity and reliability were ensured through the use of a variety of data generating methods. The use of multiple research methods has been mentioned as one strategy of promoting qualitative research validity (Burke 1997: 292-293). In an attempt to improve validity of this research I compared data relating to the conceptualization and design of technology teacher education programmes, which was gathered through the use of interviews with the lecturers, with data collected from the curriculum documents for the technology teacher education programmes.

With regard to the implementation of the technology teacher education programmes, the responses of technology educators to the interviews were also compared with the lecturers' responses to the interviews. Data pertaining to the practice of technology educators in schools (and the impact of the technology teacher education programmes), which was collected by means of narrative interviews with technology educators, was also compared with data collected through the use of the observation schedule.

Comparing data from different sources was an attempt to find similarities and differences in responses to the interviews with lecturers and technology educators as well as in curriculum documents and my own observations.

3.9 LIMITATIONS OF THE STUDY

The only limitation of the study was related to the way some technology educators responded to the interviews. When technology educators were asked to explain how they integrated environmental issues when they designed their technology activities they could not answer the question since they had little or no idea about environmental issues.

The qualitative data production methods that are described in this chapter were relevant and useful for the purpose of the study. The results from these data generating methods are documented in the next chapter.

CHAPTER 4

THE INTEGRATION OF ENVIRONMENTAL EDUCATION WITH TECHNOLOGY EDUCATION

4.1 INTRODUCTION

As indicated in the previous chapter the purpose of the study was to find out if environmental awareness formed part of the technology teacher education programme and how technology educators integrate environmental issues when they teach technology education in their schools. This chapter presents the responses of technology educators and the lecturers who were interviewed and gives a brief description of the researchers observations when he visited the classes that were conducted by the interviewed technology educators. Attention is also given to the findings of the researcher when he studied the curriculum documents of the technology teacher education programme.

The chapter is divided into four sections. The first section focuses on the responses of technology educators to the questions that were asked during the interview session (Appendix 2). In the second section attention is focused on the observations of technology educators' practice in schools. The third section deals with the responses of the lecturers who were also interviewed (Appendix 1) and the last section examines curriculum documents of technology teacher education

programmes in relation to Appendix 4. A brief analysis and interpretation is given after each question in each section.

4.2 RESPONSES OF TECHNOLOGY EDUCATORS

4.2.1 Difficult Learning Outcome for Technology Education

The first question attempted to find out the learning outcome that was perceived to be most difficult by technology educators when they facilitate learning towards its achievement. Technology educators were given a list of three learning outcomes mentioned in 1.1 and requested to give reasons for their answers.

From the responses of four technology educators it became evident that the third learning outcome was perceived to be most difficult. One response indicated that all the learning outcomes were difficult while another technology educator could not tell which learning outcome was difficult. The following reasons were given to explain why the third learning outcome was difficult.

- There are no clear guidelines for the facilitation of the third learning outcome. All technology textbooks place emphasis on technological processes (outcome 1) and knowledge (outcome 2).

- It is not clear in the official documents and in the textbooks how learners could demonstrate the understanding of interrelationships between science, technology, society and the environment.
- Some technology educators knew very little about environmental education.
- An integrated approach to the teaching/learning process is new and some educators are not familiar with it.

The respondent who could not tell which learning outcome was most difficult mentioned that she had not given herself time to read and understand the learning outcomes for technology education as she was facilitating learning in many learning areas and trying to cope with pressure from these learning areas.

The technology educator who found all three learning outcomes difficult explained that he was not exposed to technology education in his pre-service teacher training as it is a new learning area.

4.2.2 Design of learning activities to achieve learning outcome 3

The second question aimed at finding out, in a narrative form, ways in which technology educators designed their learning activities so as to enable their learners to achieve learning outcome 3.

Unfortunately the responses given had little or no relevance to the achievement of learning outcome 3. The learning activities that were described were general and applicable to almost all the learning areas. Some educators mentioned that they design their learning activities by allowing learners to work in groups or in pairs. Others stated that they use teaching aids such as pictures and also make use of tasks and peer assessment. It is important to note that there was no reference at all to environmental issues when the educators were narrating ways in which they designed their learning activities for technology education.

4.2.3 The pre-service training for technology teachers

The third question aimed at establishing whether technology educators thought that their pre-service teacher training prepared them well to design activities that integrate environmental education with technology education or not. Reasons for the answers given were requested from the educators.

