

**AN EXPLORATION OF AN ENVIRONMENTAL RESOURCE MANAGEMENT
COURSE FOR SUSTAINABLE DEVELOPMENT PRACTITIONERS IN KENYA:
A CASE STUDY**

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ABSTRACT

Environmental challenges facing the world currently call for efforts that can avert eminent disasters related to these challenges. In an effort to engage in conservation, the Environmental Resource Management course at Technical University offers an opportunity to train for sustainable development in the country. However, the development and implementation of courses aimed at developing careers in sustainability in institutions of higher learning are coming under scrutiny as questions are being asked about their contributions to sustainable development. This research explored the Environmental Resource Management course to understand how it was developed and implemented to address a practitioner in the environmental resources conservation sector. The study surfaced the contradictions in the course which can be used as a lens to re-orient the course to enable a practitioner in education for sustainable development to emerge.

In Kenya, vocational courses in environmental education are a career choice for secondary school leavers and those engaged in the environmental conservation sector. This study carried out at Technical University of Kenya (TU-K) between January 2009 and April 2012 aimed at exploring how a diploma course; Environmental Resource Management (ERM) enabled the learners to become practitioners in environmental resource management. It surfaced contradictions and suggested transformative approaches to re-orient the course for sustainable development. This was necessitated by the paradigm shift in environmental education from environmental conservation education that emphasised ecological studies to Education for Sustainable Development that is broader and more holistic, encompassing social, economic and environmental aspects. The course has to be re-orientated to enable a practitioner in Education for Sustainable Development (ESD) to emerge considering the United Nations Decade of Education for Sustainable Development (UNDESD, 2005-2014). The course aims at training personnel for deployment in environmental conservation and management organisations to work as, resource officers/supervisors in national parks, forestry management, water management, energy development projects officers, etc.

Data was gathered through document analysis, questionnaires, interviews, observation and focus group discussions. Cultural Historical Activity Theory (CHAT) was engaged in surfacing contradictions in the Environmental Resource Management learning system in terms of its development and implementation. While Communities of Practice (COP) principles were used as the ontological underpinning for the ERM course.

The results indicate that the ERM course was revised between 1998 and 2002 by experts from Saskatchewan Institute of Science and Technology (SIAST) in collaboration with TU-K staff under the programme, *enhancing environmental management in Kenya*. The research also established that the ERM course review process was informed by sustainable development principles, as outlined in Agenda 21. Further it was realised that, Develop a Curriculum (DACUM) process was engaged to develop the learning units. This course development envisaged Competency Based Education (CBE) as the main mode of the ERM delivery. CBE is student centred and allows for multi-entry and exit. The study however realised that at implementation this approach was partially incorporated, as the country's education system is examination oriented and time bound.

The study findings indicate that most of the units taught were on ecosystem management with the social and economic aspects having less space and time, therefore the three pillars of Education for Sustainable Development were not adequately addressed in the course to enable a practitioner in the concept to emerge. Also teaching and learning in the course was found to be more theoretical than practical with little hands on activities because the main focus of the course was to enable the learners to acquire a certificate through examination rather than gain the appropriate competencies. Although the course was found to be enhancing ESD in relation to global and local sustainability issues, there were contradictions or challenges in the system that affected full realisation of the skills, knowledge, values and attitudes. For example the exclusion of the recipient staff in the planning of the course, lack of training of the lecturers on how to train on CBE, insufficient practical field excursions devoid of community engagement, lack of funds, lack of equipment and poor coordination.

This study recommends a re-orientation of the course to a more practical approach to teaching such as:

- Engagement of students with the community to solve real-life environmental problems;
- Mainstreaming ESD in all courses in the institutions of higher learning so that environmental concerns are addressed by everyone;
- Reviewing the educational policy to encourage solving of real-life environmental problems rather than passing theoretical examinations;

- Enhancing competency based learning to enable students become competent in their areas of specialisation;
- Encouraging networking and direct involvement of the students in the community instead of spending more time in class; and
- Establishing a Community of Practice among the students in Higher Education Institutions to enhance conservation practices.

The study contributes in-depth insight into exploring courses in Technical Vocational Education and Training institutions using Communities of Practice as a lens within the Kenyan context. It gives some empirical and explanatory insight into how learning can emerge and be expanded in Education for Sustainable Development through relevant courses such as Environmental Resource Management course. It also provides learning tools to work with contradictions that arise from socio-cultural and historical dimensions of learning about natural resources in the Kenyan context. Its other key contribution is that it provides further insight into the re-orientation of the ERM courses to embrace ESD for a broader and a more holistic approach to natural resources conservation and poverty alleviation processes that are critical for responding to socio-ecological issues and risks and development challenges in Kenya.

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LIST OF ACRONYMS AND ABBREVIATIONS

ABE	Association of Business Executives
AISHE	Auditing Instrument for Sustainability in Higher Education
CAPA	Commonwealth Association of Polytechnics in Africa
CBD	Central Business District
CBE	Competency Based Education
CBNRM	Community-Based Natural Resource Management
CDN	Course Development Network
CHAT	Cultural Historical Activity Theory
CHE	Commission for Higher Education
CIDA	Canadian International Development Agency
CoP	Communities of Practice
DACUM	Develop a Curriculum
DEEST	Department of Earth Environmental Science and Technology
DES	Diploma in Environmental Studies
EA	Environmental Audits
EAEN	East Africa Environmental Network
EE	Environmental Education
EEASA	Environmental Education Association of Southern Africa
EFA	Education for All
EfS	Education for Sustainability
EIA	Environmental Impact Assessment
ELRC	Environmental Learning Research Centre

EMCA	Environmental Management and Coordination
EPEC	Environmental Protection and Education Club
ERM	Environmental Resource Management
ESD	Education for Sustainable Development
GHESP	Global Higher Education for Sustainable Partnership
HEI	Higher Education Institution
KASNEB	Kenya Accountants and Secretarial Examination Board
KESSP	Kenya Education Sector Support Programme
KIA	Kenya Institute of Administration
KICD	Kenya Institute of Curriculum Development
KIFCON	Kenya Indigenous Forest Conservation
KNEC	Kenya National Examination Council
KOEE	Kenya Organization for Environmental Education
KPUC	Kenya Polytechnic University College
KUC	Kenyatta University College
KWS	Kenya Wildlife Service
LUP&M	Land Use Planning and Management
MDGs	Millennium Development Goals'
MENR	Ministry of Environmental and Natural Resources
MESA	Mainstreaming Environment and Sustainability into Africa Universities
NACECE	National Centre for Early Childhood Education
NEAP	National Environment Action Plan
NEMA	National Environmental Management Authority

NES	National Environment Secretariat
NIVTC	National Industrial Vocational Training Centres
NMK	National Museums of Kenya
PBL	Problem Based Learning
RCE	Regional Centres of Expertise
SCID	Systematic Curriculum Instructional Development
SIASST	Saskatchewan Institute of Science and Technology
SMART	Specific, Measurable, Acceptable, Realistic and Time specified
STI	Science, Technology and Innovation
TU-K	Technical University of Kenya
TIQET	Totally Integrated Quality Education and Training
TIVETA	Technical, Industrial, Vocational and Entrepreneurship Training Authority
TVET	Technical Vocational Educational Training
UNDESD	United Nations Decade for Education for Sustainable Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNEP	United Nations Environmental Programme
UNLD	United Nations Literacy Decade
WSSD	World Summit on Sustainable Development
ULSF	University Leaders for a Sustainable Future

CHAPTER ONE: AN INTRODUCTION TO THE STUDY

1.0 INTRODUCTION

This research is an attempt to explore how learning takes place in a vocational diploma course entitled Environmental Resource Management (hereafter referred to as ERM) to enhance Education for Sustainable Development (hereafter referred to as ESD). The course is offered at Technical University of Kenya (hereafter referred to as TU-K), an institution of higher learning under Technical Vocational Education and Training (hereafter referred to as TVET) principles. Literature indicates that environmental degradation is on the rise and specifically climate change is threatening the very existence of both human and wildlife on Earth (UNEP, 2006a). It is therefore important for Higher Education Institutions (hereafter referred to as HEIs) to come up with innovative approaches to learning to enhance sustainable development.

In this chapter an introduction to the study and an outline of the structure of the thesis is provided. The chapter starts with a brief discussion of what motivated me to ground the research in historical evidence and the experience that I have through being involved in the course development process and in teaching the ERM course at TU-K as an emerging higher education institution. The chapter also introduces the main concepts framing the study, namely, environmental course, Higher Education and Vocational education. This is followed by a discussion of the context of the research that provides a synopsis of the status of the environment in Kenya, the development of ESD in Kenya and, specifically, in HEIs and particularly TVET institutions. Course development and implementation for ERM is also outlined and there is a brief description of the institution within which the study was conducted. The chapter also introduces the research focus, goals, the research questions and highlights of the methodology used in the study. The chapter concludes with an outline of the structure of the thesis.

1.1 MOTIVATION FOR THE STUDY

I have been an environment and conservation educator for over fifteen years as a secondary school Geography teacher and now as a lecturer in Environmental Studies at TU-K. The ERM course that is currently offered at the institution focuses on the management of natural resources in Kenya and how these can be utilised in a sustainable manner. As a lecturer on the course, I derive great pleasure in my students being introduced to and engaging in the world of work with confidence to enhance sustainable development in Kenya. The ERM

course offered at TU-K aims at enhancing the students to become aware of how to manage environmental resources in a sustainable manner. I believe that the resources should be utilised in a way that will not jeopardise future generations' needs and wants as was proposed in the 1987 *Brundtland Report*. To me, the future generation means my grandchildren, great grandchildren and so forth. These generations should find and maintain a healthy environment for the future. This interest led me to take a particular interest in ESD principles and issues as outlined in Agenda 21 mainly because ESD is said to offer a more holistic approach to sustainability (UNESCO, 2006). It was around these concerns that I developed this study to probe how the ERM course was developed and implemented to provide an induction into the environment and sustainability concerns of Kenya in order to produce ESD practitioners able to work for a more sustainable environment.

I was part of the review process that reframed the environmental studies course through an intergovernmental programme, 'Supporting Environmental Education program in Kenya', funded by the Canadian International Development Agency (CIDA) between 1998 and 2002. In this programme, it was my role to organise the lecturers to prepare the learning materials for the revised natural resource management component. It is through this project that the ERM diploma course and a certificate course in Environmental Land Use Planning and Management were prepared at TU-K. I was in charge of the preparation of the certificate course, which was specifically developed for the Ministry of Lands officers in the Department of Planning in Nairobi, as requested by the then director of the Physical Planning Department.

The technical officers in the department, that is, the architectural design assistants, had expressed a desire for a course to enable them to understand how best to manage natural resources because they were involved in planning for these resources and their plans directly affected the natural resources in the country. Their knowledge, skills and competencies on the management of the environmental resources in the country was expected to enhance sustainability. A certificate course was offered in 2003 and it became popular, as it not only attracted students from other departments but also secondary school leavers who had not attained the minimum requirement for entry into a diploma course but were interested in a

career in natural resources management. The certificate course is currently a bridging course for the diploma course in various fields at the institution.

Through my participation in the revision of the diploma course and preparation of the course materials in ERM, undertaken in collaborations with the Canadian experts, I gained experience on how to prepare a course through the Develop a Curriculum (here after referred to as DACUM) (section 5.5) process and Competency Based Education (hereafter referred to as CBE) (section 5.6). This was introduced to us as a teaching approach whereby the learner is supported to develop professional skills so as to become competent in his trade area. We learned how the CBE approach is flexible in terms of entry, exit and ability of a student as the approach allows one to join the programme at any time and to work at one's own pace to graduate in one's own time. The CBE approach does not encourage competition and examinations but emphasises becoming competent in a range of skills that would produce a competent professional in environmental resource management. The CBE approach is said to be an effective way of learning as opposed to the traditional methods (see Section 5.4) and at such it was my intention to see how this was implemented in the ERM course offered at TU-K. The staff responsible for teaching this course highlighted the advantages of a traditional way of instruction and CBE. I, therefore, felt a need to investigate how the course prepared for CBE is being implemented to illuminate the challenges in teaching and learning for sustainable development.

Developing and delivery of short and long term courses is the duty of the lecturers in my university in Kenya. The heads of departments ensure that academic courses are initiated and developed. The chief academic officer is responsible for ensuring that curriculum development and review is carried out in accordance with university regulations (Cheserek, 2012) therefore it is the duty of academic lecturers at my university to develop and deliver the academic courses. Being one of the academic lecturers in the institution I am involved in developing courses for various specialisations in environmental studies. My engagement in course development and implementation over a long time led me in the above context to ask: How can HEIs effectively train a competent ESD practitioner? I would like to see our students engaging more with the communities, not simply for employment but for solving the immediate environmental problems. I am suggesting this because our students write very

good projects at the end of the course as the assessment of the projects with the sustainability tool indicates (see Appendix, 3Bb), but they have no actual links to the areas they purport to be studying (the community).

I became interested in ESD in early 2007 when I was involved in the initial discussions at a government level in Nairobi. I was representing TU-K on the ESD strategy for Kenya. At that point, the ESD concept was not very clearly defined and, from an environmental education perspective, I felt that there was a need to engage more deeply to understand its meaning. I wanted to understand how the teachers and students engaged in a course and experienced it as enhancing their competence in ESD. It must be noted that the principal appointed a person from the environmental department to represent the institution at government level and that ESD was being spearheaded by the National Environmental Management Authority (here after referred to as NEMA) of Kenya. This created the impression that the ESD concept was about environmental conservation. I wanted to know what this concept meant in the context of my institution and how we, as an institution, could use it and could get more engaged in terms of teaching. I therefore decided to use the ERM course as a case study. In the next section, I briefly discuss some of the concepts that were embedded in the course and have been probed in this research.

1.2 RESEARCH CONCEPTS

Two developing concepts in the course and which are examined are: Environmental Resource Management and Education for Sustainable Development. A third is Higher Education as the changes in the course were part of the development of a technical university taking up training courses in response to the environment and sustainability concerns in Kenya.

The major concept is Environmental Resource Management (ERM). This is dealt with in the context of the diploma course that was investigated so as to explore how it enabled or constrained practitioners in becoming professionals and taking up Education for Sustainable Development (ESD). The wider research focus was thus ESD and the study was designed to look into the sustainable development issues in Agenda 21 around which the course was initially developed and to understand how the emerging ESD practitioner was produced and shaped by the course. The ERM course was thus viewed as being narrower than the ESD concept that is more holistic encompassing environment, economic and the social pillars.

The concept of ESD continues to be debated globally and its principles are being implemented in this decade of the United Nations Education for Sustainable Development (UNDES D). This concept is now displacing Environmental Education (EE) and Sustainable Development (SD). It is difficult to separate these concepts and draw a clear line between them; ESD could just be a re-budged EE (Robottom, 2007). In this research, these concepts are examined as a developing discourse and have come to be used somewhat interchangeably in response to the changing international concepts and agenda. The ERM course was initially prepared with a specific resource management professional in mind and has played out against a changing international background and focus towards enhancing sustainable development. How the course was developed and how the process has been playing out against a changing agenda is significant to this study. The evolving course is now implemented in a Higher Education Institution and, thus, the investigation of the approaches TU-K is using to teach for sustainability also forms part of the research.

1.2.1 Environmental Resource Management diploma course at TU-K

This is a three-year course made up of thirty units, a three month Industrial attachment, two field camps and two projects (namely, a Business Plan and Trade Area Project). The graduates are awarded a Diploma of Technology in Environmental Resource Management. This research specifically explored the course development and implementation processes with the aim of providing information on how these processes are incorporating ESD principles and practices. An analysis of the historical and course-based data gave insights on the professional emerging from the course to inform a continuing re-orientation of the course in Kenya ensuring relevance to the United Nations Decade of Education for Sustainable Development (UNES D 2005-2014). In designing this investigative study of the course development, the emerging professional and the changing context of the institution my hope was simply to develop greater understanding of what we have been involved in and to suggest ways of enhancing the sustainability courses in higher education. This research is limited to the ERM course and does not engage in institutional curriculum development, implementation and management. Below are the aims and objectives of the ERM course.

1.2.1.1 Aim and objectives of the ERM course at TU-K

The ERM course trains students to work as environmental technicians, resource officers and supervisors in national parks, forestry, community development projects and non-governmental organisations dealing with environmental issues (Appendix 1 A HD 22, p.2).

The course aims at enabling the trainee to:

- Manage environmental resources;
- Supervise community development activities;
- Use computers to manage data and write technical reports;
- Operate equipment safely and survive in the wilderness;
- Perform scientific experiments;
- Manage an office; and
- Organise environmental seminars and workshops.

A student trained in this course will be in a position to describe the environmental resources in the community, relate the community development activities to environmental degradation and develop ideas on how best to manage the resources sustainably. The student is also expected to keep abreast of technological development and should be proficient in computers. The student may be required to use certain equipment related to environmental conservation. He/she should be efficient with the maintenance of this equipment and be able to perform scientific experiments that are related to environmental management. Finally, this student will work in an office dealing with matters environment, he must therefore be able to run an office as well as organise environmental seminars and workshops.

This study examined some of the ERM course practices and their potential for enhancing ESD in a community of practice of environmental conservation discourse. In this regard, it undertook to probe aspects of coursework (content and pedagogical approaches), examinations, field trips, projects and industrial attachment.

1.3 THE ENVIRONMENT AND SUSTAINABILITY CONTEXT OF THE RESEARCH

This research is located in the field of ESD, the key concepts within which are a good life, a healthy environment, human rights, equity, social inclusion, citizenship, context based, respect and intercultural understanding (UNESCO, 2006). In this research, sustainability was approached as a process that has evolved over time. In other words, from the time man realised that the environment was becoming degraded and had to start managing it in a way that does not affect it negatively, but, rather, in ways that will ensure that it will support human life (Ferreira, 2007:38). The development of this approach is grounded in the ESD process, considered to have its roots in Environmental Education (EE) which focused on environmental maintenance and improvement (EETAP, 2013). This was followed by sustainable development (SD), which was more concerned about development and its effects on the environment. Now, Education for Sustainable Development (ESD) encompasses the broader notions of concern for the well-being of the environment, society and economy (McKeown & Hopkins, 2003). According to McKeown (2002:10) ESD is viewed as being less constrained and more holistic than traditional EE.

This research was concerned with the environmental challenges in Kenya and particularly how HEIs are teaching for the sustainability of natural resources. Environmental resources require careful management necessitating courses and training in environmental resource management to produce professionals to address the environmental challenges in the country. The course examined in this study has been developed and is now offered at a Technical Vocational Education and Training (TVET) institution of higher learning. This study aimed to understand how the course was developed and implemented to address the environmental management challenges in the country so that ESD is enhanced. This section highlights the context of the study, providing an overview of the environment and sustainability challenges and policy framework that initiated the course development in Kenya. This provides a backdrop for understanding the TVET course development process and its delivery to meet the challenges of ESD.

1.3.1 The status of the environment in Kenya

The changing status of the environment in Kenya is the foundation of this research and the driving imperative for the course that is investigated in the study. The ERM course trains officers to manage natural resources in the country as already mentioned in Section 1.2.1.1, because these resources are of paramount importance to the country as it depends on them for its economic growth and social well-being. Sustainable development issues in Kenya are complex and intertwined but can be socially, economically and environmentally classified. The social issues include human rights, peace and security, gender equality, cultural diversity, intercultural understanding, poor governance, corruption, increased incidences of diseases, erosion of cultural values and morals, among others (NEMA, 2008:5). The economic issues include corporate responsibility and accountability; marketing; increasing levels of poverty and the widening gap between the rich and poor; unsustainable production and consumption leading to inefficiency and wastefulness; and poor enforcement of policies and regulations governing production and marketing. The environmental challenges include unsustainable utilisation of natural resources, climate change, rural development, urbanization, disaster prevention and mitigation (ibid).

Kenya's wealth is endowed in its natural resources that are distributed throughout the nation. It is among the 47 countries within sub-Saharan Africa that depend heavily on their natural resources for economic and social needs (Otieno, 2008; UNEP, 2006a). Most of the country's population lives in rural areas and relies on agriculture and natural resources. However, the natural resource base is shrinking rapidly. Environmental problems are becoming increasingly severe, pushing the country into poverty and associated environmental problems such as deforestation, soil erosion, pollution and health. This indicates that these resources cannot be guaranteed for future generations in the same quantities and quality if they are not managed sustainably (NEMA, 2008). Various initiatives and responses practised and recommended have not yielded any remarkable results as environmental degradation seems to escalate.

The natural resources in Kenya include atmosphere, land, fresh water, forests and woodlands, coastal and marine environment resources and biodiversity. Due to population growth, poverty, change of land use and land degradation, increased demand for biodiversity products, climate change and global warming, these resources are threatened (NEMA, 2004;

UNEP, 2006a). Land degradation and soil loss threaten the livelihood of the majority of the Kenyan rural community and future food security, with implications for water resources and the conservation of biodiversity. As indicated by UNEP (2006a), the greatest challenge for humanity is to protect and sustainably manage the natural resource base on which food and fibre production depend, while feeding and housing a population that is still growing. There are various factors that have contributed to land degradation in Kenya, which include population pressure, land ownership and land tenure, land fragmentation, state land and state forests, political aspects, legislation, technology, the social significance of livestock, people's reluctance to move or change, historicity of colonial attitudes, economic constraints and resettlements of the landless (NEMA, 2004). The country, therefore, needs new approaches to manage its resources for future generations. The ERM course is only one approach to conserve the natural resources in the country. The following section briefly highlights the status of some of these resources in Kenya because learning about these resources forms the larger part of the ERM course content.

- **Water**

Kenya's freshwater is highly limited. The annual renewable fresh water supplies represent 647 m³ per capita, which is significantly below the 1 000 m³ per capita that the United Nations classifies as chronic water-scarcity (UNEP, 2008). Population growth alone continues to reduce per capita water availability in the future so that, by 2020, it is expected to be only 359 m³ per capita (UNESCO, 2006; WRI et al., 2007). Surface waters cover about two percent of Kenya and supplies 20.2 billion m³ of the country's estimated 30.7 billion m³ of renewable water per year. The rest, about 14% of the total water resources, comes from groundwater and trans-boundary rivers (NEMA, 2004). Water resources are threatened by pollution from various sources, industry, agrochemicals and domestic sources/waste. Due to pollution, the water hyacinth thrives in some of Kenya's major water bodies (NEMA, 2004).

- **Forests**

Kenya's gazetted forests cover a total of 1.4 million hectares, representing about 1.7% of the total land area. This compares unfavourably to the internationally recommended minimum of 10% of the country's forest cover. These gazetted forests are confined largely to the wetter, cooler parts of the country. These include Coastal, East Rift Valley Montane, (the Aberdares and Mt. Kenya); West Rift Valley Montane such as the Mau, Tinderet and Cherangani,

including Mt. Elgon; and the Guinea-Congolan upland forest (for example the Kakamega forest). There are pockets of indigenous forests on private farms and county council land, whose extent and distribution are not known, but which have significant biodiversity functions (NEMA, 2009). During the 1990s, forests suffered severe losses, with as much as 93 000 hectares cut during the decade (FAO, 2001). In total, between 1990 and 2005, Kenya lost 5% of its forest cover.

- **Biodiversity**

According to the Status of the Environment Report of 2004, biodiversity, or the diversity of species, genes, and ecosystems, is on the decline in Kenya (NEMA, 2004). Of all African countries, Kenya ranks second highest in richness of bird and mammal species. It also has high levels of species endemism, or species that live nowhere else on Earth. The loss of Kenya's rich variety of wildlife species diminishes the planet's store of living things. It is also an enormous threat to the nation's tourism industry, a mainstay of its economy, and it undermines the livelihoods of those reliant on local resources for their livelihoods (NEMA, 2008, 2009).

- **Wetlands**

Wetlands in Kenya are under threat from drainage and reclamation for agricultural development, human settlement and industrial development (NEMA, 2009). These are the biggest threats to wetland conservation and management. In the past, wetlands have been regarded as "wastelands", which harbour disease vectors. This has led to large-scale drainage and conversion for alternative uses without regard for the ecological and socio-economic values of wetlands. Many wetlands have been degraded through drainage, pollution, sedimentation, introduction of exotic species, degradation of catchments, over exploitation of resources, upstream damming and diversion, among others. The benefits derived from these wetlands have, therefore, been lost or reduced (UNEP, 2006a; NEMA, 2009).

Coastal and marine resources have considerable ecological, social and economic importance in Kenya. Local communities are heavily dependent on coastal resources such as mangrove trees for construction, for medicinal and food products and for subsistence or small-scale trade. The commercial fishing and tourism industry contribute substantially to the economies of the coastal communities. Many of these activities, however, are over-exploiting, degrading and polluting the marine and coastal resources and habitats. Coastal development

and modifications are also undermining the ability of natural landforms and other features to protect and stabilise shorelines. Coastal communities have suffered economic and social losses related to depletion of fish stocks, the deterioration of recreational and tourism attractions and rising costs of water treatment and coastal protection (UNEP, 2006a).

- **Energy**

Kenya is not richly endowed with oil and related goods and needs to import crude oil. The country mainly depends on biomass for its fuel, but this is a threat to its forest resources. Hydroelectric power production is limited and is seriously affected during dry periods. The other forms of energy in Kenya include geothermal, wind, solar, and biogas energy. The development of this sector is important for the country's sustainable economic development (NEMA, 2008).

The summary above indicates that Kenya is faced with challenges of managing its natural resources in a sustainable way and therefore needs to train its youth on management of these dwindling resources. The Kenyan population needs to be sensitised to the importance of using available natural resources sustainably to cater for the present and future generations. As the nation strives to achieve its Millennium Development Goals and targets under Vision 2030 (NEMA, 2011), it needs to effectively plan and manage its environment as well as the economic and human resources to avoid allowing recurring natural phenomena to turn into human and economic disasters. Therefore, an approach to training its youth for the future is essential. Training the youth on ERM is one option for taking care of these resources.

1.3.2 A historical perspective on the emergence of ESD in Kenya

The vision and mission of Kenya is to have quality education and training for development to provide, promote and co-ordinate lifelong education, training and research (Republic of Kenya, 2005). The nation aims at providing for the development of individuals that are productive and socially responsible. More recently, to achieve these educational goals, NEMA (2008) argued that the education sector has to promote and embrace strong partnerships with education and training institutions worldwide, in accordance with ESD principles.

The history of education in the country has a strong bearing on the current situation. Education on conservation and environmental concerns in Kenya can be traced back to the colonial period where an early focus was on soil erosion and the restoration of 'vegetal cover, 'primarily forest trees and kikuyu grass. At independence in 1963, the government of Kenya recognised education as a basic human right and a powerful tool for human resource and national development (Republic of Kenya, 2005). The provision of education and training to all Kenyans is seen as fundamental to the success of the government's overall development strategy. The long-term objective of the government is to provide every Kenyan with basic quality education and training to enhance the ability of Kenyans to preserve and utilise the environment for productive gain and sustainable livelihoods (ibid.).

At independence, reviews were made to reflect the aspirations of the independent nation, as documented in Sessional Paper No. 10 of 1965 (NEMA, 2008). However, serious concerns for the environment were initiated in 1971, with the setting up of an *ad hoc* committee to prepare the Kenya National Report on environment that was presented at the United Nations Conference on Human Environment in Stockholm, Sweden, in 1972. As a result, in 1974, the National Environment Secretariat (NES) was established to coordinate all environmental activities undertaken by various government ministries and departments (Republic of Kenya, 1972). This was a serious step towards addressing environmental matters in the country.

In 1977, the government, through the Ministry of Education, called for integration of environmental education into the curriculum (Kamunge, 1980). This policy statement led to the integration of environmental concerns into both primary and secondary school subjects. In 1986, environmental concerns were integrated in the pre-service training of primary school teachers. Recognition of environmental education was again emphasised by central government in Kenya's Session Paper Number 6 of 1988 (Republic of Kenya, 1988). It stressed that environmental education needed to be 'part and parcel' of education and training. Environmental Education (EE) was to be taught in all tiers of the education system. This led to the inclusion of environmental concerns in the development plans drafted by the government in the following years.

Since 1985, environmental issues have been defined and integrated into the curriculum in Kenyan schools (Republic of Kenya, 1988; Otieno, 2002). Environmental education and training in Kenya received considerable attention, particularly in the National Environment

Action Plan (NEAP), which emphasised that the goal of the country is to train manpower that is adequately sensitized to interrelationships between factors of economic development and the natural environment. This goal has been repeated in all national development plans and master plans since Independence (Ministry of Environment and Natural Resources (MENR), 1994; Republic of Kenya, 2005). As a result, the Kenya Institute of Curriculum Development (KICD) has developed a curriculum on environmental education for specialised environmental education personnel undergoing training in polytechnics and teacher training colleges, and all universities have incorporated some teaching of environmental education either as a specialized area or as a compulsory module (Koech, 1991). Several non-formal groups are also involved in environmental education focusing on various target groups and natural resource priorities (KIFCON, 1993; Gichuki & Nasirwa, 1997).

In Higher Education Institutions (HEIs) in Kenya, Environmental Education (EE) is being implemented as a mandatory course. In some institutions, Environmental Education is a vocational course or career for training students to become environmental officers, wildlife managers, or forestry managers, to mention a few. Some of the institutions training specifically for the environmental sector include Kenyatta University, University of Nairobi, Technical University of Kenya, Egerton University, Moi University and Masinde Muliro University of Science and Technology. These institutions train students in specific courses geared towards careers in environmental conservation.

1.3.2.1 Policy support for ESD in Kenya

According to the Republic of Kenya document in 2011, Kenya is a signatory to several international commitments and conventions related to education such as Education for All (EFA), the Dakar Framework of Action, MDGs, United Nations Literacy Decade (UNLD) and the Convention on the Rights of the Child (CRC). The Government has also prepared and implemented several pieces of legislation and policies on education (RoK, 2011). These include Sessional Paper No. 10 of 1965; the Board of Adult Education Act; the Education Act (1968) and Sessional Paper No. 6 of 1988 on Education and Manpower Training for the Next Decade and Beyond, among others. These have guided the philosophy and provision of education in the country since Independence.

The most recent policy document on a framework for Education, Training and Research is Sessional Paper No. 1 of 2005. This policy paper recognises the integral role of education and training in promoting national development and re-affirms the government's commitment to the provision of quality education and training for national development. The Sessional Paper upholds the need to address global issues such as environmental concerns, technology and gender disparities, among others, through education (RoK, 2011).

Environmental legislation is addressed in the Environmental Management and Coordination Act (EMCA), No. 8 of 1999 (NEMA, 2008). This is a legal framework that provides for effective coordination and regulation of all actions directed at, or likely to have influence on, the environment. The environmental legislation is diffuse in nature, with provisions contained in a wide variety of sectorial laws which have yet to be amended to conform to the EMCA. The Act has provision for promotion of environmental education and Kenya's vision 2030 provides a convergence point between education and sustainable development. The emphasis is on the provision of appropriate manpower training in environmental management and calls for the provision of a basis for shifting mindsets towards positive environmental behaviour. The Kenyan Constitution (RoK, 2010) has a number of bills of rights which support ESD. Article 42 states the rights of every Kenyan to a clean and healthy environment. This is supported by Article 53, which entitles every child to free and compulsory education. Article 69 of the Constitution emphasises the need for sustainable exploitation, utilization, management and conservation of the environment and natural resources.

In response to the enhancement of ESD, Kenya has developed its implementation strategy to provide an enabling environment and capacity for all sectors and stakeholders to effectively contribute towards the achievement of sustainable development. The development and implementation of the ESD strategy was, therefore, a major step towards attaining sustainable development in Kenya through appropriate learning, capacity building programmes and development of skills in sustainable use of resources at all levels. The aim is to inculcate sustainability values among the citizens to inform decisions on various issues. The ESD policy aims at providing a framework for mainstreaming education which inculcates sustainable development as a life-long learning practice in all levels of education in Kenya, in accordance with the regional and international ESD frameworks. The ESD policy for Kenya

is currently in draft form and the Minister for Environment and Mineral Resources, in his foreword in the document, emphasises the significance of ESD:

Education for Sustainable Development has now become one of the tools for attaining sustainable development in Kenya through appropriate learning, capacity building programmes and development of skills in sustainable use of resources at all levels. This will inculcate environmental values among the citizenry aimed at influencing informed decisions on various aspects. In turn, this will improve the quality of learning through better understanding of natural, social and economic processes. This policy proposes a broad range of measures and actions responding to key educational issues and challenges. It seeks to re-orient education to ensure that the citizenry attain life-long learning principles towards sustainable development.

In this message, the minister specifically outlines the need for a better understanding of natural resources, social and economic processes. Therefore higher education institutions have a key role to play in training personnel to engage in these aspects in society.

Kenya has also implemented Regional Centres of Expertise (RCEs) on sustainability, which is coordinated by the Kenya Organization for Environmental Education (KOEE) and NEMA. An RCE is a network of existing formal, non-formal and informal education organizations, mobilised to deliver ESD to local and regional communities. A network of RCEs worldwide will constitute the global Learning Space for Sustainable Development. RCEs aspire to achieve the goals of the UNDESD (2005-2014) by translating its global objectives into the context of local communities in which they operate. The functions of RCE include re-orienting education towards SD, increasing access to quality education, delivering trainer training programmes and public awareness on the importance of ESD (Fadeeva & Suzuki, 2006). The ESD strategy document highlights three objectives:

- To enhance the role of education and learning for equitable, efficient and sustainable utilisation of the country's resources.
- To promote quality education through diverse learning and public awareness for improved quality of life and productive livelihoods; and
- To promote teaching and learning that inculcates appropriate values, behaviour and lifestyles for good governance and sustainability.

These objectives are significant to this study as the ERM course proposes to enhance the abilities of students to become practitioners in resource conservation.

1.4. THE DEVELOPMENT OF THE ESD CONCEPT IN HIGHER EDUCATION

Higher education institutions around the world reflect responses to the global agenda of sustainable development. The major initiatives are seen in a number of declarations since the Stockholm conference on the human environment of 1972 (Johnston, 1995). The Tbilisi Declaration of 1977 is considered to be one of the starting points for formal, international environmental education, although the first statement made by university administrators was with the Talloires Declaration of 1990 in which a pledge was made to introduce sustainability in higher education because of the unprecedented scale and speed of environmental pollution, degradation and the depletion of natural resources. These changes were seen to threaten the survival of humans and thousands of other living species, the integrity of the Earth and its biodiversity, the security of nations and the heritage of future generations (Suzuki, 1993:4).

The Rio Summit of 1992 explored the promotion of education, public awareness and training through Chapter 36 of Agenda 21. This declaration recognised that the Tbilisi Declaration provided fundamental principles for university sustainability whose main thrusts were reorienting education towards sustainable development, increasing public awareness of environmental issues and promoting training among educators (Ogbuigwe, 2006).

The Swansea Declaration of 1993 emphasised the need for universities to review their physical operations and increase the number of environmentally literate students. It stressed quality among countries as an important factor to achieve sustainable development (Johnston, 1995). This was closely followed by the Conference of European Rectors, Copernicus Charter (CRE) in 1994, which culminated in a call for a higher education sustainability statement that would be relevant to the over 500 universities within the 36 countries that CRE represented (ibid.). The Thessaloniki Declaration 1997, that was a follow-up to the Tbilisi Conference, emphasised the need for sustainability initiatives at all levels of society. It was argued that sustainability had to be interdisciplinary and that the concept of sustainable development had to be clearly linked to poverty, population, food security, democracy, human rights, peace, health and a respect for traditional and ecological knowledge. It affirmed that all subjects in formal education must address issues related to environment and

sustainable development and that a university curriculum should be reoriented towards a holistic approach to education (Johnston, 1995).

Universities declared their commitment to prioritise the environment and sustainable development in their activities such as curricula, research and engagement with their communities in the Kasane Declaration of 2002, which was presented to the World Summit on Sustainable Development (WSSD) at the Johannesburg Conference (Ogbuigwe, 2006). Meanwhile, the Ubuntu Declaration of 2002 endorsed and reaffirmed other declarations such as the Earth Charter, Chapter 36 of Agenda 21, the Luneberg Declaration and WSSD. Eleven of the foremost educational and scientific organisations signed the declaration to ensure that learners from primary school through to higher education are aware of sustainable development (Ubuntu, 2002). These declarations notwithstanding, environmental degradation has continued unabated, which calls for innovative approaches to sustainability.

The Global Higher Education for Sustainable Partnership (GHESP), formed as a type ii partnership at the WSSD, involved three associations of universities, i.e. COPERNICUS CAMPUS, ULSF and IAU. GHESP emphasised three key dimensions of integrating sustainability into all university curricula and research programmes, playing an important role as local knowledge centres for sustainable development and making sustainable development a leading principle in their own logistics and management process. One of the participants commented that the destruction of the world is not the work of ignorant people. Rather, it is largely the result of work by people with BA, BSc, LLB, MBA, and PhD degrees (Wright, 2002; Calder & Clugston, 2005; UNESCO, 2005).

The universities in Africa are approaching sustainability both individually and in partnership with other universities. The partnerships include the Mainstreaming Environment and Sustainability into Africa Universities (MESA) programme, aimed at reviewing, expanding and introducing new courses at local levels (Ogbuigwe, 2007a). With the MESA programme, Nairobi University, for instance, has done a curriculum review and the University of Swaziland has established a MESA Implementation committee. The Uganda Martyrs University has set up an ecological site centre for nature conservation, which benefits the community through ecotourism (UNEP, 2007). Thus, the preceding highlight how, from 1997 to 2007, there was a clear trajectory towards ESD in institutions of higher learning. The process has made some level of achievement on sustainability and, yet, environmental degradation has increased with global warming and escalating cases of violence around the

world. This scenario calls for innovations in teaching environmentally related issues to manage the resources in a sustainable manner and, thus, a study or research into the ERM course.

During the UNESCO world conference meeting on ESD, (31 March-2 April 2009) in Bonn, Germany, recommendations were made to the effect that the HEIs must address sustainability beyond the classroom, because such institutions have unique opportunities to model sustainability throughout their campuses by changing practices and policies. Some large HEIs are like miniature cities providing housing, food services, employment, transportation, utilities, entertainment, shopping, etcetera, to thousands of people who visit campus each day. They can demonstrate sustainability through purchasing practices, green construction and renovation, water and energy conservation, equitable hiring practices by gender and ethnicity, payment of a liveable wage, etcetera. In this way, the human-built environment and the human and economic interactions all reflect sustainability. HEIs can be leaders in communities where, perhaps, few other sustainable practices are evident. It is argued that, in such cases, students become accustomed to seeing sustainability and will carry those expectations with them to their future places of employment (UNESCO, 2009). HEIs in Kenya have the mandate of showcasing sustainability good practices.

Also, at the Belgrade Ministerial Conference in March 2008, of the Geneva Conference on Economic and Social Council, four pillars were suggested: learning to live together, learning to know, learning to do and learning to be. This study looked at the ERM course to establish whether the students learned to be. It, therefore, looked at how the students became ERM practitioners. According to this conference, the competencies are to be established in terms of knowledge, system thinking, emotions, ethics and values and actions.

At the Geneva conference, it was suggested that the learner must have some input for, and contribute to, the ESD content. Therefore, this research asked the learners to make contributions to the ERM course, since they had firsthand experience of the course. I thought that the students could be the best informants in developing a course to enhance ESD. In the Geneva conference referred to above, the competencies discussed were developed for teachers; however these competencies are suitable for any practitioner in ESD. Box 1.1 is a summary of the sustainability movement in higher education by Corcoran, Kim, Walker & Wals (2004). This summary was found to be an excellent reference for this research.

Box 1.1: The sustainability movement in higher education

The sustainability movement in higher education

The emergence of the sustainability movement in higher education can be traced to the recognition of the importance of greening universities early in the environmental education movement going back to the late 1960s and 1970s, and to the term ‘sustainable development’, which arose in 1972 at the United Nations Conference on the Human Environment in Stockholm. In the 1990s, various declarations of commitment to intergenerational responsibility and to the particular capability of institutions of higher education to take a lead in society’s transformation to sustainability were developed. These joint declarations were seen as capable of catalyzing institutional change in higher education.

To quote from just one such declaration, the Talloires Declaration: Universities educate most of the people who develop and manage society’s resources. For this reason, universities bear profound responsibilities to increase the awareness, knowledge, technology, and tools to create an environmentally sustainable future. (University Leaders for a Sustainable Future, 1990:1) The Talloires Declaration was followed by the Halifax Declaration (Canada), the Copernicus Declaration of Association of European Reactors and the Kyoto Declaration of the International Association of Universities (Wright, in press). Taken together, over one thousand institutions have made an institutional commitment to sustainability. As institutions have moved toward defining the critical dimensions of sustainability and toward their own implementation, a range of case studies have emerged. Recent events have given strong momentum to the movement. In 2000, the Global Higher Education for Sustainability Partnership (GHESP) was formed by the United Nations Educational, Scientific, and Cultural Organization. In the same year, COPERNICUS-CAMPUS, the International Association of Universities (IAU) and University Leaders for a Sustainable Future (ULSF) were also formed. One of the outcomes of the World Summit on Sustainable Development is the inclusion of the ‘Decade of Education for Sustainable Development’ to take place 2005–2014. In universities, sustainability presents an opportunity to make education more problems based, more interdisciplinary and more applied.

Enforce International political clout in bringing environmental issues back to the forefront. Others see in sustainability an opportunity to reflect on the role the university has to play in society and in the health and lifelong learning of employees and students. At the same time there are critics of the sustainability trend. Some even claim it represents a false and superficial consensus that masks power struggles and ideologies.

Source: Corcoran, Kim, Walker & Wals (2004)

Having looked at the general development of ESD in HEIs I shall describe briefly the TVET institutions because the case study of this research is implemented in such an institution.

1.4.1 An introduction to Technical Vocational Education and Training (TVET)

This research was a case study carried out in a TVET institution, which makes it necessary to highlight the objectives and mandates for such institutions. According to the literature, countries conceptualise the TVET programme in various ways. This research adopted a definition by UNESCO (2011, p. 4), which states that ‘TVET is all forms and levels of the educational process involving, in addition to general knowledge, the study of technologies and related sciences and acquisition of practical skills, know-how, attitudes and understanding relating to occupations in the various sectors of economic and social life’. I found this definition useful because TU-K is a technological institution with an emphasis on enhancing practical skills for the real world. Further, the ERM programme was founded on Competency Based Learning (CBE) with the emphasis on a student becoming competent in the skills being taught to a score of 100%.

Gough (2005) defines TVET as an approach of training for the world of work. This is supported by UNESCO (2009) which emphasises that TVET is concerned with the acquisition of knowledge and skills for the world of work. Various terms have been used to describe elements of the field viewed as components of TVET. These include:

- Apprenticeship training
- Vocational education
- Technical education
- Technical vocational education
- Occupational education
- Professional and vocational education
- Career and technical education
- Workforce education
- Workplace education

According to Majumdar, (2009), these terms are used depending on the geographical location. TVET training is considered to be directly related to social, economic and environmental progressive or regressive developments in all parts of the world. In Kenya, Technical Vocational Education and Training is used to refer to the training in national polytechnics, youth and village polytechnics. It encompasses all skill training after secondary education in the diploma and certificate institutions.

In the Bonn Resolution of October 2004, it was argued that TVET is the ‘master key’ for alleviation of poverty, promotion of peace, and conservation of the environment (UNESCO, 2005). Therefore, its programmes will address societal problems related to the well-being of individuals to enhance sustainable development. The concept emerged in the second congress on technical and vocational education held in Seoul, Republic of Korea, in April 1999, where it was seen as a lifelong process. At this congress, a call was made for programmes to be comprehensive and inclusive to accommodate the needs of learners through flexible access to lifelong learning. It was envisaged to assure the participation of women and girls and those marginalized and excluded from educational opportunities. The Seoul Congress proposed a direction for developing competencies and skills for learners, who are able and willing to contribute to sustainable development, to become responsible citizens (UNESCO, 2005).

In alliance with the Seoul recommendations, UNESCO launched a new TVET programme in 2000. This was enhanced with the establishment of the UNESCO International Centre for Technical and Vocational Education and Training (UNEVOC) in Bonn, Germany. These developments rendered greater recognition to the TVET contribution in fostering sustainable development, promoting democracy, peace, justice, gender equity, scientific, social and economic development. The World Education Forum that took place in April 2000 in Dakar, Senegal, renewed the opportunity for strengthening and expanding skills development for youth and adults and the TVET- for- all agenda. In Dakar, Education for All was ratified as the overarching international platform for basic education within one comprehensive strategy and within a lifelong framework within the Dakar framework of action. TVET is, therefore, seen as a lifelong learning process that includes more than economics and employability. It is

expected to foster social and human values and to respond to challenges such as equity and access, quality and relevance, lifelong learning and sustainable livelihoods (UNESCO, 2005).

According to Majumdar (2009), a TVET system requires deep immersion in understanding the practices of Sustainable Development (SD) and the changing nature of the world of work, especially with regard to globalisation and technological changes their impact on the quality of social, economic and environmental conditions. TVET can play an instrumental role in developing a new generation of individuals who will face the challenges of achieving sustainable social economic development. In most countries, TVET is understood to be a mere supplier of skilled labour to industry and is, therefore, unable to respond effectively to the needs of sustainable development strategies.

Since TU-K is a TVET institution, it adheres to the TVET objectives and principles derived from the Bonn Declaration to alleviate poverty, promote peace, conserve the environment, improve the quality of life for all and help achieve sustainable development (Fien& Maclean, 2009), whose overall goal is to improve access, quality and relevance of skills for development. To achieve this goal, the following components have been proposed for the TVET investment programmes:

- Development of the national skills training strategy;
- Enhancing of transition from primary school to TVET;
- Establishment of TVET centres of excellence; and
- Skills enhancement for automation and computer integration in industry.

The objectives of the national TVET system are to:

- Provide increased training opportunities for school leavers that enable them to be self-supporting;
- Develop practical skills and attitudes which will lead to income earning activities necessary for manpower development;
- Provide technical knowledge, vocational skills and attitudes necessary for manpower development; and

- Produce skilled artisans, craftsmen, technicians and technologists for both formal and informal sectors.

This study argues for training in ERM to enable the students to become practitioners in environmental conservation. Majumdar (2009) suggests that TVET professionals need to be called upon to re-orient their curriculum towards sustainability, while maintaining the principles of 6R - Reduce, Reuse, Renew, Recycle, Repair and Rethink - perspectives. TU-K could benefit from UNDESD 2005-2014 by reviewing its courses with regard to ESD principles and guidelines so that they are relevant to the global trends in education for sustainability.

More recently, a UNEVOC meeting held in Malawi in July, 2010, emphasized that vocational education is the key to sustainability, because of its potential to generate employment for the many youths who inundate the labour market every year, from both the formal and informal education systems (Kondowe, 2010). Currently, the green TVET is being promoted, which will enable the learners to enhance a green economy (Wals, 2012) this study therefore was interested in exploring ERM course in a TVET institution to understand the course development and implementation challenges in order to give suggestions for reorientation of the course to enable ESD practitioners to emerge.

1.4.2 The development of formal courses in Kenya

The Ministry of Education in Kenya is responsible for centrally providing educational policy in the country. The ministry's vision is "to provide quality education for development" while its mission is "to provide, promote and co-ordinate lifelong education, training and research for Kenya's sustainable development" (Ministry of Education, 2008, p. 5). The mandate for course development is vested in the Kenya Institute of Curriculum Development (KICD). This is the national educational research and curriculum development centre in Kenya for public institutions. However, this research considered a course offered at TU-K a higher education institution which develops its own courses and curricula. In higher education institutions in Kenya, the process of course development involves the lecturers and the standards set by the Commission of Higher Education (CHE).

Literature abounds with models of course development. Each of these models advocates procedures and strategies that are presumably most effective in developing curricula. However, course development models appropriate for one situation may be impractical in another. This is because courses are a social construct and diverse societies do not hold universal views (Hopkins, 2001). It is, therefore, important to consider context when developing a course. This research engaged in the development and implementation of an environmental resource management practitioner course, to train personnel for the conservation sector in Kenya. It is a course that is particularly concerned with environmental conservation aspects because these were assumed to enhance sustainability.

Cheserek (2012) describes courses in higher education institutions as an organized programme of study for a given degree, diploma or certificate award, incorporating all matters such as academic staff requirements, duration of the academic programme, admission requirements, content requirements and assessment process requirements. This research specifically discusses ERM course development, review and delivery at TU-K. Literature on course development suggests that the process of development runs through four phases: design, dissemination, implementation and evaluation (Carl, 2002). These processes for the ERM course at TU-K are discussed in detail in Chapter Five and Six of this thesis.

1.4.2.1 The development of courses at TU-K

The Technical University of Kenya has a long history beginning in 1961 when it was known as Kenya Technical Institute and later renamed the Kenya Polytechnic. The Polytechnic was elevated to University College status in 2007 by an act of parliament and became the Kenya Polytechnic University College (here after referred to as KPUC). The university college expanded its scope of education and training by increasing the number of programmes and student enrolment and within five years of its elevation it became the Technical University of Kenya (TU-K) on 15 January 2013 (KPUC, 2010).