The majority of the educators pointed out that their pre-service teacher training did not prepare them well to design activities that integrate environmental education with technology education because at the time of their training, technology education was not yet introduced as a teaching subject at the colleges of education. The educators who were furthering their studies in technology education mentioned that at that particular point in time, the technology education programmes placed little or no emphasis to the

achievement of learning outcome 3. Only two respondents gave a different view from the rest of other educators. These educators mentioned that they received good training from their institutions but the observation of lessons conducted by these educators as well as the portfolios of their learners did not reflect that they received good preparation for integrating environmental education with technology education.

4.2.4 Technology lecturer's interest in environmental issues

Question 4 attempted to find answers that relate to technology lecturer's interest in environmental issues. The technology educators were asked if their lecturers showed interest in environmental issues when they conducted technology education classes at teacher education institutions. They were also requested to support their answers with reasons.

Most of the responses indicated that there was little or no interest shown by the lecturers at teacher education institutions. This was attributed to the fact that there were no technology lecturers at the time of the training of interviewees. One respondent stated that her technology lecturer was interested in environmental issues because he encouraged them to use recycled material. One respondent was not sure whether her lecturer was interested in environmental issues or not as she seemed to have little or no understanding of the concept 'environment'. All the responses did not give a clear description of

the lecturers' actions that could be claimed as showing interest in environmental issues. In other words, none of the responses had concrete evidence that technology lecturers showed an interest in environmental issues.

4.2.5 Interest of technology teachers in environmental issues

An attempt to establish technology educators' interest in environmental issues was made by asking them whether environmental issues were of interest to them or not. Almost all the respondents claimed that they were interested in environmental issues because they believe that human beings, animals and plants depend on the environment for their living. Other respondents mentioned that they always keep their classrooms and schools clean.

Technology educators seem to be interested in environmental issues from a general point of view but they need to use environmental issues to design activities that can address environmental problems using technology education. Lesson observations did not confirm that technology educators have an interest in environmental issues.

4.2.6　Teacher's involvement in environmental activities

An attempt to determine the extent to which teachers participated in
environmental activities was made by requesting technology educators to give a
brief description of their involvement in environmental activities if they were
involved.

Four out of six educators indicated that they were involved in environmental
activities such as encouraging their learners to participate in cleaning campaigns
of the classrooms, to sing and read poems during the environmental week and to
play an active role in school garden projects. The other two respondents stated
that they were not involved in any environmental issues.

The issue of the teachers' involvement in environmental activities depends on the
individual teacher's choice and interest. Those respondents who were involved in
environmental activities attributed their involvement to their will and enthusiasm
as well as to the good atmosphere of the teaching/learning environment of their
schools. The atmosphere for teaching and learning seemed to be an important
factor for the teachers' involvement in environmental activities since it could
either encourage or discourage the educators from participating in environmental
issues. Lesson observations did not indicate that the teachers were involved in
environmental issues.

4.2.7 Assessment of environmental issues during practice teaching

Question 7 attempted to find out how environmental issues were assessed during practice teaching sessions in teacher education institutions. From a variety of the responses it became clear that there was little or no attention given to environmental issues when technology educators were assessed during practice teaching sessions. Other educators were not sure as to how environmental issues were assessed, as they could not remember since practice teaching happened a long time ago.

4.2.8 Highest qualifications in technology and environmental education

The question on technology educators' highest qualifications aimed at assessing the level of the teachers' knowledge in technology and environmental education.

The qualifications of technology educators differed from one interviewee to another. One educator did environment science as a subject in her teachers' diploma and was currently studying for the Advanced Certificate in (Technology) Education (ACE) at Rhodes University. The other one had a one-year course in technology education and no qualifications in environmental education. The other one had done Technology as a subject in the Adult Basic Education and Training (ABET) programme at a Technikon but had never studied environmental education. Others were registered for the Advanced Certificate in Education with

technology as a specialization, but had no qualifications in environmental education. One educator had no qualifications in both technology and environmental education. Two technology teachers were still in the process of upgrading themselves with regard to technology education but there were no attempts to further their studies with regard to environmental education. Those who happened to do environmental science/education during their training did not see the need to take any further studies on it. The reason for lack of qualifications in environmental education could be the fact that it is not regarded as the learning area in schools and some of the teacher education institutions therefore do not see it as a necessary teaching subject, hence they do not offer it.