This research was conducted at a time when TU-K was changing from a polytechnic to a technical university. The courses that were running at the institution during the time of this research had been prepared by the Kenya Institute of Curriculum Development (KICD) and were examined by the Kenya National Examination Council (KNEC), the Kenya Accountants

and Secretarial Examination Board (KASNEB) and the Association of Business Executives (ABE). The institution was in the process of preparing its own courses that they could examine and award certificates for various professions. The course under scrutiny in this research, the ERM course, is one of the courses offered in the institution; this course has a long history of development and implementation which I explored in this research. According to the findings the course is examined by the institution which awards the certificates and diplomas. With the attainment of university status, the institution shall develop and examine its entire curriculum in collaborations with professional bodies, industry and the Commission for Higher Education. The institution anticipates the curriculum to be demand driven, flexible and to lay emphasis on technology (know-how) and medium technological changes (KPUC, 2010).

The procedure for course development for TU-K, like other universities in Kenya, was for them to develop their own programmes in consultation with the stakeholders. Once a course has been developed it is presented to the departmental academic boards for discussion and then presented to the university academic board and, finally, to the university senate for approval (KPUC, 2010). The departmental chairs are mandated to initiate and lead the departments developing new courses and reviewing old ones. As such, the university teaching staffs have a special role in determining the theory and practical aspects for the students in each course (KPUC, 2005- 2010). The kind of professionals produced depends largely on the course preparation and how it is implemented. The ERM course is seen to train for personnel that will take care of the environment and therefore it was necessary to understand the place of environmental policy and governance in the institution. In the next section I outline the environmental governance and policy at TU-K and in target NRM organisations.

1.4.3.1 Environmental governance and policy at Technical University of Kenya (TU-K) and in target NRM organisations

The Technical University of Kenya has played a significant role in the development of Kenya by training the required manpower in various fields such as engineering and technology since 1961 (KPUC, 2009-2015). Its concern with environmental sustainability can be seen in its incorporation of environmental topics in various courses. Most of the courses at the institution have incorporated environmental studies as a mandatory unit in their studies. The environmental studies unit is taught by the lecturers from the Department of Earth Environmental Science and Technology (here after referred to as DEEST).

Although the institution is constrained by limited open space, the grounds and gardens have well-maintained flower gardens. Its garbage management is well organised with personnel assigned to its management and it boasts of a clean and green environment.

Since the university is in its formative stages it does not have a policy document for environmental governance *per se*. However it created and supports the department of Earth Environmental Science and Technology where the ERM course is housed. The department is highlighting the significance of environmental resource management through training in various short courses, such as Environmental Impact Assessment (here after referred to as EIA), Land Use Planning and Management (here after referred to as LUP&M). There is also the Environmental Protection and Education Club (here after referred to as EPEC) whose membership is open to all members of the institution. The club conducts clean up exercises, tree planting and awareness campaigns in the institution and the community around.

Linkages exist between the institution and various organizations engaged in environmental conservation and management. The various organisations offer attachment and employment for the students. The majority of the students in ERM join NEMA, which is mandated to enforce the policies regarding environmental management in the country (NEMA, 2008) in accordance with the Environmental Management and Coordination Act (EMCA) of 1999. It oversees all the activities in the country and how these activities impact on the environment and advises the government accordingly. The country envisages sustainable development through the incorporation of environmental concerns in all development policies, programmes and activities. EMCA is the principle government organ charged with the supervision and coordination of the implementation of all policies and legislation dealing with the environment in Kenya; all new development projects must develop EIAs and ongoing projects must conduct Environmental Audits (here after referred to as EA) annually. TU-K is only one of the registered institutions that train personnel in EIA (NEMA, 2008). The other organisations include Kenya Wildlife Services, Kenya Organization of Environmental Education (KOE) and the Kenya Forestry Research Institute to mention but a few.

1.5 RESEARCH FOCUS

My focus on the ERM course in a TVET institution stemmed from my long teaching experience in this institution and the belief that higher education institutes turn out graduates who fill strategic roles in various fields of national, regional and local developments. Institutions of higher learning need to help future economic, political, social and cultural leaders and professionals to think and act critically about sustainable development issues to attain ecological security (Qablan, 2005). Similarly, Johnston (2007), in his final report of International Action Research on Higher Education for Sustainable Development, noted that:

In order to preserve the natural world, economic, social and environmental factors must be jointly considered and harmonized. Formal and informal learning, through raising awareness and influencing behavior, has a pivotal function if sustainable development is to be achieved. This role is especially pronounced in the realm of higher education (HE) because at this level students are being prepared to enter the labor market and emerge with skills to support green economies and as messengers of ideas.

I was interested to understand how the ERM course was developed with a sustainability foundation and implemented to produce professional staff with the skills to take up ESD. The research is significant to my institution because course review is an ongoing exercise and the findings could serve as background knowledge to the updating of existing courses and the preparation of new ones. The historical perspectives on the emergence of the course are important as they point to the orientation and current status of the course as well as possible reorientation as anticipated in this United Nations Decade of Education for Sustainable Development (UNDESD, 2005 - 2014).

1.5.1 Goals of the research

The goal of this research is to explore the emergence of the course, how it is playing out in the production of ERM professionals and what, if any, reorientation is needed for institutions of higher education in Kenya to respond better to the need for education for sustainable development.

1.5.2 Overall research question

How was the ERM course developed and implemented at TU-K to address an ERM practitioner and what re-orientation is required to address an ESD practitioner?

1.5.3 Objectives of the study

- To probe how the course in ERM was prepared at the Technical University of Kenya to train ERM practitioners and the extent to which it addresses agenda 21 (Chapter 5).
- To assess the potential for ERM course to address the wider social, economic and environmental agenda of ESD in relation to global and local sustainability issues (Chapter 5).
- To critically analyse the participation of lecturers and students in the ERM diploma course at the Technical University of Kenya to understand how the course implementation is enabling the learners to become ERM practitioners (Chapter 6).
- To find out how the ERM course functions as an activity system in ways that enables or constrain the students to become ERM practitioners (Chapter 7).
- To use an emerging understanding of how the course was designed and implemented as an ERM activity system in TU-K so as to assess what might be done to better orientate the course to an ESD agenda (Chapter 8).

1.5.4 Research questions

1. How was the ERM course prepared at Technical University of Kenya to address ERM practitioners? (Chapter 5)
2. To what extent is the ERM course addressing ESD in relation to global and local sustainability issues? (Chapter 5)
3. What practices are evident in the implementation of the ERM diploma course at Technical University of Kenya to produce ERM practitioners? (Chapter 6)
4. How does the ERM course activity system enable or constrain the students to become ERM practitioners? (Chapter 7)
5. What might be done to re-orient the course to enable an ESD practitioner? (Chapter 8)

1.14 THESIS OUTLINE

This section is a summary of the eight chapters in this research; Chapter 1 is the introduction, Chapter 2 is the review of the related literature, Chapter 3 presents the theoretical framework for the study, Chapter 4 is the research design and methodology, Chapter 5 describes the ERM course development and examines the extent to which the ERM course has incorporated Agenda 21 issues, Chapter 6 explores the ERM course implementation, Chapter 7 explains the contradictions in the ERM course and Chapter 8 and concludes the study with recommendations. More details of these chapters follow.

CHAPTER ONE: INTRODUCTION

Chapter 1 is an introductory chapter that highlights my motivation for this research. The chapter introduces the main concepts framing the study, namely, environmental course, Higher Education and Vocational education. A discussion of the context of the research that provides a synopsis of the status of the environment in Kenya, the development of Education for Sustainable Development in Kenya and, specifically, in Higher Education Institutions and Technical Vocational Education and Training in particular. Course development and implementation for Environmental Resource Management is also outlined and an overview of curriculum development in Kenya is given. Course development at TU-K is highlighted and environmental governance and policy at (TU-K) and in target NRM organisations is mentioned. The chapter also introduces the research focus, its goals, the research objectives and questions. The chapter concludes with an outline of the structure of the thesis.

CHAPTER TWO: LITERATURE REVIEW ON THE MAJOR CONCEPTS

Chapter 2 serves as a review of the related literature to the main concepts of the study; Environmental Resource Management (ERM) Technical Vocational Education and Training (TVET) and Education for Sustainable Development (ESD). The chapter begins with a brief introduction of the contents of the chapter and goes on to explain the background to the environmental crisis and degradation that gave rise to the implementation of related courses in formal institutions to address the environmental issues. The chapter explains education's response to environmental degradation by exploring the evolution of environmental education. The chapter explains the significance of TVET courses and the related policy in trying to solve the environmental challenges. Sustainable development and sustainability

concepts are discussed. Environmental resource management/natural resource management approaches to environmental education are explored and methodologies associated with sustainability are highlighted.

CHAPTER THREE: THEORETICAL AND ANALYTICAL FRAMEWORK

Chapter 3 examines the process of ‘becoming’ as a general introduction to the theoretical and analytical framework for this research. The chapter explains Communities of Practice (CoP) after Lave and Wenger (1991) as a framework that was used to analyse the ERM course as a process where participants become ERM practitioners. The chapter highlights the students, lecturers and the stakeholders’ communities and goes on to describe the elements of Wenger’s CoP as a context for situated learning in ERM at TU-K. The concept of practice is explained and participation as a key concept to negotiating meaning in practice is discussed. The concept and process of ‘legitimate peripheral participation’ and situated learning are also highlighted. The application of Wenger’s theory to the analysis of learning processes on the ERM is explained and learning as a process of becoming is discussed (this includes understanding learning on the course). The chapter then describes the three generations of Cultural Historical Activity Theory (CHAT) as this was used to surface the contradictions in the ERM course activity system.

CHAPTER FOUR: RESEARCH DESIGN AND METHOD

This chapter describes the research design and methods that were used in this research by giving a brief outline of the nature of the study as an interpretative case study. The chapter goes on to explain how I worked with theory in this interpretive research. The chapter highlights the nature of the case study by defining and explaining case study design decisions. It briefly explores the disadvantages of case study design and gives an overview of the phases for this case study. In the first phase the context and history of the course are explained. The second phase is a review of the pedagogic practices of the ERM course and in the third phase tensions and contradictions in ERM course implementation are explored and discussed in relation to ESD.

CHAPTER FIVE: AN ACCOUNT OF THE DEVELOPMENT OF THE ERM COURSE AND THE EXTENT TO WHICH THE COURSE INCOPORATES AGENDA 21 ISSUES.

The chapter provides the background information on the development of the ERM diploma course at TU-K, which was prepared to train vocational workers in Environmental Resource Management (ERM). The course revision is examined as a process that developed a course framework for a student to become an ERM practitioner by being inducted into an ERM community of practice. The course thus had the purpose of enabling the learner to support a Kenyan transition to sustainable development, the environmental conservation policy imperative of the time. The goals for course review are outlined and the chapter describes the method used by Canadian experts to support the revision of the course. The revised ERM course was developed using the Develop a Curriculum (DACUM) approach; this is a process of course development, which uses industry to establish the expected competencies for training. In the development of learning materials Competency Based Education (CBE) was engaged as the process to prepare the learning materials for the course. The chapter explores the relationship between the initial Environmental Studies course that was prepared in 1984 that was used as a background for the course review process of 1998/2002, as the institution embraced the country's aspiration to heed the global efforts to stem environmental degradation and strive for sustainable development. The chapter summarises the ERM course as developed between 1998 and 2002 and explores the extent to which the ERM course has incorporated the issues in Agenda 21. This chapter examines how sustainability issues have been addressed in the ERM course. Working from Agenda 21, the evidence from the study is discussed to map out focus areas to better align the course so that it responds to ESD and the sustainable development challenges of the region. The areas of employment for the graduates are highlighted. Finally the chapter outlines the lecturers' perception of the ERM course and the challenges that emerged through how the revised course was designed to produce a new generation of ERM practitioners.

CHAPTER SIX: THE PROCESS OF BECOMING A PRACTITIONER IN ENVIRONMENTAL RESOURCE MANAGEMENT IN VOCATIONAL TRAINING

This chapter addresses the second research objective and question: to critically analyse the pedagogical practices of the ERM diploma course at the Technical University of Kenya with a view to understanding how the course enabled the learners to become practitioners in ERM. The chapter presents data on student learning as processes of becoming ERM practitioners with Communities of Practice theory providing the lens for the interpretation of learning on the course. In this chapter the culture of ERM learning site and how the learning transforms those who enter and complete the course is analysed as a Community of Practice. The chapter examines evidence of the learning-taking place in those who enter the institution to become practitioners in the area of environmental conservation. The chapter highlights the activities the students, lecturers and other stakeholders engage in to become ERM practitioners. Mutual engagement is looked at in terms of the activities the students, lecturers and stakeholders perform together. Attention is also given to the shared repertoire; here tools used both in the institution, and outside, in the workplace, to contribute to acquiring the necessary environmental conservation knowledge and skills. Here fieldwork/camping, industrial attachment/ industrial based learning and trade area projects are analysed to probe how the course in prepares the students to become ERM practitioners. The chapter raises more challenges to be examined in Chapter 7 where the course is analysed as an emerging activity system to produce ERM practitioners.

CHAPTER SEVEN: A REVIEW OF THE DEVELOPMENT AND IMPLIMENTATION OF ENVIRONMENTAL RESOURCE MANAGEMENT COURSE.

This chapter responds to the third objective; to find out the challenges in the ERM course as a learning process for practitioners in the conservation sector. The chapter reviews the development (Chapter 5) and implementation (Chapter 6) of the ERM course as an activity system, to understand the challenges facing the learners as they train to become ERM practitioners as envisaged in the course outline. The chapter reviews the evidence generated in Chapters 5 and 6 to examine tensions initially experienced as challenges in the system.

Cultural Historical Activity Theory (CHAT) is used as the lens for an analysis of tensions and contradictions that might explain factors that are limiting the functioning of a CoP to produce ERM professionals. Contradictions are examined in relation to key aspects of the course design and its functioning to produce ERM professionals. The chapter then examines the existing course in relation to the emerging policy imperative of ESD. Here the ESD pillars (ecological, economic and social) are discussed as the ERM focus is being displaced by a concern for ESD in the UN Decade of Education for Sustainable Development.

CHAPTER EIGHT: SYNTHESIS, REFLECTIONS, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the synthesis, reflections, conclusions and recommendations of the findings of this research on how the ERM course offered at TU-K can enable ESD practitioners to emerge. In the chapter the ERM course development and implementation are summarised and the possibility of an emerging competent ESD practitioner examined. The chapter goes on to give an overview of the Environmental Resource Management course development and discusses social learning as an approach for natural resource management. Becoming a practitioner in ESD and adequacy of the current pedagogical practices of the ERM course are described and conclusions and recommendations are outlined. Finally suggestions for further studies are outlined and limitations explained.

CHAPTER TWO: LITERATURE REVIEW OF THE MAJOR CONCEPTS IN THIS RESEARCH

2.0 INTRODUCTION

In Chapter 1 the major concepts which framed the study were introduced, namely, Environmental Resource Management (ERM) and Education for Sustainable Development (ESD). This chapter opens with a review of literature on the emergence of environmental conservation concerns that initially gave impetus to TVET courses to produce ERM professionals and, recently, an emerging concern for the wider focus on ESD in Kenya's higher education sector.

Research shows (Qablan 2005; Kinyanjui, 2007; Jasper, 2008; Dalelo, 2010; Raselimo, 2010; Eilam & Trop, 2010), that studies on ESD in Higher Education Institutions have concentrated on the incorporation of ESD in the various disciplines with little research attention on vocational programmes in Environmental Resource Management/Natural Resource Management in TVET institutions. This research therefore explored the development, implementation and functioning of an Environmental Resource Management course at the Technical University of Kenya to understand the extent to which it enabled an ERM practitioner to emerge. This research is significant because the ERM course is viewed as directly addressing a conservation practitioner who is expected to enhance ESD. As far as I know, there is no study that has looked at an ERM practitioner development and ESD in higher education institutions, specifically TVET institutions in Kenya. Therefore, this study intended to fill this gap. The research gives suggestions on how environmental learning for sustainability is currently taking place so as to better inform ESD in higher education institutions.

2.1 THE ENVIRONMENTAL CRISIS

Many writers on environmental issues have argued that environmental degradation is pervasive and accelerating (Wals, 2012; UNEP, 2006a; Barber, 2003; Glasby 2002) and yet there is more capacity in conservation now than ever before. The global environmental challenges are diverse and worsening by the day, currently global warming (climate change) is a major concern, loss of biodiversity is on the rise, desertification is accelerated as the

population grows, deforestation is threatening our very existence, soil erosion is a major threat to plant life, water catchments reduce daily, air, water and soil pollution continue unabated, poverty and environmental refugees grow by the day, political instability and economic depression are on the rise. Among these, climate change is now recognised as one of the defining challenges of the 21st century (UNESCO, 2009). This scenario calls for new innovations, policies and approaches to teaching and learning to address the issues.

The negative impact that human activities are having on the world's natural environment is a major issue on the world's political agenda. This impact, which is popularly referred to as the 'environmental' or 'ecological crisis', threatens the future survival of the human species and other life forms on Earth, due to the unprecedented levels of disruption and degradation caused to the Earth's life supporting systems (UNEP, 2007). Documented examples of the nature of the environmental crisis highlight common issues across different regions of the world, but also reveal unique regional differences, which require unique regional responses (UNEP, 2007).

In the Kenyan context the main forces leading to resource degradation are:

- The increasing pressure on the limited resources (land, water, energy);
- Low productivity in agricultural systems, especially subsistence production systems;
- Inadequately designed and managed settlement schemes;
- Migration of farmers to the semi-arid areas, applying agricultural practices of the high potential areas that are unsuitable for these semi-arid areas and causing resource conflicts with the livestock-holders/pastoralists who depend on the semi arid areas for their dry-season grazing;
- Encroachment of forest areas, leading to de-forestation, soil erosion on hilltops and sloping areas;
- Utilisation of sloping lands, riverbanks without applying appropriate conservation measures;
- Subdivision of agricultural lands through heritage; eventually resulting in uneconomical units;
- Migration to urban areas; (people who cannot find a living in agriculture eventually will migrate to urban areas);
 - Decreased access to the dry season grazing areas in the semi-arid areas;

- Increasing frequency and intensity of droughts (herds cannot recover fully, thus resulting in decrease in production of animals and milk, threatening pastoralists with a growing risk of food insecurity);
- Deteriorating security situation;
- Sedentary policies;
- Inadequately designed and poorly managed development projects; and
- Inadequate marketing opportunities.

The increasing pressure on natural resources is leading to increased occurrence of resource conflicts between:

- Agriculture and livestock;
- Agriculture and wildlife;
- Livestock and wildlife; and
- Humans and wildlife.

The main indicators of resource degradation are: loss of vegetation cover, loss of forests (5 000 ha/year), increased soil erosion, decrease in soil fertility, reduction in biodiversity, decreasing quality and quantity of water, and decreased agricultural productivity (GOK, 2006). Therefore a need exists for approaches that can mitigate these environmental issues in the formal education sector. In the next section I highlight the education response to environmental degradation.

2.2 CONCERNS ON ENVIRONMENTAL DEGRADATION

The roots of modern day concerns over human-induced environmental deterioration can be traced to the industrial revolution in Britain during the mid-19th century (Irwin and Lotz-Sisitka 2005). Fears were expressed then over the resultant combined effects of mass production of consumables and wasteful demand on Britain's natural environment, as well as over the spread of social ills such as urban squalor and disease (Irwin & Lotz-Sisitka, 2005). The concern over environmental quality spread to the rest of Europe, the United States and Asia. In Kenya, concern for the environment reached its first peak during the early 1970s (section 1.3.2) fuelled by degradation of the forests, loss of soil fertility and dwindling wildlife as a result of commercial farming. The period after the Second World War witnessed an increase in public interest worldwide in environment quality and management amid calls for a new world order.

The importance of protecting the natural environment has a long history both in the media and the formal institutions, for example, *Silent Spring* (Carson 1962), *The Tragedy of the Commons* (Hardin, 1968) *The Population Bomb* (Ehrlich, 1968) *The Limits of Growth* (Meadows, Meadows, Rensders & Behren, 1972) raised public concern over the importance of protecting the natural environment. The significance of the natural environment is further highlighted by the numerous organisations established to protect the natural environment, these include World Conservation Union (IUCN), World Wildlife Fund (WWF), United Nations Environmental Programme (UNEP) also there have been numerous local, regional and international conferences on conservation of the environment, notable among these are; Stockholm, (1972), Tbilisi Declaration, (1977), Talloires Declaration, (1990), Rio Summit, (1992), Swansea Declaration, (1993), Thessaloniki Declaration, (1997), Kasane Declaration, (2002), World Summit on Sustainable Development, (2002), Ubuntu Declaration, (2002), Luneberg Declaration, (2002), Global Higher Education for Sustainable Partnership, Mainstreaming Environment and Sustainability into Africa Universities, Belgrade Ministerial Conference, to mention but a few (Section 1.4).

Numerous documents have been produced to shape human interactions with the natural environment, for example the *World Conservation Strategy* (IUCN/UNEP/WWF, 1980), *Our Common Future* (WCED, 1987), *Agenda 21* (UNCED, 1992), the *Earth Charter* (UNESCO, 2008) and the *Johannesburg Implementation Plan* (UN, 2004). In addition various legal and non-legal frameworks have been put in place to protect the Earth's natural environment. At a global level these include conventions on international trade in endangered species, desertification, and biodiversity.

Kenya is a signatory of the following international and regional conventions:

- UN Convention on Biological Diversity (UNCBD), 1992;
- UN Framework Convention on Climate Change (UNFCCC), 1992;
- UN Convention to Combat Desertification (UNCCD), 1994;
- Protocol for Sustainable Development of the Lake Victoria Basin, 2004;
- Stockholm Convention on Persistent Organic Pollutants (POPS);
- Basel Convention on Control of Trans-boundary Movements of Hazardous Wastes and their Disposal, 1989;
- Montreal Protocol on Substances that Deplete the Ozone Layer, 1987;
- Convention on International Trade in Endangered Species, 1973;

- Ramsar Convention, 1971.

Kenya's Constitution guarantees all her citizens the right to a healthy environment and promotes the protection of the country's natural resources (NEMA, 2008). Recent legislation which has been enacted to protect Kenya's natural environment includes, a large number of national policies and strategies that incorporate environmental components or are closely related to the key environmental issues: Agricultural development related policies and strategies include : Strategy for Revitalizing, Agriculture (2004 – 2014); draft National Livestock Policy, 2006; draft Fisheries Policy, 2005; Kenya Rural Development Strategy (KRDS) (2002 – 2017); draft; Food and Nutrition Policy; and Arid and Semi Arid Lands (ASALs) Policy (2004). Other sectoral policies and strategies include the Energy policy – Sessional Paper No 4 of 2004; Forest Policy (2004) and Forest Act (2005); Water Act (2002) and associated policies; Wildlife Conservation and Management (Amendment) Act (1989); and; Mining Act and policies. National plans and Policies include the National Development Plans; The Poverty Reduction Strategy Paper (PRSP); and Economic Recovery Strategy (ERS) for Employment and Wealth Creation (2003-2007). At the national level, the two main organisations directly responsible for dealing with environmental issues are the Ministry of Environment and NEMA. The Environmental Management and Coordination Act (EMCA) (1999) is one of the best framework laws on environment. The act came into force in 1999 and its main function is to provide for the establishment of an appropriate legal and institutional framework for the management of the environment. The Act is administered by the National Environmental Council and implemented by the National Environmental Management Authority (NEMA). Other relevant legislation includes:

- The Environmental Impact Assessment and Audit Regulations, 2003. The Environmental (Impact Assessment and Audit) Regulations of 2003, contained in Kenya Gazette Supplement No. 56, Legal Notice 101, have been legislated;
- The Environment Management Order (2004) (Lake Naivasha Plan);
- The Forest Act (2005);
- The Water Act (2002); and
- Approximately 77 sectoral and other laws (e.g. Agriculture, Mining, Factory Acts etc.).

Regulations in draft form include:

- The Environmental Impact Assessment Guidelines (2004);
- Environmental Quality Standards (2004) (for land degradation, water quality, waste, chemicals, biodiversity, economic instruments and air emissions). Civil society organisations

have gained in strength over the past years. There are approximately 600 nongovernmental organisations (NGOs) that are operational in the environmental sector in Kenya. Civil society organisations (CSOs) that have been successful in lobbying and advocacy include: East Africa Wildlife Society (EAWS), Kenya Forests Working Group (KFWG), the Kenya Land Alliance (KLA) and the Green Belt Movement. In all these approaches education and particularly formal education plays a significant role in environmental conservation.

2.3 EDUCATION'S RESPONSE TO ENVIRONMENTAL DEGRADATION.

The degradation of the natural environment have spurred a search for strategies that can be used to counteract, reduce or even remove their root causes because this threatens the future survival of life on Earth. Chief among the recognised strategies is that which involves educating the public, other examples being inter alia policy development, infrastructure provision, good governance and regulation compliance (Lotz-Sisitka, 2004). Education plays a central role in addressing the world's environmental challenges and has been stressed at numerous environmental conferences. For instance, it was at the 1972 Stockholm Conference that the use of education as a means of protecting the environment was first formally recognised, leading to the formation of the International Environmental Education Programme (IEEP), which was mandated with coordinating international efforts aimed at developing environmental education (Gough, 1997).

Many key documents have shown the need for education in helping to steer the world towards a more sustainable nature-human relationship and are shaping national and international environmental policies. For example, *Caring for the Earth* speaks of the need for information to be disseminated through formal and informal education so that actions needed to live sustainably are understood (IUCN/UNEP/WWF, 1991, p. 8). *Agenda 21* (UN, 1992) devotes the whole of Chapter 36 to outlining how this can be achieved under the general themes of basic education, education reorientation, public awareness, and training. In addition all 39 chapters that constitute this document have an education, public awareness and training theme running through them. The role of education in the protection of the environment through sustainable development was strengthened further at the 2002 World Summit on Sustainable Development. In the *Johannesburg Implementation Plan* (UN, 2004)

governments are urged to promote education as a key agent of change and to use it as a tool in the various forms of human endeavour such as rural development and health care. In addition, the Johannesburg conference recommended that a decade of education for sustainable development be proclaimed. In December 2002, the United Nations General Assembly proclaimed the period 2005-2014 as 'The UN Decade of Education for Sustainable Development.' The role of education as a driver of change towards sustainable living lifestyles was reaffirmed at the Fourth International Conference on Environmental Education that was held in 2007 at Ahmedabad, India (UNESCO, UNEP & Government of India, 2007). Environmental Education has been developed in the formal institutions as an approach to sustainable development (Rosenberg, 2009). According to NAAEE, 2010: p. 2 "The goal of environmental education is to develop a world population that is aware of and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones". Environmental Education therefore is an important approach to sustainable development.

2.4 THE EVOLUTION OF ENVIRONMENTAL EDUCATION

The evolution of environmental education is well documented in the literature internationally (Robottom & Hart, 1993; Gayford, 1996; Edwards 2006; Stevenson, 2007), in the region of southern Africa (Irwin, 1990; O'Donoghue, 1993; Obol, Allen & Springall Bach, 2003; Irwin & Lotz-Sisitka, 2005), and in Kenya (Koech, 1991; Ndaruga, 2003; Atiti, 2008; Odeke-Epus, 2009). Over the years since 1972, an understanding of environmental education has evolved from a relatively narrow conception of human-environment relationships to a more complex understanding of humans 'interaction with all aspects of environment, including its biophysical, social, economic and political dimensions (O'Donoghue, 2007; Irwin & Lotz-Sisitka, 2005; Edwards, 2006; Wals, 2012). Its name changed from nature study, to outdoor education, to environmental education, to education for sustainability (EfS), to education for sustainable development (ESD), as it became periodically reconceptualised internationally.

Environmental Education (EE), as proposed in the Belgrade charter (UNESCO/UNEP, 1976) and the Tbilisi Declaration (UNESCO, 1978) was born within modernity as a reaction to the impact of "progress" associated with exacerbated capitalism. Against this backdrop, it started out reformist: it was mainly a question of resolving and preventing the problems caused by the impact of human activities on biophysical systems. In this light a number of educators or

authors (including Hungerford, Litherland, Peyton, Ramsey, Tomera, & Volk; 1992; Giodan & Souchon, 1991) proposed environmental pedagogical models that focused on learning problem solving and environmental management skills within the framework of scientific and technological education, open to social realities and aiming to change behaviour of individuals as citizens. According to Jickling (1992) EE is a concept that is nurtured within the wider educational framework and conceptualised in a diverse context whereby every discipline is regarded as having a unique opportunity to contribute towards understanding the holistic aspect of the environment. EE focuses on enhancing the appreciation of the environment as relevant, valuable, diverse and complex as well as how it has shaped the people's way of life over the ages. Fien and Gough (1996) describe environmental education as an essential component of the resolution of environmental problems, while for Le Grange (2002) environmental education represents education's response to environmental issues and risks. Lotz-Sisitka (2004) saw the role of environmental education as lying in strengthening individual, public and institutional capacities for participation in environmental management.

The development of the field of environmental education has been driven by overall concern for the natural environment Irwin and Lotz-Sisitka (2005) noted that modern environmental education arose out of concern over increasing and wasteful demand of natural resources during Europe's Industrial Revolution era. The environmental education of the 1970s offered a new framework for conservation education of the 1950s and the 1960s: the environment as a resource became more the environmental problem. The magnitude, seriousness and multidimensional nature of socio -environmental problems were stressed. For many educators, however, environmental education retained the characteristics of naturalistic romanticism: environmental education was often restricted to nature education focusing on the personal experience of the environment as nature (Palmer, 1998).

Environmental education entered the postmodern era in the 1980s as a socially, critical, environmental education movement. Robottom and Hart (1993) defined environmental education as a process of critical analysis of interrelated environmental, social and educational realities (which are the vessels or reflections of ideologies) in order to transform these same realities. Grassroots environmental education emphasises association of environmental education with a dynamic of community change that takes into account the

specific social and cultural characteristics of the people and the particular context in which they live (Ruiz, 1994). Environmental education has become a process in the perspective of bioregional development and emphasises pedagogy of place or place based environmental education, as proposed by Orr (1992). A dialogue among various types of knowledge (disciplinary and non disciplinary) is advocated as a strategy for creating critical knowledge that could be useful in resolving problems or developing local projects. Traditional experiential and concrete everyday knowledge is emphasised and held up against scientific knowledge to determine how they challenge and complement each other. In the 1980s the representation of the environment as a place to live, associated with the idea of environment as a community project, made it possible to broaden and give new meaning to the conceptions of environment as nature, as a resource, or as a problem.

However, the 1990s have seen environmental education, 'step backwards' and be reduced to a tool for sustainable development in the international discourse. The UNESCO Connect magazine (Colin, 1997), which has hitherto been devoted to environmental education, now limits the educational niche of environmental education to the disciplinary fields of science and technology. In this changing context, contemporary environmental education is characterised as a conceptual issue, narrowly related to many problems posed by its practice.

Environmental Education is viewed as a multidisciplinary form of education that focuses on nature, environment and society as independent and inseparable entities (Dreyfus, Wals, & Van Weelie, 1999). There is growing concern about the fact that limiting the scope of EE to a subset of any one of these components does not reflect the nature of environmental issues. From this general description it follows that by its very nature EE is multidisciplinary. This multidisciplinary nature poses fundamental educational challenges. For example, it is not sufficient to take a piecemeal approach by attempting to integrate the various parts and components of EE in different school subjects or science disciplines. The knowledge, awareness and skills to be developed in these subjects and disciplines will need to be developed in a coherent and interrelated way. In conclusion environmental education is evolving from a more scientific approach linked to conservation to a field of education that addresses the social, economic, political and biophysical aspects that shape the life of humans. An all-inclusive 'global' agenda for environmental education is difficult to achieve and runs the danger of meaning everything and nothing in particular. In South Africa,

Schreuder (2004) argued that EE has developed locally, not so much as a result of international trends and influences, but more in response to local social-political development and people thinking and working together. Therefore, environmental education best addresses local environmental problems through critical analysis of its causes and the identification of viable local solutions, whilst recognising the wider context of the need for global sustainability.

Environmental education in HEIs has been enhanced in various ways in the Kenyan context. In the teacher education careers, environmental education is compulsory and universities in various careers are developing compulsory environmental education units. There are also options to take environmental education and related studies as a career (Section 1.3.2). At TU-K the ERM course as a career choice is offered at certificate, diploma and degree levels. It is a vocational training course in a TVET institution aimed at imparting skills, knowledge and values on environmental issues. The trainees are expected to enter the job market as environmental conservation officers in various sectors. Therefore in the next section I shall highlight the mandate of TVET education.

2.5 TECHNICAL VOCATIONAL EDUCATION AND TRAINING IN KENYA

Kenya has a vast network of technical and vocational institutions providing a wide range of programmes for all categories of school leavers. There are two national polytechnics that have become universities, two national polytechnics and one technical teachers college. There are 19 technical training institutes (TTI's), 17 institutes of technology (IT) and over 900 other vocational training institutions operated by private sector (Kerre, 2010). In addition there are other tailor-made vocational and technical training programmes for school leavers run by government ministries, state corporations, non-governmental organisations and industrial firms. (RoK, 1988).

Kenya is among the countries that are geared towards Education for All (EFA), a process that will lead to vastly increased numbers of young people completing primary and secondary education. Correspondingly, technical institutions must determine ways of increasing enrolments in their programmes (RoK, 2005). In Chapter One (1.4.1) there is a brief general

introduction to TVET education as this research is a case study of such an institution. This section presents an overview of the TVET programmes in Kenya. These programmes are important to the country, as the education of young people is the foundation of every nation. The role of TVET as an effective means of empowering society to engage in productive and sustainable livelihoods cannot be overemphasised: producing a properly and effectively trained, disciplined and patriotic youth that can make a positive contribution to the development of the nation is the mandate of these institutions (RoK, 2005). Comparing the diversity in the provision of TVET across and between countries, we can draw conclusions about disparities in historical, political, educational, cultural and economic development. TVET has not escaped changes brought about as a result of political, economic and social pressures.

According to Simuyu 2009, TVET institutions in Kenya comprise those providing training in the informal sector (Jua Kali), primary schools, secondary schools, and ministries, national industrial vocational training centres (NIVTCs), youth polytechnics, and technical training institutions, institutes of technology, national polytechnics and universities. Curricula vary according to the level of training. NIVTCs are government-owned and are responsible for the pre-service and in-service training of personnel working in technical fields in government and industry. Youth polytechnics (formerly village polytechnics) are responsible for artisan training courses, popularly known as ‘government trade tests’ for primary and secondary school-leavers or dropouts. Technical training institutes and institutes of technology mainly prepare secondary school graduates in craft and diploma courses. National polytechnics normally offer diploma courses. It is worth noting that diploma courses are a prerequisite for most mature-entry university admission criteria. This study aims to examine the ways in which one such TVET institution in Kenya- Technical University of Kenya- is training for environmental conservation and thus enhancing practitioners in ESD.

Over the decades since Kenya gained independence (1963), TVET has experienced both structural and curricular changes that have had an impact on graduates. TVET is fundamental to the world of work. For most people, finding a job is the anticipated outcome of their education and it is through their work that people achieve self-fulfilment (Lasonen & Burge 1991). Following the current international trends in technology, there is a need for all

countries to make adjustments to ensure that technological and vocational education is compatible with the contemporary economy.

2.5.1 The meaning of TVET

Technical Vocational Education and Training (TVET) is a comprehensive term referring to an educational process. It involves, in addition to general education, the study of technologies and related sciences and the acquisition of practice, skills and knowledge relating to an occupation in various sectors of economic and social life (UNESCO, 1984). In the present study, the concept of vocational education implies the preparation of an individual for an occupation or career. This involves both the liberal and technical aspects of education. The liberal aspects include the philosophical, moral and cultural elements that an individual must possess to fit into a given society. Technical aspects include the knowledge and skills required to perform a job successfully. TVET is the major connecting link between the school system and the employment market, which means that developments in TVET are closely linked to general trends in the economy (UNESCO, 1990). There is growing dissatisfaction with formal academic education, particularly its failure to provide the much-needed skill training for employment, self-reliance and so on. It is an indisputable fact that a large number of young men and women do not meet the entry requirements for public universities. Their only hope of continuing their education would be through middle-level colleges offering TVET programmes. This route is currently being developed into one of the ways through which learners may proceed to higher levels of technical training. Some national polytechnics in Kenya offer courses up to first-degree level. The implication is that planners and policy-makers should design a strategy for TVET programmes providing the necessary skills and attitudes that would assist, among other things, in making young people more productive and self-sufficient. Following the current international trends in technology, there is a need for all countries to make adjustments to ensure that technological and vocational education is compatible with the contemporary economy. This will enable the young people graduating from secondary schools to further their education and fill the gap in industry for the hands on workers.

2.5.2 The historical development of TVET in Kenya

TVET as an art and science began in Kenya long before the arrival of the Europeans. Kenyans knew how to build their own houses, make agricultural implements, spears, knives, hoes, axes, cooking utensils and pottery. Traditionally, these skills were passed on from parents to children within the family or clan through an apprenticeship system (Okaka, 2001). The coming of the Europeans and the decision to build the Kenya-Uganda railway attracted Indian traders and labourers who, beginning in 1924, were instrumental in the training of artisans and craftsmen at the Kabete Industrial Training Depot. Christian missionaries brought in technicians and made an effort to train Kenyans in different skills to assist in the maintenance of tools, equipment and services for the railway. The Second World War brought a greater influx of people, more sophisticated equipment and machinery, and a greater need for training. The army corps was established and recruitment on a very large scale began among Kenyans. There was a need for drivers, motor mechanics, builders, electricians, welders, carpenters and clerks. The early 1950s saw industrial depots being upgraded to vocational schools and, by the early 1960s, they were further converted into secondary vocational schools. A major breakthrough for TVET in Kenya was the setting up of a Commission for Higher Education in 1954, whose main recommendation was the establishment of the Royal Technical College in Nairobi. This institution later became the Nairobi University College and, subsequently, the University of Nairobi. The Mombasa Institute of Muslim Education was already in existence, having been established in 1948 to provide technical and vocational education to Muslim students in East Africa. It was converted into the Mombasa Technical Institute and later became the Mombasa Polytechnic in 1972. In 1961, the Kenya Polytechnic was established to provide basic craft courses, which were phased out after 1966 following the introduction of similar courses in technical and vocational schools. Currently some of the national polytechnics have been upgraded to university status and there is a debate on how their certificate and diploma courses shall be taught. The national polytechnics that have been upgraded to university status are the Mombasa and Kenya polytechnic. Since independence, there has been a tremendous growth and development of TVET as a result of direct government intervention and involvement, as well as through community participation.

2.4.3 The significance of TVET courses

The development of courses at HEIs is a complex undertaking engaging both the teacher and a diversity of stakeholders governed by the societal trends (Walker, 2008). It requires time, commitment to change and finances. The education system and indeed the courses for sustainability should enable the students to become ESD practitioners, although as noted, the reality is that education plays a part in reproducing an unsustainable society (McKeown, Hopkins, Rizzi & Chrystalbride 2002). This is an indication that changes regarding how things have always been done, particularly in the education system to enable students to learn what will enable them to face reality with a perspective of caring sustainably, needs attention (Puk & Makin, 2006).

Nyerere 2009 argued that TVET can improve the quality of human life and promote sustainable development: Kenya can re-orient itself towards sustainable development using TVET as a vehicle for socio-economic and technological transformation. This is seen as critical for Kenya to meet the challenges of increased unemployment, poverty, food insecurity and environmental degradation.

In Kenya TVET encompasses technical training institutions, MSE training and demonstration centres, youth polytechnics and national youth service skills development centres. Other institutions offering TVET programmes are spread across government ministries as well as private institutions (Nyerere, 2009). Graduates from TVET institutions are awarded certificates and diplomas in various disciplines. Currently two national polytechnics; (The Kenya and Mombasa polytechnics) have been upgraded to universities to offer degrees in TVET disciplines and will continue to offer certificate and diploma programmes (GOK, 2008).

A large population of unskilled, unemployed youth amidst growing poverty may lead to chaos such as seen during Kenya's general elections of 2007 (Nyerere, 2009). To address some of the underlying causes of the restlessness among youth, the government has taken initiatives for skills development. This includes investment within the framework of the Kenya Education Sector Support Programme 2005-2010 (KESSP). According to KESSP the aims and purpose of TVET in Kenya are to include:

- Involvement of stakeholders in the development of a national skills training strategy;
- Establishment of mechanisms and appropriate incentives to promote private sector investments in the development of TVET for increased access;
- Provision of loans and bursaries to enhance access to TVET taking special account to marginalized groups, such as female students and the physically challenged;
- Establishment of a national coordinating body, the Technical, Industrial, Vocational and Entrepreneurship Training Authority (TIVETA) for TIVET institutions in order to provide relevant programmes and effective management and governance; and
- Mobilization of resources to rehabilitate facilities in public TIVET institutions to ensure quality training.

TVET should offer learners equal opportunities to advance to the highest level of learning either through the academic or TVET channel. The Kenya Institute of Curriculum Development (KICD) is mandated to develop vocational curriculum for village polytechnics and national polytechnics in conjunction with the institutions concerned. KICD works in close collaborations with the country's examining body, Kenya National Examination Council (KNEC) to prepare the curriculum.

2.5.4 TVET Policy and the development of educational courses in Kenya

According to the Ministry of Education and Ministry of Higher Education Science and Technology, the TVET sub-sector in Kenya has experienced moderate growth over the last 40 years. However, the sub-sector is yet to produce adequate and skilled middle level human resources required to meet the demands for national development. The Vision 2030 has however placed special demands on TVET as the leading engine for the economy to rely on to produce adequate levels of middle level professionals needed to drive the economy towards the attainment of the vision (RoK, 2012).

Vision 2030 proposes, amongst others, the legal frame -work for TVET to provide for the establishment of an authority to oversee the systems (GOK, 2008). The authority is intended to strengthen the mechanisms for the implementation of the necessary reforms aimed at enhancing the capacity of the sub-sector. The Technical and Vocational Education and Training Act, No. 29 of 2013 governs vocational training in Kenya. This is an Act of Parliament that provides for the establishment of a technical and vocational education and

training system; the governance and management of institutions offering technical and vocational education and training; coordinated assessment, examination and certification; institutes a mechanism for promoting access and equity in training; assures standards, quality and relevance and connected purposes (GOK, 2013).

TVET has been addressed variously, for example, through the 2003-2007 Kenya Education Sector Support Programme (KESSP), a policy document that addresses the issues of education. It looks at education and training with a wide lens that includes all sub-sectors. It balances the need to expand and revitalise the secondary, TVET and the public university system with the hugely important requirement to chart out generous and transparent pro-poor pathways.

The Gender Policy in Education is another government document that addresses issues of increased enrolment, retention, transition and achievement in the TVET sector, especially for girls and women. While the government has made these recommendations in policy documents, they have not been implemented or there is no documented evidence to show progress. For instance, there is no clear indication that TVET in rural areas has benefited from the policies formulated at the national level, for example, a report on Loita division in Narok South district, a marginalised area, indicated that since independence, there has been no effort from the government to develop the TVET sector to promote the Maasai (an ethnic group living in Loita district) informal sector through skills development that can enhance their livelihoods. The report further indicates that this scenario is replicated in most of the marginalised communities in Kenya (GOK, 2008).

The aim of the TVET programme in Kenya is to absorb the large proportions of students who cannot progress to secondary and higher levels of education, immediately so that they are enabled to contribute meaningfully to the economic development. The TVET sub sector in Kenya is facing challenges posed by an inflexible and outdated curriculum, a mismatch between skills taught and those demanded by the industries, an inadequate quality assurance mechanism, inadequate physical and learning resources and low participation of the private sector, which is necessary to bridge the school-work gap (Konayuma, 2006). Therefore it was the intention of this research to understand how the ERM course was developed and is being implemented in a TVET institution to train personnel in the conservation sector to ultimately

become ESD practitioners. In the next section I discuss the concepts of sustainable development and sustainability as a background for re-orientation of the ERM course for ESD.

2.6 SUSTAINABLE DEVELOPMENT AND SUSTAINABILITY

In 2005 the United Nations launched the Decade of Education for Sustainable Development. This was the result of a long process of international deliberation on the sustainability of development models, which began in 1972 at the United Nations Conference on Human Development held in Stockholm. Twenty years later, in 1992, the international community affirmed the important role of education, training and public awareness in achieving the goals of sustainable development, in Chapter 36 of Agenda 21 at the United Nations Conference on Environment and Development held in Rio de Janeiro. Agenda 21 indicated that all levels of education and training would need to re-orient towards a more sustainable model of development that meets the needs of the present generation without compromising or jeopardising the capacity of future generations to meet their needs. Through emphasizing education, training and public awareness, Agenda 21 indicated that all sectors of society should be involved in a lifelong learning process oriented towards sustainable development. Ten years later, the Johannesburg Implementation Plan produced at the World Summit on Sustainable Development in 2002, confirmed the importance of Education for Sustainable Development in achieving the interrelated and intergenerational social, economic and environmental goals of sustainable development. The Johannesburg Implementation Plan recommended the declaration of a UN Decade on Education for Sustainable Development, which was adopted by the UN General Assembly through Resolution 57/254 with UNESCO designated as the lead agency. In 2005 UNESCO released an International Implementation Scheme for the UN Decade of Education for Sustainable Development (UNESCO, 2005), which has led to implementation processes across the world at regional, sub-regional and national levels.

In March 2006 African Ministers of Education made a commitment to implement the UN Decade of Education for Sustainable Development in the context of the Second Decade on Education in Africa. Their statement of commitment emphasises the need to situate UNDESD activities within key policy initiatives such as the Millennium Development Goals,

the United Nations Declaration on the New Partnership for African Development (NEPAD), the African Union's Second Decade on Education Plan of Action, and the Dakar Framework for Action aimed at achieving the Education for All goals. Kenya faces a myriad of challenges in sustainable development. The Kenyan economy is driven by its natural resources base (NEMA, 2008). It is therefore imperative that national resources are utilised sustainably. ESD could be one of the tools to ensure that this happens. The Government, Civil Society Organisations (CSOs) and private sector have made notable ESD-related responses in relation to society, environment and economic spheres of sustainable development. These include policy formulation, advocacy and public awareness, resource material development, research and innovations, capacity building, networking, partnerships and vision building.

However sustainable development is a heavily contested concept which means many things to different people (Mudacumura, 2006; Banerjee, 2003; Edwards, 2005a; Jickling, 2005; Munier, 2005; Shriberg, 2002; Huckle, 1991). Fergus and Rowney (2005, p. 19) point out that the 'meaning of the term has become vague, ambiguous, undefined, and often contradictory'. Further, its meaning seems to vary in different contexts. However the most widely used definition is that of the Brundtland Report: "development that meets the needs of the present without compromising future generations to meet their own needs" (WCED, 1987, p. 43). According to this report there should be a balance between development, population growth and the ecosystems. It advocates for a balance between economic growth and environmental protection.

Many writers have contested this definition, for example, in the wider academic literature O'Riordan (2003, p.35) defines sustainable development as: 'a constant process for transformation of a society and an economy towards acting as trustees for future generations of the planet that maintain and nurture life and habitability'. In this study 'future generations' is used to imply 'eternity' meaning that as long as human beings are on Earth, development should be in such a way as not to jeopardise the next generation. If all humanity can be mindful of tomorrow this can enhance sustainable resource utilisation, although there may be other factors contributing to unsustainable resource use.

Sustainability has many definitions; it is broad and vague and as a result has attracted much criticism with its eco-friendliness and ‘green’ solutions. For instance sustainability can be seen through the integration lens: “In the integral view sustainability is not about environment, economic growth, or trade *per se*, but about building a better model of civilization that will carry us far into the future” (Lagerroos, 2004, p. 324)

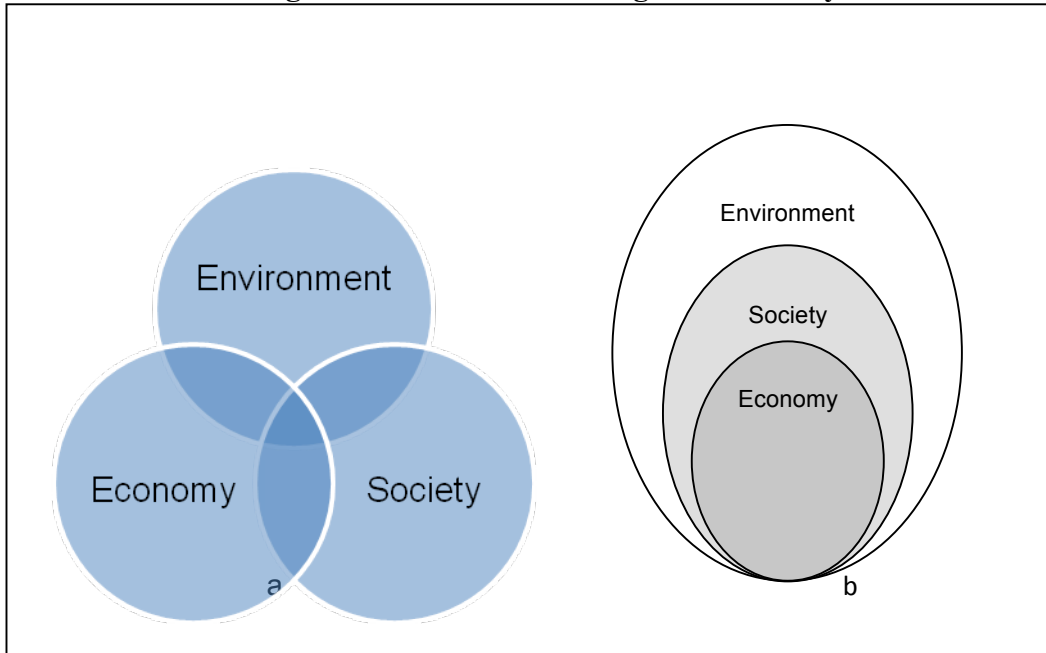
Lagerroos (2004) argues that sustainability cannot be attained through economic, ecological or social perspectives alone; rather it must be integrated and adapted as structures change. It advocates for social learning as changes take place and dismisses learning as knowing. This echoes the views of UNESCO (1997, p. 1). “The concept of sustainable development is not a simple one, and there is no road map to prescribe how we should proceed”

The key agenda at the Earth Summit in 1992 held in Rio de Janeiro was sustainable development. This was further reinforced at the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002, where a new paradigm of sustainable development was endorsed. It was declared that sustainable development is built on three interdependent and mutually reinforcing pillars; namely social development, economic development and environmental protection. This was based on the premise that pressure on the environment and natural resources has kept the state of the world’s environment fragile thereby resulting in increased poverty, unsustainable production and consumption patterns (NEMA, 2008).

This study chose to engage with sustainable development as conceptualised by Hattingh (2005) and shown in Figure 2.1 the three sphere model (see b). According to this model the three pillars are intertwined thereby implying a holistic process of sustainable development. This illustration further implies that activities in one sphere may have a negative or positive impact on the other spheres. It further implies that economic, social and environmental considerations do not have their own logic and values separate from the other spheres as illustrated in Figure 2.1 a. Institutions of higher learning therefore need to engage in this holistically and avoid addressing issues by sector.

Figure 2.1b illustrates the interdependence of the three pillars. If the ecological pillar is not sustained then the economic and social pillars collapse. I argue that a sustainability course should address the three spheres by including the necessary information in the course content to stimulate an understanding in the students of strong (b) rather than weak sustainability (a).

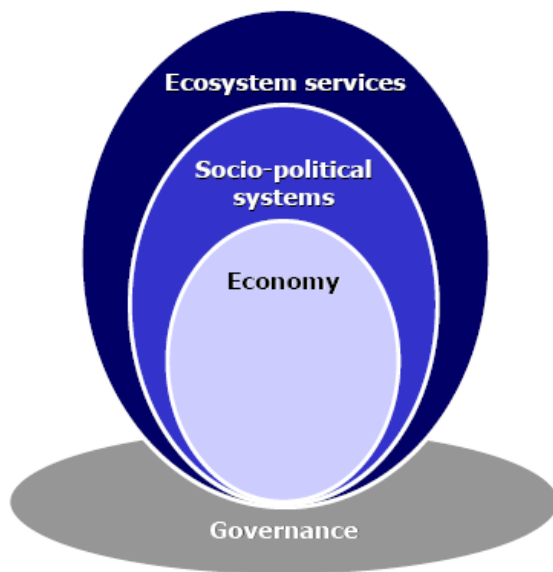
Figure 2.1: Weak and strong sustainability



Source: Hattingh, (2005)

According to NEMA (2008) communities in Kenya have relied on indigenous knowledge and technology to interact with the environment. This has enabled communities to coexist stably with their immediate environment maintaining the ecological equilibrium. However, industrialisation, globalisation and population increase (growth rate of 2.9%) have presented new challenges in sustainable utilisation of the country's resources. Population growth has resulted in the disruption of natural and cultural systems. Capacity building to ensure sustainable use of national resources with good governance has become necessary. Figure 2.2 is a diagrammatic presentation of strong sustainability with good governance as the basis. This scenario calls for formal and non- formal education courses geared towards the sustainable use of the resources (NEMA, 2008). The ERM course that forms the basis of this study represents an attempt that contributes towards sustainable resource management.

Figure 2.2: Social economic factors underpinned by governance



Source: DEAT (2008)

My view is that sustainable resource management will be attained when the four spheres complement one another and therefore a student learning to become a practitioner in ESD must understand the interconnectivity between these spheres. Despite the many different interpretations and understandings of sustainable development, developing sustainability and sustainable development as an integral part of the curriculum is essential (Jutvik & Liepina, 2013).

2.7 THE ORIGINS AND MEANING OF EDUCATION FOR SUSTAINABLE DEVELOPMENT

The historical development of ESD is well documented as outlined in Box 2.2 (UNCSD, 2013). This summary of the historical development of Education for Sustainable Development from 1972 through to 2013 indicates that concern for sustainable development is a global issue. The governments around the world have therefore consistently co-operated to come up with ideas on how to manage world resources.

Box 2.2: The history of Sustainable Development in the United Nations

1972 The United Nations Conference on the Human Environment held in Stockholm brought the industrialised and developing nations together to delineate the 'rights' of the human family to a healthy and productive environment. A series of such meetings followed, e.g. on the rights of people to adequate food, to sound housing, to safe water, to access to means of family planning. The recognition of the importance of revitalising humanity's connection with Nature, led to the creation of global institutions within the UN system.

1980 The International Union for the Conservation of Natural Resources (IUCN) published the World Conservation Strategy (WCS) which provided a precursor to the concept of sustainable development. The Strategy asserted that conservation of nature cannot be achieved without development to alleviate poverty and misery of hundreds of millions of people and stressed the interdependence of conservation and development in which development depends on caring for the Earth. Unless the fertility and productivity of the planet are safeguarded, the human future for humans is at risk.

1982 Ten years later, at the 48th plenary of the General Assembly in 1982, the WCS initiative culminated with the approval of the World Charter for Nature. The Charter stated that "mankind is a part of nature and life depends on the uninterrupted functioning of natural systems".

1983 The World Commission on Environment and Development (WCED) was created and, by 1984, it was constituted as an independent body by the United Nations General Assembly. WCED was asked to formulate 'a global agenda for change'. In 1987, in its report *Our Common Future*, the WCED advanced the understanding of global interdependence and the relationship between economics and the environment previously introduced by the WCS. The report wove together social, economic, cultural and environmental issues and global solutions. It reaffirmed that "the environment does not exist as a sphere separate from human actions, ambitions, and needs, and therefore it should not be considered in isolation from human concerns. The environment is where we all live; and development is what we all do in attempting to improve our lot within that abode. The two are inseparable."

1992 In June the first UN Conference on Environment and Development (UNCED) was held in Rio de Janeiro and adopted an agenda for environment and development in the 21st Century. Agenda 21: A Programme of Action for Sustainable Development contains the Rio Declaration on Environment and Development, which recognizes each nation's right to pursue social and economic progress and assigned to States the responsibility of adopting a model of sustainable development; and, the Statement of Forest Principles. Agreements were also reached on the Convention on Biological Diversity and the Framework Convention on Climate Change. UNCED for the first time mobilized the Major Groups and legitimized their participation in the sustainable development process. This participation has remained constant until today. For the first time also, the lifestyle of the current civilization was addressed in Principle 8 of the Rio Declaration. The urgency of a deep change in consumption and production patterns was expressly and broadly acknowledged by State leaders. Agenda 21 further reaffirmed that sustainable development was delimited by the integration of the economic, social and environmental pillars.

The spirit of the conference was captured by the expression "Harmony with Nature", brought into the fore with the first principle of the Rio Declaration: "Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature".

1993 In 1991 UNCED instituted the Commission on Sustainable Development (CSD) to follow-up on the implementation of Agenda 21.

1997

In June 1997, the General Assembly dedicated its 19th Special Session (UNGASS-19) to design a "Programme for the Further Implementation of Agenda 21".

2002 In 2002, ten years after the Rio Declaration, a follow-up conference, the World Summit on Sustainable Development (WSSD) was convened in Johannesburg to renew the global commitment to sustainable development. The conference agreed on the Johannesburg Plan of Implementation (JPOI) and further tasked the CSD to follow-up on the implementation of sustainable development.

2009 On 24th December 2009 the UN General Assembly adopted a Resolution (A/RES/64/236) agreeing to hold the United Nations Conference on Sustainable Development (UNCSD) in 2012 - also referred to as 'Rio+20' or 'Rio 20'. The Conference seeks three objectives: securing renewed political commitment to sustainable development, assessing the progress and implementation gaps in meeting already agreed commitments, and addressing new and emerging challenges. The Member States have agreed on the following two themes for the Conference: green economy within the context of sustainable development and poverty eradication, and institutional framework for sustainable development

Since UNCED, sustainable development has become part of the international lexicon. The concept has been incorporated in many UN declarations and its implementation, while complex has been at the forefront of world's institutions and organizations working in the economic, social and environmental sectors. However, they all recognize how difficult it has proven to grant the environmental pillar the same recognition enjoyed by the other two pillars despite the many calls by scientists and civil society signalling the vulnerability and precariousness of the Earth since the 1960s.

- 2012 on Rio +20 The Rio+20 conference on sustainable development, which took place in Rio de Janeiro, Brazil in June 2012 was the biggest UN conference ever and a major step forward in achieving a sustainable future – the future we want.
- 9 July 2013 – The General Assembly established a new High-level Political Forum, which will replace the United Nations Commission on Sustainable Development, to boost efforts to tackle global economic, social and environmental challenges.

In a resolution adopted by consensus, the 193-member Assembly emphasized the need for an improved and more effective institutional framework for sustainable development, and decided that the Forum should provide “a dynamic platform for regular dialogue and for stocktaking and agenda-setting to advance that process.” The decision follows up on a key recommendation of 'The Future We Want,' the outcome document of last year's UN Conference on Sustainable Development, known as Rio+20. “Establishing the Forum marks a major step forward in implementing 'The Future We Want',” said Secretary-General Ban Ki-moon. “The Forum can provide the political leadership and action-oriented recommendations we need to follow up on all the Rio recommendations and meet urgent global economic, social and environmental challenges. “Countries must do their utmost to realize the Forum's potential.”

Source: United Nations, (2013)

The precise origin and meaning of ESD continues to be a subject of worldwide debate despite the many reports prompted by the United Nations Decade for Sustainable Development 2005 to 2014 (UNESCO, 2011). ESD is seen as a learning process or approach to teaching, based on the ideals and principles that underlie sustainability and it is concerned with all levels and types of education. According to Jutvik & Liepina, (2013, p. 8), the aim of the UN Decade is to ensure that “education for sustainable development is practiced in schools and other educational establishments in order to highlight the central role that education and learning play in the common pursuit of sustainable development and that quality education is a prerequisite for education for sustainable development at all levels and in all aspects of education”.

ESD supports five fundamental types of learning, namely, to know, to be, to live together, to do, and to transform oneself and society (UNESCO, 2009). According to UNESCO 2005, Education for Sustainable Development should be seen as a complete package for quality education and learning within which key issues such as poverty reduction, sustainable livelihoods, climate change, gender equality, corporate social responsibility and protection of indigenous culture, to name but a few, are found. The holistic nature of ESD means it can be a potential tool for achievement of the Millennium Development Goals (MDG) and the Education for All (EFA) goals. Both these initiatives have a set of objectives to be achieved by a certain time limit and, therefore, higher education curriculums and particularly courses should reorient to address these issues, particularly those courses training specifically on sustainability practices (such as in the case of this research. Box 2.3 is a summary of ESD as highlighted in the UNESCO document of 2005.

Box 2.3: Background to Education for Sustainable Development

The period 2005- 2014 was declared the United Nations Decade of Education for Sustainable Development at its 57th session in December 2002, the United Nations General Assembly by adopting Resolution 57/254. (DESD) emphasizes the critical role of education in achieving sustainable development, and designated UNESCO to lead the Decade. UNESCO was made the lead agency for coordinating and promoting the implementation of the DESD. As required by Resolution 57/254, UNESCO led the preparation of an International Implementation Scheme (IIS) in consultation with Member States, UN agencies, IGOs, NGOs, universities and partner networks. The Decade was launched internationally by Mr Koïchiro Matsuura; Director-General of UNESCO at UN Headquarters in New York on 1st March 2005 this was followed by a series of regional and national DESD launches. The DESD offers an opportunity to promote the vision of a more sustainable and just global community through different forms of education, public awareness and training activities. Moreover, the framework for the Decade gives visibility to the critical role of education and life skills programmes in enabling communities to devise sustainable local solutions to problems related to poverty and vulnerability. The primary goal of the DESD spelt out in the United Nations General Assembly Resolution 59/237 ‘encourages Governments to consider the inclusion ... of measures to implement the Decade in their respective education systems and strategies and, where appropriate, national development plans’. To this end, the DESD aims to integrate values, activities and principles that are inherently linked to sustainable development into all forms of education and learning and help her in a change in attitudes, behaviours and values to ensure a more sustainable future in social, environmental and economic terms. The basic vision of the DESD rests on the principle of using education - formal, non-formal and informal – as an effective vector to bring about change in values, attitudes and lifestyles to ensure a sustainable future and the evolution of just societies. To this end, the DESD offers national governments the opportunity to rethink and reorient various dimensions of education and skills training so that the learning process has locally relevant real-life applications, encouraging learners to view the world through a lens of concern for sustainability and, consequently, for sustainable development. The DESD strives to achieve these results through the following objectives: facilitate networking, linkages, exchange and interaction among stakeholders in ESD; foster an increased quality of teaching and learning in education for sustainable development; help countries make progress towards and attain the Millennium Development Goals through ESD efforts; provide countries with new opportunities to incorporate ESD into education reform efforts.

Education for sustainable development

Education for Sustainable Development extends its scope to deal with the complex amalgamation of issues relevant to environment, society and economy. ESD prepares people to cope with and find solutions to problems that threaten the sustainability of the planet. Most ESD related topics were identified at the following conferences: The Earth Summit at Rio de Janeiro in 1992 where issues regarding the sustainability of the planet were brought to the international discussion table; and The World Summit on Sustainable Development (WSSD), held in Johannesburg in 2002, where it was recognized that education has in fact the capacity to put sustainability concerns at the centre of the learning context. At that Conference, governments agreed to reorient national education systems to a vision of sustainability that links economic well-being with respect for cultural diversity, the Earth and its resources.

The DESD focuses on four thrusts of education for sustainable development: improving access to quality basic education; reorienting existing education programmes; developing public understanding and awareness; providing training.

Essential characteristics of education for sustainable development:

ESD: is based on the principles and values that underlie sustainable development; deals with the well-being of all three realms of sustainability – environment, society and economy; promotes lifelong learning; is locally relevant and culturally appropriate; is based on local needs, perceptions and conditions, but acknowledges that fulfilling local needs often has international effects and consequences; engages formal, non-formal and informal education; accommodates the evolving nature of the concept of sustainability; addresses content, taking into account context, global issues and local priorities; builds civil capacity for community-based decision-making, social tolerance, environmental stewardship, adaptable workforce and quality of life; is interdisciplinary: no one discipline can claim ESD as its own, but all disciplines can contribute to ESD; uses a variety of pedagogical techniques that promote participatory learning and higher-order thinking skills.

The transition towards a more sustainable future begins with each and every person making informed choices for a better understanding of how our present production and consumption patterns impact the planet's natural resources. It also implies the ability and capacity of different peoples around the world (and future generations) to meet their needs. With millions of young people, as well as adults, spending large periods of time in education (in formal, non formal and informal settings), the role of schools and other education.

Source: Wals, 2012

According to Wals 2012 ESD as a concept has a long history that can be traced back to 1992. Wals notes that ESD has attracted more attention since 2005, the start of the United Nations Decade of Education for Sustainable Development (UNDESD) as highlighted in his report (2012, p. 9) as quoted below:

“The roots of ESD and the DESD can be traced to the United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit, held in 1992 in Rio de Janeiro. UNCED resulted in a landmark publication, Agenda 21, a comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations system, governments, and major organizations (NGOs, CSOs and networks) to reduce the human impact on the environment. Agenda 21, the Rio Declaration on Environment and Development, and the Statement of Principles for the Sustainable Management of Forests were all adopted at the Earth Summit by more than 178 Governments. The Commission on Sustainable Development (CSD) was created in December 1992 to ensure effective follow-up of UNCED and to monitor and report on implementation of the agreements *at the* local, national, regional and international levels.”

Other writers (McKeown, 2002; Lotz-Sisitka & O’Donoghue, 2006; Edwards, 2005) have pointed to the 1972 conference at Stockholm on Human Environment as the origin of ESD and claim it has roots in two distinct areas of core interest for the United Nations: quality basic education and sustainable development (Lotz-Sisitka & O’Donoghue, 2006). The ESD concept therefore is not a recent phenomenon. My thinking is that education for sustainability may have started with man’s realisation that nature was under stress as a result of human activities that were causing degradation such as the dust bowl in the US in the 1930s. The effects of environmental degradation on humans contributed to the search for knowledge on sustainable living. As a result the world came together in conferences and other groups to try and develop ways of reducing the effects of environmental degradation as this was increasingly becoming a global challenge. The quality criteria and characteristics of ESD as outlined in Sections 2.7.1 and 2.7.2 indicate that ESD promotes a holistic approach to sustainable development.

2.7.1 The quality criteria for ESD

Quality criteria for ESD are important in analysing a course concerned with the ESD concept. As argued by Breiting *et al.*, (2005) ESD deals with people's dependence on the quality of environment and access to natural resources now and in the future, it is also concerned with aspects of participation, self efficacy, equality and social justice. These are essential perspectives in preparing students in their engagement in sustainable development. Sustainable development is the main principle to keep in mind when planning schools daily life as well as long term changes and development. ESD aims to offer students a context for developing active citizenship and participation embracing the complexity of combined social, economic, political and environmental dimensions of sustainable development. Breiting et al (2005) suggested a list of the various quality criteria perspectives:

- Quality criteria in the areas of perspectives for the future where students seek relations between the **past**, the **present** and the **future**, in order to get a historical understanding of the issue concerned.
- Quality criteria in the area of a culture of complexity whereby students work on constructing their understanding of the problem, looking for different interests and different points of view, before trying to find a solution. Teaching in all subjects is based on seeking out relationships, multiple influences and interactions. Students have the opportunity to appreciate and confront diversity -biological, social, cultural – and to look at this as ‘opportunities’ for broadening options for change. Students are encouraged to listen to their emotions and to use them as a way to reach deeper understanding of the problems and situations. Students and teachers accept uncertainty as part of the daily life and prepare themselves “to expect the unexpected and to deal with it” being aware of the importance of the precautionary principle.
- Quality criteria in the area of a teaching- learning approach whereby the teachers listen to and value the concern, experiences, ideas, and expectations of the students, and their plans are ‘flexible’ and open for changes. The teachers encourage cooperative learning and experiential learning. The teaching takes into account the

value of practical activities by linking them to students' concept development and theory construction. The teachers facilitate students' participation and provide contexts for the development of students' own learning, ideas and perspectives. The teachers search for ways to evaluate and assess students' achievement consistent with the above mentioned criteria.

- Quality criteria in the area of visible outcomes at school and in the local community. This includes physical / technical changes in the school and in the local community, relevant for ESD, seen as an opportunity for teaching and learning and used for participation and democratic decision-making. The changes obtained and the outcomes reached at school and in the local community are nurtured and maintained.
- Quality criteria in the area of perspective for the future whereby students work with visions and scenarios, seeking alternative ways of development and changes for the future and establishing criteria for choice. The students get involved in comparing short-term and long-term effects of decision and alternatives, seek relations between the past, the present and the future, in order to get a historical understanding of the issue concerned and work with planning as a way to reduce future risks and to accept uncertainty.
- Quality criteria in the area of critical thinking and the language of possibility whereby students work with power relations and conflicting interests e.g. in the local situation, between countries, between present and future generations. Students are encouraged to look at things from different perspectives and to develop empathy by identifying themselves with others. Students are encouraged to give arguments for different positions, look for examples of what is (or was) useful and fruitful in other situations, in order to imagine new possibilities and alternative actions.
- Quality criteria in the area of value clarification and development in this case the students work with the distinction between factual knowledge and value-based opinions, and investigate the values and interests behind them. Teachers focus on

students' clarification and discussion of their own values, thereby strengthening reflection, mutual respect and understanding of other values. Teachers accept the challenge of not imposing their own values and opinions allowing students to hold their own positions.

- Quality criteria in the area of action perspectives whereby students work on issues and actions regarded by the teacher for their educational value and not only as a way to solve real problems. The students participate in decisions on action to influence the problem, and are learning from reflecting on their experiences. The teaching focus lies on authentic action strategies, on action possibilities and on experience from real actions. The students' involvement in action is accompanied by reflections on local and global effects, comparing risks and possibilities of alternative decisions.
- Quality criteria in the area of participation whereby teachers focus on students' capacities needed for meaningful participation and co-operation, e.g. listening, expressing point of view, taking responsibility and showing solidarity. Teachers give space for students to take part in the decision-making process appropriate to the students' age and capacity. Students become experienced in democratic participatory processes.
- Quality criteria in the area of subject matter teachers in ESD focus on problems issues – the subject matter should be functional and relevant for the students' understanding of the complexity of the issues. The theories and concepts from the academic disciplines are utilised to rationalise often naïve and uncritical experiential knowledge. Teachers look for ideas and perspectives in ESD to reactivate and innovate teaching and learning in traditional subject matters.
- Quality criteria in the area of the school policy and planning whereby the school includes a focus on ESD in its mission and annual action plan. The school leadership encourages teachers to use future perspectives to plan their long-term ESD work. The school allocates appropriate school time for the students' work with SD, as well as for the teachers' reflections and clarifications on ESD issues at the school. The school

establishes a procedure to respond to teachers' needs for further education relevant for ESD.

- Quality criteria in the area of the school climate whereby the school atmosphere is such that everyone feels that she/he can contribute with innovative ideas and proposals without fear. The school leadership has a particular role in facilitating this. The school is seen as an arena where all the stakeholders exercise democracy and participation, and are involved, at different levels, in the decision-making processes. The whole school community, especially parents, is informed of the relevance of ESD for students' general learning and is involved in the school development.
- Quality criteria in the area of school management whereby the school makes a regular audit concerning the school's needs in the direction of sustainability, involving students, teachers and staff. The school decides every year what the new challenges are and what actions to take for a continuous improvement of the school management. The school strives to be an example of careful management of resources and evidence of the result obtained are shown to the internal and external community.
- Quality criteria in the area of reflection and evaluation on ESD initiatives at school level whereby the school allocates appropriate school time for teachers' reflections and research on their ESD issues. The school clarifies and develops quality criteria for ESD according to its vision of ESD, and uses them for internal evaluation. The school establishes procedures to make use of gains and achievements from ESD, as well as of the obstacles encountered, for the benefit of the whole school, even for teachers not involved in ESD initiatives.
- Quality criteria in the area of community co-operation whereby the school involves the community as a resource for teaching/learning in meaningful ways. The school uses the community as an arena for genuine action. The school enables the local community to address its concerns to the school and serve as a 'community-centre'.

- Quality criteria in the area of networking and partnerships. The school co-operates with other schools in order to develop, exchange and compare ideas and information relevant for ESD. The school is part of local, national, or international networks relevant for ESD in which they are encouraging students to take initiatives. The school is seeking co-operation with institutions active in educational development in the field of ESD.

2.7.2 Characteristics of ESD

According to UNESCO (2007) ESD is facilitated through participatory and reflective approaches whose characteristics are listed below:

- Is based on the principles of intergenerational equity, social justice, fair distribution of resources and community participation that underlie sustainable development;
- Promotes a shift in mental models which inform our environmental, social and economic decisions;
- Is locally relevant and culturally appropriate;
- Is based on local needs, perceptions and conditions, but acknowledges that fulfilling local needs often has international effects and consequences;
- Engages formal, non-formal and informal education;
- Accommodates the evolving nature of the concept of sustainability;
- Promotes life-long learning;
- Addresses content, taking into account context, global issues and local priorities;
- Builds civil capacity for community-based decision-making, social tolerance, environmental stewardship, adaptable workforce and quality of life;
- Is cross disciplinary. No one discipline can claim ESD as its own, but all disciplines can contribute to ESD; and
- Uses a variety of pedagogical techniques that promote participatory learning and critical reflective skills.

UNESCO (2007) further describes ESD related processes as involving:

- Future thinking: actively involves stakeholders in creating and enacting an alternative future;

- Critical thinking: helps individuals assess the appropriateness and assumptions of current decisions and action;
- Systems thinking: understanding and promoting holistic change; and
- Participation: engaging all in sustainability issues and actions;

2.8 DEFINING ENVIRONMENTAL RESOURCE MANAGEMENT/NATURAL RESOURCE MANAGEMENT (EDUCATION)

Environmental Resource Management or Natural Resource Management is a form of education that focuses on natural resources their uses and management. According to Fien & Gough, 1996, natural resource education helps learners to; develop a sound understanding of natural resources, their characteristics, distribution and status, both present and potential uses. Natural resource education can help learners to make informed decisions on natural resource consumption, understand the structure and functioning of the natural world, different cultural perceptions and use of the natural resources, appreciate the effect the use of the natural resources have on the biophysical world, and the structure and operation of the political and legal systems that control the use of the natural resources.

Natural resource management is multi-sectoral, encompassing many sectors, including environment, agriculture, irrigation, forestry, livestock, water supply and energy, to name the most obvious. This sectoral approach is not only found in the informal sector but also the formal sector including Higher Education Institutions that train personnel in several sectors. The Government of Kenya recognises that environmental management, poverty reduction and economic growth are closely linked, and has designed policies and institutional frameworks to address the situation. The Government's long-term development strategy, Vision 2030, accordingly includes strategies for action in the environment sector include conservation of natural resources, pollution and waste management, high-risk disaster zone management, environmental planning and governance, and climate change adaptation. Programmes and projects to be implemented in the environment, water and sanitation sectors within the period of the first Medium-Term Plan (2008-2012) are identified in sector-specific plans

2.9 APPROACHES TO ENVIRONMENTAL EDUCATION

There are various approaches to implementing and delivering environmental education (EE) programmes based on differing views on its definition, its core elements and social purpose (Marsden, 1997). Robottom & Hart (1993) distinguish positivist, interpretive and socially critical approaches to environmental education based on the type of curriculum models driving the environmental education process (Section 1.3.2.1). Different writers have come up with various typologies of environmental education such as Lucas (1995) education in/about/for the environment model which corresponds to educational processes, educational content and social purposes. Sauve' (2005) recognises fifteen variants of environmental education: Naturalist, Conservationist, and Problem solving, Systematic, Scientific, Humanistic, Value centred, Holistic, Bioregionalism, Praxis, Socially critical, Feminist, Ethnographic, Eco-education and Sustainability/Sustainable Development. She defines currents of environmental education as 'general ways of envisioning and practicing environmental education'. Her typology provides an effective vantage point from which to analyse trends in environmental education, and how they have played out in the various forms of environmental education that have emerged. The major approaches to environmental education according to Sauve have been the naturalistic and conservationist currents. The majority of the currents take a more relational view of environmental education, and adopt approaches that either take a holistic view of environment such as the systematic and holistic currents, or relegate the natural environment into the background in favour of other constituents that make up the human environment such as the feminist and value currents. This research on the ERM course is grounded on the conservationist/naturalist environmental education currents (Section, 1.2.1).

2.9.1 METHODOLOGIES IN ENVIRONMENTAL RESOURCE MANAGEMENT EDUCATION /NATURAL RESOURCE EDUCATION

According to O'Donoghue (2007), methodologies refer to pedagogical approaches in environmental education ranging from top-down communication strategies to those which are more local, critical and participatory. He argues that the emergence of the various environmental education methodologies in South Africa is a response to changes in social political and environmental risk climate in the country. Lotz-Sisitka, 2002, explained that approaches to environmental education in South Africa evolved in response to changes in the

country's ideologies, especially those which relate to the democratization of the curriculum development process, curriculum approaches, learning theories and the role of education in South Africa's society.

Environmental education in Kenya today is carried out in two dimensions: one approach is geared towards teaching about nature and ecology, in subjects like biology, natural science and geography. This approach is used in the classroom situation where the teachers have to follow to a given curriculum. Environmental education is a compulsory subject at university level, for the degree courses. In tertiary institutions there are courses in environmental education for those who have decided to take environmental studies as a career. This is done at certificate diploma and degree levels. There are also various post-graduate courses in environmental education. The second approach involves creating awareness, developing skills and active participation. This method is used in schools to a small degree in the extra curriculum activities. Schools have clubs such as environment clubs, young farmers clubs, geography clubs and wildlife clubs, in which students are members and take part in various environment awareness and conservation activities. Government departments and NGOs that are involved in conservation, also participate in environmental education, by involving the public in their activities. Such organisations include: the National museums of Kenya, the Kenya Wildlife Services, Nature Kenya and the Wildlife Clubs of Kenya.

There have been changes in environmental education thinking, the courses and pedagogical approaches which have impacted on ERM/Natural Resource Education practices especially in the classrooms and these include:

- Natural resource as conservation messages;
- Natural resource education as science education;
- Natural resource education as natural experiences;
- Natural resource education as socially critical education; and
- Natural resource education as education for sustainable development

Natural resources education in the form of conservation messages represents one of the earliest approaches to the field and involves top-down media and extension campaigns to get conservation message to the target group (O' Donoghue, 2007p. 145). In the mid twentieth century this played a significant role in conservation of wildlife natural habitats and soil erosion (Irwin & Lotz-Sisitka, 2005). This form of conservation is based on the premise that natural resource degradation is due to lack of awareness among the population and the

assumption that awareness will lead to behavioural change of attitude. Therefore the courses specified their objectives according to the behavioural changes expected. This is the approach that is promoted by the Belgrade Charter: the fostering of environmental awareness; promotion of environmental knowledge and skills; and the creation of new patterns of behaviour (UNESCO/UNEP, 1976).

Natural resource education as science education represents what Sauve (2005) calls the scientific current. It places emphasis on the development of knowledge and skills deemed essential for effective decision making. This approach is based on the premise that knowledge is factual and of a simple procedural nature, and that which is objective and easily assessed for example basic principles of ecosystem structure (Stevenson, 1993). According to Le Grange 2003 a number of institutions are training for ecology at all levels and natural resource education is part of schooling in South Africa. The preferred methods of pedagogy within this approach to environmental learning include experiments, objective observation and scientific quantification (Kyburz-Graber, 1999). This approach fails to address the real social, economic and political causes of environmental degradation promoting the status quo (Hudson, 2001). This approach regards expert- produced knowledge as the only form of valid knowledge and it encourages rote learning produced by external experts with minimal input by local community.

Natural resource education as nature experiences is based on the interpretive or practical model, which values experiential learning. It developed as public interest in ecology grew, and alienation from nature was seen as contributing to environmental degradation (O'Donoghue 1986, 1993). It aims at creating environmental awareness, like environmental messages however it creates hands on learning opportunities for learners to engage with wild nature as a strategy to help urban based learners reconnect with nature. According to Sauve's 2005 typology this falls under the naturalist current. The purpose of the nature experiences is to develop an understanding and appreciation of the natural environment through first hand observations and to stimulate a reconsideration of attitude and behaviour towards nature (Stevenson, 2007). The nature experiences can be of a cognitive, affective, spiritual, or sensualist in nature, and involve the use of various strategies such as immersion, interpretation, sensorial and discovery activities (Sauvé, 2005).

Natural resource education as socially critical education approach is based on a critical approach to courses and seeks to empower learners to question existing power relations and ideologies and to take action towards solving environmental problems in their local communities (O'Donoghue, 2007; Lotz-Sisitka, 2002). It promotes social and environmental justice. To understand and mitigate the root causes of environmental degradation, Kyburz-Graber 1999, maintains that the nature of the underlying dominant social and political practices must be questioned. This means a shift from the emphasis on the course content to the process. Critical environmental education is defined as “ a process of developing capacities for intelligent social action, rather than one of transmitting discrete elements of knowledge” (Huckle, 1990 p. 199). Factual knowledge transfer is replaced by real environmental problems in the community, which the learners investigate and solve. As a result the learners develop reflexive and critical thinking skills and political literacy capacities as they critique the ideological and social dynamics which contribute to environmental problems (Firth &Plant, 1996). However, critical environmental education has been difficult to implement worldwide (Stevenson 2007). Walker 1997 identified the essential criteria for successful environmental education as suitably qualified teachers, committed teachers and communities, financial support, and problems that are solvable by learners.

Natural resource education as ESD falls under the sustainable development current (Sauve, 2005). There is a growing interest in ESD as a result of the adoption of sustainable development as the common goal of environmental protection and social economic development, its reaffirmation and strengthening at the 2002 Johannesburg Summit, which culminated in the declaration and adoption of the UN Decade of Sustainable Development. In addition the drive towards achieving the Millennium Development Goals targets (especially Goal 7) and those of Education for All (Section 1.3.2.1) has increased support for educational approaches that address social and economic considerations when dealing with environmental issues. ESD calls for integration of sustainable development into all levels of education and provision of lifelong learning opportunities (Lotz Sisitka, 2004). However the relationship between ESD and EE is contentious. Some environmental practitioners such as Sauve (2005) and Rose and Bridgewater (2003) have argued that EE and ESD is the same thing with different names. McKeown and Hopkins (2003), writing from a North American perspective saw EE and ESD as totally different concepts driven by different philosophies and goals, but

which are capable of existing side by side enriching the other. Knapp (2000) writing from a western European perspective, acknowledged the major flaws inherent in current EE pedagogic practices, such as the lack of sequential learning, the over reliance on activity guides, and the failure of the infusion strategy, and saw these as valid reasons for sidelining EE. A major issue of contention around ESD was noted by Jickling and Spork (1998), and McKeown & Hopkins (2003), centred on the instrumentalist approach to education promoted by ESD. This point is elaborated by Scott (2002) when he argued that learners should be given the opportunity to critically explore sustainable development and its implications for their lifestyle decisions, instead of simply accepting the concept at face value, which is tantamount to educational indoctrination.

Given Kenya's sectoral approach to natural resource management, natural education exists as, for example, Wildlife Management, Forestry Management, Water Resource Management, Soil Conservation, and so on. This scenario requires a shift to look at the resources in totality and to understand how the economic, social and political factors impact on them in order to develop an approach that is all encompassing ESD practitioners. The ERM course explored in this study is one of the approaches to ESD (Section 1.2.1).

2.10 APPROACHES TO THE DEVELOPMENT OF ENVIRONMENTAL RESOURCE MANAGEMENT EDUCATION COURSES

In this research the term course is used to refer to the programme or course outline used by lecturers as a guide for imparting knowledge, skills, values and perspectives in environmental resource management. The course outline version used in this research was prepared between 1998 and 2002 by experts from Kenya Polytechnic and Saskatchewan Institute of Applied Science and Technology (SIAST) Canada and other local stakeholders and implemented in 2002. According to McKeown, 2002, a course reoriented to address sustainability must address both local and global issues in terms of knowledge, skills, perspectives values and issues as summarised in Table 2.1. In terms of knowledge, McKeown argued that people need basic knowledge from the natural sciences, social sciences and humanities to understand the principles of sustainable development, how they can be implemented, the values involved and ramifications of their implementation. Knowledge based on traditional disciplines supports ESD because it focuses largely on the major social,

economic and environmental issues. It requires practical skills and perspectives to understand both global and local issues. Values are an integral part of ESD and McKeown (2002) suggested that in developing a sustainability course one needs to understand the goals of the society (Table 2.1).

Table 2.1: Summary of an ESD course

Knowledge	<ul style="list-style-type: none"> • Natural sciences • Social sciences • Humanities • Principles of sustainable development
Issues	<ul style="list-style-type: none"> • Issues in Agenda 21 • War and militarism • Governance • Discrimination and nationalism • Renewable energy sources • Multinational corporations • Refugees • Nuclear disarmament • Human rights • Media influencing
Skills	<ul style="list-style-type: none"> • Ability to communicate • Ability to think about systems • Ability to think in time –to forecast, think ahead and to plan • Ability to think critically about value issues •
Perspectives	<ul style="list-style-type: none"> • Social and environmental problems change with time • Interlink ages and interrelatedness of environmental issues • Humans have universal attributes • Understand local issues in a global way • There are differing views • Economic, societal and religious values differ • Technology and science alone cannot solve all of our problems • Individuals are both global and community citizens • Individual consumer decisions are far reaching • Employ the precautionary principle
Values	<ul style="list-style-type: none"> • Democratic process • Community participation • Volunteerism • Social justice

Source: McKeown, 2002

Rizzi, 2002 argued that reorienting the current curricula to address sustainability is a challenge because change is difficult and takes time. He argued that tradition is a powerful force in keeping the status quo and deliberate action is required to drop or add anything to a curriculum. Each country therefore needs to decide on how to address its own local challenges.

Various authors of the current state of curriculum and range of pedagogies in formal educational institutions argue that ESD research is a prelude to more positive suggestions for improvement (Bottery, 2000; McKeown 2002; MESA 2009; NEMA, 2010). ESD argues for good practices; however the development of a curriculum is influenced by a number of factors including but not limited to; social trends such as globalisation of the curriculum, vocational, economic trends, and political environment (Rizzi, 2002).

ESD can be seen as an ongoing global research and development programme for the future of humanity on Earth but the extent to which education can achieve desirable social change by itself without social structural changes, is an issue as ESD tries to address all social cultural and economic aspects. Parker (2008) argued that anybody engaged in education for sustainability must have a sound knowledge of the basics of sustainability as for any subject such as mathematics. Sustainability is perceived as a wide and controversial topic with varying ideas about the basics. Parker (2008) proposed a framework approach in which people understand more clearly that sustainability questions necessarily cross boundaries between the range of domains of reality for which appropriately different forms of explanation and understanding have been developed. He further posited that knowledge of the constituent parts of the sustainability research is complex as are the relationships between different kinds of system and knowledge about those relationships for those concerned with Education for Sustainability; the task is to find ways of entry for diverse learners in their different contexts. Parker argued that Education for Sustainability proposes some of the hidden and forgotten knowledge of humanity, and also engagement with some of the most ambitious enlightenment aims of human self-understanding and conscious adaptation.

Environmental problems have been addressed variously, for example, Jackson (2004) asserted that as a result of colonialism and imported Western education, many former colonies, such as India and many African countries, initially tried to address their environmental problems through the lenses of Western environmentalism. In India there is a tendency to focus on effects, that is technical definitions and solutions rather than on causes – which are predominantly social, economic and political in following western environmentalism. Earlier, Sulliman (1993) argued that the Africa green movement uncritically adopted Western environmentalist values and perspectives and, as a result, was unable to respond to the problems of the environment in local contexts. I agree with these writers as most of the ideologies of conservation are western oriented as opposed to the local traditions where people co-existed with nature.

The appropriateness of applying northern values to address southern problems has been recognised. An example of the realisation that ‘environment’ is more than the biophysical surroundings that secure our survival was described by Schreuder, one of the founders of the Environmental Education Association in South Africa (EEASA). In his keynote address to the 2004 EEASA conference he described the change in his perception as starting with the realisation that the struggle to survive was directly related to the prevailing apartheid policies, which forced the majority of black people to live in ‘homelands’ characterised by impoverished soils and degraded environments. As a result of political, economic and social conditions, they were denied the basic rights to quality life.

In Africa a large proportion of the population are subsistence farmers living directly from the surrounding soil and natural resources. The quality of these resources and people’s access to them directly affect their quality of life. The experiences of those who live in close proximity to their local ecologies lead to different views of the ‘environment’. For many rural Africans, ‘environment’ does not only mean resources. For example, the Sena tribe in central Mozambique attributes spiritual powers to certain trees and animals. Areas of sacred forests can only be entered after asking permission from the local medicine man and whoever does not honour this tradition will be lost forever. Also, the ground where ancestors are buried is seen as sacred. Indigenous knowledge (IK) played a significant role in conservation. In other places such as Kenya studies show that independence, attempts by African elites to follow

European footsteps and generate capital through focusing on the exploitation of the natural resources led to disastrous consequences (Long, 2004).

The World Conservation Strategy, *Caring for the Earth*, (IUCN/UNEP/WWF, 1991), proposed the concept of ‘sustainable living’, thus challenging the emphasis on the economic growth of mainstream interpretations of the sustainable development concept. In 1992, the Rio Declaration (UNCED, 1992) provided commitments for moves towards sustainable living. One of the key outcomes of the Earth Summit in Rio de Janeiro was the recommendations to governments to incorporate development and environment in the formal and non-formal education sectors. However, the international policy of ‘sustainability’ made its strongest impact on environmental education in 1997, when the Thessaloniki Declaration (Scoullas, 1997) stated that education must be reoriented as a whole towards sustainability, and environmental education was reconceptualised as including ‘education for sustainability’.

The ever changing definitions of environmental education have resulted in much debate on what a curriculum of environmental education should contain. Teachers in the South African education system are meant to be not only subject specialists, managers and administrators but also, ‘pastors’ giving moral guidance and support to learners (Rosenberg, 2004). Rosenberg argued that by addressing everything, nothing will be addressed “‘now that we enter a decade of education for sustainable development, we run the danger of finding environmental education everywhere and nowhere’” (Rosenberg, 2004). Rosenberg argued that the environmental educator should be able to develop a central focus, while recognising the role of other issues. She also recognised the dangers of environmental education carrying an unwieldy burden of important things to address. The curriculum debate about what constitutes the main focus for environmental education is continuing in South Africa, as it is elsewhere.

The vocational neo-classical (behaviourist) orientation focuses on educating the individual on knowledge and skills so that s/he can take his/her place in society. This is often adopted in vocational training where mastery of skills is needed. Such education is supportive of current

political structures with little change or critique invoked. Environmental education in this perspective relates to the teaching of knowledge and skills to create attitudes and behaviours in humans that are favourable to the environment and as such, support the western view of the environment as something we must protect. However, this orientation neglects the importance of the forces that determine the way people relate to and use the environment as a living space. This orientation is often applied in the school sector and teacher training, as can be seen from the publication *Environmental Education in Action in Secondary Teacher Training in Zimbabwe* (Chimbodza, van Ongevalle & Madondo, 2004).

The liberal/progressive educational orientation hopes to create, or strengthen, appreciation for the environment. In this approach the purpose of education is to prepare students for life conducted in harmony with their environment. This orientation is criticised as having too few contextual links to the socio-economic and political aspects related to the environment. Education in the environment is often used in southern Africa in field trips and visits to nature field centres. It is part of teaching environmental education in school as well non-school sectors.

A course should be prepared in such a way as to address local issues while keeping global issues in perspective. The knowledge and skills to address global problems should be developed in individuals so that they have a world view with values that will sustain global resources.

2.11 INNOVATIONS IN TEACHING ISSUES ASSOCIATED WITH SUSTAINABILITY

According to Jutvik and Liepina (2013), teaching and learning takes place where knowledge is best cultivated. They argued that, although the school tradition is strong and teaching is usually carried out inside a classroom, students should be exposed to their own unique experiences something that is direct, personal and cannot be replaced by anything else. They emphasised the importance and value of close contact with the natural surroundings and local community in environmental or sustainable education. They argued that outdoor education can mean, for example, highlighting the ecological aspects of the school grounds, the

riverbank or nearby forest area. They recommended that it was also worthwhile developing close contacts with the local community by, for example encouraging dialogues and cooperation with parents, politicians, companies and other interested parties. A school where education for sustainable development is well developed is also seen as an important stakeholder in establishing practical and local sustainable development. This creates cooperation and a win-win situation both for teaching and learning and society's democratic processes. Since the ERM course is sustainability based it should enable the learners to deal with real life environmental issues in their locality. This is supported by Problem Based Learning as an approach to sustainable development.

Problem Based Learning (PBL) is one of the approaches for sustainable development that gives a student real life experience. Although the distinction between PBL and other forms of cooperative or active learning is often blurred because they share certain common features, hybrid approaches abound as instructors adapt methods for particular situations. An essential component of PBL is that content is introduced in the context of complex real world problems. Students work in small groups to identify what they know and more importantly, what they don't know and need to learn to solve problems. The role of the instructor in PBL is to facilitate group processes and learning and not to provide answers (White, 2008). This study endeavoured to identify the various Problem Based Learning innovations that facilitators adopt and how they use these in ERM to promote sustainability.

Problem Based Learning emerged as a response to criticism that traditional classroom environment does not provide essential contextual features that enable students to understand and apply information. It originated from the medical schools where traditional preclinical science learning activities course trained physicians to be problem solvers and lifelong learners. PBL has since then been applied in areas other than the medical field including physics, biology, geology and history (Duck, 1996; Thompson, 1996; Miller, 1996). The method has been successfully rated as compared to other methods of teaching because it engages students in real life situations and this makes learning interesting for both the teacher and the student, (Allen 1996; Koenig 1996; Lieux 1996; Claire & Palmer 2001; Brody & Ryu 2006).

Learning occurs when students are given problems and situations that present genuine complexity (Brondy & Ryu, 2006). PBL prepares students to solve real world interdisciplinary problems associated with sustainability once they leave the classroom environment and become practitioners in conservation. According to Brondy & Ryu, 2006, PBL promotes the idea that nothing is ever learnt exhaustively, that interdisciplinary learning coincides with solving the complex interrelated problems of sustainability (ibid). The major areas of the PBL process that have been built into the ERM course which is the basis of this study are:

1. Apply the principles of sustainable planning and development to real world problem domains working alone and in groups.
2. Develop individuals and collective student expertise on topics related to sustainability to enhance professional development and increase effectiveness after graduation.

Environmental Resource Management students are exposed to real life problems when they engage in field excursions. The trips to the coastal region and to the highlands of Kenya expose the students to the real environmental issues in these regions. Therefore as the students write, the field reports, they explain ways of solving the environmental problems they have witnessed in the field trip. The students also engage in an industrial attachment to have a real life experience by learning from the community of practice. This is engagement from the periphery according to Lave & Wenger (1991), to understand the competencies and skills required in the world of work. The students also engage in research for their end of the course project for examination, this helps to link the students to the community in problem identification, data collection and analysis. In the next chapter I describe the theories that were engaged in this research to understand how the ERM course was developed and implemented to train a practitioner in the conservation sector and how this can ultimately be reoriented to develop practitioners in ESD.

CHAPTER THREE: THEORETICAL AND ANALYTICAL FRAMEWORK

3.0 INTRODUCTION

This research set out to establish how an Environmental Resource Management (ERM) course offered at Technical University of Kenya (TU-K) enabled its learners to become practitioners in Education for Sustainable Development (ESD). This chapter describes the theories that were found relevant to the research and which were used as a lens to understand the ERM course development, implementation and how the course can be a vehicle for ESD. Theory plays a critical role in research by enabling the researcher to understand the type of data to collect and how to analyze it. Theory in research is more than a methodology and epistemology, it affects research because it is pragmatically bound up with the activities of planning a study and gaining entry to the field, recording observations, conducting interviews sifting through documents and writing up research. Theories are the basis of practically any activity. Therefore this research engaged with the ‘ideology of becoming’ as a lens to establish how the students became environmental resource managers in the training. The ideology of becoming posits that if a learner does not become what he/she is taught to become, then it is a waste of time. This is particularly the case for, natural resource learners who should become natural resource managers by participating on conservation and not merely by engaging theoretically in the classroom (Tuguta, 1995).

The Communities of Practice (COP) theory put forth by Wenger (1998) supports learning as a social activity that comes by through observing experts in an activity and, with time, the observer takes up the observed role. In a community of practice, tensions exist that bring about contradictions and therefore things don’t work as expected. To understand these challenges, Cultural Historical Activity Theory (CHAT) became an important tool for surfacing these contradictions. Agenda 21 is highlighted in this chapter as a lens that was used to understand the extent to which the ERM course was sustainability based. The extent of incorporation of Agenda 21 serves as an indicator that the course is ‘in tandem’ with global issues as ESD has largely originated from the Rio Summit that developed these issues on sustainable development.