4.2.9   Support for integrating different subjects

The source of support and assistance that could enable technology educators to integrate environmental education with technology education was explored in question 9. The idea was to establish which sectors or structures supported teachers to integrate environmental education with technology education.

Four respondents indicated that they got support from the following sources: media, newspapers, textbooks, colleagues, workshops and people who are exposed to technology and environmental education. The other two respondents confessed that they did not get support. The support that was mentioned by

technology educators was not adequate and relevant for effective integration of environmental education with technology education in the teaching/learning process. It is clear that there is little or no cooperation between technology educators and environmental organizations. This highlights a need for partnerships between teacher education institutions and various organizations that are concerned with environmental issues to discuss the best ways of dealing with the third learning outcome for technology education.

4.2.10 Assistance by environmental organizations on learning outcome 3

Question 10 attempted to find out the organizations that were assisting technology educators and their learners to achieve learning outcome 3. All the responses indicated that there was no organization that was assisting teachers and learners to achieve learning outcome 3. Based on the responses of the teachers, it is quite clear that there is no intervention by the organizations in assisting teachers and learners to achieve learning outcome 3. At the same time the organizations might be not aware that their assistance is required in technology education.

4.2.11 Involvement of learners in addressing environmental problems

The focus of question 11 was mainly on the ways in which teachers involved their learners to use technology education in addressing environmental problems. The responses of the teachers reflected their willingness to involve their learners to use technology in addressing environmental problems. Although some of their responses could be related to the cleaning of the environment and the collection of the used materials from the environment for designing technology products (recycling), there was no satisfactory description of learner-involvement in terms of ensuring the achievement of learning outcome 3 and the involvement of the learners in the design of activities was not well coordinated.

4.2.12   Consideration of environmental issues in the assessment of learners

Question 12 attempted to find out how technology educators took environmental issues into account when assessing their learners. Some of the responses were only limited to the neatness or cleanliness of the classroom and some were not very clear in answering the question. The respondents did not show knowledge of a broad perspective of environmental issues. The responses to the question were not convincing enough that environmental issues were really taken into account when the learners were assessed. One interviewee confessed that he did not take environmental issues into account when assessing learners.

According to the observation most teachers do not take environmental issues into account when assessing learners.

4.2.13 Confidence of teachers in designing learning activities

Question 13 was asked to determine confidence levels of technology educators in designing technology education activities within the context of the environment. Most of the interviewees indicated that they are not confident to design technology activities within the context of the environment. They stated clearly that they had no problems with designing activities for the achievement of learning outcomes 1 and 2 but when it came to learning outcome 3 they did not have clear guidelines as to how learning activities could be designed.

4.2.14 Teaching Aids used to achieve learning outcome 3

Question 14 intended to find out different kinds of teaching aids that were used by technology educators to assist their learners to achieve learning outcome 3. The responses to this question were general and not specific to learning outcome 3. The educators mentioned the following teaching aids: tins, magazines, catalogues, wood, books, newspapers, batteries, drawings, pictures, flashcards, television and paper. One of the respondents indicated that her use of teaching aids depended on the topic she was dealing with at that time and what she wanted to achieve. From the observations of technology classes it became clear

that most educators did not use teaching aids to assist learners to achieve

earning outcome 3.

4.2.15 Comments on the integration of environmental education with technology education

The final question gave technology educators the opportunity to give their own

comments or feelings regarding the integration of environmental education with

technology education. The following are some of the comments or feelings of the

interviewees:

- If the learners are expected to demonstrate an understanding of the interrelationships between science, technology, society and the environment, technology educators need to understand technology in terms of the environment in order to assist the learners.

- It is good to integrate learning areas but workshops are necessary because educators should get more training and assistance from different sectors.

The questions that were asked in the interview played a role in making teachers

reflect on their practice and encouraged them to realize the importance of

integrating environmental education with technology education. They

emphasized the need for more workshops and assistance from different sectors.

In other words the teachers acknowledged their shortcomings and expressed

their willingness to face the new changes and challenges of the Revised National

Curriculum Statement for Technology Education.

4.3 OBSERVATIONS OF TECHNOLOGY EDUCATORS' PRACTICE IN SCHOOLS

My observations focused on the practice of six interviewed technology educators in and outside their classrooms. A brief description of my observations is given in the following section.

4.3.1 Inclusion of environmental issues in the planning and designing of technology activities

Most technology educators seldom include environmental issues when planning and designing technology activities.

4.3.2 Encouragement of the learners to use technology to address environmental problems

The majority of the educators who were observed seldom encourage the learners to use technology in order to address environmental problems.

4.3.3 Teaching aids used to integrate environmental education with technology education

The results of the observations show that most technology teachers do not use teaching aids with the specific aim of integrating environmental education with

technology education. The teaching aids used are of diverse nature and can also be used in other learning areas. Examples of these teaching aids include charts, pictures and drawings.

4.3.4 Assessment of learning outcome 3

From the assessments that were observed it became clear that the main focus was on the application of technological processes and skills as well as the application of technological knowledge and acquisition of knowledge. There was little attempt made to assess the learners' understanding of interrelationships between technology, society and the environment.

4.3.5 Promotion of values and attitudes

The idea of this observation was to find out if technology educators do promote attitudes and values when teaching technology education. The results of the observations show that some educators promote attitudes and values in a general way and not with specific reference to the environment. Examples of attitudes and values that were promoted included responsibility to clean technology rooms and keeping equipment in proper places after they had been used. Consideration of the safety of other learners when using equipment in class was another example.

4.3.6 Evidence of environmental awareness in class

Although there were pictures and drawings in some classrooms they were not related to the promotion of action that is needed to address environmental problems. In other words there was little evidence of environmental awareness in technology rooms that were observed.

4.3.7 Evidence of environmental awareness in learners' portfolios

The results of the observations of activities in learners' portfolios did not show evidence of environmental awareness in the learners' portfolios. This was another indication that environmental issues were not considered when the learners were assessed as learner portfolios are another form of assessment.

The implications of the results shows that technology educators pay less attention to the inclusion of environmental issues in the assessment of the learners' activities, hence this is also not shown in the learner's portfolio's.

4.4 RESPONSES OF THE LECTURERS IN TEACHER EDUCATION

INSTITUTIONS

The section below presents the responses of the lecturers who were interviewed in teacher education institutions (Appendix 1). The interviews focused on the conceptualization, design, implementation and impact of technology teacher education programmes.

4.4.1 Conceptualisation of technology teacher education programmes

Only two questions were asked with regard to the conceptualization of technology teacher education programmes. The first question aimed at finding out how technology teacher education programmes had been conceptualized to meet environmental, societal and work needs and the second question attempted to find out who was involved in the conceptualization of the programmes. By asking the second question the researcher hoped to see whether the implementers of the programmes were also involved in the conceptualization and design of the programmes or whether they were implementing what was conceptualized and planned for them by other people, who were not part of the implementation phase.

Some of the respondents did not show any understanding of how their programmes had been conceptualized to meet environmental, societal and work

needs. For more clarity on this issue, I gave examples of the needs that could be met in the conceptualisation of the programme, but the explanation given by the respondents did not reflect exactly how their programmes had been conceptualized.

The responses relating to the second question indicated little or no involvement of the lecturers in the conceptualization of the programmes. One interviewee mentioned that he got his technology teacher education pogramme from the Western Cape Education Department and assumed that curriculum planners might have been responsible for the conceptualization and design of the programme. The other two respondents also stated that they were not involved.

4.4.2 Design of the technology teacher education programme

The focus in this section was on the design of the technology teacher education programmes with the purpose of examining exit level outcomes of the programmes and their relationship to environmental, societal and work needs. Other purposes were to investigate the way the programmes were structured or planned to be taught and to find out if assessments were planned in ways that required environmental issues to be taken into account.

4.4.2.1   Exit level outcomes

One lecturer stated that the exit level outcome of his programme was the demonstration of the ability by the students to teach technology from grade R to 9. Some of the lecturers seemed to be confused and could not tell precisely what the exit level outcomes of their programmes were. The line of interpretation of the question among the lecturers and myself was quite different although I tried to repeat the question and put it in simpler terms so that we could have a common understanding of the question and its expected answer.

4.4.2.2   The relation of exit level outcomes to environmental, societal and work needs.

When the lecturers were asked to respond as to how the exit level outcomes of their programmes relate to environmental, societal and work needs, they could not give specific answers. It became clear that some of the lecturers were still faced with the challenge of relating the exit level outcomes of their technology teacher education programmes to environmental, societal and work needs when they design their technology teacher education programmes.