3.2 THE IDEOLOGY OF BECOMING AND VOCATIONAL HABITUS

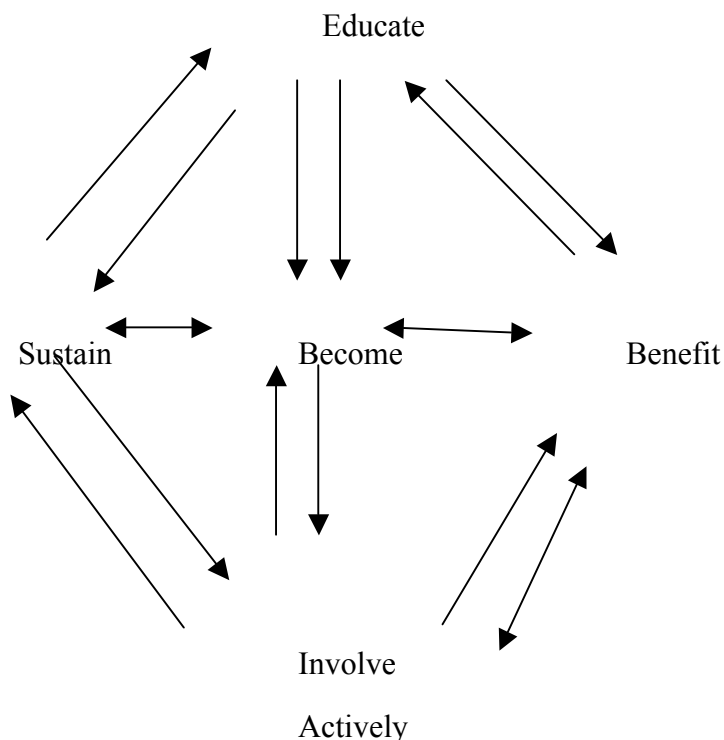
The research was informed by a model of teaching with active learning because it anticipated that the students in ERM participate actively. It was also informed by the concept of learning that is learner- centered. Atwater, 1999 argued that active learning is based on the principle of transforming the learner from passive to active and learning is a process of transformation, whereby the student is in touch with the community and that which goes on around him in the course process. UNESCO (2006) proposed that in active learning the student is expected to identify problems affecting his immediate environment (community) and offer suggestions/solutions using the knowledge acquired in class this is further supported by NEMA, 2008.

As mentioned earlier, TU-K is a TVET institution whose main emphasis is practical hands-on learning to enable students to apply the skills learnt in their areas of specialisation. TVET's main objective is practical learning (see Section 1.4.3.1) and as Tuguta (1995) argued, education would be short-lived if it was not sustained through constant selling and benefiting from the fruits of sustained actions. Being actively involved in community development matters after formal schooling, that is work-place learning, can be seen as an indication that the learners become promoters of sustainable development.

The ERM course framework (Appendix 1 A HD22) suggests that learners should get an 'all round' learning experience that allows teachers and students to work jointly towards the resolution of a problem of mutual concern in the community. According to Tuguta, 1995, action research in education began with John Dewey's philosophy of reflective thinking that criticised schools separating thought from action and thinking from doing. Dewey advocated for involving students in the real world with the aim of improving the community for everyone, to make the future better than the past. Action research is a methodology that addresses problems in society by linking theories of change with practical action. It is designed to promote critical thinking at every stage of the process. This type of learning enables the student to get involved practically in problem solving in the community thus the student becomes a practitioner in the area which he has been trained (Colley, Hodkinson

&Malcolm, 2003). Tuguta (1995) has illustrated this ideology with the becoming model as presented in Figure 3.3 which shows that learning is a continuous process. It illustrates that for a student to become what he/she is supposed to be, he/she must be exposed to the working systems that have a direct existence relationship with his/her being. Exposure of an individual to the working systems provides the individual with the relevant knowledge and facts about the systems of which the individual has an existence relationship. The model also perceives that the exposition is not confined to verbal exposure but involves active sustainability as a continuous process in the creation of the desired individual (Colley et al, 2003). Thus knowledge, active involvement and sustenance mechanisms must inter-relate among themselves to create a continuous process that brings about the new being desired. Meanwhile, the being so created can remain sustained by continuous sustenance of the working systems with which the individual has direct interrelationship (Figure 3.3). Awareness alone may not be a solution: it must be engaged and supported by appropriate programmes.

Figure 3.3: The becoming model



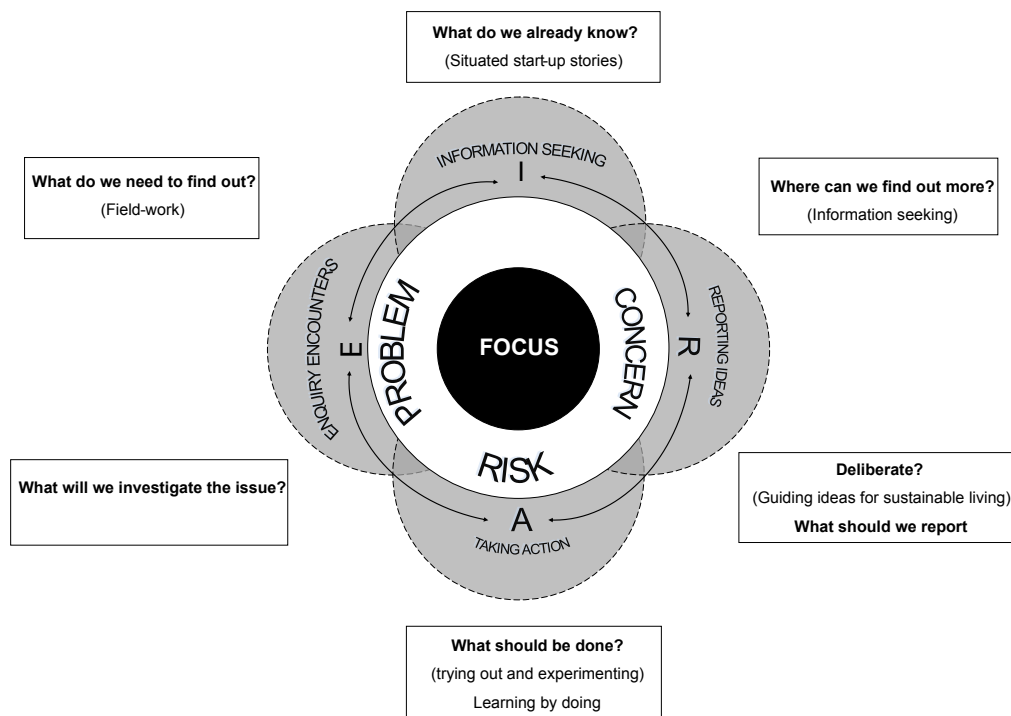
Adopted from Tuguta 1995, p.94

Tuguta (1995) argued that the model of becoming perceives that the exposition is not confined to verbal exposure but involves active sustainability as a continuous process in the

creation of the desired individual. Thus knowledge, active involvement and sustenance mechanisms must inter-relate amongst them to create a continuous process that brings about the desired new being. The being created can remain sustained by continuous sustenance of the working systems with which the individual has direct interrelationships. This means that the person thus involved in learning should be an active participant and this will enable continued involvement in the actions that need to be taken. In this research an ERM student must become an active participant in activities concerning conservation in the community such that he continues doing so after completing the course. In so doing the activities are sustained.

This model is enhanced by COP theory, put forth by Wenger (1998) who defined a community of practice as a group of people who have a common interest in achieving something. They share ideas on the best way of achieving their common goal and thus a community is characterised by mutual engagement, joint practice and shared repertoire. O’Donoghue’s Active Learning Model (2001), illustrated in Figure 3.4, and indicated that learning is continuous.

Figure 3.4: Active Learning Model



Source: O’Donoghue 2001

Lotz-Sisitka & O'Donoghue (2006) argued that more sustainable levels of development could be attained through education as prescribed by the curriculum intention and the central role of learning processes by fostering change towards sustainability. This may enable lifelong learning whereby the student is able to engage critically with their world, in addition to commanding those sorts of competences required for survival in it, especially the ability to adapt to new roles and situations (Wood, 2007). The curriculum framework suggests that learners should get an all rounded learning experience that allows teachers and students to work jointly towards the resolution of a problem of mutual concern. I hold the view that persistent environmental degradation calls for graduates that encourage a more sustainable existence. Although currently there are more people with formal education, environmental degradation is accelerating more than ever before, an indication that formal education does not necessarily translate to sustainable living. The world is more learned now but there are persistent and worse unsustainable activities (UNEP, 2006b). There may be several underlying factors to this scenario as curriculum ideology suggests that one must understand how the whole system works to have a positive attitude and care for the environment in order to reap its benefits.

ERM exposes students to the relevant knowledge, skills and values related to sustainability to enable them to become ESD practitioners as outlined in the ERM course (Appendix 1 A, HD1). Barret (2006) argued that there is a need for an education that enables us to interrogate the how of knowing. In this approach, we can gain some understanding of how teachers and learners are 'allowed to be' and how it is decided what is possible and permissible in education. In his discussion, Barrett (2006, p. 509) posited that "an emphasis on interrogating discursive production of experience and subjects is very much about becoming, and in particular, what environmental education has, and might, become".

A study by Hall and Burns (2009) on identity development and mentoring in doctoral education argued that using identity theory as a lens for understanding mentoring underscores the need for faculty mentors and administrators of education doctoral programmes to examine their assumptions about what it means to become a researcher. In this study, the ERM course was examined to understand how it enables students to become ESD practitioners. In the next

section, I focus on communities of practice, an ontological lens used in this study to interrogate the ERM course.

3.3 COMMUNITIES OF PRACTICE

The term Communities of Practice was coined by Lave and Wenger (1991). A community of practice is formed by people who engage in a process of collective learning in a shared domain of human endeavour. They share a concern or a passion for something they do and learn how to do it better as they interact regularly. Communities of practice are said to be everywhere and we all belong to a number of them such as at work, at school, at home and in our hobbies. They were developed as a theory for exploring the notion of situated learning within a particular domain of social practice (Lave & Wenger, 1991; Depres & Chauvel, 2000).

According to Lave and Wenger (1991) learning is situated that is, it is embedded within activity, context and culture. It is also usually unintentional rather than deliberate. Lave and Wenger (1991, p.35) called this a process of “legitimate peripheral participation”. This occurs as learners inevitably participate in communities of practitioners and master knowledge by moving toward full participation in the socio-cultural practice of a community (ibid, p.29). This implies that people learn new things not from the community but by being part of a Community of Practice.

A member negotiates his being in the community which entails a continuous interaction of gradual achievement of give and take. Communities develop their practice through a variety of activities, For example, Lave and Wenger (1991) in their ethnographic studies of the apprenticeship of Yucatec midwives, tailors, quartermasters and non-drinking alcoholics, argued that a new-comer learns from old timers by being allowed to participate in certain tasks that relate to the practice of the community. As time passes, the new comer will move from the periphery to the centre and become a full member of the practice Odeke-Epus (2009, p.68) citing joint participation and mutual engagement of learners and community members in Eco-School activities in Kenya noted that ““it is also possible that learning can start from mutual engagement between the newcomers and the old timers””.

Communities of Practice have three parts: domain, community and practice. Domain is a sense of joint enterprise (that which matters to people) that brings members together. This sense of joint enterprise creates identity and a shared domain of interest and a commitment to this domain. It has an identity defined by a shared domain of interest (e.g. radiologists, Star Trek fans, middle school history teachers, Seahawks football fans, etc.); it's not simply a network of people or club of friends. Membership implies a commitment to the domain. In this research the commitment is expected in the conservation of environmental resources; thus a person learns about conservation and develops a passion for the conservation of environmental resources.

A community as defined by Wenger (1998a) is a group of people who have a common interest in achieving something. They share ideas on the best way of achieving their common goal. Members engage in joint activities, they help each other and share information with each other in the pursuit of their joint enterprise. They belong to the participants in the community of practice because they are the ones who negotiate a response to the situation they will be facing (ibid. p.4). A community is only a community of practice if members interact on a regular basis and learn from each other about the best way to achieve their enterprise (Rock, 2005). In this research I wanted to understand how the members in the ERM course engaged with one another and, further afield, how they engage with the organisations involved with environmental management.

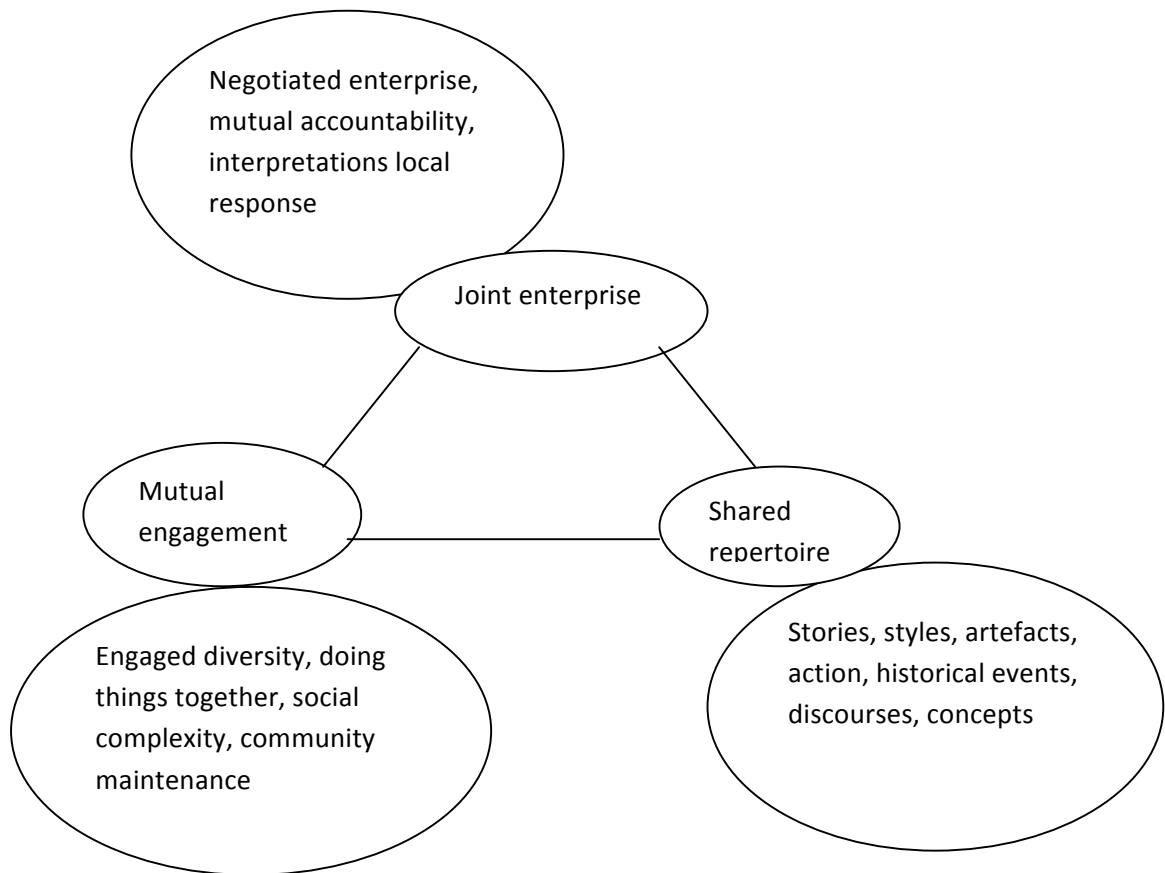
Members of a community develop a shared repertoire; they are practitioners in a particular aspect that is, practice. Wenger (1998a, p.79) summarised repertoire as “‘‘routines, tools, ways of doing things, stories, words, gestures, symbols, genres, action or concepts that the community has produced or adopted in the course of its existence, and which have become part of its practice’’”. Members of a community of practice are practitioners and sustained collective learning results in practices that become the property of a kind of community created over time by the sustained pursuit of a shared enterprise.

In a community of practice, people share ideas about the best way of achieving their common goal and thus a community is characterised by mutual engagement, joint practice and shared repertoire as summarised in Figure 3.3. According to Wenger (1998) ‘mutual engagement’ refers to a situation where members interact with one another not simply in the course of doing their work but to clarify that work, to define how it is done and even to change how it is done. Through this mutual engagement, members also establish their identities at work. Mutual engagement is also defined as “‘people who are engaged in actions whose meanings they negotiate with one another’” (Wenger, 1998a, p.73). There exists accountability in terms of negotiating actions. The community members could be heterogeneous but share routine words, tools, and ways of doing things, stories gestures, symbols that the community has developed over time and which have become part of its practice. Identity emerges as a form of individuality defined in respect to a community.

Wenger (1998a), referred ‘to joint enterprise’ as a goal that is shared by members of a community of practice as they respond to their situation irrespective of all the factors that might be beyond their control ‘Shared repertoire’ can be seen as “‘routines, tools, ways of doing things, stories, words, gestures, symbols, genres, action or concepts that the community has produced or adopted in the course of its existence, and which have become part of its practice’”.

The combination of these three elements constitutes a Community of Practice as illustrated in Figure 3.5. A COP is a small group of people that has worked together over time and has developed a common sense of purpose and a desire to share work-related knowledge and experience. This study sought to find out whether a common sense of purpose was seen in the ERM programme as lecturers taught the various subjects to enable the development of ESD practitioners. Learners were expected to become active participants in the practices of social communities and construct identities in relation to these communities. This was sought in an industrial attachment as students engaged with the stakeholders. Enhancement of this with more activity throughout the course will be important to the students as well reduction of the theory sessions and replacement with practical sessions. The camping exercise and field work were interrogated for sufficiency requiring more interaction on the daily activities of a student. I was also looking for instances where the government could enhance this by using students for data collection on a daily basis to monitor natural resources.

Figure 3.5: Dimensions of practice as the property of community



Adapted from Wenger 1998, p.73

This study engaged three types of communities; students, lecturers and stakeholders.

3.3.1 The student community

Community is defined as a body of people having common rights, privileges, or interests, or living in the same place under the same laws and regulations (Webster, 2010). The student community for this study comprised all the people registered by TU-K in the department of Earth Environmental Science and Technology taking a diploma course in ERM. This group has a common interest in environmental management and study according to the regulations of the institution within a specified period. People cease to be part of the ERM student community as soon as they complete their course. The students at TU-K form smaller communities depending on their selected course. This study engaged the community of ERM

students registered between 2006 and 2009. These students obviously belong to the wider TU-K community.

3.3.2 The lecturers' community

The lecturers' community comprises all those employed as teaching staff at the institution and who are specifically teaching ERM. They interact with the larger TU-K community on various issues but their main duty is teaching the ERM students. They form smaller communities depending on the faculty, the school and the department.

3.3.3 The stakeholders - community

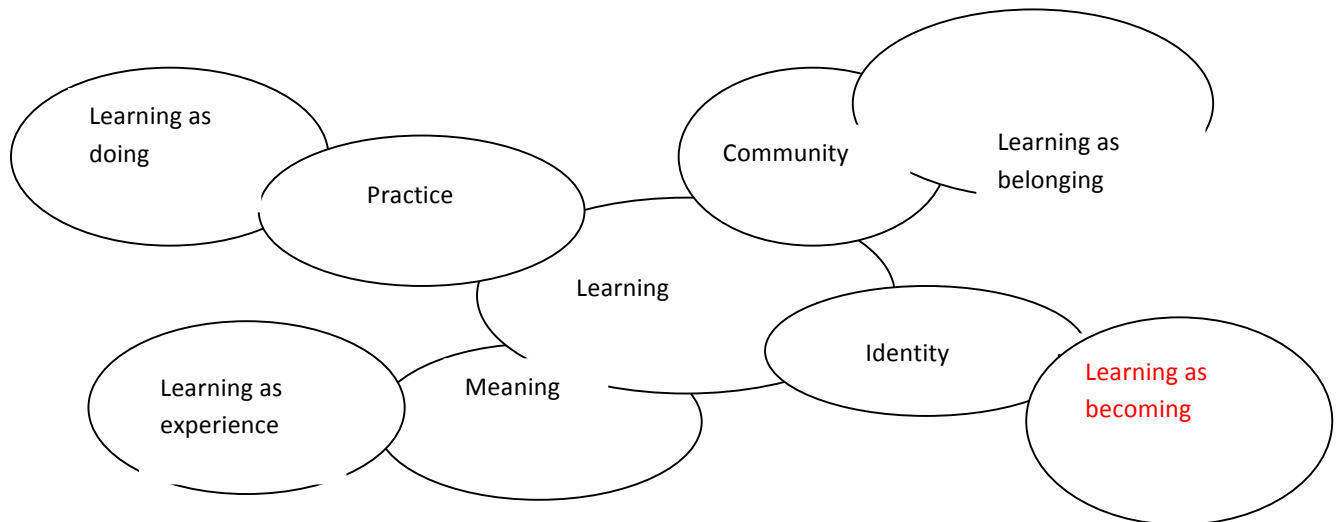
The stakeholders' community comprised the parents/guardians of the students and the organisations concerned with the conservation of natural resources in the country; the parents/guardians were involved in the payment of the student's fees and upkeep. This is the community concerned with the welfare of the students' study. The places that the students were attached to are also seen as part of the stakeholders' community. It was important for the students to get from this community experience and finally the places that offered jobs to these students at completion of their studies. Some of the students were already in employment and were training on 'the job'.

3.4 ELEMENTS OF WENGER'S THEORY OF LEARNING

According to Wenger (1998a) learning is fundamentally a 'socio phenomenon' where learners are active participants in the practices of social communities and construct identities in relation to these communities. Wenger claimed that the social theory of learning consists of four elements: **meaning, practice, identity** and **community** (see Figure 3.6). He explained each of the elements as follows: 'Meaning' as a way of talking about our changing abilities individually and collectively to experience the world as meaningful; 'practice' as a way of talking about shared historical and social resources frameworks and perspectives that can sustain mutual engagement in action; 'community' as a way of talking about social configuration in which social enterprises are defined as worth pursuing and in which participation is recognisable as competence and 'identity' as a way of talking about how learning changes who we are and how learning creates personal and social histories of becoming in the context

of communities and social practices. He claimed that these elements are deeply interconnected and mutually defining they can be switched in any of the four positions in the Figure without changing the meaning and the Figure would still make sense. This theory emphasises active participation for any meaningful learning to take place.

Figure 3.6: Elements of Wenger’s theory of learning



Adopted from Wenger (1998a p.5)

Wenger (2007) developed this further and argued that communities of practice are ways of promoting innovation, developing social capital, facilitating and spreading knowledge within a group, spreading existing tacit knowledge etc.

A commentary posted by On-Purpose Associates on their website: (<http://www.funderstanding.org>) inspired this study with regard to how Communities of Practice have an impact on education:

This approach to learning suggests that teachers understand their students’ communities of practice and acknowledge the learning students do in such communities. The communities of practice theory also suggests educators structure learning opportunities that embed knowledge in both work practices and social relations—for example, apprenticeships, school-based learning, service learning, and so on. Plus, educators should create opportunities for students to solve real problems with adults, in real learning situations.

In response to the above I ask rhetorically ‘Is this the case in today’s practice?’ Does the ERM course enable the students to solve real life problems encountered locally? Wenger (2006), in his analysis of the application of the concept communities of practice in education argued that the perspective of communities of practice affects educational practices along three dimensions: internally, externally and over the lifetime of a student. He explains the three dimensions as follows:

- *Internally*: refers to how to organise educational experiences that ground school learning in practice through participation in communities around the subject matters.
- *Externally*: refers to how to connect the experience of students to actual practice through peripheral forms of participation in broader communities beyond the walls of the school.
- *Over the lifetime of students*: that is how to serve the lifelong learning needs of students by organising communities of practice focused on topics of continuing interest to students beyond the initial schooling period.

From this perspective, Wenger (2006, p.4) argued that:

the school is not the privileged locus of learning. It is not a self-contained, closed world in which students acquire knowledge to be applied outside, but a part of a broader learning system. The class is not the primary learning event. It is life itself that is the main learning event. Schools, classrooms, and training sessions still have a role to play in this vision, but they have to be in the service of the learning that happens in the world.

Engagement with the community enables an ERM student to experience learning outside the classroom.

3.4.1 Communities of practice as the context for situated learning in ERM course at TU-K.

The ERM students participate in activities geared towards sustainable development in field excursions, industrial attachments and project research. In these cases they engage with the communities in sustainability management. In a community of practice information is developed through informal interactions with specialists to develop a common shared

understanding of events and action in dealing with events. For example in his seminal analysis of communities of practice, Sharp (1997a) stated that because of their personal interaction, face-to-face traditional communities of practice develop knowledge and understandings that go beyond their 'book learning' and formal certification in a trade. Through informal interactions with like specialists they develop new information about how to do their job and how to act in certain settings. Through collaboration a community of practice generates a common, shared understanding of events and an action orientation for dealing with such events the next time they arise.

On the other hand, situated learning is one of the models of social learning theory. This model suggests that learning is always contextualised:

The context and the activities through which learning takes place are an integral part of what is learned and the environment in which the learner engages in learning is an integral part of the learning experiences and shapes that which is learned' Benzie, Mavers, Somekh & Cisneros-Cohernour 2005,p.180)

The main characteristics of Lave & Wenger's concept of situated learning as per Altrichter's (2005) view are;

- Learning means engaging in the social world (Wenger 1998a; Hanks, 1991)
- Learning is situated (Lave, 1991)
- Learning occurs in and through communities of practice (Lave & Wenger, 1991 Hanks, 1991)
- Learning occurs in socially structured situations (Lave, 1991; Lave & Wenger, 1991)
- Learning involves formation of identity in communities of practice (Lave, 1991)
- Learning occurs through a process of 'legitimate peripheral participation' (Lave & Wenger, 1991; Hanks, 1991).

Wenger's theory, in order to give a social account of learning, explores in a systematic way the intersection of issues of community, social practice, meaning and identity (Austin, 2002). The concept of practice' as shaped up by the concept of '*participation*' is explored in this research owing to the focus of the study.

3.4.1.1 The concept of ‘practice’

Practice is one of the central ideas of Wenger’s understanding of learning as noted by Tusting (2005). According to Wenger (1998a), “‘practice connotes doing, but not just doing in and of itself. It is doing in a historical/social context that gives structure and meaning’”. The practice itself makes a community of practice a community of practice and researchers using communities of practice should take care not to replace practice with communities (Duguid, 2005). In this study the practice is in activities that the students engage in the course of their study so as to become Environmental Resource Management practitioners.

3.4.1.2 Participation as a key concept to negotiating meaning in practice

Wenger (1998a, p.52), defined meaning as “‘an experience that is located in the process of negotiation of meaning... and negotiation of meaning involves interaction of two constituent processes called participation and reification and these are fundamental to the human experience of meaning and thus to the nature of practice’”.

Participation emanates from the interaction amongst people as they take part in a practice within a community of practice (Wenger, 1998a). Against this background, this study focused on exploring participation as it constitutes practice in the context of the ERM framework in their respective organisations. Essential characteristics of cross-functional communities of practice pointed out in this definition are:

- They are not defined by organizational mandate (e.g., the ‘organization chart’), but rather by the ways people actually work together;
- They involve many different ‘roles, as opposed to a flat structure; and
- They experience an ongoing flux of community members, who enter the community from the periphery and gain status as knowledgeable members through participation in the community of practice.

This finding is particularly important in the context of this study because it accommodates the diversity of actors and practitioners in environmental resource management/natural resource management that the students and graduates of the ERM course get to interact with in the course of study and in real work contexts.

Wenger (1998a) stated that placing the focus on *participation* means that learning is an issue of engaging in and contributing to the practices of their communities for *individuals*, refining their practice and ensuring new generations of members for *communities*, and sustaining the interconnected communities of practice through which an organization knows what it knows and thus becomes effective and valuable as an organization for *organisations*.

Wenger's article *Communities of practice; The Social Fabric of a learning Organization* (1998b, pp.4-5) reinforced the importance of the concept of participation in negotiating meaning in practice by asserting that:

- “Learning is a matter of engagement in practice”. He maintained that the experience of identity is a matter of competence, of being able to participate in socially defined activities and to contribute to a community and its enterprise.
- “Learning reflects our participation in communities of practice”. He noted that, learning is a matter of engagement in socially defined practices, the communities that share these practices play an important role in shaping learning (Wenger, 1998b, p.4)

3.4.1.3 The concept and process of ‘legitimate peripheral participation’ and situated learning

Wenger (1998b) in his paper *Communities of practice; Learning as a social system* broadly argued for the need to legitimise participation. He stated that:

Organisations can support communities of practice by recognizing the work of sustaining them; by giving members the time to participate in activities; and by creating an environment in which the value communities bring is acknowledged. To this end, it is important to have an institutional discourse that includes this less-recognized dimension of organizational life. Merely introducing the term "communities of practice" into an organization's vocabulary can have a positive effect by giving people an opportunity to talk about how their participation in these groups contributes to the organization as a whole.” (Wenger, 1998b, p. 7).

The concept of legitimate peripheral participation as used by Wenger (1998b) to characterise learning, broadens the traditional connotations of the concept of apprenticeship from a master/student or mentor/mentee relationship to one of changing participation and identity transformation in a community of practice. Odeke-Epus (2009, p. 68) commented that Lave and Wenger understood social learning as a ‘situated activity’ through the notion of legitimate peripheral participation. He observed that they explain legitimate peripheral participation in the sense that “...learners inevitably participate in communities of practitioners and the mastery of knowledge requires newcomers to move toward full participation in the socio-cultural practice of a community” (Lave & Wenger, 1991, p. 29 was quoted by Odeke-Epus 2009). This implies that people learn new things not from the community but as part of being a community of practice (Smith, 2007). Lave & Wenger (1991, p.55) state that “legitimate peripheral participation refers both to the development of knowledgeable skilled identities in practice and to the reproduction of and transformation of communities of practice”. Odeke-Epus (2009, p.68) referring to Eco-Schools in Kenya noted that it is also possible that learning can start from mutual engagement between the newcomers and the old timers.

Lupele (2007), in his study on learning as it happens amongst the members of the Course Development Network (CDN) in environmental education, established that sharing of the lived experience of the members acted as a learning curriculum to members. However an ethnographic study of 14 high school students’ experiences who worked for an environmental management organisation which was run by the Institute of Ecosystem Studies in America indicated that the power dynamics between the novice and the experienced hindered the learning of the new-comers (Hogan, 2002). Another study carried out in the UK on the experience of doctors that were training to become general practitioners also indicated that being on the periphery was not necessarily conducive to learning (Cornford & Carrington, 2006). This suggested that participatory and mutual engagement throughout the learning process should be further explored in this context. This study was an attempt to explore participatory and mutual engagement of ERM course students at TU-K and the natural resource management community in different organisations through some ERM course processes and practices. These processes and practices were important to the contextualisation process.

Hodkinson & Hodkinson (1999) argued that legitimate peripheral participation concerns newcomers. Newcomers act from the periphery before they get to the centre stage in an enterprise. This research was informed by this notion in establishing how students become full members of the community of practice. In this study the community refers to the place where learning takes place. The practice is their concern for the environment and therefore the practice are those activities they engage in as environmental conservationists. I wanted to establish how they become full members, the experience they brought about and how they adjusted to fit into the community. (Wenger 2007, Hodkinson & Hodkinson 1999).

Members of a community of practice join a community with experience from elsewhere; this experience refers to “habitus” as used by Bourdieu (Hodkinson, Biesta and James 2007). The habitus idea was explored among the lecturers and students engaged in the ERM course. Brown, Collins & Duguid (1989) developed situated learning theory further to emphasise the idea of cognitive apprenticeship; they argued that cognitive apprenticeship supports learning in a domain by enabling students to acquire, develop and use cognitive tools in authentic domain activity and that their learning, both outside and inside school, advances through collaborative social interaction and social construction of knowledge.

Situated learning is related to Vygotsky’s notion of learning through social development. Vygotsky regarded education as a quintessential socio-cultural activity and he considered the capacity to teach and to benefit from instruction, a fundamental attribute of human beings. He argued that if the adult does not take the child in tow, making him the object of pedagogy, the child would never become an adult. Communities of practice are connected to the rest of the world and those that belong to a community of practice relate to this world and learn from it (Wenger, 1998a). In this study the researcher explored the organisations and institutions that are linked to TU-K and how they work as a community of practice. Work place learning, a social theory that explores “habitus” and “field” as used by Bourdieu informed the study (Hodkinson, et al, 2008).

In concluding this section, I was inspired by David Stamp's cover story in the Training magazine entitled 'Communities of Practice: Learning is Social, Training is Irrelevant?'

Learning and innovation happen on the job every day. That much we know. The question is, can the ideas bubbling up around communities of practice be used to map a strategy for moving away from the artificial 'training curricula' we have today to 'learning curricula' that reflect the way work - and learning - really happens?

This research investigated how the students and lecturers engaged in ERM course as a community of practice within the institution and the wider world to promote ESD. This was through exploring the common activities of members of the community of ERM (where the graduates end up) for economic wellbeing as well as for environmental/ecological sustainability and social justice (in accordance with the pillars of sustainable development as defined in international implementation scheme of the DESD). The study further sought to look into ways through which the students in the ERM course at TU-K mutually engage with the community and establish their identities at work to manage natural resources in a sustainable manner by addressing the environmental issues, risks and associated sustainable development challenges facing the community through a learning process.

Sustained collective learning results in practices that become the property of a kind of community created over time by the sustained pursuit of a shared enterprise (Wenger 1998a, p. 45). A member negotiates his being in the community; negotiation entails a continuous interaction of gradual achievement and of give and take. There are three dimensions for association and practice in the community: a mutual engagement, a joint enterprise and a shared experience. Membership of a community is a matter of mutual engagement and it is this mutual engagement that defines the community. There exists accountability in terms of negotiating actions. The community members could be heterogeneous but share routine words, tools, and ways of doing things, stories, and gestures, symbols that the community has developed over time and which have become part of its practice. Identity emerges as a form of individuality defined with respect to a community.

3.5. APPLICATION OF WENGER’S THEORY TO LEARNING ERM

The first component in Wenger’s theory is meaning. This enables us to see learning as experience. As the students engage in the ERM course, they learn by experience to become practitioners in matters pertaining to environmental resource management. It is expected that as the students enter first year they have little knowledge on sustainability. When they exit the system, they should have become competent in environmental resource management and should be confident to engage with sustainability issues. They have also worked with other people concerned with environmental resource management and by the time they graduate from the ERM course, they belong to a number of organisations that are dealing with environmental conservation.

Identity provides a way of discerning learning as becoming. The students at the entry point have some knowledge, skills and competencies necessary to manage the environment from their primary and secondary school education. Engagement in the ERM course enables them to understand who they were and who they are becoming. This they will realise as they go through the course engaging in classroom lectures, field excursions, an industrial attachment and projects. There ought to be a change in the students’ perspective.

3.6 LEARNING AS A PROCESS OF BECOMING

Prescribed curricula for TVET courses emphasise acquisition of skills (job specific and transferable) along with underpinning knowledge to ensure their appropriate deployment in the workplace. Textbooks used for courses on teacher education in further education have for many years presented learning as an individualised, mainly cognitive process and have drawn upon a set of specific psychological theories of learning and motivation to inform teachers about it (Colley et al; 2003; Castling 1996; Reece & Walker, 1992; Curzon, 1990); however they all seem to lack a sense of learning as becoming. Various studies have shown that education, for example, environmental education co-exists with continued environmental challenges (Sterling, 2003). I take this to imply that the learners do not become what they learn in college or there are underlying factors contributing to environmental challenges; what is clear is that currently we have more graduates in environmental studies than ever

before and yet environmental resource degradation is worse than ever before. We need an approach that will make a difference and reduce environmental challenges.

This research conceptualised vocational learning as a process of becoming an ESD practitioner through an ERM diploma programme at TU-K. Lave and Wenger (1991) argued that the learner identifies with his workplace and learns from the periphery the roles and the tasks he has to perform (see Section 3.3.1.3). According to Wenger (1998a, p.52), participation is the key concept to negotiating meaning in practice. Wenger defined meaning as “‘an experience that is located in the process of negotiation of meaning... and negotiation of meaning involves interaction of two constituent processes called participation and reification which are fundamental to the human experience of meaning and thus to the nature of practice’”. Formal education therefore becomes relevant to enable the student understand the relevant theories.

According to Wenger (1998a) participation emanates from the interaction amongst people as they take part in a practice within a community of practice. They conceptualise the process as one of legitimate peripheral participation in ‘communities of practice’. They argue that it is the social participation rather than cognitive acquisition, which enables newcomers to learn from more experienced practitioners and it is intimately bound up with the social context in which it is situated. I think that participation alone in a community of practice may result in lack of the technical skills that one acquires in formal education as a process of becoming. A person can acquire necessary technical skills from formal education, which can thus be seen as complementary to social learning.

Colley et al., 2003 argued that immersion in the social, cultural and emotional aspects of work are central to learning and becoming is a crucial part of this process. Learning as becoming is one of the many theories that are gaining ground in the field of vocational Education and Training, as proposed by Colley and others in their three cases of Transforming Learning Cultures in Further Education. They argued that learning is a process of becoming because learning cultures and the vocational cultures in which students are steeped, transform those who enter them.

Participation is not sufficient; formal education plays a role in the becoming process. Thus people are not inherently suitable for particular jobs; rather people, through formal education and later participation, learn to engage in particular jobs. Despite Wenger's emphasis on workplace learning I feel there is need for formal education. In the classroom vocational learning is actively constructed by teachers and students. The classroom construction is influenced by notions and structures which affect the teacher's pedagogy (Colley et al, 2003).

Colley et al., 2003, developed the concept of habitus to explain a central aspect of students experience as they have to orient to a particular set of dispositions both idealised and realised. It is argued that prepositions related to gender, family background and a specific location within the working class are necessary but not sufficient for effective learning. Vocational habitus reinforces and develops these in line with demands of a workplace. Vocational habitus involves developing a sense of how to be and sensibility, learning is seen as identity transformation as explored by early sociological studies of occupational socialisation. The sociologists present it as a relatively passive and once and -for- all absorption of the individual into the prevailing culture of workplace and the norms of a particular role (Coffey & Atkinson, 1994; Killeen, 1996 as quoted in Colley et al., 2003).

In formal education the hidden curriculum can be obscured. This emerged from two studies in the United Kingdom in metalwork and healthcare. The 'hidden curriculum' for metalwork could be considered as adjustment, conformity and submission to superiors, while in healthcare it comprised of idealised devotion to caring for others, conformity to hierarchical work relations and a willingness to abnegate one's own interest especially regarding wages (FENTO, 2003). These aspects do not come out in the curriculum; they are learned in the workplace.

3.6.1 Understanding learning as a process of becoming

The aspect of learning as transformation has been explored as identity transformation by early sociologists in areas of occupational socialisation. They explored adjustment after direct

entry into the labour market and tended to represent it as a relatively passive and once-and-for-all absorption of individuals into the prevailing culture of a workplace and norms of a particular role (Coffey & Atkinson, 1994; Killeen, 1996). More recent theories of work adjustment have drawn on economic theory to advance notions of psychological contract to explore processes of negotiation and behaviour between employee and employers. But these have not considered the relationship between vocational learning and identity, and again they are relevant to workplace situations rather than further education.

In this research my interest was to understand ways cultural approaches have been used to understand learning in the context of a TVET programme. The studies carried out previously such as Bates (1984), discussed the role of vocational curricula and careers education in school as a form of anticipatory socialisation prior to labour market entry that seeks (with varying degrees of emancipation or controlling intent) to promote young peoples' adjustment to the general demands of employers for a disciplined workforce, or to the limited range of opportunities on offer to them. Willis (1997) presented a more active concept of socialization in relation to compulsory schooling and general processes. However these studies consider compulsory schooling rather than vocational training.

Lave and Wenger (1991) advanced the concept of learning as participation in the workplace; they conceptualised the process as one of legitimate peripheral participation in communities of practice. They argued that it is social participation rather than cognitive participation which enables newcomers to learn from more experienced practitioners and this is intimately bound up with social context in which it is situated. Immersion in the social, cultural and emotional aspects of work is central to learning.

I was inspired by this quote from Lave and Wenger (1991, p., 53): "Learning thus implies becoming a different person with respect to possibilities enabled by these systems of relations. To ignore this aspect is to overlook the fact that learning involves the construction of identities...identity, knowing and social membership entail one another..."

Particular forms of learning (or occupation) may attract people from similar backgrounds or with similar dispositions: "Communities of practice consist of and depend on a membership,

including its characteristics biographies/ trajectories, relationships and practices “(Lave & Wenger, 1991, p.55).

Such a view challenges the essentialist idea that certain people are inherently suitable for certain jobs. A cultural or situated perspective on learning allows us to ask more complex questions about how learners are prepared to enter occupations or are diverted from them:

- What is it that makes learners feel they are suited to a particular job?
- What are their experiences of the community of practice they seek to enter?
- How does their sense of identity change as they become members of that community?

These questions are directly relevant to the experience of learning in the site researched. However, Lave and Wenger’s exclusive emphasis on the authenticity of workplace learning means that they tend to dismiss the value of learning in more formal educational settings such as Further Education (Colley et al. 2003).

Frykholm and Nitzler (1993) considered learning as an active process of becoming, but in the context of formalised courses. Their study of vocational and career education in a Swedish secondary school, drawing on the theories of Bourdieu and Bernstein, treated the issue of identity as central. Their analysis directly challenged the assumption of TVET curricula and Further Education National Training Organisation (FENTO) standards as they suggest that: vocational teaching is characterised more by socialisation than by qualification, i.e....it is more a question of transmitting dispositions and attitudes than of giving the knowledge and skills required for specific tasks”.(ibid.,1993, p.,436). Further they reckon that ‘notion’ has a very powerful influence on learning, on identity even in the classroom. . Notions comprise both subjective and structured aspects of the ways in which people organise and bring meaning to their surrounding world including work and occupation. In the classroom, vocational learning is actively constructed by teachers and students, determined in part by the dominant structures of thought that prevail in particular employment sectors and particular occupational levels within those sectors. Teachers adapt their pedagogy to the habitus (rather than general ability level) of their students, but at the same time students’ habitus is informed by vocational notions which also influence teachers’ discourse.

The studies on metalworkers and healthcare workers described previously revealed a hidden curriculum in the sense that what was expected of these workers is not necessarily what they covered in the curriculum. For the metal worker the expectations are: adjustment, conformity and submission to superiors, while for a healthcare worker: idealized devotion to caring for others, conformity to hierarchical work relationships and a willingness to abnegate one's own interests especially regarding wages. These factors are normally obscured by curricula with specific objectives of technical knowledge and skills.

The study by Frykholm and Nitzler (1993) investigated school settings rather than formal education. Colley et al (2003) investigated a combination of college courses and workplace experiences. My study investigated a technical course on sustainability which trained students to work in various work places on environmental issues.

In the context of post compulsory TVET, (Bates 1991, 1994a) had challenged the view that learning consists of skills and knowledge acquisition. She argued for job suitability. Her study of a youth training scheme for girls going into care of the elderly showed how the scheme effectively selected and then further sifted and acculturated the trainees. The system sifted out the unsuitable ones until the ones who were left felt that they were the most suitable for the job. Bourdieu (1986) terms this the choice of the necessary. Similar analysis has been used in individual case studies of fashion design course (Bates, 1994b), a catering course (Riseborough, 1994a) and a bricklaying course (Riseborough 1994b). Hodkinson et al (1996) utilised the concept of vocational notion analysing the interplay of habitus and field, their study of ten young people moving from school into vocational education training was primarily concerned with the process of career decision making rather than that of learning itself. Colley et al (2003) presented a contribution to understanding the process of learning in vocational education training by offering a comparison of three different vocational courses in further education based on in-depth insights into teaching and learning in each site. They sought to refine further the theoretical concepts of identity transformation in relation both to learning cultures and the vocational cultures with which they are associated. This study looked at a multi-disciplinary sustainability course to understand how the learners find identity and become sustainability officers in a variety of fields.

At the end of the ERM diploma course the graduate becomes an environmental resource manager. This graduate can be absorbed into a wide range of organisations because the training is not limited to a specific organisation; his/her skills range from garbage management to landscaping to making policy decisions on environmental issues (Section 6.4.2).

3.7 CHALLENGES IN APPLYING WENGER'S FRAMEWORK

According to Maistry (2008), Wenger's model does not recognise the role of the teacher and the model sees a community of practice as the only way of learning, so it lacks pedagogic aspects. She further argues that the model will not enable one to explain the interaction of the teacher in the class. Although the students can form a community of practice they need knowledge from an expert to guide them through the course. Thirdly, the model does not give sufficient attention to wider social and economic inequalities within which participants in a community of practice are embedded because it does not offer sufficient insight into understanding inequalities and disadvantages that may be peculiar to individuals within a community. In most communities there will be differences emanating from the geographical location, ethnicity etc. The challenge that Wenger's framework presents is to incorporate the broader issues of social and economic inequalities that may exist beyond the actual site of learning, fully into the analysis of learning. In every region there are social and economic inequalities.

In this research these differences are not addressed as the research was interested mainly in how the course enables the students to become practitioners, regardless of their economic and social background. In the TU-K institution these differences should not play a part in influencing how learning takes place. If the inequalities are put to the fore then learning may become difficult. Although I agree that one's background may have an impact on how one learns and how one teaches, this was not a concern of this research. The intention of this study was to explore how things are done to enable practitioners in a collective way without looking into individual differences. I support peripheral participation as a way of learning for environmental management and thus I discuss legitimate peripheral participation as one of the approaches used to learn ERM (Sections 6.3, 6.4 and 6.6). One aspect that needs to be addressed in Wenger's theory is how learners acquire the theoretical aspects of the skills and knowledge of the trade. This is the aspect that is addressed in formal education and

particularly in HEIs. This study argues that the formal schooling must be combined with the social learning for the student to become an effective Environmental Resource Manager. The study argues that this aspect is addressed in the fieldwork, attachment and trade area projects as presented in Chapter six. There are tensions and contradictions in the lecturer and student activity systems that challenge the learning activity and therefore require solving for the system to enable a practitioner in conservation to emerge. Therefore in the next section I describe Cultural Historical Activity theory and explain how this theory enabled me to surface these tensions and contradictions in the activity system. The aim of this is to enable change in the system so that ESD practitioners emerge.

3.8 CULTURAL- HISTORICAL ACTIVITY THEORY (CHAT) AS A METHODOLOGICAL AND ANALYTIC TOOL FOR ERM PRACTITIONERS

3.8.1 Introduction to CHAT

According to Engeström (2001, p.133) any theory of learning must answer at least four central questions:

- Who are the subjects of learning, how are they defined and located?
- Why do they learn, what makes them make the effort?
- What do they learn, what are the contents and outcomes of learning?
- How do they learn, what are the key actions or processes of learning?

Cultural Historical Activity Theory (CHAT) provides a robust conceptual framework, both epistemologically and methodologically for analysing and exploring an environmental resource management course that is training students to become ESD practitioners. CHAT also offers a broad approach and provides opportunities for expanded learning opportunities for learners in an activity system (Engeström, 2001). According to Murphy and Rodriguez-Manzanares 2008 p. 453):

One of the strengths or advantages of Activity Theory is how it offers a broad lens of inquiry that encompasses various aspects of the educational setting such as students' and teachers' backgrounds and perspectives, the whole institution setting, and the evolution of the activity system over time.

Therefore this research found it appropriate to use Activity Theory in analysing the ERM course and how students learn as a social engagement in an institution system to become environmental resource managers. CHAT is a theory of learning and development that was developed by Engeström based on the work of Vygotsky and his Russian colleagues Leont'ev and Luria (Roth & Lee, 2007). The CHAT theory was informed by the classic German philosophies of Kant and Hegel, Marx and Engels (Engeström and Miettinen, 1999; Quek & Alderson, 2002). In CHAT, knowledge is viewed as contextual and transformative and is generated through a process of reflexive investigation; collective activities are purposefully conducted towards a common object and learning. Edwards, (2005b, p. 50) defined learning as “concerned with within –person changes, which modify the way in which we interpret and may act on our world... and in turn change it by our actions”. The learning is facilitated by the conceptual and material tools which help the learner to understand the object better.

According to Engeström an activity system is heterogeneous and multi-voiced (Engeström, 1987, 1999, 2001 and 2005) because subjects construct the object of the activity system in different and conflicting ways due to perspectives which are informed by their histories and positions in the division of labor. ERM course development and implementation was therefore explored to understand both the student and lecturer activity system and how the course was understood in the broader system of ESD. In this section I shall describe the activity theory through its three development generations. Although I have used the second and third generations as units for data analysis, the second generation has been used to understand the history and the implementation of the ERM course and the third generation to highlight the contradictions in the initiation and implementation of the ERM course. It is also necessary to discuss the first generation activity theory as it provides the foundation for the other two and the subsequent generations build on this. It was also necessary to understand the interrelationship of the three generations and how they have developed thus far. In the following section I discuss the three CHAT generations and how my research borrowed from each.

3.8.2 First generation CHAT

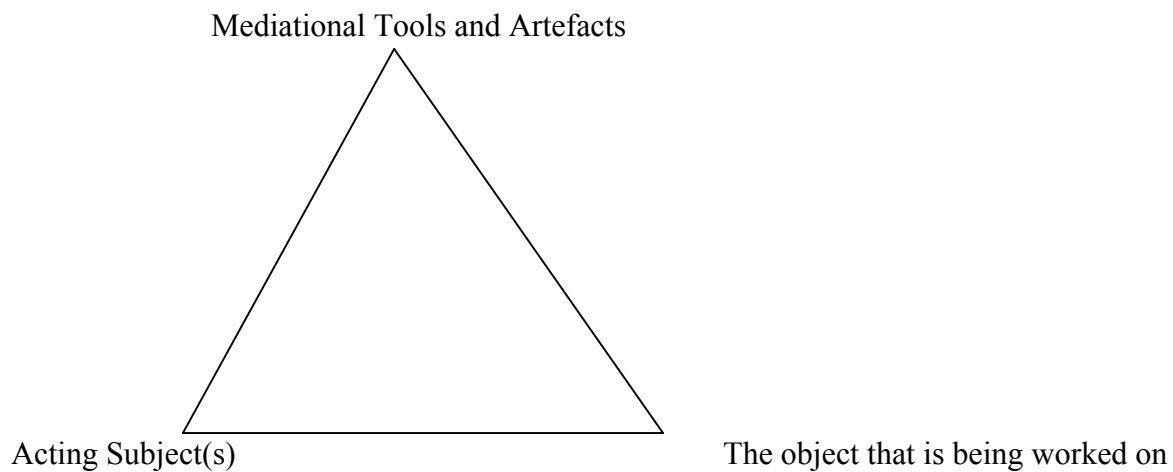
Engeström (2001, p. 134) summarised the development of activity theory as follows:

Cultural-historical activity theory was initiated by Lev Vygotsky (1978) in the 1920s and early 1930s. It was further developed by Vygotsky's colleague and disciple

Leont'ev (1978, 1981). Activity theory has evolved through three generations of research (Engeström, 1996). The first generation, centered on Vygotsky, created the idea of mediation. This idea was crystallized in Vygotsky's (1978, p. 40) famous triangular model in which the conditioned direct connection between stimulus and response was transcended by 'a complex, mediated act.

Vygotsky's idea of cultural mediation of actions is commonly expressed as the triad of subject, object, and mediating artifact as presented in Figure 3.5. According to the previous quote, the first generation was developed by Vygotsky and Leont'ev consisting of a triad: subject, tool and object conception of activity system on the symbolic mediation of culture analysing the relationship between human action (individual and cultural artifacts (tools). He argued that people learn from their culture and history by applying its conceptual structure and material to transform the object (Edwards, 2005a). Leont'ev shifted the focus from mediation tools to the object in the triad and argued that activities are motivated by their object, resulting in revealing the object-oriented nature of learning and doing. This model shows how one can use the mediational tools and artifacts to trigger thoughts on the object that is being worked on. The model can also be used to solve problems by understanding the cultural and historical mediational tools and artifacts.

Figure 3.7: A basic mediational triangle



Adopted from Edwards (2005, p.5)

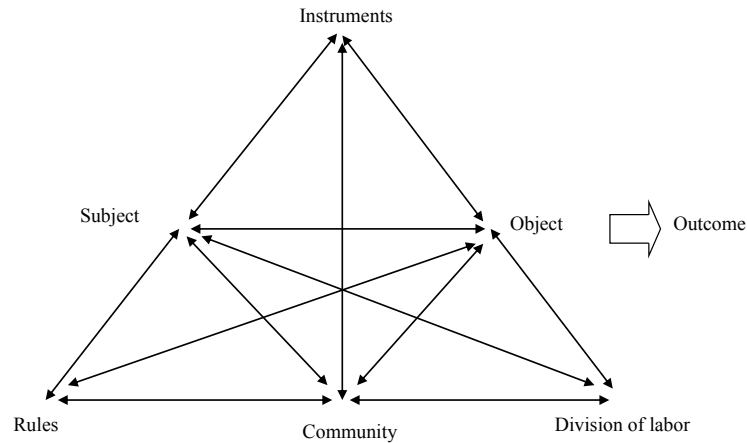
This first generation CHAT may be applied to the learning on the ERM course by taking the students as the subject using various tools such as the syllabus, lectures, textbooks and other tools for learning to become ERM practitioners, which in this case may be seen as the object. In this case then the interest would be on the syllabus, textbooks and other tools as they mediate the relationship between the students and the object.

3.8.3 The second generation CHAT

The second activity theory was developed by Engeström based on the work of Leont'ev and the first generation activity theory. The second-generation activity theory adds more components to the triad, creating a triangle of 'mediates' by infusing social relationships: adding the community rules and division of labor. The importance of the second generation CHAT was that it brought interrelations between individuals and his/her community into focus (Daniels, 2001). The activity process societal structures and subjects go through a transformation process to become new individuals with better characteristics (Engeström, 1999). A model developed by Cole and Engeström (1999), was used to illustrate interrelationships in a learning institution. The activity system model (Figure see 3.2) incorporates various mediation means within which the subject and object relationship including cultural artifacts (tools and signs), community, divisions of labor and rules interact. In the model the individual action (subject, object, and tools) relates to the larger cultural and historical context by the relationships represented by the other triangles. Engeström (1999,

2000, and 2001) thus expanded the activity system to include community, rules and division of labor (see Figure 3.8).

Figure 3.8: Second generation human activity theory model



Adopted from Engeström, 1987, p.178

An activity system is therefore made up of: subject, object, tools/instruments, community and division of labor. All these structural components combine to produce an outcome. These are the structures that can both enable and constrain the learners in the activity system as their engagement is mediated by these structural and socio-cultural dynamics in order to achieve an outcome (Engeström, 1999, 2001; Roth, 2004, 2007; Edwards, 2005b). Outcomes (e.g. becoming a practitioner in environmental resource management in the community that show evidence of action competence development), can be brought about by features of the learners themselves (i.e. characteristics of the subject), the nature of the objects that motivate their participation, the mediating tools they use (e.g. what conceptual and material facilities they use to support them), the community of which they are part (their peers, lecturers, parents/guardians, and others), the rules that pattern their learning(e.g. norms and rules in the institution and community related to conservation), and the division of labor (how tasks are divided in the institution and who does what) (Engeström, 1987, 1999; Edwards, 2005; Roth et al., 2004). These structural elements of an activity system form nodes of an activity system (Russell & Kelly, 2002). I shall explain each of these nodes showing how I drew on each for this study.

- The subject of an activity system is the individual or group whose viewpoint is adopted. In this case TU-K representatives include the senate, the board governing the institution, the administrative staff with their various roles, the lecturers with their

various roles and activities. The subjects in this case are all those that facilitate the student at the institution right from the point of admission to graduation. These will include all the administrative staff with their various roles, the lecturers with both their administrative and teaching responsibilities and the subordinate staff with all their responsibilities, i.e. all staff that make it possible for the student to enter the institution as a trainee and leave as a graduate to join the world of work. I did not work in detail with all the subjects but concentrated on those engaged with the students directly to enable them to become practitioners in ERM and help them gain diploma certificates.

- Object “refers to the ‘raw material’ or ‘problem space’ at which the activity is directed and which is moulded or transformed into *outcomes* with the help of physical, symbolic, external and internal tools” (Engeström, 1993, p. 67). It precedes and motivates activity. In this case the TU-K students who are being moulded and transformed to the desired practitioners in the community on environmental matters or issues are regarded as the outcome. The object is sustainable development. In this case the larger community where they will have to work after completing their studies will be the beneficiaries of the competent workers. Students are not passive as they go through an institution. Therefore the products or the outcomes should not be viewed as passive empty containers to be filled up with knowledge and skills but partners in the activity system; they actively participate in learning to become what is expected of them by the community. The students have their own contributions to make but the bottom line is that they are regarded as the product of an academic activity system to work in various areas. An academic activity system devoid of students ceases to be an activity system because the administrative staff, the lecturers and subordinate staff become jobless without students. The main interest of the academic activity system is the students and therefore the outcome of the activity system. For this case the training is for the management of the environment whose ultimate goal is sustainable development. The aim of the course is to train personnel to manage environmental resources sustainably, which will ultimately sustainable development.
- Tools/ instruments mediate the object of activity. They can be external, material (e.g., a textbook a computer) or internal, symbolic (e.g., language). Tools take part in the

transformation of the object into an outcome, which can be desired or unexpected. They can enable or constrain activity. In this case the tools are all the instruments and the equipment in TU-K that the lecturers, students and others in the institution use to mould the students to become what is expected. The students interact with various tools and equipment in the process of their learning to become practitioners in environmental resource management. These tools include the laboratory equipments, the vehicles etc.

- Community refers to the participants of an activity system, who share the same object. In this case all the people that work with the lecturers and students to facilitate the learning of those entering the institution for this purpose. In summary the students in becoming ESD practitioners interact with various communities in the process of learning. These communities assist in their becoming the expected practitioners by training them and later accepting them as members of an enterprise in resource management the community also includes the other learners in the system ranging from classmates to the entire institution community, the lecturers, the institutions and organisations that offer places for research and attachment etc.
- The division of labour involves the division of tasks and roles among members of the community and the divisions of power and status. In this case this involves all the administrators and those who make it possible for the students to learn in the institution. The tasks that have to be performed to enable the learner to become include the administration staff,; admissions and registration, the heads of the various departments that the learner has to interact with, the lecturers, the examination processors, the other learners holding certain authoritative positions etc.
- Rules are explicit and implicit norms that regulate actions and interactions within Systems (Engeström, 1993; Kuutti, 1996):
The rules refer to explicit and implicit regulations, norms and conventions that constrain actions within the activity system. The overall importance of this model of a second generation activity system is the recognition that all outcomes are determined by a complex mix of culturally and historically derived mediating influences, which comprise mental models held by each individual (subject) and more widely socially embedded influences within the community of which each subject is a part. There is a constant dynamic interaction between the internal and external mediating influences” (Sandars, 2005, p. 194).

According to the above all outcomes are determined by a complex mix of culturally and historically derived mediating influences, the rules and regulations in this case have been influenced by the history and culture of the TU-K activity system. The institution has the rules and regulations for every student entering the system in order to complete their studies and be awarded diploma certificates. There are rules dealing with admissions and registration. The students need to make applications at certain times, register at a given time with various conditions and attend classes as expected by the given course. There are rules and regulations, which are part of the course itself, and even class attendance has its own rules and regulations. Students have to make sure that their activities do not contravene the rules and regulations set by the institution, or they will be suspended and not be able to complete the course.

In the model as presented in Figure 3.4, the subject refers to the individual or sub-group whose agency is chosen as the point of view in the analysis. The object refers to the raw material or

problem space at which the activity is directed and which is molded and transformed into outcomes with the help of the physical and symbolic external and internal mediating instruments including both tools and signs (University of Helsinki, 2009).

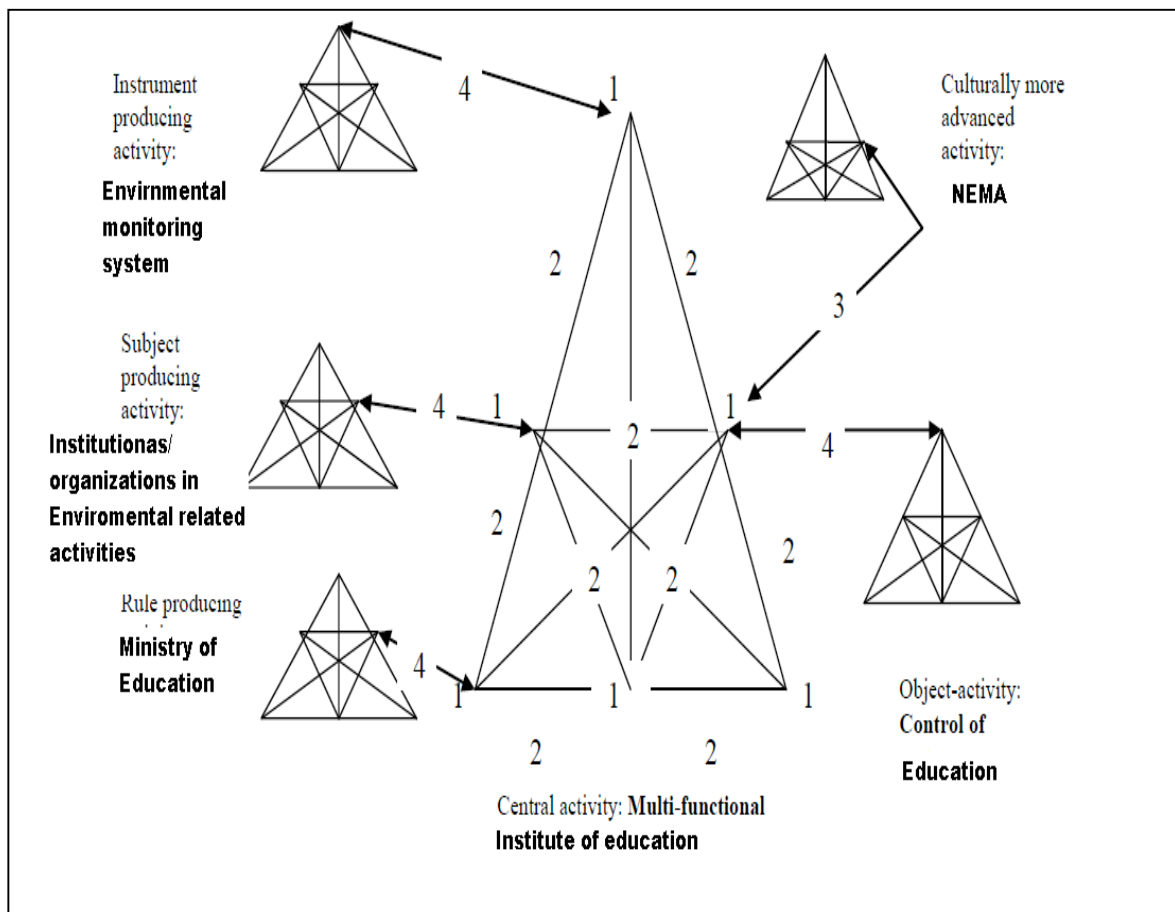
In this study, the subjects of the activity system are the students in the ERM course. The community involved was the student's classroom, the university, the organizations and institutions where they are employed and other stakeholders' i.e. the government, parents and guardians. The mediating artifacts include the language of communication, their teaching facilities and materials. The objects are the officers enhancing conservation and in a broad sense, education for sustainable development. The outcome represents the new learning communities who live in a sustainable way with their environment and influence their communities to be sustainable.

3.8.4 Third generation CHAT

Third generation activity theory was developed by Engeström and focuses on the interaction between different activity systems that exists when there is more than one activity system of the second generation and there is interaction between the activity systems (Edwards, 2005b was quoted by Mukute, 2010). An activity system does not exist in a vacuum; it interacts with

a network of other activity systems (University of Helsinki, 2009). This means that an activity system is affected by other activity systems from outside and these may cause an imbalance. The activity system is constantly working through contradictions within and between its elements. In this sense, an activity system is a virtual disturbance and innovation-producing machine. Figure 3.9 is an illustration of the networks of activity systems as I visualised them in the ERM learning environment.

Figure 3.9: Third generation activity theory: Idealised network of activity systems



Source: Adapted from Engeström (1987, p. 89)

In recent literature the nature of the interactions seems to have shifted from the notion of central activity system interacting with others to that of a number of activity systems that are in interaction and have shared object (see Figure 3.10) learning between such systems. This involves boundary crossing as seen in institutions of higher learning where there are linkages and collaborations among the academic institutions and other organisations. In this research

the networks are seen in the system of education in the country, curriculum preparations, the attachment period, the fieldwork, the research for trade area projects etc.

Figure 3.10: Two interacting activity systems as minimal model for the third generation

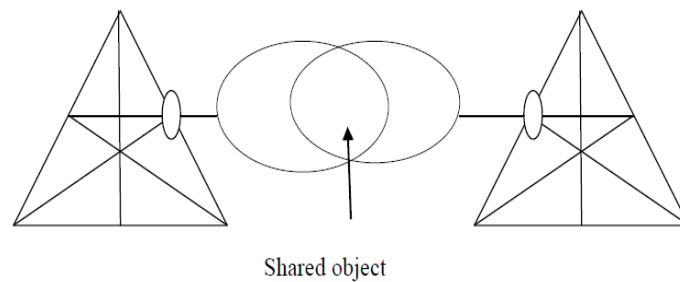


Figure 3.4: Two interacting activity systems as minimal model for the third generation of activity theory

Source: Engeström, 2001, Figure 3, p. 136

According to Engeström (2001, pp. 136-137) principles for boundary crossing in an activity system are:

- A network of relation to other activity systems;
- Multi-voicedness because an activity system has different people with different histories. Multi-voicedness is a source of trouble and innovation demanding actions of translation and negotiation. When an activity involves a lot of people it is prone to much criticism which needs to be negotiated to come up with a common idea leading to many contradictions;
- Historicity. The problems and potentials of activity systems can only be understood against their history and they are transformed over a long time;
- The role of contradictions as a source of change and development. Contradictions are not the same as problems or conflicts but can be seen as a tension developing between activity systems. Contradictions take place when an activity system adopts a new element from outside as a result of networking. The new element collides with the old, the collision causes tension and disturbances but it also brings new ideas leading to innovative change; and

- The possibility of expansive transformation in activity systems. This occurs when some individual participants use the contradictory ideas and move away from their norms, which bring about expansive change in the activity system.

The research found it necessary to engage with other systems specifically those that directly engage the students for attachment and employment at the completion of the course. Contradictions or challenges occur in an activity system and this brings me to the discussion on contradictions as used in CHAT. This research tried to surface contradictions in the system that challenged learning ERM. It is important to understand these challenges as the solution of the challenges allows for development.

3.8.4.1 Contradictions in the lecturer / students activity system

According to Kuutti (1996), contradictions are misfits within elements, between them, between different activities or between different development phases of a single activity. Engeström (2001) referred to them as historically accumulating tensions. Barab, S.; Barnett, M.; Yamagata-Lynch, L.; Squire, K.; and Keating, T. (2002) conceptualised them as dualities and used the term systemic tensions instead of contradictions. Further contradictions are said to be a form of disturbance or dissonance (Capper & Williams, 2004; Dick & Williams 2004) or disruptions (Berge & Fjuk, 2006). Mukute (2010) argued that contradictions are structural tensions between related issues that pull in the opposite directions and may manifest themselves as conflicts on the surface. He further claimed that in CHAT contradictions happen when there is a clash within or between elements of activity systems and they serve as a potential driving force for change, development and learning. They provide the starting point for reviewing the tensions and creating opportunities for analysis and problem solving during which more learning and meaning making happens. When contradictions are resolved, learning happens and a more advanced activity system emerges (Edwards, 2005b). In this research I view contradictions as challenges and constraints that the lecturers and students have to contend with in their activity systems. Internal contradictions and inconsistencies are areas that prevent or discourage an institution lecturer or student from engaging with ESD. These internal contradictions in the system can be the driving force for change and development for the system. Resolving these contradictions encourages change and enables ESD practitioners to emerge.

Although contradictions have a potential to result in transformation in an activity system, the transformation does not always occur if the contradictions are not acknowledged and resolved Nelson 2002. Murphy & Rodriguez-Manzanares, (2008) argued that in order for systemic contradictions to lead to innovation their resolution cannot occur at the individual level, because contradictions are in social/ material relations among groups of people and the tools they use. Further they argued that contradictions may not lead readily to transformation because they may not be easily identifiable or they may not be easily acknowledged, visible obvious or even openly discussed by those experiencing them. Dick & Williams (2004) further argued that the most difficult contradictions to use as springboards for growth are those that are 'invisible' or 'undiscussible'. An invisible contradiction is one that is so much part of the team's everyday life that the members don't even recognise it as a difficulty. Invisible contradictions include anything that is 'taken for granted', and especially covers cultural assumptions about how things are done and how relationships are managed (University of Helsinki, 2009)

The principle of contradictions in CHAT guided this research in analysing those factors or challenges (contradictions) that were constraining the efforts of the learners in becoming sustainability practitioners as envisaged in the ERM course. There are four levels of contradictions: primary, secondary, tertiary and quaternary. According to Engeström (1987) contradictions occur at these four different levels as highlighted below:

Level 1: Primary inner contradictions occur within each constituent component of the Central activity, for example, between the members of a community such as the administration of TU-K can have a contradiction with the lecturers.

Level 2: Secondary contradictions occur between the constituents of the central activity such as between the division of labour and rules and regulations governing the institution.

Level 3: Tertiary contradictions occur between the object/motive of the dominant form in the central activity for example, the object/motive for learner participation in the normalised activities and the object/motive of a culturally more advanced form of the central activity that would be the object motive of the envisioned or ideal learner participation within action competence framework

Level 4: Quaternary contradictions occur between the central activity and its neighbouring activity systems for example, the contradiction between the object of the lecturer activity system and the learner activity system.

According to Dick & Williams, (2004, p.9), these levels of contradictions are referred to as sources of contradictions as outlined below:

1. *Within* components of an activity system (e.g. between rules)
2. *Between* components of an activity system (e.g. between rules and object)
3. *Between activity systems* (e.g. a tool used in an organisation's object to reduce injuries, and another tool used to support the same organisation's object to sell product)
4. *Historical disturbance* – between what is now and how it used to be (i.e. between a newly introduced tool and an old rule).

The subjects of the activity system in this research were the ERM students: in becoming ESD practitioners many factors come into play in shaping the outcome. This happens within the elements, between the elements, element and element in another activity system and between systems. For instance in the ERM course, lecturers may have issues among themselves or with students and the administration or with other support systems, such as places where the students are attached and places they go to for educational trips (see Chapter 7). The contradictions emerging thus from the lecturer/ student activity systems lead to transformation or change when they are identified and addressed. This leads to expansive learning (Engeström, 2001).

3.8.2 Expansive learning

According to Engeström (1987) contradictions are potential growth points that allow the system to improve while affording the making and remaking of the participants and their identities. The activity system undergoes continuous change, which in part is brought by the system's response to contradictions or inconsistencies (Engeström, 2001; Roth, 2004). The identification of contradictions within and across activity systems is a central component (Engeström, 2004) of the activity system, as rising tensions and contradictions offer expansive learning opportunities for learners in activity systems. Engeström (2001) explained expansive learning as a historically new type of learning, which emerges as participants struggle through transformations in their activity systems. I worked with the students and the lecturers in their activity systems to identify the contradictions and to develop ways of working around these contradictions to allow for expansive learning.

3.9 ADVANTAGES OF ACTIVITY SYSTEMS

Roth and Lee, (2007) in explaining ‘Vygotsky’s Neglected Legacy: Cultural-Historical Activity Theory’ argued that learning is enhanced by participating in Legitimate Activity. Therefore when students are engaged in hands-on activity they do not memorise content to prepare for the next academic level nor merely for the purpose of passing tests or obtaining grades. Rather the students learn to expand their knowledge and help the community. Hands-on activities were very successful even with students who experienced difficulties teaching (Roth & Lee, 2007). A study of students engaged in the conservation of a creek using CHAT claimed that engagement in activity enabled students to learn more easily than when taught by theory alone (ibid).

3.10 AGENDA 21 AND ESD FRAMEWORK

The defining moments for sustainable development was the 1992 United Nations Conference on Environment and Development (UNCED) that was held in Rio de Janeiro in (UNESCO, 1992). The Rio conference came twenty years after its predecessor conference in Stockholm (section 2.7). UNCED gave birth to a number of international instruments that continue to provide the framework for sustainable development. This included Agenda 21, which offered a practical approach to applying sustainable development policies at the local and national level, and the Rio Declaration on Environment and Development. Agenda 21 sought to provide a comprehensive blueprint of action to be taken globally, nationally and locally by organizations of the UN, governments, and major groups. The Rio Declaration established 27 principles intended to guide sustainable development around the world (Dodds, Schneeberger, & Ullah F 2012).

The emphasis on the central role of sustainable development emerged at the Rio Conference in 1992 through Chapter 36 of Agenda 21. Critical in its position was to achieve environmental and ethical awareness, values and attitudes, skills and behaviour that are consistent with sustainable development and effective public participation in decision making

need to be an inherent component at all levels of society (UNESCO, 2006b). Agenda 21 is divided into four main sections:

- Social and economic development (Chapters 1-8);
- The conservation and management of resources for development (Chapters 9-22);
- Strengthening the role of major groups involved in achieving sustainable development (Chapters 23-32); and
- Means of implementation (Chapters 33-40).

This research critically analysed the first three sections against the ERM course to understand the extent to which the course incorporates these principles.

It was specifically noted that there was a need to reorient the curricula in all levels of formal education towards an education that must be a vehicle of knowledge and thought patterns and values needed to build a sustainable world (Ogbuigwe, 2007; UNESCO, 2009). Agenda 21 provided a comprehensive plan of action to be taken up globally, nationally and locally by UN agencies, governments and major organisations (NGOs and related networks) to reduce the human impact on the environment. Subsequently the World Summit on Sustainable Development (WSSD) in 2002 identified Education for Sustainable Development (ESD) as a critical intervention area for furthering the goals for sustainable development at a global level. The ESD concept appears in Agenda 21 in the chapter entitled 'Promoting Education Public Awareness and Training' (UNESCO, 1992). The concept carries with it the inherent idea of implementing programmes that are locally relevant and culturally appropriate. It identified four major thrusts to begin the work of ESD:

- Improve basic education;
- Reorient existing education to address sustainable development;
- Develop public understanding; and
- Training.

This research was interested in the concept of re-orienting education to address sustainable development by exploring the ERM course that was developed on sustainability principles to see how it may develop ESD practitioners. McKeown (2002) argued that training informs people of accepted practice and procedures and gives them skills to perform specific tasks. In the ERM course the learners are trained to become environmental resource managers or technicians in various sectors engaged in environmental conservation/management.

The concern of this research was to understand the extent to which the ERM course is aligned to Agenda 21 issues (see Table, 4.3) to see how the ERM course had incorporated the issues highlighted in the agenda in the course content. The research probed the first three components, as a lens to understand the extent the course was sustainability based. Agenda 21 is seen as the foundation for sustainable development (UNESCO, 2006), and this is behind the reason for using it as a lens in this research to understand how the ERM course can enable students to become ESD practitioners. In the next chapter I describe the methods and methodology engaged in this research.

CHAPTER FOUR: RESEARCH DESIGN METHODOLOGY AND METHODS

4.0 INTRODUCTION

Having covered the key concepts and theory in the previous chapters, I now focus on the research design, methodology and methods. This chapter describes the case study design of the research that was undertaken in three phases. Here an interpretative design was used to generate data to probe the history of the ERM course (Phase 1: Chapter 5), how its implementation enabled the learners to become ERM practitioners in their vocational area (Phase 2: Chapter 6) and how this translated into an activity system that is examined towards an overall concern for ESD (Phase 3: Chapter 7).

A case study methodology and the methods consistent with an interpretive study included document analysis, use of questionnaires, both structured and unstructured interviews, observations and finally focus group discussions. The justification for the use of these techniques is provided along with their limitations and ways of ensuring data quality in the context of this study of a course to produce ERM professionals. To achieve the overall goal of the study, interpretative case evidence generated using the methods outlined above is used for an analysis of the course against the current imperative of Education for Sustainable Development (ESD). This is undertaken through an analysis of the ERM course against Agenda 21 issues and the UNESCO framework of ESD.

In addition the chapter provides an overview of the theoretical perspectives used to read the data. It describes how Communities of Practice (CoP) is used as a lens to explore the phase 2 data on the ERM course implementation as a social learning process (Chapter 6). It also outlines how Cultural Historical Activity Theory (CHAT) was similarly used to examine the course as an activity system and to probe for contradictions in its development and implementation as a course within the Technical University of Kenya. The methods of data analysis are explained for each phase along with a discussion on research validity and ethics.

4.1 AN INTERPRETATIVE CASE STUDY APPROACH

Different research paradigms demand that a researcher approaches a research process from a particular angle, starting from the types of questions that can be asked, to the different methodologies and methods that can be employed to answer them (Cohen, Manion and

Morrison, 2007). This case study was framed and conducted within an interpretive paradigm that probed how the course implementation was playing out as ESD. According to Orlikowski & Baroudi (1991), interpretive studies assume that people create and associate their subjective and inter-subjective meanings as they interact with the world around them. These authors argue that researchers attempt to understand phenomena through accessing the meanings participants assign to them. In this case my concern was initially with the meaning that the lecturers and students derive from and assign to the ERM course and then the operation of the course as an activity system producing ERM professionals who are now mandated to initiate ESD in Kenya.

Walsham (1995) argued that methods of research start from the position that our knowledge of reality, including the domain of human action is a social construction. There is thus no objective reality there to be discovered by researchers but instead the research challenge is to generate data to get inside the world of that emergent perspective on ERM for their professional practice. In this case study research instruments were designed to engage with and represent the ERM perspective of the lecturers and the students as emergent ERM practitioners before examining the whole process as an activity system.

Here knowledge was generated through interaction with the people involved so as to understand how their actions and interpretations shaped both the course context and its outcomes (Guba & Lincoln, 1989). Such a study regarded people as agents who take meaningful reflective actions in the everyday contexts of their professional work. Interpretive research in education is considered to be a process of lived experience from which knowledge can be gained through interpretive analysis of, in this case, the ERM course development and implementation (Cohen et al., 2007; Merriam, 2001).

4.1.1 Working with theory in interpretive research

Walsham (1995) described three philosophical traditions underpinning interpretive research: phenomenology, ethno methodology and hermeneutics (Zuboff, 1988; Suchman, 1987; Boland & Day, 1989). This research is an interpretative study in the hermeneutics tradition. Its purpose is to probe the significance of the ERM course for the lecturers and students at TU-K. Hermeneutics focuses on the significance that an aspect of reality, in this case the course, takes on for the people engaged in it;

Hermeneutics focuses on defining shared linguistic meaning for a representation or symbol in order to reach shared understanding. In hermeneutic theory, subjects must have access to shared linguistic and interpretive resources. The hermeneutic approach is guided by the hermeneutic circle, where the process of understanding moves from parts of a whole to a global understanding of the whole and back to the individual parts in an iterative manner (Klein & Myers, P. 67, 1999)

This research was developed with a hermeneutic design according to circles of iteration (phases) where the context of course development is reviewed to inform the implementation process so as to ultimately understand the course as an activity system and to assess how the outcomes measure against the current imperative for ESD. To this end, the research probed how the ERM course enabled the learners/ students to become practitioners in the area of conservation so as to examine the course as a case of how education for sustainable development was emerging in Kenya. The review of the ERM course is described in Chapter Five and the implementation of the course is examined in Chapter Six. Chapter Seven examines the course as an activity system to surface and examine contradictions and tensions in the emerging course. My overall purpose is to try and improve the course so that it might become a more effective vehicle for training ESD practitioners.

As briefly mentioned above, from an interpretive perspective, human action is seen as an outcome of external influences and has reasons as Connole (1998) argued that human actions take place within a structure of social rules within which they construct meaning. These actions often have intentions and may be accompanied by reflection. Meanings are generated, negotiated and shared through language and other forms of symbolism. This implies that the task of the interpretive researcher is to understand the meaning-making processes and the course context within which they take place (Wenger, 1998a). In this research I tried to understand how meaning is generated within the activities on the ERM course as a TU-K activity system producing ERM professionals. I did this by generating data to interpret the course activities and to represent these as a course activity system within the institutional setting and involving the students and the lecturers (Phase 3). The broad activity system was identified as the course in the learning institution where the programme was developed and the teaching took place.

4.2 THE CASE STUDY

The term ‘case study’ is used differently by different writers; however the main contention seems to be between those who use it as a methodology, research strategy or approach and those that use it as a method. According to Cohen et al., (2007), a case study is one of the eight major research methodologies or styles in education; the others are ethnography, historical research, surveys, correlation research, experiments and action research. Others with a similar view are Flyvbjerg (2004), Creswell (2003), Yin (2003) and Tellis (1997). In this research, the case study approach as a methodology was found to be most appropriate because the researcher was interested in investigating a single case of an ERM course as a bounded activity system emergent within TU-K (Stake, 2005; Merriam 2005; Gerring, 2007; Babbie & Mouton, 2001). The study thus examines the course at Technical University of Kenya, giving particular attention to its implementation and how it played out from 2009 to 2012 as ESD became a global concern.

4.2.1 Defining and explaining the case study

The definition for case study has attracted a number of views and perceptions, for example Gerring (2007, p.341) referred to the definition of case study as being in a state of “definitional morass”, meaning that the definition is confusing and may not be well understood. Merriam (2005) argued that the definition should include three categories: process, an end product or a unit of study. Yin (2009, p.18) defined a case study as:

An empirical inquiry that investigates a contemporary phenomenon within its real-life context and boundaries between phenomenon and context are not clearly evident. It has to cope with the technically distinctive situations in which there will be many more variables of interest than data points and as one result relies on multiple sources of evidence, with data needing to converge in a triangulation fashion and as another result benefits from prior development of theoretical propositions to guide data analysis.

This definition describes a case study as an empirical study that looks at contemporary phenomena within their real life context. I adopted this definition as this research engaged individual students and lecturers in their natural and current engagement to understand their meaning making of the course and its effect on their real life context. The three phases of the research develop an in-depth case study to understand the emergent meaning-making on the

course and how this has developed and might now be reviewed as an emerging Education for Sustainable Development response to environment and sustainability concerns in Kenya. Case studies are studies of singularities or bounded systems (Bassey, 1999; Stake, 2005) with a finite quality in it either in terms of time, space and components. The process of conducting a case study begins with the selection of the ‘case’ (Merriam 2002; Stake, 2005; Berg, 2004; Gerring, 2007). In this research, the case, the ERM diploma course, was selected and became the unit of analysis both in its development (Chapter Five) and its implementation (Chapter Six) so that the whole process could be reviewed as an activity system (Chapter Seven).

In this case study observations of the characteristics of the case were made; the purpose was to probe deeply and analyse intensively the multifaceted nature of activity with the view of establishing inferences about the broader socio-historical context of Kenya from which the case derives (Cohen et al., 2007). This case reflected significant socio-cultural factors that influenced and shaped learner engagement in environmental conservation activities (Merriam, 2001; Cohen et al., 2007), both in the broader context of environmental education discourses in Kenya (Section 1.4.2) and in the institution (Section 1.4.4.2) and provided a holistic description and of the activities enhancing the study of ERM.

There are several types of cases, for example, Stake (2005) described three types of cases which he categorised in terms of the reasons for undertaking a research: intrinsic, instrumental and multiple case studies. This research was intended to provide insights on the ERM course and can thus be seen as an instrumental case study. An instrumental case is undertaken to provide insight into an issue or to redraw a generalisation. The case is looked at in depth, its contexts scrutinised and its ordinary activities detailed, to help us to pursue the external interests. The choice is made to advance understanding of the other interest. In this study, the case of an ERM course was made to understand how the developing ERM course incorporates sustainability concepts to enable learners to become Education for Sustainable Development practitioners and promote sustainable development.

A case study refers to the collection and presentation of detailed information about a particular participant or a small group, frequently including the accounts of subjects themselves. It looks intensely at an individual or small participant pool, drawing conclusions only about that participant or group and in that specific context. This case study was conducted for the ERM course that is offered at TU-K and was conducted in three phases for in-depth information on its history, implementation and contradictions. The study was

exploratory and descriptive because it did not focus on the discovery of universal generalisable truth, nor typically looked for cause-effect relationships. Berg (2004) proposed three case designs; exploratory, explanatory and descriptive. This research was descriptive concerned with interpreting the course planning and delivery to understand how it is producing ERM professionals to respond to the Education for Sustainable Development.

Flyvberg (2011) stated that choosing to do a case study is not so much a methodological choice, but rather a choice about what to study (the bounded unit represented by the case). My interest was to provide rich and thick description of the phenomenon and the case study methodology allowed for the use of both qualitative and quantitative data to create detailed description that provided a clear grasp of the developing course and its implementation. As noted by Cohen et al., (2007) I was interested in providing data in a form that is accessible to the general public to contribute to the democratisation of knowledge. This information can be used by institutions of higher education to create courses that enable the learners to become the professionals envisaged in the course design. The findings of this study will assist in giving recommendations for the development of an Education for Sustainable Development course at TU-K and contribute to the Mainstreaming Environment and Sustainability in African Universities (MESA) programme in terms of innovations engaged in an institution in environmental resource management as a contribution to the UNDESD (2005 to 2014).

4.2.2 Case study design decisions

Having decided on the case study methodology a decision is made on the nature of the study, the number of sites to be studied, how to select the sites and which research methods to use (Yin, 2003). The decision on the nature of study was based on the type of the research questions (Section 1.5.3), which are descriptive in nature. This nature of a case study requires detailed information on the phenomenon within its context. The phenomenon described in this study is how the ERM students became conservation officers and ultimately ESD practitioners. The study aimed at providing in-depth information on what goes on in the course, thus providing an insight into how the education for sustainable development practitioners may be prepared to face the challenges of sustainable development. I opted to carry out the study in one institution as I was interested in getting quality rather than the quantity information provided by a survey. I was also interested in a course that was

specifically prepared on the sustainability foundation to train personnel to work in the area of resource management for sustainable development.

4.2.3 Disadvantages of case study design

A case study design can be deceiving in the sense that its findings can be used to make general comments and decisions on the subject or the problem under investigation. Therefore there is need for careful interpretation of this type of study's initial findings: they may seem convincing enough to be released as conclusions, but this should not occur prematurely. It may be necessary therefore to guide the authority to the fact that more research may be required before making such conclusions. Secondly, Cohen et al., (2007) cited as disadvantages the lack of generalisability of results and susceptibility of the research process to researcher bias. However the purpose of a case study is to represent a single unit and not a general population; in this research I represent a single unit of the ERM course (Stake, 1994). Yin (2003) also argued that this methodology lacks systematic procedures and it generates a large amount of data that often result in lengthy reports. The lengthy reports need to be filtered and reduced to manageable size and presented in a way that is clear and comprehensive as suggested in Cohen et al., (2007). I had trouble selecting what to present and what to leave out as the amount of information collected was massive. Ryan (2011) argued one needs to select the data to use and discard the rest, depending on the question that is being addressed in the research. I therefore selected the data that directly addressed the research questions as outlined in Section 1.5.4. The next section is an overview of the phases in this particular case study.

4.3 AN OVERVIEW OF THE PHASES FOR THIS CASE STUDY

This research on the ERM course case was developed in three unfolding phases:

Course development (Phase 1 – Chapter Five)

Implementation shaping the ERM practitioner (Phase2 – Chapter Six)

An analysis of the course development and implementation as an activity system to assess it as an ESD process (Phase 3 – Chapter Seven)

These have been represented in Table 4.1 for ease of reference and then each phase is outlined in the following three chapters that explain the unfolding research design and the analysis that allowed me to represent the detail of the ERM practices in the chapters of this study.

Table 4.2: Summary of the research design

Methods for data generation	Purposes	Instrument used for data generation	Coding system
<p>Phase 1</p> <p>Question 1</p> <p>Context and history of the course</p> <p>Document analysis:</p> <ul style="list-style-type: none"> - Analysis of the existing Environmental Studies course outline - Analysis of course outlines, reports and minutes of meetings generated during the development of the ERM course (Index in Appendix 1A) - Analysis of question 1 with lecturers who were involved in the course developers (Index in Appendix 2A) 	<p>To understand the background to the ERM course</p> <p>Understand the processes in the development of the ERM course</p>	<p>The environmental studies course outline</p> <p>a) Question 1 from questionnaires for the lecturers Appendix 2A)</p> <p>b) Follow-up semi-structured interviews with a sample of lecturers involved in course development (Appendix 2A)</p> <p>Analytical categories developed from the review of the course revision process</p>	<p><u>Inductive</u></p> <p>Analysis of the framing and production of the course subjects, objectives, aims and course content</p> <p>Analysis of:</p> <p>Stakeholders,</p> <p>What they did,</p> <p>The driving ideas.</p> <p>Coding of categories, memos developed (Appendix 5C) and representation Chapter Five</p>
<p>Phase 2</p> <p>Question 2</p> <p>The pedagogic practices in the ERM course implementation (a) and the student experience of becoming ERM practitioners (b)</p> <p>Interviews with the lecturers and students in the implementation of the course</p> <ul style="list-style-type: none"> - Observing of the lecturers and the students on their fieldwork experiences. - Analysis of the attachment reports - Analysis of the trade area projects - Focus group discussions with students to probe the significant features of the course to their becoming ERM practitioners - 	<p>To present data on how the ERM course was delivered</p> <p>To understand how the experience of the course is shaping the students as ERM practitioners</p>	<p>Questionnaire with follow-up interviews (Appendix 3A, 4A, 5A, 7A).</p> <p>Fieldwork observation schedule(Appendix 6)</p> <p>(Appendices 4 and 5)</p> <p>Analysis template for assessing projects (Appendix 6.1)</p> <p>-Semi structured questions for focus group discussions with students (Appendix 4)</p>	<p>Inductive</p> <p>Coding the data for categories that relate to the research questions</p> <p>Chapter Six</p> <p>Use Communities of Practice</p>
<p>Phase 3</p> <p>Questions 3 and 4</p> <p>Review the course as an emergent activity system so as to surface tensions and contradictions in the course development and implementation and an assessment of the extent to which the course is currently addressing ESD</p> <p>The course, ERM AND ESD</p> <p>Chapter Nine: Synthesis, Conclusions and Recommendations</p>	<p>To understand the challenges facing the ERM course at KPUC</p> <p>Understand the tensions and contradiction in the student activity system to become an ESD practitioner</p> <p>Understand how the course enables becoming and ESD practitioner</p> <p>Understand the extent to which the ERM course has incorporated global and local sustainability issues.</p>	<p>Focus group discussions on the fieldwork, industrial attachment and trade area projects (Appendices 4B, 5B, 6B and 7B)</p> <p>The proposed ERM Course</p>	<p>Inductive and the use of CHAT to categorise the contradictions</p> <p>Chapter Seven</p> <p>Agenda 21 categories Chapter Eight</p>

4.3.1 The first phase - the context and history of the ERM course

In Phase One I examined the context and history of the course by analysing the existing documents generated before, during and after the 1999-2002 ERM course review. These documents were arranged chronologically, indexed with the abbreviation HD standing for Historical Documents and numbered one to twenty three (HD1 to HD23) - see Appendix 1A in the research record. The documents included departmental meetings minutes, reports, training notes, posters and course outlines. The bulk of these were used in and generated during the 1999 – 2002 ERM course review process. The other important documents that I analysed were questionnaire responses on specific aspects of research. The questionnaire responses indicated the roles and the perspectives of the lecturers in the revision and later implementation of the course (Appendix 2A, 3A, 4A, 5A, 6A, 7A, and 8A in research record).

4.3.2 The second phase - review of the pedagogic practices of the ERM course

In the second phase of the research I interpreted the questionnaire responses, made observations and probed what was going on in the implementation of the course. After the initial analysis of questionnaires, the research process included interviews and focus group discussions with both the lecturers and the students on the ERM course over the period of its implementation. I categorised this information on the course process into four themes:

- general lecturing/teaching methods,
- fieldwork/field camping practical work,
- industrial attachment in the workplace, and
- Trade area projects undertaken during student's attachment (internship placement).

The main aspect I wanted to investigate was how the lecturers reported on their teaching practices and how the students understood and could apply what they were learning. Therefore my interest was in how learning took place to enable the students to become practitioners in sustainable development.

The first step was to administer a general questionnaire for both the lecturers and the students. This provided background information on how learning took place and also gave me insights on how the lecturers and students understood the ERM course.

The second step was to make observations on how learning was taking place during the activities on the course. I was particularly interested in the activities of the students as this course was meant to be student-centred from the planning stage. Observations were generated across the four categories outlined above and photographs helped to capture the student activities, particularly fieldwork.

The third step was to review and discuss the interpretative data with the lecturers to clarify their interpretations of the ERM course. The fourth and final step was to engage the students in focus group discussions to probe their experiences of the course activities (classroom, fieldwork, attachment and the trade area projects).

I drew on Communities of Practice theory (Lave & Wenger, 1991) as an interpretative lens to understand how the lecturers worked as a community of practitioners engaged in the conservation sector. The students were legitimate participants being inducted into becoming ERM practitioners in conservation through the course. Here the study emphasised fieldwork, industrial attachment and trade area projects, as these were seen to be the key learning environments after an initial period of classroom experience. In this way it was possible to track the progression of the students' learning, from the periphery in the classroom to the field where they had to take the lead increasingly as ERM practitioners in matters pertaining to environmental conservation. See Section 3.3 for a detailed description of CoP theory.

4.3.3 The third phase - tensions and contradictions in ERM course implementation

In the third phase I closely examined the learning interactions between lecturers and students as the course as an activity system was implemented within TU-K. Here I collated information from the lecturers and held focus group discussions with both the students and lecturers on their experience and perspectives on the course as a whole. I also asked the students who had completed the course and were already working in conservation, about their experience on the course. This was done by email (Appendix 11B) and telephone. From their emails I interpreted the comments and concerns that they raised about the course. Here, I

drew on the Cultural Historical Activity Theory's (CHAT) framework as a second lens to map out and model the features of the emergent and implemented course as an activity system and was able to begin to identify contradictions across the course development and implementation process (Section 3.8).

This analytical work on the course as a whole allowed me to begin to examine how the course was functioning to produce ERM professionals as well as the extent to which the ERM course was addressing the issues on sustainability as contained in Agenda 21 and thus emerging as an Education for Sustainable Development response to the environmental risk in Kenya. This was one of my primary research interests that I probed by listing the issues in Agenda 21 and mirroring these in the ERM course activity system to explore the extent to which the course is addressing these issues (Section 3.9). The aim of this analysis was to enable me to think critically about the course as an ESD process in higher education and as a global discourse to reduce sustainability challenges (Wals, 2012).

4.4. THE THREE PHASE RESEARCH DESIGN

4.4.1 Introduction

This research was conducted in three phases as described in Sections 4.3.1, 4.3.2 and 4.3.3 and as such, Phase One informed Phase Two on course implementation procedures. There were multiple sources of evidence from interviews, questionnaires, observations, focus group discussions and documents as recommended by Yin (2002 p.13). The meaning that the different methodological perspectives brought about in this research complemented each other. Flick (2006 p. 37) conceived this as 'complementary compensation of the weakness and blind spots of each single method'. The different methods that I used in this research complemented each other to fill in the gaps that may occur by using only one method.

In summary, the first phase, generated data from documents and interviews to review the course design. In the second phase structured questionnaires were used to examine the course implementation as a community of practice producing ERM practitioners. The case evidence generated in Phase One and Two was used to examine the course and its implementation as an activity system, enabling a critical review of tensions and contradictions in the system, and allowing the course to be analysed with Agenda 21 as a Kenyan response to the global imperative for ESD. This analysis was done with the use of the ERM course that was

reviewed between 1998 and 2002; I examined the units that were being taught against the issues outlined in Agenda 21. I particularly examined the units that directly addressed the three first chapters of the agenda (table 4.3).

4.4.2 Phase one: Review of ERM course development

The aim of the first phase of data collection and analysis was to answer the question:

How was the ERM course developed to play out as a learning process for ERM practitioners in Kenya?

To respond to this question, existing documents on the planning of the course were collected and their content analysed (see Section 4.3.1). Content analysis is the process of summarising and reporting written data- the main contents of data and their messages (Cohen et al., 2007). Content analysis as defined by Asgedom (1998, p.8) is “a research technique for objective, systematic and quantitative description of the manifest content of communication”. According to O’Leary (2004, p.177), content analysis involves the “collection, review, interrogation and analysis of various forms of text as a primary source of research data”. O’Leary emphasised that these documents that are analysed pre-exist the data that are generated by a given project. For this research I adopted O’Leary’s approach to content analysis. The texts, which I analysed using this method, were the various materials generated during the review of the ERM course between 1998 and 2002. I accessed several key documents (Appendix 1A) from the department of Information and Liberal Studies where the course was hosted during the ERM course review period. In the process of reviewing the course a number of documents were generated and I analysed these to understand the process that was used to develop the ERM course. Content analysis can be undertaken with any written material, from documents to interview transcriptions, from media products to personal interviews.

The advantages of content analysis include: it is cost effective, it is an unobtrusive technique in that one can observe without being observed, it is accessible and it works with data that is permanent and stable (Merriam, 2005; Cohen et al., 2007). There are, however, disadvantages: bias of the documents because they were not produced for the purpose of this

research; they may be incomplete; they may contain information that is not relevant and may not be freely available.

Content analysis in this research focused on the interpretation of the latent content. The coding in this type of analysis has no strict rules to guide the coding process and each case is treated individually “to make the most compelling and contextually sensitive interpretation” (Ahuvia, 2001, p.162). Each of the documents that were collected was coded individually and I interpreted the general meaning of each of the documents to support my arguments on data presentation. In such an interpretation of the content Berg (2004) recommended that there should be detailed excerpts of text available to document the trajectory of the researcher’s interpretations. With the historical documents used during the process of the ERM course review, I was able to describe the information used for course review. See Appendix 1A for the list of all the documents that were collected and analysed for this research.

In this research the inductive approach to data analysis was used because it allows categories to emerge from data as opposed to the deductive approach. The latter is based on the use of pre-determined categories to analyse text and stands the risk of overlooking some of the data (Berg, 2004). I read carefully through each of the documents and established the categories.

Finally, content analysis of the third year research projects was carried out to understand the nature of research that the students engage in and the extent to which they address sustainability. I picked ten projects at random from the previous years and all the fourteen projects for the final year students of 2009 for analysis. I used the sustainability assessment tool for trade area projects developed specifically for this research (Appendix 3Bb). With this I analysed the selected projects with regard to the three sustainability pillars (environmental, economic and socio-political). This informed the research on how ESD is addressed by the ERM students. An analysis of the projects was necessary to see the details covered by the students and thus the effectiveness of the course theory. See Appendix 3Bb for the sustainability tool developed to grade the final year student trade area projects.