4.4.2.3 Consideration of environmental issues when assessing students

The lecturers were asked if the assessments of the student teachers required environmental issues to be taken into account. Some of the lecturers claimed that they took environmental issues into account when they assess their students but the examples that were given did not relate to the achievement of learning outcome 3.

4.4.2.4 Plan for teaching technology teacher education programmes

When the lecturers were asked how they planned to teach their teacher education programmes and whether there was sufficient time allocated to visit environmental sites, they indicated that they did not plan to pay visits to environmental sites as such visits could disrupt the teaching schedules of other lecturers. The programme was planned in such a way that the teaching/learning processes should take place in class and there were no plans for visits by people from different environmental organizations. There was therefore no contact between technology educators and environmental organizations. It became clear that the lecturers did not give themselves and the students time to visit environmental sites.

4.4.3 Implementation of technology teacher education programmes

Attention in this section is focused on the manner in which technology teacher education programmes were implemented. Specific reference was made to teaching and assessment and the manner in which environmental issues were incorporated.

4.4.3.1 Programme implementation

From the lecturers' responses it became clear that the implementation of teacher technology education programmes varied from one institution to the other. Two lecturers mentioned that his programme was implemented through formal lectures that focused on the theoretical and practical components. Another lecturer stated that he used 6 40-minute periods per week for teaching the content and for educating the student teachers how to teach technology (methodology).

4.4.3.2 Interest of the lecturers in environmental issues

The lecturers indicated that they were interested in environmental issues but it was difficult for them to show their interest in technology education classes.

4.4.3.3 Assessment of environmental issues during practice teaching sessions

All the responses indicated that environmental issues were not regarded as crucial during practice teaching sessions. Inclusion of environmental issues in the teaching/learning process was not one of the assessment criteria for good practice teaching. There was no indication that the student teachers were provided with opportunities for developing teaching materials for technology education which could be related to environmental issues. This could be caused by the lack of knowledge and expertise on environmental issues. Other responses revealed that there were no practice-teaching sessions at all since technology educators were already qualified teachers who were studying for the Advanced Certificate in Education (ACE) – Technology Education.

4.5 EXAMINATION OF CURRICULUM DOCUMENTS

The curriculum documents of technology teacher education programmes were consulted with the aim of finding out how the programmes were conceptualized and designed or planned. The same procedure that has been discussed in 4.4.2 above was followed. The exit level outcomes of the programmes and their relationship to environmental, societal and work needs were examined. Emphasis was also placed on the manner in which assessments took

environmental issues into account and on the amount of time allocated to visit environmental sites or to be visited by environmental specialists.

4.5.1 Exit level outcomes

The curriculum documents of all technology teacher education programmes that were consulted did not have exit level outcomes. This indicated a lack of proper planning and collaborative efforts in the planning of teacher education programmes.

4.5.2 Relationship of exit level outcomes to environmental, societal and work needs

Since there were no exit level outcomes it was not possible to explore the relationship between the outcomes and environmental or societal needs.

4.5.3 Assessment of environmental issues

My perusal of the curriculum documents indicated that the assessment of activities does not take environmental issues into account. Consideration is given to the final or end product and the process of producing the product. This suggests that assessments in technology teacher education programmes focus more on knowledge and skills than on attitudes and values (outcome 3).

4.5.4 The structure of the programmes

The programmes were not structured in ways that could allow visits of environmental centers by student teachers or visits of teacher education institutions by people from different environmental organizations. This indicated little or no planned interaction or partnerships between education institutions and the society. Even though some of the lecturers claimed to love the environment, their effort to plan for the integration of environmental issues in their technology teaching programmes was minimal.

As stated in the previous chapter a variety of data generating methods were used in order to find similarities and differences in the responses of the lecturers and technology educators to the interviews as well as in curriculum documents and the researcher's observations. Such similarities and differences contributed in shaping the research findings that enabled me to draw conclusions and put forward some recommendations in Chapter 5.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

In Chapter 3 it was stated that curriculum documents of technology teacher education programmes, observations of technology classes and the interviews with technology educators and lecturers were used to collect data. The aim of the current chapter is to present the research findings and put forward some recommendations and conclusions in the light of all the data generating methods that were used in the study. The chapter is divided into two sections. The first section focuses on the results of the research and the conclusions while the second section puts forward some recommendations.

5.2 THE RESULTS OF THE RESEARCH AND CONCLUSIONS

The focus in the following section is on similarities in responses to a variety of data collection instruments th...t were used.

5.2.1 Similarities between the responses of technology educators and classroom observations

By comparing the responses of technology educators to narrative interviews with my own classroom observations, the following research findings could be drawn:

- Most technology educators regarded learning outcome no 3 as difficult to deal with in their teaching practice and some find it difficult to use learning outcomes in their lesson planning and teaching practice. According to my class observations, teachers also found learning outcome 3 most difficult than any other learning outcome.

- Most technology educators seldom design learning activities that enable the learners to achieve learning outcome 3. Lesson observations also showed that most teachers seldom include environmental issues when planning and designing technology activities. Therefore technology educators find it difficult to design their learning activities in order to assist the learners to achieve learning outcome 3.

- Since it seems difficult for technology educators to facilitate learning towards the achievement of learning outcome 3 they are unable to assess the learning process that they did not plan for. Classroom observations also indicated that technology educators did not conduct assessment that is directed at the achievement of learning outcome 3.

It can be therefore concluded that the emphasis in the practice of technology educators at the moment is on the acquisition and application of technological knowledge, processes and skills. There is little or no promotion of values and attitudes that are specific to the environment and the society. However, an attempt is made by some technology educators to promote values and attitudes that relate to the cleanliness of technology classrooms and the safety of other learners when using technology equipment.

5.2.2 Similarities between the responses of technology educators and technology lecturers

With regard to the implementation of technology teacher education programmes, the following similarities could be identified between the responses of technology educators and technology lecturers in teacher education institutions:

- The majority of the educators pointed out that their pre-service teacher training did not prepare them well to design activities that integrate environmental education with technology education. When technology lecturers described the manner in which they implemented their technology teacher education programmes, there was no indication of the involvement of technology educators in environmental activities. No mention was made about visits from or to environmental organizations.

- Most technology educators stated that their lecturers at teacher education institutions did not act in ways that show much interest in environmental issues. Although some technology lecturers indicated that they were interested in environmental issues, they admitted that it was difficult for them to show their interest in technology education classes.

- Both the lecturers and technology educators claimed that they had an interest in environmental issues but there was little or no evidence to show their involvement in environmental issues.

- No attention was given to environmental issues when technology educators were assessed during practice teaching sessions as their inclusion in the teaching/learning process was not one of the assessment criteria for good practice teaching.

It can be concluded that technology teacher education programmes do not entirely prepare technology educators to integrate environmental issues with technology education as is required by learning outcome 3 of technology education, hence technology educators find it difficult to facilitate learning towards the achievement of this learning outcome. Technology educators also find little or no support in the form of in-service training with regard to the integration of environmental education with technology education.

5.2.3 Similarities between the responses of technology lecturers and the design (planning) of technology teacher education programmes

An examination of data relating to the planning of technology teacher education programmes, collected from both technology lecturers and curriculum documents highlighted the following similarities:

- There was lack of proper planning and collaborative efforts in the planning of teacher education programmes as some of them did not have exit level outcomes.

- It was not possible to explore the relationship between the exit level outcomes of technology teacher programmes to environmental and societal needs since the exit level outcomes were non-existent.

- The plans for assessing activities in technology education do not take environmental issues into account.

- The structure of technology teacher education programmes is not planned in ways that could allow visits of environmental centers by student teachers or visits of teacher education institutions by people from different environmental organizations.

It can be concluded that there is little or no planned integration of environmental education with technology education as well as planned interaction or partnerships between education institutions and the society.

5.3   RECOMMENDATIONS

If learning outcome 3 for technology education expects the learners to demonstrate an understanding of the interrelationships between science, technology, society and the environment, technology educators should be able to facilitate learning towards the achievement of this outcome. The ability to facilitate such learning could be fostered through the following ways:

- A series of workshops that aim at assisting technology educators to integrate environmental education with technology education should be organized by the Education Department.

- The Education Department should involve specialists in environmental education and plan the workshops for technology education together with environmental organizations.

- Curriculum Advisers should take a leading role in ensuring that technology educators receive the necessary support. Educators should also work together with their sister schools and share their problems and

experiences regarding different ways of designing learning activities for integration.

- Teacher education institutions need to re - visit their pre – service training programme and ensure that student teachers are prepared well to design activities that integrate environmental education with technology education. Technology lecturers should be reflective on their practice and evaluate their programmes continuously.

- Technology lecturers should ensure that their technology teacher education programmes are conceptualised and designed to meet environmental, societal and work needs.