4.4.2.1 The analysis of ERM course development process

The historical documents that I analysed for this research are listed in Appendix 1A as already mentioned in Section 4.4.2. My task was to read through each one to understand the process that was used to review the ERM course and produce the updated course. Some of

the documents were very short, for example the minutes of meetings were one page; others were lengthy such as the CBE process. My interest was to understand the processes engaged in reviewing the ERM course and to uncover the rationale and design of the new course.

I analysed the step by step development of the ERM course starting from its inception, that is, the time the Canadian experts moved into the then Kenya Polytechnic to start the '*Supporting Environmental Education in Kenya*' programme. At the time of the ERM course review, the institution was a polytechnic that was structured according to departments. One of the departments was known as the department of Information and Liberal Studies (ILS). Each department had various academic courses on specific skills and each of these courses was referred to as a section. The section on Environmental Studies was the site for the programme for reviewing the ERM course. According to the information gathered both from the documents, the questionnaires and my own experience, the ERM course review was conducted systematically as follows:

- The first step was to train the lecturers in the section of Environmental Studies on how to prepare lessons (lesson plans) by the Canadian expert.
- Secondly the Canadian experts trained the lecturers at the Kenya Polytechnic on Competency Based Education (CBE).
- Thirdly the lecturers were involved in the development of the course in a programme called the Develop a Curriculum (DACUM) process. For the DACUM process a two-day workshop was held involving the stakeholders that had been identified from the industry, the Kenya Polytechnic staff and the Canadian experts (Chapter Five).

The workshop participants developed a list of areas that should be covered which were then developed into thirty-one units. These units were to be covered in three years producing an Environmental Resource Manager to work in the environmental management sector in the country. The stakeholders identified in this research were the likely employers of the ERM graduates.

I therefore analysed the details of each of these documents used and have described the processes used in Chapter Five on the development of the ERM course. Analysis of the documents was descriptive outlining in most cases the content of the document.

4.5 WORKING TO GENERATE BASELINE DATA

Case study protocol recommends that there should be informed consent from participants before research is conducted (Yin, 2003). I informed the students that I had been granted permission to carry out the research by the institution administration (see Appendix 1, for details on permission requested and granted). I assured them that their responses would remain anonymous as I wanted them to feel free to give honest opinions about the ERM course implementation. I promised privacy and security from victimisation. All students were requested to respond to a questionnaire developed to understand their understanding of Education for Sustainable development concept. This was done in a classroom situation with their permission after an explanation of the questionnaire. On completion of the questionnaires I requested further discussions as need arose (Appendix 5A).

My point of entry, as noted above, was the opening questionnaire to the lecturers on their basic perspectives on the ERM course (Appendix 2A). This allowed me to undertake the Phase One enquiry into the course development process. Its analysis allowed me to identify themes to be followed up in the implementation phase with further semi-structured interviews and focus group work.

To this end, I developed a follow-up questionnaire and interview process to probe problem based learning (Appendix 3A), because the course design emphasises supporting the solving of local problems by local people. My interest in this was to understand how far they were using Problem Based Learning as an approach in teaching the ERM course. I also administered a follow-up questionnaire on course implementation (Appendix 4A) that was used in a similar way to generate more data on the dimensions of the course and on how these were developing in teaching and learning interactions.

At this stage of the developing research I also administered questionnaires to the students as they engaged in learning specific knowledge and professional practices in particular units of the course. On their field trip to the coast, for example, I administered a questionnaire to understand their experience of and perspectives on the field exercise (Appendix 7A). Care was taken that research instruments were administered in the normal course of events as we would be the case with periodic evaluation instruments or even synthesis activities on a particular focus or theme. My concern here was not to position my research as an evaluation of the course; I would be undertaking the study while teaching normally: researching how the

course was playing out and what features were contributing to the students becoming ERM practitioners working on sustainable development issues in the region. The concern with sustainable development would allow me to begin to open up the issue of ESD in my research so that recommendations on the improvement of the course could be made from this research project.

4.5.1 Questionnaires as a method for data collection on ERM course

The use of questionnaires was my entry point into the research in trying to understand the background to the ERM course and the concepts being worked with and developed among the lecturers and the students in the course. The survey with the ERM lecturers and students enabled me to gather background information on the course. This was used to identify broad themes that were then taken up into further interviews and focus group discussions. Questionnaires were also used to generate data on key areas of the course planning and implementation. These were followed up with further interviews and focus group discussions. This approach of opening with a questionnaire and using interviews and focus groups to probe for detail was effective and it enabled me to collect sufficient data. It also allowed me to deepen the focus in Phase Two and also to reflect back some of the emerging themes into the course development and to begin to identify tensions that could be examined as possible contradictions in the Phase Three analyses that followed.

The questionnaires were invaluable as they provided opening information on the views of the students and lecturers about the ERM course (Appendix 2A to 7A). Being one of the course lecturers, I felt that the students would feel free to be honest if they remained anonymous in responding to the opening questionnaire and many of the instruments that followed. The same was true of the lecturers who preferred questionnaires to meetings at the institution or elsewhere, as they saw this as less time consuming. Students may be shy or afraid to give information as they may want to please or could be afraid; it really depends on the rapport between you, the researcher, and the people you wish to get information from. A questionnaire has the quality of having a structured framework of questions for all the respondents. The questionnaire and developing research design used a progressive approach whereby each question and the lines of follow-up led to further in-depth probing as suggested by Munn & Drever (2004), (see Appendices 2A to 7A).

The ERM diploma course takes three years and since I was interested in how learning took place for the whole course, all the students in session between January and December 2009 were part of the study sample. All the students in the course were requested to respond to the first questionnaire, which was addressing background information on the course and its relationship to the ESD concept (Appendix 5A). The second questionnaire targeted the second-year students to shed light on how they were engaging with the course and also the problems they had experienced in the course thus far (Appendix 6A). The third questionnaire targeted the first-year group to understand the work covered in their first year and their feelings after a year of ERM course study (Appendix 6A). The fourth and fifth questionnaires were administered later in the research study and targeted the second and third year students during their fieldwork experience (Appendix 7A). The sixth questionnaire targeted those who had just been admitted to the ERM course and had not started learning, to look at their entry point, to understand why they had chosen the course and also to share their expectations for selecting the ERM vocational course (Appendix 8A). This information is summarised in table 4.3.

Table 4.3: Summary of the questionnaires in this study

Target	Questionnaire	Issue	Reasons
All ERM students	Appendix 5A	ERM/ESD	Understanding and relationship between ERM and ESD
3 RD year ERM students	Appendix 6A	Total course experience	To understand their full experience of the course
2 nd year ERM students	Appendix 7A	Challenges	To understand their challenges in the course
1 st year ERM students	Appendix 6A	Learning methods	To understand how they were learning
2 nd and 3 rd year students	Appendix 7A	Fieldwork experience	To understand their experience in fieldwork
Newly admitted	Appendix 8A	The expectations in the ERM course	To understand their entry point to the course

All the questionnaires were administered in a classroom situation in my presence during normal classroom lessons, similar to an examination situation. Each of the students filled in

the questionnaires and returned them to me before leaving the classroom. This enabled me to receive the responses immediately. This also prevented questionnaires from being misplaced or lost. I found this way of administering the questionnaires to be very effective as the students did not have time to consult with one another and influence each other's perceptions about the ERM course and their experiences. My presence was important as I could clarify anything that the respondents did not understand and was able to ensure that the questionnaires were filled in correctly (Cohen et al., 2007). The main challenge with this style of questionnaire administration is sense it gives the students of an examination situation. What was useful for me was that I was able to gather information from students immediately and students did not consult each other, giving me a clear picture of each student's 'perception of the course. The questionnaires were anonymous and open-ended to give the respondents freedom to give as much information as possible.

To begin with, the questionnaires were piloted on five students. Piloting a questionnaire is of paramount importance and its pre-testing is crucial to their success (Cohen et al., 2007). The pilot has several functions, principally to increase reliability, validity and practicability of the questionnaire. This informed the research on the issues that needed attention within the unfolding phases of the study. The opening questionnaire in this study was structured using the three ESD pillars (Section 2.7). The use of the ESD framework allowed for the later analysis of the sustainable development trajectories of the course as ESD, the current international focus to which the future programme needs to be aligned. Responses to the questionnaires informed Phase One interviews with participants on the course development as well as follow-up interviews and focus group discussions in Phase Two.

4.5.2 Analysis of the questionnaires

According to Cohen et al., (2007), processing questionnaire data requires reduction into a form that is suitable for analysis. Data reduction consists of editing followed by coding. Questionnaires are edited to eliminate errors made by respondents, which involve checking for completeness, accuracy and uniformity. The questions were mainly open-ended, apart from those that required a one-word response such as gender. The rest of the questions were open ended and these were summarised into a frequency tally to generate a range of the responses as a preliminary coding classification and further summarised into graphs. Simple

statistical measures of central tendency were used to qualify particular quantitative references in the research. A detailed analysis of the questionnaires surfaced many of the issues that were taken into follow-up interviews. The formal analysis of the questionnaires was undertaken as a statistical analysis using Excel because this is a quick way of analysing frequencies. The questions asked had required listing of ideas so these had to be coded and probed. Here I initially looked at how each had responded and calculated the percentages and averages of the responses. The moment-to-moment developments and my thoughts on opening lines of enquiry were documented in a research journal and in the next section I highlight how I used a researcher's journal.

4.5.3 Researcher Journal

Merriam (2002) suggested that a researcher should maintain a researcher journal to record the experiences, ideas, fears, mistakes, confusions, breakthroughs and problems that may arise during fieldwork.

The function of a research journal is to set down on paper your thoughts about the primary and secondary source material you are reading. It is a record of your questions about the material and your tentative answers to those questions. It documents the connections you make between the materials you read, and provides a place to record the questions this material raises. The object of the journal is to record your thoughts about the primary and secondary material at hand. You want to do this as close to the moment of having the thought as possible, and you want to minimize anything that hampers this objective. (p.1)

I kept a research journal where I wrote my thoughts during the process of this research. The journal became my support reference in data analysis by providing a record of feelings, attitude reflections and subjectivities during data collection. I found journal writing to be a fundamental aspect of research process that facilitated greater personal insight and connection with events, realisation and understanding as outlined by Southwood (2000, p. 50). According to Borg (2001) a research journal plays a central role in a collaborative research context by providing all participants in the research process with a means of expressing, recording and sharing their experiences. In this study I noted down all feelings and thoughts that came into mind with regard to the study. I found myself jotting down a line or two of reflections on various events that I deemed useful to this research. Later I typed this

and it became part of my source of information for analysis see Appendix RJN (Research Journal Notes).

4.6 PHASE TWO: ERM COURSE IMPLEMENTATION

This phase aimed to answer the question: What pedagogical practices are used in the ERM diploma course (KP, 2002) at Technical University of Kenya to enable the learners to become environmental resource practitioners?

The second phase of this research tried to understand how the ERM course was implemented at TU-K to train the students to become environmental resource managers. The ERM course was implemented in 2002 and is still being offered at TU-K in the department of Earth Environmental Science and Technology. Here the purpose of the research was to document and review the course as a case study so as to understand how it was being taught and how the students were learning to become ERM practitioners.

Interviews (Appendix 2A), were used for lecturers who responded to research questions related to the course development in Phase One above. Data on student experiences and opinions were collected by means of interviews (Appendix 4A). This informed later follow-up interviews and focus groups discussions (Appendices 5B, 6B, 7B, and 8B) that generated data on the key learning events in their becoming ERM practitioners.

4. 6.1 Interviews

Interviews were conducted with six lecturers involved in ERM course design between 1998 and 2002 at the then Kenya Polytechnic University College. This was done to understand the background to the course and shed light on the intentions of the course and how it was expected to be implemented. I interviewed the lecturers individually because I wanted to understand their views on the ERM course and how they related it to ESD. Since I am a lecturer myself, it was easy for me to have brief discussions whenever we met. I found this useful as I did not have to organise a long stretch of time with each. Therefore we could discuss a particular issue whenever we met. This kind of interview gave the lecturers freedom to express themselves freely and they did not feel obliged to complete a session at one sitting. It took me a lengthy period of time but I found it to be most satisfying. At times I could discuss an issue over lunch or even when having a cup of tea. The lecturers seemed to feel

comfortable and offered information freely during these informal meetings rather than in a scheduled interview. I used scheduled interviews to probe the lecturers and the students in ERM course. All the lecturers and students that were in session during this research were involved. The research was spread between 2009 and 2012.

Using the content analysis and questionnaire data as a baseline on the course and its developing context, interviews were conducted with the lecturers who were teaching in the department of Earth, Environmental Science and Technology (Appendix 9A). There were twelve lecturers and all were included in this research in the first phase (Section 4.3.2) of responding to questionnaires but only six were involved in the interviews as indicated above. As indicated in Table 4.1 and discussed in Section 4.5, interviews were used as a method of data generation to clarify details from the first phase and to get detailed information on the implementation of the ERM course in the second phase. The idea behind interviewing participants on the course development process was to explore such as feelings, thoughts and intentions as argued by Patton (2002).

I interviewed the students who had just completed the course on why they chose to study ERM, the challenges in their places of work and on their views on the environmental challenges in the country and how they will react to these challenges (Appendix 10A). I also conducted interviews with six lecturers in the course to explore their understanding of ESD, and how they categorise the disciplines in ERM using the ESD pillars. I also wanted to understand how the lecturers related ERM to ESD. Furthermore I wanted to explore the innovations in their teaching the ERM course (Appendix 2B). The interviews allowed me to capture the perspectives of the participants as a background to understanding the course development and implementation processes intended to enable learners to become ESD practitioners. Here I needed to understand what the participants felt about the course so as to develop an understanding of how they connected it to ERM as their professional field and whether they saw it as a vehicle for the emerging global focus on ESD.

There are three types of interviews: structured, semi-structured, and unstructured (Chambers, 1994; Mikkelsen, 1995). Semi-structured interviews were undertaken with the lecturers, as

this allowed me to make prior decisions about what to look for, categorisation, recording and construction of a schedule for flexibility to decide how best to secure and make sense of this information. Following the questionnaire, semi-structured interviews were used because they give rise to synergistic insights and solutions that would not come about without them and add depth and meaning at a very personal level of experience. They also gave me freedom to modify the order of questions based on my perception of what seemed most appropriate in the context of the conversation; this enabled me to change the way they were worded, gave explanations and leave out particular questions which were inappropriate with a particular interviewee or add in other questions. The objective was to get high quality data in a social context where people can consider their own views in the context of the views of others. The lecturers were in a position to explain their own views on ESD and discuss the implementation of a course that should enhance the concept. The semi-structured process helped to strengthen and modify the interviews for rich and in-depth information (Patton, 1990; Robson, 1993; Terre & Durrheim, 1999 and Neuman, 2000).

4.6.2 Generating data to deepen insights into emerging focus areas

Concurrent with the interpretative analysis of questionnaire data, I undertook my normal course activities, observing how the course was unfolding and conducting interviews on issues that arose. These data were documented in my research journal and the research record that was compiled later. As a significant issue or theme emerged I was also able to conduct focus group discussions to probe these key issues in the unfolding data collection process. There were no clear-cut boundaries but a progression through the Phase One work with documents and base-line questionnaires, which fed into Phase Two data, which was responsive and progressive and used observations, interviews and focus groups. Focus group discussions on specific aspects of the course were of particular importance. I held focus group discussions with the students on:

- Their field experience (Appendices 5B and 6B); and
- Trade Area Projects (Appendix 8B) that the students wrote at the end of the course.

Here I wanted to understand how the students chose the topics and how they carried out the study. In addition I wanted to explore the challenges they encountered as they carried out

their research for the project write-up. Also integrated into this data gathering and consultative process was a review of projects and assignments. Here of particular significance were:

- The marking of the projects using a guideline on sustainability to probe how the activity engaged the students practically and in writing on local sustainability issues (Appendix 3Bb).
- The students attachment records where I analysed the reports they presented at the end of the attachment period to understand the issues they experienced and the constraints they faced (Appendix 10B).

Informal and ongoing interviews were also conducted with individual students to probe their course experience as and when significant moments were identified. I engaged with many of the respondents during this time as this was part of my work anyway. I also discussed the course whenever I met someone from the department willing to have a talk, keeping records of discussions and using the emerging picture to frame research instruments that would allow me to probe the key issues that were shaping emerging ERM professionals with a grasp of, perspective on and skill to support sustainable development.

Following and alongside this ongoing data generation process and flowing from issues raised in the questionnaires, lecturers were engaged in follow-up interviews (Appendix 2B) and focus group discussions (Appendices, 4B, 5B, 7B, and 8B) to probe their feelings about the course and their insights on the emerging issues.

4.6.3 Focus group discussions

Focus group discussions were conducted with some of the groups such as first-year students at the end of year one (Appendix 7B). Focus group discussions were also held with the lecturers (Appendix 4B), others focused on the fieldwork (Appendices 5B and 6B) and the trade area projects (Appendix 8B). This was later repeated at the end of 2012 to explore if the students had different views from the first set of students interviewed in 2010.

The goal of focus group discussions is to seek in-depth understanding of meanings that are socially constructed or developed by actors within a group setting (Berg, 1998; Southwood

2000; Babikwa, 2003). There should be mutual interest between the researcher and the group; however the researcher should take the role of a leader to guide the discussion and each participant needs to be given a voice in the process (Wellington, 2000). Literature recommends four to twelve participants for interactive data yielding discussion (Krueger and Casey, 2000) large groups can encourage “social loafing”(Morgan 1988 p.43). In accordance with this literature, the aim of my focus group discussions was to give me in-depth information on the issues that had been addressed in the questionnaires and interviews. I took the role of the leader to control the discussions and avoid drifting away from the focus of the research. I also worked with a small group of students because too large a group wastes time and slows down the process.

I carried out a discussion with a focus group of five students studying ERM on the implementation of Environmental Resource Management course the attachment experience, the fieldwork and the trade area projects. Wellington (2000) argued that a focus group is often a homogenous group of people that meets perhaps three to four times or has as many as a dozen meetings. A group session may last from forty-five minutes to two hours. The focus group sets up a situation where the synergy of the group interaction of the members can add to the depth or insight of either an interview or a survey. He further argued that members of a group brought together in a suitable, conducive environment can stimulate or “spark each other off” (ibid. p.146; Berg, 2004; Southwood, 2000). This added depth to the findings with the focus groups and an opportunity for rich discussion on the research. I decided to have some sessions with the focus groups away from the precincts of the institution at an office hired for this purpose. I noticed that the students became freer and discussed more openly than when they were in the institution where sometimes there was a lot of disturbance from other students and lecturers. These focus group discussions mainly focused on the trade area projects, the fieldwork experience and the industrial attachment (Appendices 5B, 6B and 8B).

Focus groups were also intended to bring about ease because an individual can often relax more in a group than when interviewed alone. Members should feel free discuss openly and this will enrich research (Berg, 2004). Lotz (1996) suggested that during focus group discussions, interactions between the participants should be informal to stimulate in-depth discussions and reflection on the topic. My focus groups were homogenous in the sense that the students were in the same institution and studying the same course. This is important because of the assumption that they will have similar concerns in matters pertaining to environmental sustainability. The focus group questions had the following themes:

- Trade area projects
- Camping/fieldwork
- Industrial attachment

The focus group that responded to the above themes contained former students of the ERM course. The group was gender sensitive consisting of three male and two female former students. These were selected at random from the previous classes and to some extent, the choice was biased: I used the telephone to get hold of the former students and the first five that were available, willing and had time were selected. We had several meetings to deliberate on the three issues between January 2011 and April 2012.

4.6.4 Observations

Alongside these processes observations were carried out to further document the various practices, particularly what was happening in the day-to-day delivery of the course and where the students work in community contexts. I chose observation because it gives ‘live’ data from naturally occurring social situations and it is authentic: one can record what one sees and one does not need to rely on what one is told (Cohen et al., 2007). This was important for the fieldwork exercise where I particularly wanted to observe exactly what the students and lecturers engaged in. I wanted to see whether they covered what is in the course outline and also to understand the extent to which this enabled the students to become ERM practitioners. According to Robson (1993), a natural and obvious technique is to watch what is done and record this in some way and then describe, analyse and interpret the observations. I directly looked at what was taking place in *situ* and gathered narrative evidence from the students and lecturers through interviews as already described. Cohen, et al., (2007) argued that observation will yield more valid or authentic data and can be used in the interpretation of interview data. Creswell (2003) described observation as a method in which the researcher takes the field notes on the behaviour and the activities of individuals at the research site. I observed the activities that the lecturers and students engaged in to represent and track the learning interactions within the course (Jones & Somekh, 2006). The method entails being present in a situation and making records of one’s impression of what takes place. In this process I had to be fully involved in observation by participating in the activities carried out. This required an ethnographic perspective in the observation processes. Ethnography is a

branch of the interpretive paradigm concerned with participant observation – where the observer is ‘not a fly on the wall’, but becomes a participant in the activity being researched (Bassey, 1999). I was part of the learning process in my department and this gave me an opportunity to watch and see what the lecturers and students engaged in. Flick (2006, p. 228) outlined the features of ethnography as follows:

- A strong emphasis on exploring the nature of a particular social phenomenon rather than setting out to test hypotheses about them.
- A tendency to work primarily with unstructured data, that is, data that have not been coded at the point of data collection in terms of a closed set of analytical categories.
- Investigation of a small number of cases perhaps only one in detail.
- Analysis of data that involves explicit interpretation of human actions, the product of which mainly takes the form of verbal descriptions with quantification and statistical analysis playing a subordinate role at most.

These features are characteristic of this research that was based upon the ERM materials and practices to probe how this course process is translated to action by the students. The main approach to data collection was the gathering of in-depth case evidence in ERM practice. The observations took place at the lectures’ natural settings at TU-K and involved direct observation of the display of natural resource management posters in the polytechnic and practical action. I was able to record the activities and behaviour of my respondents as they related to the course instead of relying on secondary sources such as interviews. This is one of the unique strengths of the observation method (Cohen et al., 2007).

The observation method has its own critiques such as selective observations and data entry, the effect of the presence of the researcher on the respondent’s behaviour, the researcher’s lack of control of the research situation, the relatively small sample sizes and the difficult of gaining access to the research sites (Cohen et al., 2007). The ERM course has a component of field excursions also known as camping, which takes place twice in the course of the study (see Section 6.3). The first camping exercise is carried out at the end of first year and the second at the end of second year. During this research I participated in the field excursions and camping as organised by the subject lecturers to understand how this exercise is carried out. During this time I took photographs of the students’ and lecturers’ activities in the field

as presented in Sections 6.3.2 and 6.3.3 for the coastal and the highland trips respectively. Cresswell (2003) stated that the qualitative researcher, when making observations, may engage in roles that vary from non-participant to complete participant. I was a complete participant in this research as I am part of the staff that is engaged in teaching the ERM course. Therefore in the next section I shall discuss my role as a research participant.

4.6.5 Participant Observation

This study engaged in practitioner research; this means that I observed people at my own work-station. Participant observation is one of the main methods of data collection in qualitative research (Reed Danahey 1997; Denzen & Lincoln 2002). Participant observation consists of observing the activities of study subjects. I asked some of the lecturers if I could peruse their teaching materials such as the notes, learning guides and course packs. I obviously had a copy of the course (Appendix 1A HD22) and as the section head of environmental studies I observed the lecturer's instructional practices and how they translated their views into actions, giving particular attention to understanding how they worked with their students to help them shape professional perspectives and how the emerging views related to environment and sustainability.

During my observations I drew on my research on the emergence of the course (Phase 1) used my theoretical lens (CoP) to gain insights into the course and write field notes. These are the written accounts of what I heard, saw and experienced as a lecturer and in the company of other lecturers and the students. In recording my field notes I took particular care to follow the format described and carefully reflected and commented on them after each observation to prepare for analysis. Field notes consist of two parts: descriptive and reflective. The concern of the descriptive portion is to provide a word picture of the setting, people's actions and conversations as observed. The reflective portion is the part that captures more of the observer's frame of mind, ideas and concerns (Bogdan & Biklen 1998; Cohen et al., 2007).

As a section head of the ERM course it was sometimes difficult to distinguish when I was collecting data for the research and when I was doing my work. I kept a record of important and salient events, my own reflections, observations and activity interpretation that had a bearing on the research as Patton (2002) recommended. It was through the immersion that

this side of the study provided that I was able to begin to identify tensions and contradictions that might not have been apparent to me in the normal course of my work.

4.7 PHASE THREE: TENSIONS AND CONTRADICTIONS REVIEWED AGAINST ESD

The third phase of the study was concerned with surfacing the tensions and contradictions in the ERM activity system using CHAT (Section 3.8.3). The phase also paid attention to the extent to which the ERM course reflected the global sustainability issues particularly those outlined in Agenda 21. This third phase was therefore divided into two parts.

The first part probed the tensions and contractions in the development and implementation of the ERM course as an activity system in TU-K. Here I worked with the data from Phase One and Phase Two, surfacing tensions and contradictions using a methodology put forward by Dick & Williams (2004). They suggested that CHAT-based inquiry combines three components i.e. systems, learning and developmental. They argued that these three components are constructed from seven basic propositions as follows:

1. Activity Theory is based on the proposition that learning is a social and cultural process not simply a biological process.
2. Activity is what happens when human beings operate on their environment in order to satisfy a needs state.
3. Information must flow through the activity system in order for the desired results to be achieved.
4. We use tools to manipulate our environment and to get information from the environment. The tools we use mediate (or shape) the way we do the work.
5. The human systems social, cultural and organisational within which we work, also mediate the ways in which we conduct our activities.
6. When tools, rules, community and organisation operate as expected those within the activity system proceed by conducting standardised tasks with predictable results. But the system will often be interrupted by unanticipated events (disturbances) or surface underlying tensions between elements of the system (contradictions). When a team,

program or organisation encounters these it will founder unless it is able to learn how to deal with these issues. Thus disturbances and contradictions in system components allow us to learn about the real world.

7. When a contradiction's potential as a spring board is triggered by the actions of the system participants they enter a cycle of Expansive Learning. (Dick & Williams, 2004,p. 3 - 10)

This research considered the sixth and seventh propositions, using the course data to probe the activity system so as to understand tensions and contradictions that might point to (trigger) changes that might enhance the course through a critical analysis of its outcomes as a response to ESD. To achieve this it draws on the diagnostic questions set for these two propositions (6 and 7) as presented by Dick & Williams (2004). The diagnostic questions are presented in Box 4.4 and 4.5. These form the steps that were engaged in this research to come up with the tensions and contradictions in the ERM activity systems at TU-K (section 7.2).

Box 4.4: Diagnostic Questions for Proposition Six

The diagnostic questions after Dick & Williams (2004) that follow are read in relation to the ERM course as an emerging activity system within TU-K and DEEST to produce ERM professionals.

- What contradictions are there within the system? What have been the consequences? How have people responded? How could they respond?
- What generalisations do people make about the performance of the system? What exceptions to those generalisations are there? What learning is there from these "small" contradictions?
- What disturbances unanticipated events have happened? What were the consequences? What is the potential learning?
- What are the historical underpinnings of these contradictions and disturbances? How is the "past" interacting with the "present"; the "old" with the "new"?

The course as an activity system emergent within TU-K and the in the Department of Earth Environmental Science and Technology (DEEST) have over the years engaged in training environmental resource managers. The above questions will be addressed with regards to how learning is taking place in the development and implementation of the course within the department of DEEST that is specifically training for sustainable development. This is done by particularly emphasising the natural resources and how they can be managed sustainably.

In responding to how the course as a system is developing ERM professionals, I have looked at the history of the emergence of the ERM course (Phase One data) and its implementation (Phase Two data). This gives the foundation of the course as an activity system in TU-K, as discussed in Chapter Five. The weaknesses in the system are highlighted in Chapter Six that discusses the implementation process of the ERM course. The things that are missing in the system are discussed and the strengths explained with regards to the activities that are conducted in learning for ERM.

Box 4.5: Diagnostic Questions for Proposition Seven

- What is the history of how current activities came to be as they are now?
- What kinds of weaknesses exist in the relationships between the elements of the system?
- What is missing that is needed?
- What is not working as well as it might? What relationships are not working as they should?
- What strengths are there in the system? Are they being used as well as they could be?
- What potential for growth and development is there in the system? What is desirable? What weaknesses and deficiencies need to be rectified before the potential can be tapped?
- How could possible changes impact on the existing activity system? What are the learning opportunities and how can they be enhanced?
- Are adjacent activity systems likely to be affected? If so, in what way and how can these leanings be exploited?

The data to address these questions can be found in Chapter Six that deals primarily with the implementation of the ERM course.

Part 2

To understand the extent to which the ERM course has responded to and incorporated global and local sustainability issues, content analysis was used as the principle technique. In the third phase the ERM course was analysed against the agenda 21 principles around which it had originally been constructed. This was necessary to understand whether there were any omissions if the course is to train effective ESD practitioners.

To what extent is the ERM course addressing ESD in relation to global and local sustainability issues? This question was assessed as follows:

- Determining analytical categories
- Establishing units of analysis
- Determining criteria for sorting data into analytic categories
- Assessing and interpreting the number of entries in each of the categories

For the first step, determining analytical categories, the units in the ERM course were categorized as follows:

Common support subject	-	30%	-	Denoted by: C
Support applied units' subject-		20%	-	Denoted by: A
Trade specialisation subject	-	50%	-	Denoted by: S

These three categories represent the units in ERM and all the categories were subjected to analysis. These categories were established from the course outline as presented in HD 22 Appendix A.

Establishing units of analysis

The specific subjects in step one have been used as units of analysis. These units account for 100% of the total course requirement to graduate as a diploma holder in ERM.

Determining criteria for sorting data into analytic categories

The criteria used include sustainability issues being clearly mentioned in the statements of objectives and / or corresponding course descriptions. The issues likely to be addressed in the ERM course were identified in Table 4.1.

Assessing and interpreting the number of entries in each of the categories

This was undertaken by counting the cases (specific subjects with objectives and/or contents related to sustainability issues). All the ERM units, taught were analysed and categorized according to Agenda 21. ESD focuses on social, economic and environmental issues that threaten the sustainability of the planet. The issues that threaten the planet were identified at

the 1992 Earth Summit in Rio de Janeiro and outlined in Agenda 21 (UNESCO, 2006b). The forty chapters in the Agenda 21 document are grouped into four broad categories:

- Socio and economic dimensions
- Conservation and management of resources
- Strengthening the role of major groups
- Means of implementation

UNESCO (2006b) posits that understanding and addressing the issues identified in Agenda 21 lie at the heart of education for sustainable development. In line with this the present study selected thirty issues, which are more likely to be addressed in the ERM course, for analysis from the three sections of Agenda 21.

4.8 AGENDA 21 AND ESD AS A FRAMEWORK FOR ANALYTICAL REVIEW OF THE ERM COURSE

The ESD concept appears in Agenda 21 in the chapter entitled ‘promoting Education Public Awareness and Training’ (UNESCO, 1992). The concept carries with it the inherent idea of implementing programmes that are locally relevant and culturally appropriate. It identified four major thrusts to begin the work of ESD.

- Improve basic education
- Reorient existing education to address sustainable development
- Develop public understanding
- Training

This research was interested in the second, re-orienting education to address sustainable development and the fourth thrust, training, by engaging a course that is sustainability based to see how it develops ESD practitioners because training informs people of accepted practice and procedures and gives them skills to perform specific tasks (McKeown, 2002). In the ERM course the learners are trained to become natural resource managers or technicians.

This research drew from Agenda 21 issues to see how the ERM course had incorporated the issues that are listed in this document as presented in Table 4.3. The research looked at the first three components as a lens to understand the extent to which the course took up the concern of sustainable development. Agenda 21 is seen as the foundation for the development

of Education for Sustainable Development as detailed in Chapter Two and thus the reason for using it as the lens in this research.

I examined the ERM course outline against Agenda 21 to understand the issues that have been directly and indirectly covered in the course.

Table 4.4: The issues selected from Agenda 21

Section/ chapter	Issues/themes	Section /Chapter	Issues/themes
	SECTION ONE: SOCIAL AND ECONOMIC DIMENSIONS		SECTION TWO: CONSERVATION AND MANAGEMENT OF RESOURCES
I/3	Combating poverty	II/9	Protecting the atmosphere
I/4	Changing consumption patterns	II/10	Managing land sustainably
I/5	Population and sustainability	II/11	Combating deforestation
I/6	Protecting and promoting human health	II/12	Combating desertification and drought
I/7	Sustainable human settlements	II/13	Sustainable mountain development
I/8	Making decisions for sustainable development	II/14	Sustainable agriculture and rural development
	SECTION THREE: STRENGTHENING THE ROLE OF MAJOR GROUPS		
III/24	Women in sustainable development	II/15	Conservation of biological diversity
III/25	Children and youth in sustainable development	II/16	Management of biotechnology
III/26	Strengthening the role of indigenous peoples	II/17	Protecting and managing the oceans
III/27	Partnerships with nongovernmental groups [civic groups]	II/18	Protecting and managing fresh water
III/28	Local authorities	II/19	Safer use of toxic chemicals
III/29	Workers and trade unions	II/20	Managing hazardous wastes
III/30	Business and industry	II/21	Managing solid wastes and sewage
III/31	Scientists and technologists	II/22	Managing radioactive wastes

4.9 ESTABLISHING THE RIGOUR IN RESEARCH

According to Qablan (2005), establishing rigour in qualitative research is a critical issue. The trustworthiness of research should be thought about during research design as well as in the midst of data collection. All qualitative researchers must establish a sound strategy to ensure

credibility of their results. In the sections that follow I shall explain how I ensured rigour in my research in the following sections.

4.9.1 Ethical issues and considerations

I used two major documents as a guide on how to deal with the ethical issues of the study. These were Rhodes University Ethical Guidelines (Rhodes University, 2005) and Creswell's Research Design (2003). The first ethical issue that I dealt with was getting permission to conduct research in a public institution, TU-K. Permission was obtained from the Principal of the institution, the lecturers and students involved (see the permission letter, Appendix 1). From the respondents I obtained informed consent. I informed the respondents of their right to withdraw from the study at any stage. In all cases, oral permission to conduct the research was granted. The third ethical issue was about respecting the respondents as human beings. I did this by being sensitive to their cultural norms, respecting their space, and making sure that the study did not cause them physical or psychological harm. I also shared the results of the research with them on an ongoing basis. The fourth ethical issue involved ensuring respondents' confidentiality and I did not mention their names in the final research report.

Blanche, Durrheim and Painter (2006, p.61) argued that "the essential purpose of research ethics is to protect the welfare of research participants, scientific misconduct and plagiarism which includes respect for truth, democracy and persons". There are four widely accepted principles that are applied in various ways to determine whether research is ethical: autonomy and respect for the dignity of persons, non-maleficence, beneficence and justice. To enhance the ethical standing, Blanche et al. (2006, p.68) have suggested eight practical principles: collaborative partnership, social value, scientific validity, fair selection of study population, favourable risk/benefit ratio, independent ethical review, informed consent, and ongoing respect for participants and study communities.

Qualitative research deals with persons and therefore I had to show respect for persons, knowledge, democratic values and quality of educational research. This was done by explaining comprehensively the purpose of the research and seeking for permission from the principal and the department. Permission was granted through the chair of the department

who also explained the research to the students I was careful to get informed consent for the interviews and promised confidentiality as Cohen et al., (2007) suggested that informed consent has four elements: competence, volunteerism, full information and comprehension. Permission was granted by responsible, mature and capable of decision-making individuals. The subjects concerned were also asked for permission. This gave me the freedom required to gather the information.

The participants were free to choose to take part and exposure to risks was undertaken knowingly and voluntarily; all interviewees were adults and of sound mind. They were requested to participate in the research on their own volition. They were assured that they were free to withdraw at any time. The participants were fully informed about the research. I made sure that the participants fully understood the nature of the research project. Care was taken to avoid harm to the participants when collecting data as reminded by Flick (2006). Students had the option not to indicate their names on the questionnaires and I avoided situations where participants might be embarrassed and ensured confidentiality in the written report.

4.9.2 Data validation and reliability

According to Maxwell (2005, p.106) validity is “correctness or credibility of a description, conclusion, explanation, interpretation or any other sort of an account”. In its broadest sense, validity refers to the degree to which the research conclusions are sound or are what they claim to be and reliability is the extent to which a research fact or finding can be repeated given the same circumstances (Bassegy, 1999, p.75). There are several types of validity depending on the type of research carried out. These include: internal validity, external validity, measurement validity, interpretive validity and statistical validity (Blanche et al., 2006, p.90). In qualitative research, validity has two threats: researcher bias and the effect of the researcher on the individuals studied often called ‘reactivity’ (Maxwell, 2005, p.108) Maxwell suggested that researcher’s bias can be overcome by the researcher’s declaration of personal values and beliefs that she/he brings to the study. In this study I believed in the potential of an environmentally related course to enable learners become ESD practitioners.

Maxwell (2005) suggested various strategies for threats to qualitative research. These include: intensive long-term involvement, rich data, respondent validation, intervention, searching for discrepancy and negative cases, triangulation, quasi statistics and comparison (ibid. pp.111-114). Being an employee of the institution, long-term involvement was taken care of. Participant reactivity in the research process was minimised by intensive and prolonged engagement with the subjects and through data transcription. Indeed I was in contact with the subjects frequently in their classrooms, fieldwork and their project works. This prolonged engagement helped me overcome (as highlighted by Guba and Lincoln 1989), the effect of misinformation, distortion, or presented 'fronts'. Both long term involvement and intensive interviews enabled me to collect rich data that was detailed and varied enough to provide a full and revealing picture of what is going on as suggested by Maxwell (2005).

Member checking was done after data analysis to confirm that the record was a true reflection of the course. This was done by requesting two lecturers and two students to go through the records to confirm that it was a true reflection of the ERM course. This is the single most important way of ruling out the possibility of misinterpreting the meaning of what participants say and do and the perspectives they have on what is going on. It is also an important way of identifying the researcher's biases and misunderstandings of what is observed (Bassey, 1999, p.77). In the use of questionnaires I tried as best as I could to make sure that the questions were as unambiguous as possible so that they would be interpreted in the same way by all interviewees all the time. I also had similar semi-structured interviews, with the same format and sequence of words and questions for each respondent to ensure validity. The interview questions were carefully prepared to avoid leading questions as suggested by Cohen et al. (2007).

In summary I used triangulation to help build a more complete picture of how the ERM course was developed and implemented. Cross-checking the field notes and transcripts with the respondents helped in examining the accuracy. I held discussions with critical friends and colleagues, to share research experiences with them, and to gain their input into the project (peer debriefing). I kept a record of all the major steps of the research process and explanations of all the major decisions that I took (audit trail). I constantly reflected on how my personal biography might be influencing my understanding and interpretation of what I saw, heard or read with regard to the integration of ERM (reflexivity). I developed detailed contextual profiles of Education for Sustainable Development (Chapter Two), theoretical framework (Chapter Three), ERM course development (Chapter Five), ERM course

implementation (Chapter Six) and the contradictions in the ERM course (Chapter Seven) to ensure field-based reflexivity.

In conclusion, in this chapter I have described the research design decisions made to identify and establish appropriate methods for generating data about the how the ERM course was enabling ESD professionals. A major key to the choice of methods was clarifying philosophical assumptions about the nature of reality and how knowledge is created. This chapter introduced the interpretive paradigm as the main philosophical base of the research project, described its key features and how they influenced the entire research process. The chapter further explained why the case study methodology was used and the selection of semi-structured interviews, observations and content analysis as the main methods of data generation. The chapter provided details on the procedure, which was followed during the analysis of the different items, and described the construction and role of the different research instruments used during the analysis. The chapter also included strategies that were employed to ensure rigour in the research. The chapter ended with a description of how various ethical issues were dealt with in the study. The next three chapters detail the analysis of the ERM course, how it was prepared and implemented and the contradictions thereof starting with the course development pedagogic discourse,

CHAPTER FIVE: AN ACCOUNT OF THE DEVELOPMENT OF THE ERM COURSE AND THE EXTENT TO WHICH THE COURSE INCOPORATES AGENDA 21 ISSUES.

5.1 INTRODUCTION

This chapter seeks to address the first research objective in Section 1.5.3 and research question as outlined in Section 1.5.4, namely:

To probe how the course in ERM was prepared at the Technical University of Kenya to train ERM practitioners and the extent to which it addresses agenda 21.

The revised course is currently offered on a full or part-time basis. As the university settles to its new mandate, the course is under review to embrace the institution's vision to train for the real world. Currently, on successful completion of the course, students are awarded a Diploma of Technology in Environmental Resource Management. This is the qualification that ERM professionals need to work in conservation related fields.

The use of the concept of a community of practice (Wenger, 1998a) provided an analytical lens (Section 3.3) that enabled me to probe how the course was constituted and delivered as a scaffolding activity system to enable course participants to be supported to enter the ERM field and to become effective ERM practitioners. The analysis is centred on the course development processes that gave rise to a revised course with its purpose, content, and unfolding course processes designed to produce ERM practitioners.

As outlined in the previous chapter, data on the revision of this course was gathered through secondary sources and is represented here through an analytical review of documents generated during the 1998-2002 course revision. The output of the course development process is viewed as the blueprint for the training of Environmental Resource Management practitioners to support learning and change towards a more sustainable environment. The documents that were used to derive the historical data for analysis are listed in Appendix 1 A. For ease of referencing management, as many of the documents are not in a published form but are minutes and working papers, these documents have been indexed and will be referenced as historical data using an HD prefix that can be found in Appendix 1A. The course thus developed is also analysed in this chapter using agenda 21 guidelines.

Questionnaires were used to generate background information on the course and to identify participants in the course development process so that information and perspectives could be verified and derived from those who were involved in the process (Appendix 2A). The background information from the questionnaires provided me with the first categories for generating interview data that is represented in this chapter to construct an account of how the revised course was developed for implementation in 2002. It should be noted that I participated in the course development process so it was very interesting for me to undertake an analysis to give a deeper grasp of what I had been involved in. This, allowed me to raise questions and carry these into a review of course implementation in Chapter Six. In the next section I describe the revision process from the initial Environmental Studies course to the emerging Environmental Resource Management course.

5.2 THE BACKGROUND TO THE ENVIRONMENTAL RESOURCE MANAGEMENT COURSE

The Environmental Resource Management course has a long history beginning with the inception of a course entitled Environmental Studies initiated at TU-K to train manpower for the environmental sector in the country in 1984 (Appendix 1A HD1, p.1). The aim of the initial course was to train for the environmental sector in the country as environment degradation was escalating and reaching alarming levels globally (Section 2.1). The Stockholm Conference of 1972 and the formation of the World Commission on Environment and Development (WCED) 1987 attest to this (Section 1.4). Therefore the environmental course started at TU-K in 1984 was in response to the emerging global environmental challenges.

Also, at this time, the education system in Kenya was in transition from the 7-4-2-3 to 8-4-4 system (Section 1.4) prompting the teachers in the advanced level department at the institution to design a new training programme to enable them remain relevant in the changing institution. These teachers were faced with a difficult situation of either seeking deployment in the secondary schools or resigning. In 1984 the advanced level of secondary education (Form Five and Six classes) were abolished and a new system of education was implemented in the public institutions. The teachers who had been teaching these classes

were therefore being phased out. These teachers, as a matter of necessity, developed and implemented the initial Diploma in Environmental Studies (DES) in the Department of Information and Liberal Studies (ILS), of the then Kenya Polytechnic (Appendix 1A, p.1). This was designed to train environmental officers for the government and Non Governmental Organisations (NGOs) to work in the environmental conservation sector. Delivering the course as primarily subject content to be learned and examined, the initial course was a technical programme whose national aims were to:

- Provide increased training opportunities for the increasing number of school leavers to enable them to be self-supporting;
- Develop practical skills and attitudes which will lead to income generating activities in the urban and rural areas through self employment;
- Provide practical education and training skills which are responsible and relevant to Kenya's agricultural, commercial sectors and enhance the place of this nation development;
- Provide the technical knowledge and vocational skills necessary to enhance the pace of the nation's development; and
- Encourage self-employment while at the same time producing skilled artisans, technicians and technologists for both formal and informal sectors at the ratio of one technologist to five technicians to thirty craftsman artisans (1:5:30) (Appendix 1A HD1; p.1).

According to the course outline, the objectives of the technician programme were to:

- Develop skills which will be responsive and relevant to the country's human resource required at the middle level;
- Prepare the trainees so that they can enter the world of work with confidence for either salaried employment or self-employment function; and
- Impart adequate skills which will enable the trainee to operate either as craftsmen or perform middle supervisory function. (Appendix 1A HD1, p.2).

The Environmental Studies course was designed to prepare knowledgeable and effective graduates to meet the needs and challenges of environmental management and conservation

with specific reference to East Africa. The general objectives of the course were that on completion of the course, the trainee should be able to:

- Assess the environmental impacts resulting from human activities;
- Recommend and implement strategies suitable to combat environmental degradation;
- Interpret policies and regulations pertaining to environmental issues;
- Understand the process of environmental degradation
- Acquire the necessary skills to effectively deal with environmental problems; and
- Participate in the formulation of policies. (Appendix 1A HD1, p.4)

5.3 INTRODUCTION TO THE REVIEW OF THE ENVIRONMENTAL STUDIES COURSE

The review process of the Environmental Studies course at the then Kenya Polytechnic was carried out between 1998 and 2002 so that vocational training would be better orientated to the needs of industry and the labour market in the country. The revision was part of an international post secondary education project to prepare employable graduates for industry (Appendix 1A HD2). The review of the Environmental Studies took place under the programme *Supporting Environmental Education in Kenya* which was aimed at “providing tools to develop modern, competitive economies through adaptation of the necessary changes in the post secondary educational curriculum” (Appendix 1A HD2, p.2). This review was undertaken with support of Saskatchewan Institute of Science and Technology (SIAST) Canada, the Commonwealth Association of Polytechnics in Africa (CAPA), Grant MacEwan Community College, Canada, Soft wave’s Educational software INC, East Africa Educational Publishers (EAEP) and TU-K.

The review of the Environmental Studies course was funded by Canadian International Development Agency (CIDA) in response to alarming rates of environmental degradation due to rapid population growth (GOK, 1994). The escalating environmental challenges alarmed the government and given that the 1994 development plan prioritised environmental education both in these sectors, the government was ready to embrace change to enhance environmental conservation in both these sectors. The formal institutions were facing challenges in teaching environmental education due to shortage of funding, limited teaching

resources and lack of sufficient teacher training (Appendix 1A HD22, ACCC report, p.7). Besides, the increasing number of secondary school leavers necessitated more post-secondary training.

The then Kenya Polytechnic was selected for *Support Environmental Education program in Kenya* programme, to train for environmental conservation. The Department of Information and Liberal Studies, where the Environmental Studies course was taught, became the site to launch the programme to review the course to focus more directly on sustainability principles. This was to meet the societal needs for environmental resource technicians (practitioners) to work in the sector of environmental conservation (Appendix 1A HD2).

As mentioned above, the team of experts to review the course comprised SIAST staff, CAPA representative, Grant MacEwan Community College, Soft wave's Educational software INC, East Africa Educational Publishers (EAEP) and TU-K. The experts from SIAST coordinated the review process using their Develop a Curriculum (DACUM) process and envisaged a Competency Based Education (CBE) approach as the mode of course delivery. It is important to note that the initial review of the course was managed by the Canadian experts but they did not take part in its implementation. On completion of the review process, the TU-K teaching staffs were mandated with the implementation of the course.

The TU-K course facilitators were engaged in the programme at the stage of developing the units at the DACUM workshop. Here they participated in compiling learning materials. One of the lecturers (L5) involved in course development, points out that the TU-K teaching staff was involved at a much later stage. "We were involved in generating information for our specialised subjects and not from the beginning of the whole process" (Appendix 2B). This implies that the teaching staff of TU-K did not play a significant role in the consultation with prospective employers or in planning for the course, rather they were brought on board at the DACUM workshop and to engage in preparing the teaching materials for their areas of speciality as reported in the interviews with the lecturer.

There seems to have been limited engagement in the planning of the TU-K experts as reiterated by the main expert from Canada, Osteneck, in her thesis on the process (Osteneck, 2011 p.13) stated that:

"....without malice or conscious intent, facilitators from first world projects may

forge ahead with the project focus without having gained information about current acceptable lesson delivery methods in the developing country they have come to assist. Certainly I do not remember even asking how lessons were usually delivered in these settings. The reality is: we brought our Canadian curriculum, our Canadian ideas, and our Canadian learning materials (textbooks, learning manuals, learning guides) and we expected the Kenyans in our project to accept the content and materials that we brought.”

This indicates that the level of involvement of the staff at TU-K was very low and yet they were expected to implement the programme that had been prepared for them. As a result, the envisaged CBE approach failed and teaching reverted back to the traditional mode. My view is that full engagement of the staff concerned, together with their experiences, shortcomings and strengths plays a significant role on programme implementation. This was overlooked in the planning and implementation of this particular programme and thus it fell short of the expected results as detailed in Chapter Six on ERM course implementation.