- Technology lecturers need to find ways in which they would show to the teachers that they are also interested in environmental issues. In that way the interest will then filter to the teachers and then to the learners.

- Environmental issues should be included in the practice teaching sessions of student teachers and should also form part of the assessment. Student teachers should also be informed that their presentations of technology lessons should include environmental issues.

- Teacher education institutions should establish partnerships with environmental organizations, work closely with them in developing their learning programmes and encourage student teachers to do service learning.

- Teacher education programmes should not only focus on knowledge and skills but should also promote values and attitudes.

- Since technology education is a new learning area that needs a lot attention in order to understand its dynamic nature and its demands, technology educators should be encouraged to further their studies in both environmental education and technology education.

- Environmental activities should not be practiced at the school level only, but should also be filtered down to the community. Environmental clubs and cluster groups can assist teachers to be involved in environmental activities.

- The assessment of learners should provide indications of learner achievement in the most effective and efficient manner and ensure that the learners integrate and apply skills. The learners' portfolios should also reflect evidence of environmental awareness.

- Technology teacher education programmes should provide sufficient time for student teachers to visit environmental sites. This is an important factor that can stimulate student's interest in environmental issues.

- Technology educators should be given opportunities to initiate environmental projects that could benefit the school and the community and the learners should be encouraged to design and make technology products that could be useful to those environmental projects. Examples of such projects include garden projects that could improve the quality of people and their environment.

- The management of schools needs to play a vital role in ensuring that technology educators comply with the needs and demands of the National Curriculum Statement for Technology Education in order to ensure that environmental education is integrated with technology education.

- Curriculum documents of lecturers in teacher education institutions should consist of exit level outcomes that relate to environmental, societal and work needs.

- Learning support materials for both Technology and Environmental education should form an intergral part of Curriculum development and be viewed as a means of promoting good teaching and learning.

Since educators are regarded as agents of change, it is crucial for both pre-service and in-service training centers to develop learning programmes that could enable technology educators to integrate environmental education with technology education in the teaching and learning processes. The present study is an attempt to encourage technology educators and their lecturers not to treat technology education in isolation to the environment and society. The integration of environmental education with technology education could enable the learners to take informed decisions and actions towards the resolution of their local environmental problems.

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APPENDIX 1: INTERVIEWS: TEACHER EDUCATORS (LECTURERS) IN TEACHER EDUCATION INSTITUTIONS

1. Conceptualisation of technology teacher education programme:

1.1 How has the programme been conceptualized to meet environmental, societal and work needs?

_____

_____

1.2 Who was involved in the conceptualization of the programme?

_____

_____

2. Design of technology teacher education programme:

2.1 What are the exit level outcomes?

_____

_____

2.2 How do the exit level outcomes relate to environmental, societal and work needs?

_____

_____

2.3 How do assessments take environmental issues into account?

_____

_____

2.4 How is the programme structured – Is there sufficient time allocated to visit environmental sites?

_____

_____

3. Implementation of technology teacher education programme:

3.1 How is your programme implemented?

_____

3.2 Are you interested in environmental issues?

_____

3.3 How do you assess environmental issues during teaching practice?

_____

_____

**APPENDIX 2: NARRATIVE INTERVIEWS: TECHNOLOGY EDUCATORS
IN SCHOOLS (GRADES R – 9)**

The Revised National Curriculum Statement for Technology Education requires the learners to achieve the following 3 learning Outcomes:

The learner will be able to:

1. Apply technological processes and skills ethically and responsibly using appropriate information and communication technologies.

2. The learner will be able to understand and apply relevant technological knowledge ethically and responsibly.

3. The learner will be able to demonstrate an understanding of the interrelationships between science, technology, society and the environment.

The following questions attempt to find answers that relate to the achievement of the third learning outcome.

1. Which learning outcome do you find most difficult in your teaching practice?

    _____

    Give a reason for your answer

    _____
    _____
    _____
    _____

2. How do you design the learning activities in order to enable your learners to achieve learning outcome 3?
    (Take your time, relax and narrate your story)

    _____
    _____
    _____
    _____
    _____
    _____
    _____

3. Do you think that your pre-service training prepared you well to design activities that integrate environmental education with technology education?

_____

Give a reason for your answer.

_____
_____
_____
_____
_____

4. Were your technology lecturers interested in environmental issues?

_____

Give a reason for your answer.