5.4 THE GOALS FOR REVIEWING THE ENVIRONMENTAL STUDIES COURSE

In the 1994 development plan the government of Kenya expressed the need for environmental education and commitment to conserve its environment through various efforts, such as formal education which plays a significant role in the development agenda of a nation; therefore the country decided to improve its delivery of knowledge at institutions of higher learning by enhancing the courses in these institutions. As the excerpt below from HD 2 indicates, the goals of the review were:

- To support and strengthen Kenya’s long-term plan for sustainable development through environmental education and training;
- To build institutional capacity within the Kenya Polytechnic to enable it to plan, deliver and manage environmental education training and learning resources development; and
- To promote environmental citizenship through the polytechnic faculty students (Appendix 1A HD2)

In this programme these three initial goals were translated into five specific components to enhance sustainable development:

- Fostering the green college concept;
- Establishing an Environmental Learning Resource Centre;
- Updating the Environmental Studies Curriculum;
- Developing capacity in desktop publishing; and
- Expanding the project to other countries through CAPA. (Appendix 1A, HD2)

This research focused on the third component, ‘updating of the Environmental studies course’, to equip future sustainability personnel to work in the field of conservation. In the process of course development, consultations were held with the respective industry/workplaces that absorb the course graduates.

The DACUM process was used to come up with the various competencies that a trainee in the course should be competent in to be awarded a diploma certificate in the course. In the next section I give a brief outline of the DACUM process.

5.5 DACUM APPROACH TO ERM COURSE DEVELOPMENT

The ERM diploma course at TU-K was reviewed using the Develop a Curriculum (DACUM) process. This is an approach to occupational (job) analysis extensively used in Canada at post secondary level. It is said to be effective, quick and low cost (Appendix 1A HD7). According to the DACUM expert (Appendix 1A HD7) for the ERM course development, the purpose of the DACUM process is:

- To develop a current relevant localised curriculum for new and existing programmes (maximise input from industry and business the future employers of the graduates); and
- To prepare job descriptions, do performance appraisals and as a plan for future training.

The philosophy of this process as outlined in HD11 is:

- Expert workers from the occupation can best describe/define their occupation;
- Any job can be described in terms of the tasks that the workers in the occupation

perform; and

- All tasks include knowledge and attitudes that workers must develop in order to perform the tasks.

The DACUM process is said to benefit the learners, instructors and employers (Appendix 1A HD11 p.9-10). It is done through a workshop using a specific procedure, operational guidelines, job tasks and a facilitator. As recorded in Appendix 1A HD11, the process operates on the following three premises:

- Expert workers can describe and define their job more accurately than anyone else;
- An effective way to describe a job is to define the tasks that expert workers perform; and
- All tasks, to be performed correctly, demand certain knowledge, skills, tools, and attitudes. (HD 11 p.8)

Therefore the stakeholders who are defined here as those who will employ the students who have done this course, were expected to define their jobs and explain the tasks that their workers are to perform. They outlined the knowledge, skills, tools and attitude that were required for the job. In the following section I outline the DACUM process as was used to review the ERM course at TU-K.

5.5.1 The DACUM process in developing the ERM diploma course at TU-K

The DACUM process for the review of the environmental studies at TU-K was conducted in a two-day workshop held at Multimedia University College in July 2000 (Appendix 1 A, HD7). The workshop involved the experts from Canada, TU-K lecturers and various stakeholders identified as employers of the graduates of the course. The stakeholders included Kenya Wildlife Service (KWS), National Museums of Kenya (NMK), Kenya Institute of Administration (KIA), various university representatives, the Ministry of Education, to mention but a few. These stakeholders generated a list of the skills needed by a trainee in the course should have to be employed as an environmental officer in various places (Appendix 1A HD2). It is important to note that the students and parents/guardians were not involved in the process.

The DACUM process requires a carefully chosen group of about eight to ten experts from the occupational area to form the DACUM committee (Appendix 1A HD11). The committee members were recruited directly from business, industry, or professional organisations. The

committee worked under the guidance of a facilitator for two days to develop a DACUM chart (Appendix 1A HD2). Modified small-group brainstorming techniques are used to obtain the collective expertise and consensus of the committee. The DACUM committee was carefully guided through each of the following steps by the facilitator:

- Orientation;
- Review of job or occupational area description;
- Identification of general areas of job responsibility;
- Review and refinement of task statements;
- Sequencing of task statements;
- Identification of general knowledge and skill requirements of the occupation, tools, equipment, supplies, and materials used, and desirable worker traits and attitudes; and
- Other options, as desired (that is, identification of entry-level tasks).

This exercise does not require advance preparation because the participants are expected to have occupational expertise. It is said that participants on past DACUM committees have, without exception, found the activity to be a professionally stimulating and rewarding experience (Appendix 1A HD11).

After the DACUM process, the implementers of the course were brought in to prepare the learning materials. Participants in this workshop also developed the learning competencies for the eight identified components: Personal Competency, Communication, Research, Operating Equipment, Managing Environmental Resources, Office Administration, Information Management and Training (Appendix 1A HD2).

These competencies were to be developed into learning units and as such, each of these areas were assigned to the TU-K lecturers (Appendix 1A HD3) and then broken down into specific duties for which learning modules were developed (Appendix 1A HD20). I participated in the design and development of the course as a coordinator of the Managing Environmental Resources component. This involved coordination of lecturers in developing course content in their areas of specialisation and also developing the materials for teaching. The lecturers developed the learning materials from textbooks and their personal notes. In the next section I give a brief outline of the learning materials expected at the end of the DACUM exercise.

5.5.2 An overview of the learning materials

At the end of the DACUM process the lecturers prepared the learning materials for the identified tasks. For each of the competencies, three types of instructional materials were to be developed or selected as outlined:

- The learning guide directions and any print based instructional materials that will be enclosed in the learning guide (i.e. introduction, instruction sheets, review exercises, answer keys, practice exercises, skill test assignments, etc.);
- External materials that direct the student to learning such as textbooks, manuals, video tapes, audio cassettes, and computer based instructional programmes etc.
- Materials that support the delivery of instructor led activities that the students are directed to participate in (i.e. instructor manual). (Appendix 1A HD17, p.152).

The teaching staffs at TU-K were tasked to prepare all the learning materials for course delivery. The report by the Canadian consultant (Appendix 1 a HD20) indicated that 22 learning guides were completed by 17 March 2002 but eight had not been completed as expected. The report further indicated that the format of the learning guides was presented as expected although some areas of the DACUM were not adequately represented. The outcome was that the ERM programme had thirty units to be covered in two years (Appendix 1A, HD22). These covered the eight areas of competency identified by the experts at the onset of the project. The ERM programme prepared in this way was to be implemented using the Competency Based Education (CBE) approach.

5.6 COMPETENCY BASED EDUCATION (CBE)

A Competency Based Education (CBE) approach was recommended for the ERM course (Appendix 1A HD22). The approach (Appendix 1A HD9 and HD10) suggests that the course should be student-centred, giving the students the authority to take the lead in learning as opposed to a teacher-centred approach, where the teacher has the authority and directs the learning process. In student-centred learning, the teacher and the student work together in terms of problem identification and solution seeking. This approach to the course was

influenced to a great extent by the thinking of the Canadian experts because the personnel and materials used were mainly drawn from Canada, the Wascana Campus project of 1999.

The goals of the revised course were influenced by environmental thinking because it was to be anchored in environmental education and training. The conceptualisation of the course was informed by various organisations that appear to have brought in various theories, environmental thinking and resources. Materials development was mediated along a participatory route (as outlined above), and many different stakeholders took part in its formulation. The various stakeholders brought different perspectives and interests into the development of the programme that resulted in thirty units to be covered in the course.

The mode of learning at TU-K at this time was the traditional subject content delivery with formal examinations. This was deemed unsatisfactory for sustainability learning compared with the CBE approach. The advantages of CBE over the traditional mode of learning were overwhelming: CBE gives freedom of multi-entry and multi-exit and it is a flexible and relatively open system (see Table 5.1). It takes care of the learner since it is self-paced: one does not compete with others. According to the CBE approach, credit is granted for each module that is measured and based on industry standards (Appendix 1A HD10, p.98, see excerpt in Table 5.5).

Table 5.5: Traditional versus Competency Based Education Delivery

Traditional delivery	CBE delivery
<ul style="list-style-type: none"> • Limited entry/exit (September after two years) • Entry requirements are usually based on academic grades/subjects • Preset learning time with: timetables, exam schedules, graduation dates • Instruction occurs in groups • Credit is granted when courses are completed • Grades are norm-referenced (letter/numerical grades) 	<ul style="list-style-type: none"> • Open entry/exit (all year) • Flexible and relatively open access • Variable self paced learning time within an established programme length • Instruction is individual • Credit is granted for each module that is measured • Grades are based on industry standards(mastery/ non-mastery)

SIAST (2002) *Learning Guide*.

The ERM course outline indicates the competencies required for each of the units as

summarised in Appendix 1A HD22, p.3. The units are described using the competencies the students are expected to have achieved by the end of each course unit. In the CBE approach the learners have to attain functional competence in each of the units taught and this was to be demonstrated practically before the learner could graduate (Appendix 1A HD22). The units covered a wide range of environmental management issues as suggested by the experts and the stakeholders.

5.7 THE ERM COURSE

The revised Environmental Resource Management course outline prepared between 1998 and 2002 emphasises competency learning. It is here that the first differences in the course are notable because the revised course specified competences rather than end-point objectives that were mostly assessed in tests within the various subjects as outlined in the following excerpt from Appendix 1A HD22, p.2:

- Manage environmental resources;
- Supervise community development activities;
- Use computers to manage data and write technical reports;
- Operate equipment safely and survive in the wilderness;
- Perform scientific experiments;
- Manage an office; and
- Organise environmental seminars and workshops.

The above list is competencies that were envisaged by the revised environmental resource management course. The revised ERM course was developed in a DACUM process (Section 5.5.1)

5.8 THE RELATIONSHIP BETWEEN THE INITIAL ENVIRONMENTAL STUDIES AND THE ERM COURSE

An analysis of the two course documents (Appendix 1A HDI and HD22) indicates that the ERM course was initially made up of the subjects that were in the Environmental Studies course as summarised in Table 5.2 see the old course (Environmental Studies) and the revised course (Environmental Resource Management). It is clear from Table 5.6 that the initial course had three years duration. Some of the units were continuous from one year to the next, which means that a unit could be done continuously over a period of two years. The new

course introduced the modular system that allowed completion of a unit in one semester. This means that a student could do units separately and not necessarily in consecutive semesters. In other words units were prepared as complete packages in themselves. The modular form is more flexible as one can study a unit without relying on the previous year. The new course also had more units to cover, for example, year one had ten units whereas the old course had eight. At the end of first year the students went for a fieldwork/camping period of one week; this was not a requirement in the old course. There are two camping exercises in the new course, one to the coastal region and the other to the highlands of Kenya, to give the students a real life experience. The new course has three optional subjects, code 318, 319 and 320. In summary the new course has more units and course content to cover than the old course and it was designed for more hands on experience (Competency Based Education). One of the lecturers (L5) involved in the development of the ERM course explained how the ERM course was similar to the old course in terms of subjects, the major difference being that there were more subjects in the new one and more detailed content:

I do not see much difference in terms of the subjects, we have all the subjects we had in the old one, but there are several new ones and some of the old ones were expanded, I mean some were split and now there is more content and we have to use competency based learning although it is not very clear. (Appendix 2B, L5)

In the initial environmental studies course the project paper component (ES 16) was presented as a written paper for the final examination whose aim was to give the trainee(s) experience in an extended piece of practical work and an opportunity to develop and implement their own ideas. It was also an experience of working with the supervisor and peers in carrying out the instructions of the supervisor in writing a technical report and in keeping records of work during the industrial attachment. The industrial attachment took 330 hours, during this time each trainee was attached to a supervisor who was expected to give a report to TU-K at the end of the attachment period (Appendix 1A HD1). In the new course the trainees were expected to write a project whose aims were similar to those of the initial course. In the revised course, the industrial attachment remained the same, only there were additional forms to be filled in by both the student and the field supervisor (Appendix 9B).

In the revised course seven new units were introduced in the first and second year of study and in the third year there were six units; these new units are indicated in red in Table 5.1. I have observed that although there were many new units introduced there is no indication of

additional time to cover them. This means that all the old and new units in the revised course were taught within the time schedule for the initial course. My observation is that either previously there was too much time or more content was covered. It is also important to note that the units either remained with the same title or they were split into two and acquired a different name. For example, environmental ecology and soils became two units; Environmental Ecology and Soil Management. Human Ecology and Land Use became Contemporary Land Use Practices and Human Ecology was dropped. Maps and Images became Maps, Photogrammetric and Remote Sensing etc. In reality the old course was enhanced with some units being given new names (Appendix 2 Table 5.2). I have noted this change in this way because it reflects the point at which the tension between teaching and examining content knowledge, managing and assessing a course with wider knowledge and skill components began to surface in a way that was to impact on the course delivery in future.

The two course documents indicate that changes in the course expanded the previous units to cover a wider area and the new course was also more detailed than the previous one. The major shift however was in the emphasis on competencies.

5.9 ENVIRONMENTAL RESOURCE MANAGEMENT AND SUSTAINABLE DEVELOPMENT (SD)

The reviewed ERM course was made up of thirty units or subjects; these units address different aspects of sustainable development. The ERM course addresses sustainability through content that explains how to manage the natural resources in a sustainable manner. The course outlined in Appendix 2 Table 5.2 reflects the major natural resources in terms of their status and conservation management approaches to sustainable development. Theoretically the course creates awareness among the learners of how to manage the resources sustainably. The learners are expected to apply this in the fieldwork exercises, attachment period and in the trade area projects. These activities enable the students to become natural resource managers in a conservation community of practice. Once they complete the course they seek employment in conservation management because they are prepared to work in this sector.

Since the inception of the university in 2007, the programmes have been reviewed to make

them more relevant to the mandate of the university therefore the ERM course has also been revised. In this section I address the fourth objective and the fourth question as stated in section 1.5.3 and 1.5.4 respectively:

- To examine the extent to which the ERM course is addressing ESD in relation to global and local sustainability issues.

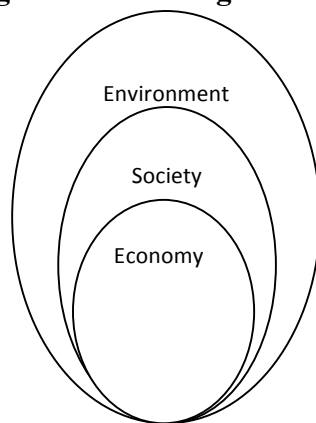
This section presents a detailed account of how sustainability issues have been addressed in the ERM course offered at Technical University of Kenya (TU-K). The intention of this analysis was to understand how the ERM course is orientated to a shift in focus to ESD.

I used Agenda 21 (table 4.3) issues as the lens to look into the content of the ERM course offered at the institution, which trains environmental officers at a diploma level to work in various fields on matters pertaining to environmental management. Agenda 21 became relevant to interrogate the ERM course because the course had been prepared using these sustainability principles. The review of the course was carried out between 1998 and 2002 and implemented in 2002 at TU-K. The issues presented in Agenda 21 outlined a path to sustainable development and were thus considered in this research as guideline for training in higher education institutions and in particular, vocational training. The ERM student is expected to have an understanding of the interrelatedness of the three spheres of sustainability to be able to work in the community on conservation matters. Thirty of the issues addressed in the first three sections of Agenda 21 are addressed to understand how they are incorporated in a course that is training personnel to work in the field of environmental management (conservation).

As explained in Chapter One and Two, the emergence of the current ESD discourse seems to have originated from the Rio Earth Summit of 1992 where Agenda 21 was meant to be a programme of action for sustainable development worldwide. Agenda 21 was designed as a comprehensive blueprint for action to be taken globally (Wals, 2012). In this research, each issue in Agenda 21 is examined in turn with an explanation of how the ERM programme has addressed the particular aspect.

In this research I was aware that sustainability is interpreted and defined differently by various writers (Jickling, 1997; Jickling and Wals, 2008) and should be incorporated in all areas. I reflected on the strong sustainability model of Hattingh (2005) as shown in figure 5.1 because I feel this model portrays sustainability in a more holistic manner (see also figure 2.1b) According to this model the economy, society and the environment are interrelated/intertwined and none works in isolation; an impact on one affects the other spheres. The research therefore tried to establish the extent to which ESD has been incorporated in the ERM course. The model that integrates society, economy and ecology states that ‘no one discipline can or should claim ownership of ESD’ (Wals, 2012; UNESCO, 2006b, p.27) as quoted by Dalelo, 2010. This research was an attempt to understand how far the ERM course has integrated ESD in an attempt to explore how best to prepare a practitioner for ESD.

Figure 4.11: Strong sustainability



Source: Hattingh (2005)

An ERM student is expected to have an understanding of the interrelatedness of the three spheres to be able to work in the community on conservation matters. This research selected thirty of the issues addressed in the first three sections of Agenda 21 to understand how they are incorporated in a course for training personnel to work in the field of environmental management (conservation).

The main concern of the Environmental Resource Management course is how the Earth provides resources and living space for society, ecosystem interrelatedness, how humans are interacting with these resources, the impacts humans are exerting on the resources and how these impacts can be reduced/mitigated. In this way the ERM graduates provide a bridge

between the natural resources and human interactions by providing solutions to environmental degradation issues in their localities and hence promoting sustainable development. ERM as a course is thus natural resource management orientated and has an ecosystems and conservation focus centred on the environment pillar of ESD. ESD has a much wider scope and focus that encompass society and economy. The ERM course put in the fore-grounded environment as the central concern whereas ESD has come to see the three elements of society, economy and environment as pillars for sustainable development.

5.9.1 ERM Course Introduction, Objectives and Graduate profile

The diploma of Technology in Environmental Resource Management course is offered in the school of Pure and Applied Sciences at Technical University of Kenya. The course prepares the trainee in environmental resource management to work with society's complex relationships with environmental resources. The short- and long-term facets of environmental resources, the social and biophysical processes that drive our relationships to resources and ecosystems over time are examined in the course. Ecology, sociology, economics, political science, philosophy and psychology provide the lenses through which a variety of issues be they historical, contemporary or eminent are examined. The goal of this course is to train a resource manager who can look at the environment in its totality, diagnose environmental resource problems/issues and suggest sustainable mitigation measures at local, national and global levels. The programme is aimed at developing an awareness of the complexities of interrelationships between human and biological systems because the way society frames these relationships, determines how society allocates and/or conserves its natural resources (UNEP, 2006b). The students learn and are equipped to work as environmental technicians, resource officers and supervisors in national parks, forestry, community development projects and non-governmental organisations dealing with environmental issues.

The course is organised in a series of units as described in Appendix 2 Table 5.2. The overarching subject is an exploration of how society can manage resources sustainably, that is, how society can enjoy both goods and services while maintaining the Earth's life-support systems into the long-term future. Students choose writing projects that focus on issues of particular interest to them individually. Issues explored in class may be locally and regionally based, such as water rights and allocation or endangered species, conservation on public and private lands; or may be global in scope, such as human contributions to and ecological effects of climate change. Each issue is considered from a variety of perspectives

biological/ecological as well as through the ‘lenses’ of history and the social sciences. This multiple-perspective approach is intended to provide a framework for understanding the issue's contemporary relevance. Discussion sessions and the writing projects allow students to develop and practise their critical thinking skills, and to hone their professional writing skills. Discussion sessions and writing assignments also provide opportunities for students to brainstorm ideas for creative solutions to current resource problems.

The programme is covered in 3360 hours and 61 course units. Considering that a nominal hour for a practical semester is counted as only half a contact hour, the total contact hours on the programme comes to 2880, of which 1390 are dedicated to lectures while 1490 are taken up by practical and tutorial work.

Table 5.6: The distribution of the contact hours by subject areas

Subject Area	Nominal Hours	Contact Hours	Units	% Nominal Hrs / Units	% Contact Hrs / Units
Environmental Management Technologies	2604	2604	54.25	48.4%	55.1%
Biology	1056	624	13	19.6%	13.2%
Geography	480	480	10	8.9%	10.2%
Physical Science	432	432	9	8.0%	9.1%
Industrial Attachment	432	216	4.5	8.0%	4.6%
Social Sciences	228	228	4.75	4.2%	4.8%
Technical Studies	144	144	3	2.7%	3.0%
Total	5376	4728	98.5	100%	100%

The various courses of study in the programme are offered on the basis of coursework and written examinations. For the entire programme, coursework accounts for 44.8% while written examinations are responsible for 55.2% of the total marks a student may earn.

5.9.2 The structure and course units for the ERM course

According to the records, the ERM course was reviewed between 2008 and 2012 and was approved in the department, school, faculty and the senate and therefore implemented. This research was carried out during the same period. The interest of the research in this section is to see the extent to which the ERM has incorporated ESD through the use of Agenda 21 which highlights environmental issues. Appendix 2 table 5.4 is an outline of the latest version of the ERM course.

5.10 SECTION ONE OF AGENDA 21: THE SOCIAL AND ECONOMIC DIMENSIONS

The social and economic dimension highlights seven issues: sustainable development, combating poverty, changing consumption patterns, population and sustainability, protecting and promoting human health, sustainable human settlements and making decisions for sustainable development. I shall discuss each of these dimensions and how they are addressed by the ERM course. In the following sections the ERM subjects are explored to establish how they address the issues indicated in Agenda 21.

5.10.1 Combating poverty and changing human consumption

Combating poverty and changing human consumption issues have been addressed in the course in the following units:

- SSEE2106 Community Development

The main objectives of a community development course are to: build self determination and instil growth in community capacity for development, assess community needs and rank them in order of severity and empower the community to solve its own problems using its own resources. Students need to help the communities that they work with to come up with ways and means of helping themselves to solve poverty related challenges. Food production is

mentioned in the unit of environmental health and safety. The aspect of poverty has not been adequately addressed it has been implied in land use planning and management while changing human consumption has been left out completely.

5.10.2 Population dynamics, human health and settlement

The population dynamics issue is not addressed directly and it is only implied in the natural resource conservation units. Population growth is a major contributing factor to natural resources degradation as humans engage in various activities (UNEP, 2006b).

The issue on human health is addressed in the following unit:

- SSEE 1203 Environmental Health and Safety

The unit explains the meaning of environmental health and safety: disease patterns in the world, impact of technology on environmental safety, poor health and contaminated water, technologies to reduce pollution and associated diseases. Hazardous chemicals are explained and the effects of climate change on environment and human health are discussed. Analysis of the impact of social activities on environmental safety and human health are explained. The unit identifies commonly abused drugs and their effects on human body and resultant impact on environmental health and hazards. Also identified are the common communicable diseases and their effects. Deficiency diseases and food production are discussed. Stress and environmental regulations are discussed.

The issue of settlement is addressed in the following unit:

- SSEE 1204 Land use Planning and Management

In this unit the issue of land and settlement is discussed. Land as a resource in Kenya has been a major issue causing serious conflicts. The land use activities in Kenya are described. Land administration and land tenure Systems and their impacts are explored. Issues such as disaster and risk reduction are discussed. Land use policy is discussed as well as specific resources, land use management, Indigenous Knowledge, policies, sustainability challenges, public participation on land use decisions urban planning and management, regional planning and management.

5.10.3 Integration of the environment

The environment is central to the ERM course and thus is directly addressed in the following units:

- SSEE1101 Introduction to Environment and its Resources
- SSEE1103 Animal Taxonomy
- SSEE1104 Plant Taxonomy
- SSEE1201 Environmental Ecology
- SSEE1207 Wildlife Ecology
- 2208 Field course/camping
- SSEE 2204 Environmental Impact Assessment and Auditing

The introduction to the environmental resources unit discusses the environment and enabling the student to appreciate the environment, identify resources in the environment and relate the impacts of resource depletion in the environment. Climate change is one of the current problems tackled in this unit as the world grapples with its effects. For ecology and exploration of the fauna and flora, animal and plant anatomy and taxonomy cover this adequately. This is enhanced in wildlife ecology. The general objectives of these units are to enable the student to understand principles of zoological nomenclature, as well as to classify animals and identify animal species and their role in the environment. With the trend in biodiversity loss it goes without saying that for us to talk of sustainability we must understand both animal and plant taxonomy and other characteristics that will enable their conservation and proper management.

Environmental ecology aims at enabling the learner to describe the principles of ecology, the biosphere and ecosystems. It is important for students to understand ecosystems for conservation.

The aim of camping experience is to allow students to interact with nature. For one week the student is out there to understand the interrelatedness of nature. From the field the student is expected to appreciate nature in a better way. The student also learns certain skills that cannot be learned in a classroom environment such as; pitching tents, constructing flood check/controls around the camping site, applying fire control techniques, identifying animals

and plants taxonomically, identify poisonous/harmful plants and dangerous animals, participating in food preparation in the wilderness, identifying geological features, identifying the interactions between different animal species and between animals and their environment observing and evaluating the impact of human activities on the environment, demonstrating emergence response techniques, demonstrating communication systems in the wilderness. This unit on the field or camping wraps up the work the students have covered theoretically.

The second camping/field exercise at the coast covers various water tests such as conductivity, pH, O₂, and CO₂ depth. The students also collect and identify marine algae, sea grasses, marine invertebrates and vertebrates, seeds and propagation materials and perform seed extractions, trap fish, identify fish potential and commercial species, shrimps, lobsters and prawns. They discuss different stages of development; identify various fish breeding sites, mangroves species, habitats and adaptations. They also discuss the role of mangroves in fisheries, erosion and dynamism, threats to mangroves and over harvesting.

Environmental Impact Assessment and Auditing is important for the wellness of the environment as it discourages those activities that will have adverse effects on the environment. The unit can be seen as addressing all the social and economic aspects; only it tends to put more emphasis on the environmental aspect.

5.11 SECTION TWO OF AGENDA 21: CONSERVATION AND MANAGEMENT OF RESOURCES

The main theme of the course is the conservation/management of natural resources.

5.11.1 The atmosphere

The following unit addresses the atmospheric issues

- SSEE 2104 Atmospheric Science

The atmospheric science unit discusses the atmosphere as a component of environment, structures and composition of the atmosphere, ozone layer and ozone depletion, weather and climate, climate classification, elements of weather and their measurements, factors controlling weather and climate, in tropics ITCZ, monsoon, water bodies etc, energy in the

atmosphere, energy budget, concept of global warming, global cooling, atmospheric pollution, climate change and effects on the environment.

5.11.2. Land resources, agriculture and rural development

The issue of land resources agriculture and rural development is addressed by the following units.

- SSEE 1204 Land use planning and management
- SSEE 1206 Geology
- SSEE 2205 Resource Management in the Arid and Semi Arid Lands
- SSEE 3106 Soil Management

The land use planning and management unit aims to enable the learner to discuss land use and planning issues, outline development strategies and discuss management/conservation issues in Kenya. This subject helps to enable the student understand the issue of land ownership as well as the value and how to use it in Kenya. It also gives the student a historical background of land and ownership in the country. The student comes to understand the origin of land conflicts in the country and therefore thinks of ways of resolving those issues works towards peace in the country in terms of land.

The learner also understands the management and conservation of specific resources such as the ASALS, the mountain regions and water bodies in the country. Such an understanding will enable the student to create awareness in the community on sustainable resource use and management.

The learner understands and critiques the role of the government as far as land issues are concerned and can give a critical analysis of the issues pertaining to land. The land issues in Kenya include: tribal clashes, settlement on catchments areas, forest degradation, land ownership and succession which has contributed to land fragmentation and thus uneconomic parcels of land in high potential areas, landlessness which has resulted in unplanned settlements e.g. squatters and slums in the urban areas.

The rural/urban planning issues are also discussed because there is accelerated rural urban migration in the country. The urbanisation trend comes with a myriad of problems in the urban areas and impacts negatively on development of the rural areas. The subject therefore addresses the question of land use and sustainability.

The subject of soil management enables the students to: appreciate and know soil as natural resource, and to learn skills of conserving and managing soil.

5.11.3 Deforestation, desertification and drought

This issue is addressed in the following subjects:

- SSEE 2104 Energy Resource Management
- SSEE 2202 Forest Management
- SSEE 2205 Resource Management in ASALs

Energy resource management aims at ensuring that the learners are aware of the alternative sources of energy. This will enable the conservation of the forests and thus reduce deforestation.

Forest management has the objectives of helping the students to define the various types of forests and their formations, explain how forests are managed and explain threats to the forest resources.

In rangeland management the student should be able to: apply range improvement practices, identify range resources and their potentials, categorise range lands, use fire to manage range lands and control fires as hazards in range lands.

5.11.4 Biological diversity

The issue of biological diversity is addressed in the following subjects:

- SSEE 1107 Greenhouse Techniques and Plant Breeding
- SSEE 3203 Wildlife Management

The general objectives of Greenhouse Techniques and Plant Breeding is to enable the learner to erect a greenhouse and maintain it, conduct a flower surveys, collect seeds, test seed viability, extract seeds, store and break seed dormancy, initiate a nursery and propagate plants, develop plant media and pot plants, conservatories, gene-banks, botanical gardens. This ensures biological diversity.

The Wildlife Management subject looks into the importance of wildlife management. The students identify wildlife species and their various groupings, explain wildlife population structures and dynamics and discuss wildlife management strategies to ensure that the wildlife is properly maintained.

5.11.5 Freshwater, oceans, seas and coastal areas

The freshwater, oceans and coastal areas are addressed in the following subjects:

- SSEE 2107 Fisheries Resources Management
- SSEE 3103 Water Resource Management
- SSEE 3202 Wetlands Management

The conservation of water resources is very important. Water is life we need to take good care of it. Activities affecting the water catchments will ultimately affect the water sources. At the end of this unit the learner will be able to: classify water sources (surface, ground and rain water), explain how water resources are planned and managed, explain the impacts of water pollution explain the significance and uses of water and carry out water quality tests.

The Fisheries unit introduces aquatic ecology; describe fish ecology, habitat and protection, lentic and lentic ecosystems, fish classification and adaptation, fishing techniques and preservation, methods of fish culture, principles and management functions of fisheries, construction of fish commercial ponds; fish management principles and monitoring fish harvest levels as well as the legal aspects in fisheries.

5.11.6 Pollution and waste management

The issue of pollution and waste management is dealt with in the following subjects:

- 1205 Environmental Laboratory Practices
- 3102 Environmental Pollution
- 3204 Waste Management

The Environmental Laboratory Practices unit is important in pollution management as it enables the learner to understand laboratory design, safety, first aid, laboratory ware and layout, installation of laboratory equipments, water and laboratory waste disposal,

preparation storage and disposal of reagents, use and control of laboratory animals, vacuum technology, cryogenic techniques, photography, laboratory inspection and maintenance, laboratory management; functions, organisation, styles, records and materials, fire hazards and prevention in the lab; the fire triangle, classification of fires, precautions in fire prevention, fire alarms, fire escapes, fire barriers, fire extinguishers, Factories Act.

The general objectives of the subject on principles of Equipment Handling, Safety and Wilderness Survival enable the learner to describe equipment, demonstrate proper handling of equipment, demonstrate proper handling of chemical and safety procedures in a laboratory, fire hazards and prevention in the laboratory; the fire triangle, classification of fires, precautions in fire prevention, fire alarms, fire escapes, fire barriers, extinguishing a fire, fire extinguishers and using fire extinguishers.

The subject Pollution and Waste Management deals directly with the issues of pollution and waste management. The problem affects most areas in Kenya and it is complex due to rapid population growth and poor management. The student is supposed to understand the different types of pollutants and carry out scientific analysis and tests on pollution techniques with those engaged with waste management.

5.11.7 Management of Biotechnology

This is not dealt with directly in the course but is mentioned in some subjects

5.12 SECTION THREE OF AGENDA 21: STRENGTHENING THE ROLE OF MAJOR GROUPS

5.12.1 Gender and sustainable development

The subject of gender and development is not dealt with directly in the course but it is a topic that is handled in the Community Development module whose objectives are to enable the students to initiate and supervise community based development activities, build self determination and instil growth in community capacity for development, assess community needs and rank them in order of severity, and empower the community to solve its own problems using its own resources. The students are expected to take up work in the community and get active in natural resource conservation.

5.12.2 The youth and sustainable development

Youth and sustainable development is not dealt with directly in the course but there is the topic on gender issues under community development, which discusses the role of the youth in the community.

5.12.3 Indigenous knowledge

Indigenous Knowledge is not a subject on its own but it is mentioned in wildlife management and community development. There is a need to introduce indigenous knowledge as a unit to help the students appreciate their culture.

5.12.4 Environmental policy

Matters of policy and law are handled in the following units;

- SSEE 3205 Environmental law
- SSEE2204 Environmental Impact Assessment and Auditing

The learners need to understand the laws and regulations that govern the environment. At the end of this course the learner will be able to: define environmental law, describe sources of law, describe the structure of courts, describe the law of Tort, demonstrate knowledge of environmental, factor, wildlife, forest and water acts, enforce environmental law, and interpret environmental conventions and agreements

With the Environmental Management and Coordination Act of 1999 in Kenya, it became mandatory for every project to carry out an environmental impact assessment (EIA) before implementation. EIA is therefore a mandatory tool for all the projects in the country. The course therefore equips the student with the necessary knowledge and skills to carry it out an Environmental Impact Assessment (EIA). The unit enables the student to collect data on resources, analyse it and describe the trends on environmental resources. On completion the students can work with EIA experts in data collection and analysis. Environmental Impact Assessment cut across all the natural resources.

5.12.5 Business and industry

The ERM course deals with business and industry in a number of units as listed below:

- SSEE2108 Entrepreneurship Education
- SSEE2203 Principles and Practice of Management
- SSEE2206 Business Plan
- SSEE3104 Project Planning and Management
- SSEE3207 Business Plan
- SSEE3105 Environmental Economics
- SSEE2100 Industrial Based Learning (IBL 1)

The students are introduced to industry and business with Entrepreneurship Education to inculcate in them an entrepreneurial mind. The general objective of this unit is to describe the role of entrepreneurship education in development, advantages and disadvantages of self-employment, describe the reasons for business failure and demonstrate the characteristics of a successful entrepreneur. In the second year of study they study business plans, and are consequently supposed to develop a business plan, which is submitted for examination at the end of the course. The business plan is graded on its own with a maximum score of 100%. In the third year the students take two units on economics (project planning and management and administrative procedures). This enables the students to manage a project and an office. Engagement on the economic aspects by the students assists the students to become more business-oriented and engage in activities that can sustain their livelihoods in the community.

Administrative procedures are aimed at engaging the student in an office environment. The students should be able to understand and appreciate the basic principles and concepts necessary for efficient management of an office. They are required to understand the responsibilities of an office manager in the smooth running of the entire organisation; develop skills in identifying, appraising and solving office problems; understand the structure and channel of communication within the organisation; master legal requirements and rules of the institutions relevant to the welfare, safety and security of the employees.

Project planning and management enables the student to: distinguish project planning and design, explain the various objectives of project planning, understand various steps involved in project planning, understand network planning techniques and the various approaches to decision analysis. This particular unit is meant to enable the student to manage projects.

5.12.6 Science, technology and environment

The ERM course offers some subjects on technology and environment:

- SSEE1102 Computer Applications
- SSEE1208 Information Communication Technology
- SSEE2105 Geographic Information systems
- SSEE3101 Global Navigation Systems
- SSEE2201 Remote Sensing and Photogrammetric
- SSEE3201 Cartography

These units enable the student to appreciate the use of technology for environmental resource management. They begin with an introduction to computers, to enable them to become computer literate because ICT literacy is important in this era of technology advancement. The Internet has made the world a global village with quick information transmission. For a society to develop, its citizens must be ICT literate. Environmental resource practitioners must be in a position to follow the trends of natural resources in the world. The use of computers simplifies the spread of information. Competence in working with the Internet is crucial for an environmental/sustainable development professional.

The foregoing indicates that the ERM course has tried to incorporate Agenda 21 issues in its various units covered in the course. To a great extent the course has incorporated the major issues in Agenda 21. However this research surfaced contradictions highlighted in chapter seven that must be addressed for a practitioner in ESD to emerge from the course. The course content should be matched with the good practices as spelt out in ESD (Wals 2012).

5.13 EMPLOYMENT PLACEMENTS OF ERM GRADUATES

The student report shows that the graduates of ERM can work in a wide range of fields. The graduates from the 2010 group are engaged in a variety of areas. These areas include Kenya Wildlife Service, Airports Authority, National Environmental Authority, UNEP, to mention a few. This is an indication that the course was designed to enable the students to engage in all

fields as environmental officers and thus enhance ESD. The course addresses the environmental, social and economic aspects. However the social and economic aspects need more attention as about 80% of the course is 'ecological' (see Table 5.3 Sections 5.9 to 5.11). The course has a bias on natural resources although literature indicates that natural resource conservation is a factor of the social and economic status of a region (Kulindwa et al. (in UNEP 2006a, p.38): NEMA 2008). For instance a peaceful society is likely to manage its resources sustainably, when there is no peace in a region there are refugees who impact negatively on the environment. If the economic status is low, then antidevelopment occurs. If the three pillars of sustainability discussed in Chapter One are carefully addressed, then there can be hope for a sustainable world.

5.14. THE LECTURERS' PERCEPTIONS OF THE ERM COURSE

The ERM lecturers felt that the course was overloaded; it had too much to cover in a short time. Compared with other courses in the institution, the course had far too many units to cover in a semester and these units were very detailed. They felt that this course should be offered at degree level instead of diploma. They also felt discouraged as the facilities required in the course were not available. For instance there is no laboratory for environmental studies and therefore they have to rely on other departments for anything requiring laboratory practice; this is a real challenge. The equipment is not available, even for simple tests such as water and soil quality analysis. The Canadian programme brought in a testing kit for water and another one for soils. However these instruments were never utilised due to lack of technical skills among the ERM lecturers on handling the equipments. During a departmental meeting held on 9 September 2010 (Appendix 4B) where the lecturers deliberated on the ERM course, it was clear that the course has several issues that need to be addressed, such as:

- How the course was being taught and coverage indicated an emphasis in covering the course for the examination purpose as opposed to being competent in the trade area;
- The ERM diploma course was too advanced so it should be upgraded to bachelors level;
- The teaching should be practical as suggested in the course outline;
- Students to be encouraged to participate in projects around the institution;
- The students should be encouraged to become innovative especially with action research;

- The course was being taught by masters holders, it was suggested that diploma and bachelors holders should also be engaged;
- The students should participate in competitions for instance the Nairobi International show;
- Lack of funding for the students –scholarships; and
- The students felt they lacked identity: they were not being heard in the institution because they did not have any projects on environmental management there.

These are only some of the challenges for the course. They were important for surfacing tensions and contradictions in the Chapter Seven analysis of the emergent course as an activity system producing ERM professionals. In the next chapter I explore the ERM course implementation to understand how the course is being taught and to highlight the challenges experienced in the course. This will be taken up in Chapter Seven as contradictions that need to be dealt with for the course to train for the ESD practitioner. In the next chapter the results of the ERM course implementation are explored.

CHAPTER SIX: COURSE IMPLEMENTATION PRACTICES AND THE PROCESS OF BECOMING AN ENVIRONMENTAL RESOURCE MANAGEMENT PRACTITIONER

6.1 INTRODUCTION

This chapter seeks to address the second research objective and question in Section 1.5.3 and 1.5.4 respectively:

- To critically analyse the course implementation at the Technical University of Kenya with a view to understanding how it is enabling the learners to become ERM practitioners.

The chapter presents data on course implementation as processes producing ERM practitioners. The main interest of this research was to find out how the course was implemented and how learning is taking place to enable the students to become practitioners in environmental resource management.

Data on the key areas of the course, as already explained in Chapter Four, was gathered through interviews, observations and assessment of assignments, and focus group discussions with the students and lecturers engaged in the ERM course between January 2009 and August 2012. The concern was to understand how the implementation of the revised course served to train environmental resource managers for the Kenyan context.

In this chapter the culture of the ERM learning site and how the learning transforms those who enter and complete the course is analysed. The chapter describes how learning takes place among those who enter TU-K to study ERM and become practitioners in the area of conservation. The chapter highlights the activities of the students, lecturers and other stakeholders, which enable them to become ERM practitioners. Wenger's community of practice provides the language for the analysis of the course to understand identity formation for conservation community among the learners.

Lave and Wenger's Communities of Practice theory (1991) (Section 3.3) provided a lens for the interpretation of how learning to become an ERM practitioner is taking place on the course. Wenger (1998a) discussed a community of practice as having a joint enterprise, shared repertoire, and mutual engagement aspects (Section 3.3). In the case of the ERM course the joint enterprise across staff and students is the management of the environmental resources. Mutual engagement will thus be looked at in terms of the activities the students,

lecturers and stakeholders perform together. Attention will also be given to the shared repertoire, here tools that they use both in the institution, and outside, in the workplace to contribute to environmental conservation. I selected three pedagogical activities for this study for detailed analysis:

- Fieldwork/camping;
- Industrial attachment/ industrial based learning, and
- Trade area projects.

These three aspects were given prominence in the course revision to prepare the students to become ERM practitioners.

I will start with a brief highlighting of data generated on the general pedagogic practices in the course intended to prepare ERM practitioners.

6.2 PROCESSES MEDIATING STUDENTS TO BECOME ERM PROFESSIONALS

In this chapter I present data on the various teaching/learning methods used in the ERM course as observed during this research. According to literature there seems to be no best universal teaching method and in most cases the teaching methods depend on factors such as, culture of the institution/country/region, its vision and mission, the policy on education, the economic and social goals (UNESCO, 2006b). This study explored the teaching methods engaged by each lecturer in the ERM course. Through responses to questionnaires, interviews, observations and focus group discussions, it was noted that the main teaching and learning methods used in the ERM course were:

- Traditional classroom lectures;
- Handouts to be read;
- Individual library search tasks;
- Fieldwork/excursions;
- Group discussions; and
- Problem based learning tasks. (Appendices 2A to 8A).

Although the ERM course was developed with Competency Based Education (CBE) principles and envisaged competency education in its delivery, the lecturers reported the use of the traditional lecture method for most of their teaching with little use of any other methods specified in the revised course. The students confirmed that the lecture method was the most frequently used. In the following sections I will briefly highlight data on the following teaching\learning practices:

- Field excursions/field camping;
- Industrial attachment and
- Trade area projects.

These will later be discussed more in depth as the major means of teaching and learning in the course where the students get direct experience of being engaged in ERM. These three were given prominence in the revisions of the ERM syllabus because they take substantial student time at the institution.

6.2.1 Problem Based Learning (PBL)

The study sought to establish whether and how the lecturers used PBL as a method of learning in delivering ERM content. The results from the questionnaires (Appendix 2A) show that most of the lecturers (7/13) indicated using the method in case study assignments for identification and tackling of specific environmental problems. However this is contradictory to the data from the students who indicated that most lecturers used the lecture method. Observation and interviews with both the students and lecturers show that PBL was used to a small extent as the following excerpts from lecturer show:

L1 had this to say about teaching methods:

The innovations I have implemented, I am in the process of developing a process, especially in including the community's participatory management of resources. I use problem-based learning through developing a problem by identifying through a participatory process, diagnose the problem and suggest possible solutions. For example forest degradation: What are the causes of forest degradation? The students do not like PBL too much. They feel like you are asking too much. They prefer the lecture way and not any personal method. To get the students from that is not easy but we are trying. I personally involve and raise issues such as climate change, global

warming, and food security. We set up a discussion where they read and come up with the negative effects and what should be done. Sometimes they do a write up.

Our primary to secondary education affects the learning in such an institution seriously in terms of shaping their opinion. The real issue is changing the way of thinking. We need to start from primary through secondary such that by the time they get here they have learnt to chew things on their own. (Appendix 17B)

Lecturer 1 indicated that he tries to use PBL in some instances but he seems to be having difficulties as the students prefer the lecture method. The lecturer blames the education system in the country as the main culprit in not enabling the use of this approach.

L2 had this to say about teaching methods:

I use lecture method, also seminar method-topics to research and present in class, practical aspect do practicals in the green house, send them out to collect seeds and go to the arboretum for particular trees, I have introduced, a method where first-years have to plant in the green house and that is marked. Problems in implementing PBL include supervision. You can't supervise people up to their residence. You cannot supervise and assess the methods that have actually been taught. PBL is a good idea but implementation is hard. I think the secondary teaching was like teaching to make the students pass the examination. There is no other way of assessing our teaching. We don't even follow up once they have finished. (Appendix 17B)

Lecturer 2 said that she mainly uses the lecture method and has tried practicals in some aspects however she blames the country's system of education that places emphasis on passing the examinations. She also feels that PBL is more to do with individuals because she mentions that you cannot follow the students to their homes for them to do things with their hands.

L4 had this to say about teaching methods:

Getting an all rounded person is not easy. The proposers were not for the idea of teaching it should be taught by people from industry in the real life scenario. We do not teach this way because of a lot of politics here, the teachers were not trained and some were unwilling. CBE is an excellent idea but...there was too much and I think the thing did not work out as expected. (Appendix 1B)

According to Lecturer 3 the idea of PBL was excellent but it was meant to be used by the industry; the lecturers at the institution were not trained to use the method, therefore they were unwilling to implement it.

L3 had this to say about teaching methods:

In most cases I use science methods, I use lecture method, and laboratory practice the tissue culture innovation does not benefit us much as we meet only on open days we do not go beyond the class. The use of PBL is to do with the sciences e.g. entomology. PBL and the community is neglected by the lecturers we go by the old methods may be we shall change with time. We can hold seminars and discuss how we can do this. We can combine forces. However to put the lecturers together to do this is a challenge because there is a problem of attitude change. This is caused by underpayment of lecturers. (Appendix 17B)

Lecturer 4 feels that PBL is appropriate for the science subjects; however discussions on how to use it in ERM could be useful because according to him it is neglected.

Therefore, in summary on PBL, according to the four lecturers, is that the education system in the country has trained students with lecture methods and emphasises examination, therefore the students concentrate on cramming for the examinations as opposed to engaging in the practical work or hands-on activities. They also feel that PBL is for people in industry and therefore, unless they are trained or discuss how to use it, there are challenges on how it can be used.

Through questionnaires the research sought to find out what the lecturers saw as the role of PBL on the course. The advantages cited were that it addresses real life problems and gives solutions, it gives better understanding of the research area, develops the students from a

practical perspective, ease of understanding by students, it is fast and effective and it sparks the students to critical thinking. The disadvantages cited were that PBL can limit the scope of learning, as it is only geared towards a particular problem, it is no less theory based than practical, it makes students lazy, it requires constant monitoring and guidance, and theoretical constructs are ignored (Appendix 23B).

In conclusion the use of PBL is limited in the ERM course although it has several advantages as outlined in the previous paragraph.

6.2.2 The lecture method in the ERM Course

The study established that the major method used in ERM is the traditional lecture method, which is deemed to be an easy way of effectively passing on environmental information to students. The lecturers claimed that explanations of environmental theories are best done through the lectures. By lecturing, they said, one has an opportunity to explain the various environmental concepts quickly. They were concerned about covering the syllabus so that the students performed well in their final examination papers rather than with wasting time in trying to organise for field trips or some other form of practical sessions as the following excerpt indicates:

L6: I have to complete the syllabus so that the students meet the course requirements for the institution. Again we do not have an environmental laboratory to perform the experiments. I cannot take the students out when they do not know what is expected of them. For example they have not done any laboratory practice on toxicity analysis so that I take them out to apply the skill on fisheries the subject that I teach. (Appendix 1B)

The lecturers felt that institution management was not in support of the field excursions and therefore it becomes difficult for the teacher to organise a field exercise. They particularly cited the logistic procedures of transport for a trip. This has been very complex and time consuming. One lecturer (L2) stated:

As long as I cover the syllabus quickly for the students to sit for the exams, it does not matter. (Appendix 4B)

This perspective has become a tradition and the aim of lecturers is to cover the syllabus in readiness for the examinations. The lecturers also dictated notes, claiming that the students are not able to make their own notes as the following excerpt from L2 indicates.

L2: This course is meant to prepare a person to fit in society. You can work in an office, managerial, research, I.T. they can fit anywhere but the chances are not so many. These 8-4-4 students are not good at all you have to spoon-feed them. They cannot make their own notes. I have realised that if I ask them to read on a topic and give them an exam, they perform very poorly. But if I lecture and give notes the performance is very good. (Appendix 2B)

The students also indicated that the lecturers dictated notes or wrote on the board for them to copy as the following excerpt highlights (Appendix SE 6).

Lecture method: most of the teachers used this, method where by notes were written on the blackboard, dictated or given to student for photocopying. This method is very effective as all the students had notes to read and even those who were absent could copy from their classmates or could be gotten from the lecturer.

The perspective of this student indicates that the giving out of handouts is good, as those students who do not attend classes will get the notes.