_____
_____
_____
_____
_____

5. Are you interested in environmental issues?

_____

Give a reason for your answer.

_____
_____
_____
_____

6. Are you involved in environmental activities?

_____

If yes, give a brief description of your involvement.

_____
_____
_____
_____
_____

7. How were environmental issues assessed during practice teaching sessions at your teacher education institution?

_____
_____
_____
_____
_____

8.1. What are your highest qualifications in Technology Education?

_____

8.2. What are your highest qualifications in Environmental Education?

_____

9. Where do you get support or assistance that enables you to integrate environmental education with technology education?

_____
_____
_____

10. Which environmental organization is assisting you and your learners to achieve learning outcome 3?

_____
_____
_____

11. How do you involve your learners to address environmental problems using technology education?

_____
_____
_____
_____
_____
_____
_____
_____
_____

12. How do you take environmental issues into account when assessing your learners?

_____
_____
_____
_____
_____
_____
_____

13. How confident are you in designing learning activities within the context of the environment?

_____
_____
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14. Which teaching aids do you use to assist your learners to achieve learning outcome 3?

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15. What are your comments or feelings about the integration of environmental education with technology education?

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THANK YOU FOR YOUR CO-OPERATION

APPENDIX 3:   OBSERVATION SCHEDULE

ACTIVITY	Most Often	Often	Seldom	Not at all
1. Inclusion of environmental issues when planning / designing technology activities				
2. Learners encouraged by the educator to use technology to address environmental problems.				
3. Teaching aids used to integrate environmental education with technology education				
4. Assessment of learning outcome 3				
5. Promotion of values and attitudes by the technology educator				

ACTIVITY	YES	NO
6. Evidence of environmental awareness in the classroom.		
If yes, description of evidence:		
7. Evidence of environmental awareness in learners' portfolios		
If yes, description of evidence:		

APPENDIX 4: POINTS CHECKED FROM THE CURRICULUM

                        DOCUMENTS OF TECHNOLOGY TEACHER EDUCATION

                        PROGRAMMES IN HIGHER EDUCATION INSTITUTIONS

Conceptualization and design of technology teacher education programmes:

1. What are the exit level outcomes?

2. How do exit level outcomes relate to environmental, societal and work needs?

3. How do assessments take environmental issues into account?

4. How is the programme structured – Is there sufficient time allocated to visit environmental sites?

APPENDIX 5: FIRST LETTER FROM THE WESTERN CAPE EDUCATION DEPARTMENT

Navrac Enquiries IMibuzo	Dr Ronald Cornelissen		Wes-Kaap Onderwysdepartement
Telefoon Telephone IFoni	(021) 467-2286		Western Cape Education Department
Faks Fax IFeksi	(021) 425-7445		ISebe leMfundo leNtshona Koloni
Verwysing Reference ISalathiso	20030331-0049		

Dear Mr Teboho Khabele

Before a research project can be approved the following must be provided:

1. Full title of the research project.
2. Concise description of the research project/proposal.
3. If questionnaires/interviews/tests are to be used in the investigation, copies of such questionnaires/structured questions/test questions.
4. A letter from your supervisor/project head, must accompany the application stating that you are registered at a tertiary institution.
5. A request in writing to use any material (computer data/questionnaires/surveys) that is the intellectual property of the WCED.
6. The names of the departmental institutions (schools) where the research will be conducted.
7. Who are the Respondents (i.e. learners, parents, educators, etc.)?
8. The period during which the research will be conducted.
9. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations. (October to December 2003)
10. Personal contact details: Home address, telephone number and fax number and/or e-mail address.

If you need further assistance please e-mail (rcornelissen@pawc.wcape.gov.za).

Yours in Education

HEAD: EDUCATION
DATE: 2003. 03. 31

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MELD ASSEBLIEF VERWYSINGSNOMMERS IN ALLE KORRESPONDENSIE / PLEASE QUOTE REFERENCE NUMBERS IN ALL CORRESPONDENCE / NCEDA UBHALE IINOMBOLO ZESALATHISO KUYO YONKE IMBALELWANO

GRAND CENTRAL TOWERS, LAER-PARLEMENTSTRAAT, PRIVAATSAK X9114, KAAPSTAD 8000
GRAND CENTRAL TOWERS, LOWER PARLIAMENT STREET, PRIVATE BAG X9114, CAPE TOWN 8000