6.2.3 Assignments and Presentations

The lecturers often used assignments and presentations, which they said, enabled the students to carry out studies on their own. This was said to be a very enriching activity although the lecturers noted that the students were not reading much on their own. It is a method of teaching that enables the students to search for information on their own and helps them to think critically. The presentations were done in the form of written papers and are part of the continuous assessment tests contributing 30% towards the end of year examination. Such assignments have been taken seriously by the students because of their being part of the examination.

In some cases the lecturers asked the students to research a topic and make a presentation in class. In my teaching experience this was also taken seriously as the students wanted to prove to their fellow students that they were good at making presentations. They researched in-

depth to avoid the embarrassment of not making a good presentation. This exercise enabled the student to address people on various matters after completing the course. It gives the student confidence to relate with the public more easily. In my units such as land use planning and management, the students made very good presentations and scored above average. For example L6 said that:

I put the students in groups. Give each group a question; they decide how to tackle the question. They will then have to present it to the rest of the class. As they present I make comments and these will be incorporated into the presentation. The students like this teamwork. They handle the question together rather than when an individual has to do it alone. In a way it encourages knowledge sharing and participation. I like the method as it encourages them to research.

6.2.4 Laboratory Practical in ERM

As noted from the course planning and design, the revised course was meant to be more practical or hands-on than theoretical (Section 5.6). One of the lecturers reported that he would like to do more practicals but was constrained by lack of materials required for the experiments. The lecturer in soil management said that there was no laboratory and therefore, it was difficult for him to do the tests that he wished to do and it also took a very long time to get the required materials. As the following excerpt from L3 indicated:

Instead of using applied, in most cases I use science methods... I use lecture method, and laboratory practice. Laboratory practice is a challenge here because we do not have an environmental lab. Even when I need to do soil testing I do not have the materials and the equipment. It is also difficult to get money to buy the things that you need for the practical. You can imagine how long I have been asking for these things to be bought, it is difficult.

The lecturer for water management had a problem with water quality testing because of lack of the necessary equipment and she had not been trained in that area and therefore she needed to be trained first before she could do it. As the following excerpt from L1 indicates:

There are a number of problems teaching in this institution. We do not have most of the facilities. You know we do not have an environmental laboratory. I took the students to Lake Naivasha and we collected water samples but we do not have a lab. I have to rely on the chemistry laboratory for the analysis and these delays everything. You can imagine the samples have been sitting under my desk since last week. I am still chasing the laboratory person. It is a problem, even getting information from other places like UNEP you have to spend your own money the institution does not give support. We do not have most facilities. I send my students to the chemistry laboratory to be trained by the technician. I need the training before I can do this for the students and we do not have a laboratory for environmental studies. We need one because environment needs to be taught in the laboratory.

The students also indicated that they were exposed to a limited number of laboratory practice as the excerpt below indicates from see Appendix SE3:

Practical lessons in laboratory are meant to improve students' understanding of the methods of scientific enquiry through experiments or problem-solving activities. However I felt that practical lessons were often skipped by some lecturers therefore the few taken were not satisfactory (Appendix 11B, SE3).

These challenges were highlighted by one of the lecturers (L4) involved in the planning stage:

The course is very good but the teachers are not well equipped to handle some areas, so how do you expect them to teach. This is a technical institution. Some of the teachers are not technical. (Appendix 1B)

Discussions were also held on specific topics in the subject. A lecturer for animal taxonomy did one field exercise with the students. They visited the National Museum of Kenya, the only field exercise that the students were engaged in for the whole of the first year. This indicates that the practical or hands-on experience was minimal.

Some practical work was being done in the greenhouse unit. However the lecturer lamented that she was unable to accomplish much due to the state of the greenhouse. It has not been improved since the Canadian programme came to an end. The management uses the flowers and plants grown by the students without paying for them, so the greenhouse has run down. She had problems getting seedlings and other requirements for the greenhouse and because of these problems she had mainly used the lecture method to deliver the theory that would be examined (L2). She noted:

I have been trying to get the seedlings but it is difficult. After all the students just need to pass the examination at the end of the year. (Appendix 1B)

The plant taxonomy lecturer felt that the students were not sufficiently exposed to practical work due to the struggle that one has to go through to get transport for the students to go for fieldwork. He lamented that the course was intended to be hands on but the way it has been implemented makes it just theoretical. The main practical they carried out was collection of plant leaves for identification. He said:

This was a very good course on sustainability and well-intended course that would have moved things a notch higher at the polytechnic, but the way it has been implemented does not reflect its initial intentions at all. The teachers were not ready, they are not technical. (L4)

Computer application is a practical subject where time is spent in the laboratory. By second year the students should be proficient in Microsoft office packages in readiness for GIS and GPS that are done in second year. However this research revealed that this was not achieved due to a lack of qualified personnel and a lack of computers. The lecturer who has been teaching this course since 2000 is not trained in ICT. She only has a certificate in Basic Introduction to Computers. Learning computer applications has been grounded by lack of sufficient computers in the institution. This is a major challenge in teaching the subject. As the minute of a meeting held on September 9th 2010 indicates:

The lecturers felt that they were innovative because they were trying many ideas with the students. Although some felt that they were not well equipped to handle certain areas for example the lecturer for computers indicated that although she has been teaching computers for a long time she only had a certificate qualification. This is very basic because it is just an introduction. They suggested that the teachers need to be facilitated for training as some of them felt that they needed to be proficient in some areas. (Appendix 4B)

In the next sections I review the data generated on fieldwork/camping and industrial attachment. These projects were selected as they are in this realm of work and it was possible to more closely examine the learning through legitimate peripheral participation using a Community of Practice lens. It was noted that these activities are where students experience and undertake the real activities of an ERM professional.

6.3 CAMPING/ FIELDWORK IN A COMMUNITY OF PRACTICE FOR ERM STUDENTS

The planning of this course envisaged a CBE approach which is more hands on than theoretical (Section 5.6). The survey of staff also indicates that practice is seen as very important in any field of study (Section 6.2.1). According to the course outline (Appendix 1 A HD22) this exercise is mandatory at the end of first and second years of study. During this research the students engaged in two field camps, one to a coastal region and a second to the highland regions of Kenya. I participated in both these activities and played the role of an observer as I did not want to be seen to be influencing the activities of the students. After a period as participant observer I held a focus group discussion to tease out the detail on the activity as a process of producing the ERM professional. In the next sections I present data on the two field exercises as processes contributing to the production of ERM professionals.

6.3.1 Preparation for the field/ camping exercise

A focus group discussion on the camping exercise was conducted during the field trip. Its purpose was to understand how this part of the course prepared the students as ERM practitioners. The focus group discussion on the two major fieldwork exercises revealed that students were aware of the field camps in advance as it was an activity that was indicated in their letters of admission (Appendix 5B). The admission letter indicated that the students

were required to make extra payments on top of the college fees towards the field camp for accommodation and transport. The institution compensates the students by paying half of the required monies for such outings.

Secondly, the students in the focus group discussion also disclosed that they learnt from other ERM graduates the fees requirement for the field excursions as they shared experiences about the course. The students in the course met in the institution during their free time and shared information on how they were being taught. They also met during the Environmental Education and Protection Club (EPEC). This is a club made up of students from the institution with an interest in environmental conservation. The students carry out various activities ranging from clean ups to expeditions. During the club meetings they shared a lot on how to improve the environment by running awareness campaigns and other activities in the community. However the club was not found to be very active in the course of this study.

Thirdly, the lecturers mentioned the trips in passing when, during lectures, they were sometimes taken to task by the students for a lack of fieldwork and practical activities on the course. The students noted that the lecturers mentioned the field camping exercise while teaching the various units, stating that the one week long field camp would cover most of the areas learnt theoretically (Appendix 5B).

The lecturer in charge of the field trip has to inform the officer in charge of outings in the institution. This is done at least three weeks before the trip because the vehicles (two busses and 4 mini-busses) are shared across the entire university. The lecturer in charge also has to liaise with the finance officer for all the financial requirements towards the trip: transport, per diem and the student contribution. The lengthy process for acquiring the vehicle, student per diem and permission for a field trip is as summarized in box 6.6:

Box 6.6: The process for fieldwork

STEP I: The University Industrial and Liaison Officer prepares a schedule for University trips a semester prior to the actual trip.

STEP II: The chairman of the department organizes for a meeting for the department to slot in trips in the university schedule.

STEP III: The lecturer taking students (Field Trip Coordinator) for a field course prepares a pre-trip plan indicating where the trip will take place, what the trip will entail (scope and objectives), how the trip will be conducted including methodologies to be used, the staff that will be involved in the trip and facilitation arrangements and when the trip will be conducted including trip schedules and milestones and field manual. This is presented to the chairman of the department for approval.

STEP IV: A letter is written to the Deputy principal, requesting transport, impress allowances and indicating the number of bona fide students to be taken out for a study trip and duration of the trip.

STEP V: Another letter is written to the university transport manager requesting for transport facilitation enclosing a copy of approval letter from the deputy principal. The transport manager prepares, his transport team (driver, mechanic etc), vehicle and seeks necessary expenditure approvals.

STEP V: An impress form indicating per-diem is prepared from the head of Department office through Head of school and Dean of Faculty of Science and Technology, Deputy Principal to the Finance manager. This is always accompanied by Departmental (Accounting and Expenditure) AIE Book, showing the financial allocation.

STEP VI: The finance manager approves the impress, then it is internally audited and approved and then staff on field trip are facilitated with their perdiems).

STEP VII: The impressed surrender form is presented to accounts office accompanied with a field report. The form is accompanied with expenditure receipts for clearance by accounts office.

6.3.2 The coastal field camp 14-20 September 2009

I joined the students for this fieldwork/camp exercise to the coast, as I wanted to observe what went on during the exercise. The excursion took six days, taking the students and the lecturers to various places for learning and sightseeing on the coast. The students wrote a summary of the exercise as indicated in Appendix 5B at the end of the field camp. The places visited were:

- Wasini Island
- Shimba Hills National Park
- Kenyatta Public Beach
- Bamburi Nature Trail
- Kenya Forest Research Institute-Gedi Forestation
- Pwani oil refineries

In all these places the students were engaged in observing the landscape and receiving lectures on various aspects already tackled in class from the local personnel at the sites and from the lecturers leading the excursion. I was surprised to note that the students did not engage in any practical work. The course outline (Appendix 1A HD 22) indicates that the coastal trip covers the activities listed:

- Collection and identification of marine algae/sea grasses, marine invertebrate and vertebrates;
- Collection of plants specimens;
- Collection of seeds and propagation materials;
- Seed extraction;
- Trapping fish;
- Identification of fish;
- Fish processing;
- Identification of fish breeding sites;
- Identification of mangroves species, habitats and adaptations; and
- Roles of fisheries in erosion control.

According to the students report and my own observations during the field/camping exercises the lecturers and the students engaged in visiting the various places and sightseeing with some guided talks. I have presented my observations with photographs taken during this exercise. The students reported:

We visited Wasini Island, which is found in the southern part of the coast. This island lies in the intertidal zone where the mangrove forest vegetation is found. The vegetation adapted to the saline water and is a project funded by the United Nations promoting mangrove conservation. The women of the island are the ones responsible for the project (Appendix 11.6 4B)

The students and lecturers were taken around the island by one of the local men in charge of conservation. He gave an historical perspective of the island. The women were not available to share their experience of conservation with the students. The photograph below shows the students listening to a lecture about the island. Here the students observe how the construction at the coast has penetrated right to the shore. Photograph 2 shows that construction at the island is very close to the ocean, which poses a great danger especially

during high tide. This issue is part of land use planning and management a unit that is covered in the first year.



Photograph 1: A presentation at Wasini Island



Photograph 2: Settlement along the coast

On the same day the students visited Shimba Hills National park where they viewed the landscape and learnt about the vegetation in the area, the types of animals found in the park and its significance. The following photo is a general view of the area, with some of the students in the foreground.



Photograph 3: Students at Shimba Hills



Photograph 4 Swimming practice

One of the activities that the students enjoyed at the coast was swimming. In the photograph below the students enjoyed learning how to swim in the shores of the Indian Ocean at the Kenya coast. Although this activity was not part of the coastal fieldwork activities my observation is that it helped the students to appreciate the coast just like any other tourist will

enjoy swimming at the coast. It helps them to enhance coastal conservation as a leisure activity.

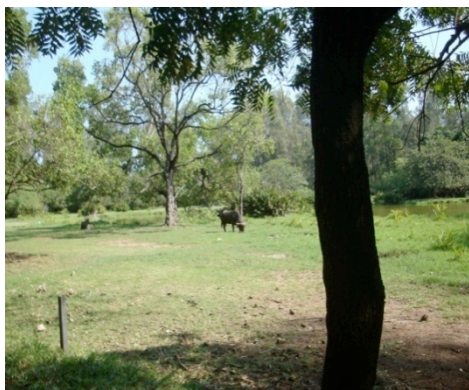


Photograph 5: Students swimming



Photograph 6: A poster of quarry rehabilitation at Haller Park

We also visited Haller Park nature trail, a cement quarry that has been reclaimed through planting trees and introducing wildlife. At this site the students learnt how quarry rehabilitation has been done by being taken on a tour and shown the reclamation works and results. They were shown an explanatory poster (Photo 6)



Photograph 7: Haller park wildlife



Photograph 8: Pwani Oil Refineries

On the fourth day of the fieldwork we visited KEFRI where students were introduced to the various activities at the centre and were given lectures by the people in charge as the following excerpt from the field trip record summarises.

5.0 DAY FOUR (18 SEPTEMBER 2009)

5.1.0 KENYA FOREST RESEARCH INSTITUTE – GEDI FORESTATION

Here they deal with research in forestry and related natural resources. The headquarters is in Kebuga and there are five regional research centres namely: Kikuyu, Karura, Londiani, Maseno, Bula and Hola. The species mainly dealt with here are eucalyptus, which are acquired from South African and Aloe Vera. There are various programmes conducted here for example,

a) Natural forests

The Arabuko Sokoke is the biggest forest in the eastern Africa coast. It covers a total of 420 km². It contains the mangrove forest, which borders the ocean, and the highest concentration of mangrove is found in Lamu. Also rehabilitation of sites and studying of species for medicinal purposes is also done here.

b) Dry land forest

The main species here is the prosopis species. It has a number of advantages such as; produce animal feeds, used for wood curving, used for charcoal production. The demerit about the prosopis species is that it invades the riparian ecosystem.

c) Plantations

Here there is the introduction of exotic species such as pines, Melina, eucalyptus and casovina. The emphasis has been on farm forestry, which is done mainly by the local community so that pressure is reduced on the existing forest. The conservation programme has been a success because of the involvement of the local community under the participatory forest management programme that was started in 1997.

The main objective of the farm forest is:

- Provide an alternative source of livelihood for the community such as bee keeping, butterfly farming, mushroom farming;
- Provide a source of wood fuel and construction material;
- Market the produce for the community;
- Educate the community on conservation issues and benefits hence capacity building; and

- Provide capital in form of seeds for planting.

d) Arabuko Sokoke forest

It is managed strictly for conservation purposes. This forest is shared between Malindi and Kilifi districts. In Malindi, there is the Dakacha woodland, which is now endangered due to the current land policy. About 30-40% of it has been lost.

The Arabuko Sokoke forest is threatened by: wood poaching for timber and for wood carvings, game meat hunting for example, antelopes, encroachment by humans. The facts about the flora and fauna of Arabuko Sokoke are: 600 identified plant species have been found. There are 263 butterfly species, 30% of the total found in Kenya.

- There are 270 bird species;
- There are 52 mammal species including 150 elephants;
- There are 6 endangered bird species namely black cerval, east casist, Sokoke pitit and aman sunbird.

Arabuko Sokoke was declared a forest in 1932 and was gazetted in 1943. It is rated the second in Africa for bird conservation and is the biggest in east Africa.

It is notable that the fieldtrip record was the primary means of recording what was done and what was learned.

We finally visited Pwani oil refineries to understand the environmental implications of the process of refining.

6.3.2.1 Sustainability of socio-economic practices at the coast

During the visit to the coast I asked the students to respond to a questionnaire on the human activities at the coast and how they understood sustainability in the region. The results in Appendix 7A responses show that the activities considered unsustainable by the students at the coast were: fishing practices, mining, wood carving, waste disposal, construction and the collection of artefacts. The students were also asked to suggest ways of improving the activities they had undertaken to make them sustainable such as reclamation/rehabilitation of land after mining and introduction of sustainable practices, controlling the rate of fishing and reduce the use of wood for curving, more mangrove forest, proper design of vessels to avoid leakage, proper treatment of waste before disposal to the ocean and strict laws that regulate the collection of artefacts.

The students considered these activities sustainable at the coast: butterfly project, mangrove construction, mushroom farming, tourism, wildlife and nature conservation at Bamburi nature trail and marine national park, forest management (the Kaya forests), bee keeping, green park conservation, unique cultures, wood curving.

The students were also asked to give suggestions on activities that they consider will enhance sustainability at the coast. These they listed as follows:

- Reclaim land after mining and introduce sustainable policies;
- Control the rate of fishing;
- Minimise the use of wood;
- Plant more mangrove forest;
- Tourism should not be high density to threaten conserved ecosystem;
- Proper design of vessels and avoid leakage;
- Proper treatment of waste before disposal to the sea; and
- Strict laws that regulator artefacts collection.

The study sought to understand the students' experience about the field exercise and established that they had a more enriching experience compared to the theoretical training received in class. Most (89%) of the students confirmed to have learnt more about natural resources during the trip than when they were taught theoretically. Of those who confirmed to have learnt more from fieldwork than when they were taught theoretically from class, 60% claimed that they were able to understand the theory part they had been taught in class and 12% said it's because they had a chance to observe the environment. The study sought to find out what the students would like to be added in the course concerning fieldwork and the majority of the students would like to have more fieldwork (78.8%).

Analysing the activities that the students engaged indicates that they did not carry out the activities indicated in the course outline listed above. They concentrated more on site seeing than engage in environmental activities. There is need to find out why they did not study what is in the course outline such as collecting samples of plants, fish etc.

6.3.3 The rift valley and central highlands fieldwork (6- 9 October2009)

The student and the lecturers took a trip to the rift valley and the central highlands in October. During this fieldwork they were to cover the activities as outlined in the course to be carried out by the students and lecturers at the highlands are listed:

- Participate in pitching tents;
- Construct flood checks/controls around the camping site;
- Fire control practices;
- Identify animals and plants taxonomically;
- Identify poisonous/harmful plants and dangerous animals;
- Identify geological features;
- Identify the interactions between different animals species and between animals and their environment;
- Observe and evaluate the impact of human activities on the environment;
- Demonstrate emergence response techniques; and
- Demonstrate communication systems in the wilderness. (Appendix 1A HD 22)

This outline guided the discussions on the trip that the students and lecturers made to the highlands.

In the following section I highlight the activities by the students and lecturers on the fieldwork to the highlands of Kenya carried out between 6- 9 October 2009 (Appendix 11.6 5B). I decided to use photographs in my observations because they tell the story visually. This method is considered to convey the message better than text (Cohen et al, 2007; Banks, 2001). Photographs 9 to 26 form a summary of the fieldwork to the rift valley and the central highlands of Kenya.

The first stop that we made was at the escarpment where we could observe the soil profile as at this point the road has cut through exposing the soil profile well. The lecturer on soil management explained soil development as seen in photograph 9.



Photograph 9: Rift Valley



Photograph 10: Explanation of soil profile

At this point the lecturer took time to explain the facts of soil formation and the students were given time to ask questions on the topic. The students in photograph 10 are attentive as the soil management lecturer stresses a point about the soil profile in the rift valley

The students then observed the land use activities in the rift valley as presented in photograph 11. The lecturer concerned explained the form of settlement here and how this may cause environmental concerns. As seen in the photograph, there have been land subdivisions to a great extent.



Photograph 11: Land use activities in the rift valley



Photograph 12: Land use activities in the rift valley



Photograph 13: Lake Nakuru



Photograph 14: Students listen attentively to a lecture about Lake Nakuru

On the first day we made a stop at Lake Nakuru where we made observations of the lake. We observed that the lake had receded significantly due to the drought that was being experienced in the country at the time. The receding lake and the effect of this on the flamingos and other wildlife in the park were explained at the park by the concerned lecturer as seen in photograph 14.

As we moved onto the higher grounds the view of Lake Nakuru was seen better and we could observe the extent of the water better as seen in photograph 15 and 16.



Photograph 15: A view of Lake Nakuru from higher grounds



photograph 16: Lecturers and students have a better view of Lake Nakuru



Photograph 17: White rhino at Nakuru national park



Photograph 18: A lecturer describes one of the plants

Photograph 17 is the white rhino in the park, so we learnt about the wildlife at Lake Nakuru national park by our classroom teachers.

Photograph 18 was taken at Kariandusi diatomite mining area. Here the plant taxonomy lecturer explains to the students about different types of plants in the rift valley.

At Kariandusi diatomite mining the students learned about diatomite mining with one of the workers at the industry. This was one of the opportunities where the students and lecturers interacted with the industry. The ERM course appendix HD 22 indicates that the course should engage industry.



Photograph 19: A lecture on diatomite mining



Photograph 20: Wetland ecosystem

Wetlands degradation is one of the major challenges in the country; at this point in the rift valley the lecturer took time to explain the status of the wetland. Therefore this was an opportunity for the students to learn about a degraded wetland ecosystem from one of the lecturers. This is presented in photographs 20 and 21.

The photograph shows that there is cultivation-taking place on the sides of the wetland. This kind of farming encourages soil erosion degrading the rivers and wetland areas with silt.



Photograph 21: land use along Wetlands



Photograph 22: Entrance to Mt Kenya National Park

On the second day we explored the areas around Mount Kenya. We made a stop at Mount Kenya national park to learn about the wildlife and landscape at the mountain region. In photograph 22 we are at the entrance into the park.

The area was very wet and presented a challenge of driving through. The students had to walk the rest of the distance to the Mooreland having parked the vehicles at this meteorological station as seen in photograph 23 and 24.



Photograph 23: pushing the vehicle stack due to wet conditions



Photograph 24: Vehicles parked as the students climb the mountain

We made observations of the various types of vegetation at the slopes of Mount Kenya as seen in photograph 25 and 26.



Photograph 25: Bamboo trees



Photograph 26: A view from higher on the slopes of Mt Kenya grounds of the mountain

The photographs indicate that the lecturers and the students mainly engaged in site seeing. The ERM course proposes hands-on activities that should be carried out. This therefore is a challenge in the sense that the course is not followed strictly. With this scenario, one then may ask, why were the lecturers not implementing the field exercises as expected?

6.3.4 Analysis of the field exercises by the students

It was necessary to discuss the views of the students about the major field exercises, one to the coastal region and the other to the rift valley and the central highlands of Kenya. The views of the students are important for transformation of the course.

6.3.4.1 The students views about the fieldwork at the coast

From observation and focus group discussions with the students (Appendix 5B), the students identified marine algae and sea grasses but did not collect the same as the course required. This appeared to be due to insufficient guidance on what was expected. For most of the groups time was also limited because the fieldwork was required to be covered in one week, according to the course outline. The time in the field was limited to only three days for some and others, five days. This was a result of delay from the institution as I observed that the

students left very late in the day due to logistical problems. Also the institution reduced the number of days because of financial constraints.

Plant specimens were covered in class theoretically but the students did not collect the specimens during the fieldwork for identification. The same applied to seed and propagation materials: this was taught in class but they did not do it practically in the field, because they did not have the required equipment for seed propagation.

We were taught in class about seed extraction but were not able to do this practically as the course content require. (Appendix 5B)

The students reported not to have trapped any fish, processing and their breeding sites because they did not get proper guidance from the lecturers.

The students were able to identify the mangrove ecosystem and its uses but not the different species types.

The students were confident to identify the various human impacts on the environment such as mining and tourism as observed in the field.

6.3.4.2. The students' views about the fieldwork to the highlands

I used the list of items outlined above (Section 6.3.3) to guide a focus group discussion on camping/fieldwork to the highlands of Kenya. The students reported that the fieldwork and camping at the Kenya highlands was not carried out as stipulated in the course outline (Appendix A, HD 22). They noted that they did not carry out pitching of the tents and even flood check controls as outlined. They said that they hired rooms for accommodation at one of the shopping centres in the area. Further they claimed that they did not know about the topics to be covered during the field camp until the detail above was outlined to them as part of this research. They said:

The course outline for this unit was not given to us beforehand. We were not told.

The fire control techniques were learnt theoretically e.g. using dry CO₂ fire extinguishers, use of a blanket whereby the fire is covered to reduce the rate of

oxygen gas and finally the use of smoke for communication, but this was never done during the field camp as expected. (Appendix 5B)

The focus group discussion revealed that the student covered animal and plant taxonomy adequately.

We also identified animals and plants taxonomically both in class and in the field whereby we classified plants according to their nomenclature; we managed to identify poisonous animals and their habitation in the biology laboratory. (Appendix 5B)

The interaction between animal species and environment was covered theoretically in class but not in the field. According to the CBE approach the students should engage in hands-on activities and become competent rather than just engage in theory. The field exercise is meant to engage the students in hands-on activities but the contradiction here is that little of this is done in the field.

The students also managed to observe and evaluate the impact of human activities on the environment under ecology and land use management, which they presented as a report on the field exercise. However they did not engage with the land users to learn about good land use practices. In a community of practice the learners should learn from those in the trade about how they manage the land resources.

The aspect of food preparation in the wilderness was handled in class in units such as survival in the wilderness, but the students did not practise this in the field (they did not prepare their own food as they stayed in hotels and lodgings in the areas they visited). The course envisaged a situation whereby the students would engage practically in the environment and link with nature and learn how to survive given the natural conditions. Making fire and preparing food in the natural way will enable more appreciation of nature than spending in a hotel environment.

Identification of geological features was covered both practically and theoretically because the students were able to identify the different geological sites and vegetation cover such as savannah grasslands, bamboo forests and moorland on the slopes of Mount Kenya. However,

the students reported lack of technical discussions in the field on specific aspects such as soils and water quality.

The students reported to have learnt in theory on emergence response. “We learned about food chocking, snakebite and minor injuries like cuts in theory” it is not possible to demonstrate such activities in the field. One can only carry out a mock demonstration; this could be done in the field for the students to demonstrate their response in emergencies. They should also have engaged with the community to share the community experience in such emergencies. The communities that live in environments that are remote from emergency facilities have ways of surviving in these conditions and the learners need to understand them because they may have to deal with such situations after their studies.

The students reported that they were unable to cover most of practical work in the field due to limited time, inadequate camping tools and equipments, ignorance and lack of qualified personnel (Appendix 5B). When implementing a course the planners should carry out a needs assessment to understand whether the course will be carried out as expected. The institution lacked camping equipment but went ahead and implemented a course that requires this. The scenario discourages learning as the learners realise that they are not able to do all that is expected of them and yet they shall be awarded a certificate at the end of the training. This is contradictory because the certificate is not fully earned because the student did not carry out all that was expected.

6.4 INDUSTRIAL ATTACHMENT AND THE CONCEPT OF ‘PRACTICE IN A COMMUNITY OF PRACTICE’

The ERM course provides for an industrial attachment that is aimed at giving the students hands-on experience in environmental resource management while still learning at the institution. This takes place at the end of the second year (Appendix 1A HD22). Since the students start the course in September this is undertaken between January and end of March every year. The students are attached to an organisation of their own choice and are expected to be assessed by their lecturer at least once in the course of their attachment. The students report directly to the industrial supervisor during the attachment and are assigned duties to be carried out during the attachment period.

6.4.1 Industrial attachment places for ERM students

Environmental management covers a wide field and therefore there are varied organisations that are engaged directly or indirectly in these processes. Those involved are the communities where the students on the ERM course secure places for attachment and ultimately places for employment. For the sample for this study the students were attached in various places, these were:

- Athi Water Service Board, Nairobi;
- National Environmental Management Authority (NEMA) in Kapsabet;
- Kenya Forest Research Institute (KEFRI) in Nairobi;
- Dagorretti slaughter house in Nairobi;
- National Environmental Management Authority Mombasa road in Nairobi;
- City Council of Nairobi (Department of Environment;

- National Environmental Management Authority (NEMA) in Makueni district;
- National Environment Management Authority (NEMA) in Vihiga District office;
- Patnership with Communities (CIPAC) an NGO on community participation in Nairobi; and
- Africa Waste and Environmental Management Centre (AWEMAC) in Nairobi.

It is clear from the list above that the graduates of ERM can secure employment in a wide range of organisations as environmental officers. These organisations assist the student to learn the trade while in training to understand what to expect in future in their workplaces. The organisations are therefore meant to teach the students how the organisations work as sites of environmental resource management. It is expected that from this exercise the student will gain the expected experience before they finally start working. During this time the students apply the knowledge they have learnt in theory and also learn new skills.

6.4.2 Activities carried out during attachment

To review the activities undertaken on attachment periods, an analysis of student reports was undertaken. According to the reports (Appendix 10B) the students on attachment during this research were exposed to a number of duties ranging from general office management to fieldwork. The range of activities they carried out is summarised:

- General office management;
 - Data collection on environmental issues;
 - Field inspection for compliance;
 - Technical report writing;
 - Participation in workshops/seminars / conferences on environmental issues;
 - Awareness creation/training on environmental matters environment.
- (Appendix 10B)

Student LR

Place of attachment: Athi Water Service Board, Nairobi.

ACTIVITIES

- Revision of EIA reports
- Inspection of boreholes in Nairobi area
- Attending public compliance meetings
- Training on EIA writing
- Binding and photocopying EIA reports
- Field survey on N’gong sewer line
- Data collection
- Report writing on Kiambu Dam
- Arranging files
- Development Assessment
- EIA project submission to NEMA
- Community awareness creation. (Appendix 14 AR1)

The ERM course covers a wide range of knowledge and skills as the student is expected to carry out various duties (Appendix 1A HD22). The students record the activities on a weekly basis and have their supervisors sign at the end of the week. The student learns the activities carried out from their supervisors and other colleagues. The industrial supervisor is expected to indicate the activities of the student on a daily basis on a form provided by the institution (Figure 6.1) and submit the report to TU-K at the end of the field attachment. As Figure 6.36 indicates, the weekly industrial attachment records show the student is expected to indicate the activities carried out each day for the whole week. At the end of the week the industrial supervisor comments on the activities that the student has carried out throughout the week.

The comments on this particular student show that the student spent some time being taught how the work is done in this office. Learning from the periphery is important as Wenger (1998a) suggested.

Figure 6.12: Weekly Industrial Attachment Records

WEEKLY INDUSTRIAL ATTACHMENT RECORDS

PART I - To be filled by the Attachee

Week TWO To _____ Weeks

Dates: From 15TH FEBRUARY To 19TH FEBRUARY

Day	Notes on Work Done
Monday	Mrs. Komon D.E.O. taught me about the arrangements of files in office. E.g. file on Licence, finance, general, project, etc. reports etc.
Tuesday	Arranged the various letters into their respective files and also wrote the inventory of industries within Kapsabet location.
Wednesday	Organised for the days we were going for the various inspections at the petrol stations within Kapsabet Municipality.
Thursday	Received guest from University of Eastern Africa Region who were on project consultation. Planned a collaboration with NEMA towards their project on Kimardi - Kinyua Island.
Friday	Spent my time writing books on State of Environment Reports in Kenya for the current State.
Saturday	
Sunday	

Remarks by the Attachee:
 Learned things which are important work etc

Name Jaw. Cheuita Signature [Signature] Date 15/2/2010

PART II - To be filled by the Industrial Attachment Trainer

Comments _____

Name _____ Signature _____ Date _____

PART III - To be filled by the Industrial Attachment Supervisor

Comments Office Management & Administration

Name Michael. Blame Signature [Signature] Date 19/02/2010

(NB - attach a separate leaf if there are more issues to report)

**DISTRICT ENVIRONMENT OFFICE
 MANDI NORTH
 P.O. BOX 943
 KAPSABET**


During the attachment period the student is expected to gain practical experience and also to get a feel for participating in the community of professional practice that he/she will join in the future on completion of the course.

The final attachment report rates the student according to the observations by the supervisor. As the report on attachment for one of the students in 2010 February to April shows in Figure 6.12. This particular student was rated excellent in all the areas: punctuality, adherence to regulations, adaptability, communication reliability and teamwork. The student was rated as good in workmanship and work output. This is an indication that this particular student was

becoming what was expected and one can assume the student will become efficient in environmental conservation when she completes the course.

Figure 6.13: Industrial attachment assessment form

**INDUSTRIAL AND INSTITUTIONAL LIAISON CENTRE
(CENTRAL REGION)**



Industrial Attachment Assessment Form
(This form to be filled by Employer)

Full Name of Attachee: JANE CHEBUD Female Male
 Admission No. 106/078HS Attachment Contact No. 0712577719
 Total length of Attachment in Months 5 MONTHS
 Period: From: Day 19 FEB Month FEBRUARY Year 2010
 To: Day 23 Month APRIL Year 2010
 Name of Training Institution THE KENYA POLYTECHNIC UNIVERSITY COLLEGE
 Name of Employer NATIONAL ENVIRONMENTAL MANAGEMENT AUTHORITY

Please, give your assessment of this attachee's performance during the period of attachment on the 5 – point scale below:

Assessment Areas	Rating Scale				
	Excellent 5	Good 4	Average 3	Fair 2	Poor 1
1. Punctuality	✓				
2. Adherence to regulations	✓				
3. Improvements in:					
(a) Workmanship		✓			
(b) Work Output		✓			
4. Adaptability	✓				
5. Communication	✓				
6. Reliability	✓				
7. Teamwork	✓				
Total	33				

Overall assessment of the attachee as determined by the average score (please tick as appropriate)
 Excellent Good Average Fair Poor

Assessor's General Remark A well behaved student with high potential to excel
DISTRICT ENVIRONMENT OFFICER
NANDI NORTH
P.O. BOX 848
 Assessed by: Name Michael Komen Position/Designation DEO NANDI
 Signature Komen Date 23rd April 2010
 Signed by the Attachee JANE CHEBUD Date 19/03/2010

6.4.3 Challenges on attachment

According to the attachment reports (Appendix 16B) the attachment period was not smooth sailing for the students. They encountered a number of problems that can be summarised as technical, social and financial as listed:

- Difficulties in finding attachment places and therefore a lot of time is wasted;
- Lack of emphasis on the various acts so that the students understand them before going out;
- Hostility in the field by the members of the public especially those who think that the students are spying on them so that they can report to NEMA;

- Lack of facilities e.g. vehicles to go to the field and stationery;
- Financial constraints as the students on attachment are not entitled to any remuneration;
- Complaints from clients who want to use corrupt means to get licensed;
- A lack of courtesy by some rude clients;
- Communication barriers particularly if one is in an office ‘up country’ where people speak the local languages; and
- Long working hours without payment.

In a community of practice and learning from the periphery, the student realises that in the workplace there are certain challenges. This exercise prepares the student for the workplace and enables one to come up with ways of solving these challenges.

6.4.4 ERM students’ approach to address the challenges on attachment

The students tried to solve some of these problems as they had to continue with the attachment exercise and acquire the necessary skills for the job market. Some of the approaches suggested by the students are listed:

- In the cases where the community was violent, they asked for assistance from the police force.
- In the cases of corruption, the relevant authority was informed.
- On technical issues the students were assisted by those who had the experience.
- The students had to learn how to manage time to avoid getting late to work due to traffic jam.
- The students had to learn how to communicate properly to their clients.

The students must have realised that they had to learn how to solve the challenges with their own initiatives and innovations to be able to continue in the trade.

Legitimate peripheral participation as suggested by (Wenger 1998a) (Section 3.4.1.3) is significant to enable the students to understand what is expected of them by initially engaging peripherally. In learning to become an environmental resource manager it is imperative to have good experience environmental conservation. The industrial attachment which is part of the ERM course gives the students an opportunity to learn more about their careers, to get to

know employers, become part of a solid network and experience their career from the periphery before completing the course and starting full-time employment. During the industrial attachment, the students learn from the periphery as they train to participate more fully in environmental conservation. During the industrial attachment the students carry out the various duties assigned by their supervisors who observe the performance of the student and send a report to TU-K. The report is important for the institution as it enables them to see where students need support and improvement. The students are free to choose their own places for their attachments. For this research I engaged with the students who were on attachment between January and April 2010.

6.5 TRADE AREA PROJECTS

In the ERM course (see Appendix 1 HD22) the Technical Communication unit in the second year basically covers research methods. The main aim of this unit is to enable the students to identify an environmental problem in the country, collect data and compile a project report by the end of the course. Students are free to choose research topics areas of interest. After identifying a research topic the student writes a proposal and makes a presentation to a panel of environmental lecturers. The lecturers make a decision on the viability of the proposal and the student is given the go-ahead to collect data under the supervision of one of the lecturers. In some cases the student may change the area of research; when this happens the course tutor may organise another supervisor. The student works on the project with the supervisor to complete and submit two weeks before the final examination. The project is marked out of fifty and combined with the business plan to make a mark of 100%.

Students need to show an understanding of the global sustainability challenges as part of the introduction to their projects. They exhibit critical thinking as they discuss the problems affecting sustainability and make informed conclusions on the researched topic. They also give practical recommendations on their topics. The projects analysed were coherent, comprehensive and their structure satisfactory.

Analysis of the trade area projects shows that the students have good knowledge of unsustainable activities in the community. However, it seems that the students are not linked

with the community because none of the students worked on the problems studied with the community. The institution and the community are separate entities; the students write about the problems of the communities and from book knowledge they understand how these problems can be tackled. The students are not in a position to implement the recommended solutions because there is no connection between them (the institution) and the community. The students may wish to put into practice the knowledge but they lack the funds and support from the concerned parties. Since the students do not offer any solutions in return to the community for the information given, the community sees the institutions of higher learning as taking advantage of them. It is important to establish ways in which students can work in close collaboration with local people on the identified problems. It is necessary for institutions of higher learning to be closely linked with the communities so that the students establish good relations and begin and continue good practices with the community.

Over the fifteen years I have spent teaching in the mid-level TVET institutions I have noticed that projects are carried out purely for examination purposes after which the projects are shelved and gather dust. I would like to see a situation whereby the projects are used by the communities to solve unsustainable practices. The communities ought to support the students to translate the research into real life engagement by implementing the suggestions given by students in their projects. Currently we are churning students through the system of education and offering little beyond the precincts of the institutions. Most students end up jobless and frustrated because they have a certificate that cannot get them employment. Somehow institutions of higher learning should enable students to become self-employed using the skills for which they trained. Trade area projects coupled with business plans should be useful to students after graduation.

I carefully analysed selected research topics to explore how they engaged with ESD. In research it is difficult to engage with only one aspect of the ESD pillars (see Chapter Two) as they are intertwined and an impact on one affects the others. It is therefore necessary for research to be holistic as it is not possible to separate people from the environment and the economic activities from politics and environment. I did try to see which aspect (environmental, economic and socio-political) was dominant and grouped the topics accordingly. The project titles that were analysed are in appendix Project Titles.

6.5.1 The trade area project process

According to the ERM timetable the student and the supervisor should meet once a week to engage with the research topic and to discuss the student's progress. Students and lecturers did not however meet as per the timetable schedule; rather the students met with their supervisors whenever they were available and depending on the needs and aggressiveness of the student. In some cases the students complained about not being able to meet their supervisors at all for the entire semester, because the lecturers were rarely available during the time-tabled period. But some students are very slow and need considerable time before they can have a meaningful and worthwhile meeting with supervisors.

This research noted that the project write-up was done alongside other units with students and lecturers concentrating more on the taught units at the expense of the project. Although the projects determine whether a student will graduate or not, the students concentrate more on the examinable units and tended to leave the project for the last minute. Some students found it difficult to choose a topic, which led to shallow research in projects.

In my research I also noted that in some cases the students only settle on a topic after the attachment. These students find it difficult to find time for fieldwork and data collection and sometimes end up copying from previous projects.

The research further established that lecturers don't go into the field to ascertain that the students actually carry out the study using real data to write up the projects. Discussions with the lecturers indicated that the students do not engage practically with local communities when doing their research for the project work. Some simply used imaginary data to write up their projects, with the aim of merely passing the examination.

The trade area projects are meant to introduce the student to the community where the study is carried out. This is a good opportunity for the student to engage with a Community of Practice that is engaged in tackling the research problem that the student is studying. In this case the student will have worked from the periphery to understand the problem and could assist in giving suggestions for solving environmental problems.

6.5.2 Assessment of the trade area projects

The trade area projects submitted by each student at the end of the course were analysed as evidence of peripheral participation in a community of practice. A trade area project is mandatory for the ERM course: each student is expected to compile and submit an academic project at the end of the ERM diploma course (Appendix 8B). The project for the trade area and the business plan are combined to account for 100% in the project unit. The students are free to select an area of interest related to environmental resource management. The students showed ability to select problems affecting their local community; a sustainability assessment tool developed by the research helped to guide the assessment of the projects (see Table 6.1) Twenty four projects were assessed using this tool (Appendix 8B STAP1). It was determined that the extent to which the title reflects ESD has a 4.21 mean score, which falls within the category of a great deal. The students' explanation of sustainability in detail has a mean score of 3.38 which is substantial, understanding of unsustainable practises in the community scored a mean of 3.88 which is very close to a great deal, the degree to which local sustainability issues and challenges form part of the project is a great deal (4.00), the degree to which global sustainability issues and challenges form part of the project is also substantial (2.79) and the extent to which the student exhibits critical thinking skills is also substantial.

The student's ability to make informed conclusions on the researched problem is rated as a great deal (3.54 mean score) and the capacity to make informed conclusions on the researched problem also rated as a great deal (3.63). Finally, comprehensiveness of the project rated well as a great deal with a mean score of 3.50.

Table 6.7: Comprehensiveness on ESD for students trade area projects

	Responses				Statistic			
	A little 1	Adequate 2	Substantial 3	Great deal 4	N	Min	Max	Mean
To what extent does the title reflect ESD?	8.3	20.8	12.5	58.3	24	2	5	4.21
Has the student explained the concept of sustainability in detail?	25.0	29.2	29.2	16.7	24	2	5	3.38
Does the project show that the student understands the unsustainable practices in the community?	12.5	25.0	25.0	37.5	24	2	5	3.88
The degree to which local sustainability issues and challenges form part of the project	8.3	8.3	58.3	25.0	24	2	5	4.00
The degree to which global sustainability issues and challenges form part for the project	41.7	37.5	20.8		24	2	4	2.79
The extent to which the student exhibits critical thinking skills	33.3	25.0	33.3	8.3	24	2	5	3.17
Does the student make informed conclusions on the researched problem?	16.7	29.2	37.5	16.7	24	2	5	3.54
The capacity to make informed recommendations	12.5	29.2	41.7	16.7	24	2	5	3.63
How comprehensive/cohesive is the project?	12.5	41.7	29.2	16.7	24	2	5	3.50
Valid N (list wise)					24			

6.6 THE CULTURE OF THE ERM LEARNING SITE AND HOW IT TRANSFORMS THOSE WHO ENTER IT

The Technical University of Kenya is a key player in the TVET programmes whose mandate is to:

- Provide post secondary technological, professional and scientific education and training up to degree level.
- Undertake research and dissemination of research outcomes to advance knowledge and its application in Kenya.
- Offer consultancy services and commercial activities.
- Conduct examinations and award certificates, diplomas and degrees to qualified students.
- Charge fees and other levies for its services.

The above mandate is fulfilled by the university five faculties, nine schools, departments, centres and institutions. Learning is by theory, practicals, field-work, internal and external industrial based learning (IBL) and examinations which determine awards of the various certificates.

TU-K's major achievement is the capacity to design and deliver hands-on training that has met the needs of industry for over five decades (since 1961). This study engaged in depth with one sustainability programme to unpack its development and implementation innovations for education for sustainable development practitioners. The Environmental Resource Management course that is sustainability based was selected because it was most suitable for ESD considerations. This was shown by a study conducted at Rhodes University by Togo (2009) on sustainability the department of Environmental Science had the strongest focus on sustainable development:

The department of environmental science has a strong focus on sustainable development (social, economic and ecological) issues across its courses. All the research in the department relates to sustainability in one way or another. The department is involved in applied research mostly by students, projects which inform policy and sustainability related charity work through donations. The department is

involved in collaborative relationships which address sustainability issues with various organisations, for example, through joint funding of programmes, joint research programmes and joint teaching of courses. (Togo, 2009, p.183)

In Togo's study of Environmental Science, all indicators under the curriculum, teaching approach and examinations clusters were allocated the maximum score of 4. The ERM course at TU-K was therefore assumed to have a high score on sustainability, the reason for its selection to probe into the teaching methods and other learning activities to see how it enabled the students to become ESD practitioners.

It is worth noting that the ERM students in third year indicated that in terms of community participation (learning as belonging), they understood the communities that they belonged to and they were aware of the places for employment. Some were also ready to start their own organisations in areas of sustainability. This means that by the time they completed the course they felt a sense of belonging to a particular body and in this case, that of environmental conservation.

6.7 AN ANALYSIS OF THE FIELDTRIPS/CAMPING IN THE SHAPING OF THE ERM PROFESSIONAL

There are two main field trips which are part of the ERM course, i.e. a one-week camp in the highlands and another camp on the coast. In my opinion, given the important role that field trips would play in the ERM course, two trips would not be sufficient for students to develop and sharpen their investigation, interpretation and inference skills necessary for sustainable management of natural resources in practice. Additionally, an ERM course such as the one at TU-K would require that students have several encounters with nature (experiential and activity based learning) so as to appreciate and critically analyse the challenges they are bound to face in real practice. This would be very useful in developing applied competence in the course of learning. In this study the two field trips were incorporated to help students to gain a real picture of student engagement in the ERM course. The trip to the coast involved four lecturers, twenty eight ERM students and fifteen food technology students. The field excursion was seen as very successful by the students but it lacked hands-on experience in the ecosystem. Apparently the students were mainly sightseeing despite the many activities

recommended in the syllabus. The field trips fell short of expectation and there is a need to engage with the communities more to form communities of practice on natural resource conservation.

This report shows that most of the work presented can be done theoretically in class. A field exercise should engage the students more in terms of carrying out experiments and getting involved practically with the community. The students could for instance collect plants for identification, collect water samples for testing, and participate in community activities.

The second trip was to the rift valley and a student report in Appendix 6B summarises the activities carried out by the students. The two reports indicate that the camps were mainly an opportunity for sightseeing as opposed to study in terms of real engagement with the community. As an ESD teaching method, the students need more exposure and more hands-on activities.

My observations led me to conclude that either the lecturers were not prepared to conduct the field visits as they are not skilled or properly trained on what to do with the students when they go out. Sightseeing is good for our students to understand the various landscapes but environmental students should engage more with the community. In a departmental meeting the lecturers indicated that most of the ERM course was taught in theory with little practical. (Appendix 4B)

Supervision by the lecturers during the attachment period is not described in the attachment form, though it is expected that the lecturers visit the students in the field at least once during the attachment period. There is no indication in the course document (Appendix 1A HD 22) on grading students during attachment. Also there is no indication on whether students score marks during this period. This fact makes the exercise a routine rather than a necessity and therefore it is not taken seriously by all the students. Some of the students who were supposed to be on attachment during this study reported they had not found places for attachment.

The ERM course as done at TUK has the required content for an ESD practitioner but the results in this chapter has indicated that there is little hands on activities by the students and little engagement with a community of practice. The course trains mainly in theory and enables the students to obtain the certificates through theory examinations although ESD requires hands on activities. In Chapter seven I explore the contradictions in the system to highlight the constraints in training ESD practitioners in Kenya's TVET institutions.

CHAPTER SEVEN: A REVIEW OF THE ENVIRONMENTAL RESOURCE MANAGEMENT COURSE AS AN ACTIVITY SYSTEM IN A CHANGING CONTEXT OF EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD)

7.0 INTRODUCTION

This chapter responds to the third objective and research question as presented in Sections 1.5.3 and 1.5.4 respectively:

- To probe the ERM course development process and its implementation as an activity system producing ERM professionals now engaged in ESD.

It thus seeks to review how the development (Chapter Five) and implementation (Chapter Six) of the ERM course functioned to enable the participants to become the expected ERM practitioners as envisaged by the revised course design. The previous chapters presented data on a number of challenges experienced in the implementation of the revised course noting developing axes of tension in the development of the course as a process producing ERM professionals. In electing to review the course development and implementation as an activity system producing ERM practitioners, my purpose was to analyse these tensions. The aim was to assess the extent to which course had produced contradictions that need to be taken into account in a review of process in terms of the emerging need in Kenya of Education for Sustainable Development.

In the first part of the chapter the course is examined as a process producing practices and tensions that are playing out as contradictions in the intended course process. Contradictions as explained by Engeström (1987) (Section 3.8.3.1) are challenges that can be surfaced at various levels of an activity system, either at the element level or between the elements and often between interacting activity systems.

In the second part, the effectiveness of the course as an activity system in TU-K is further examined against the emerging focus on ESD in the region. This is done not only to deepen my understanding of the depth implications of the way the course is operating as an ERM activity system but to also to begin to address the need to have it take up the emerging focus on sustainable development and the education processes necessary to bring these processes of changing environmental practice into effect.

The chapter examines the course as interacting activity systems involving lecturers and students so as to surface and discuss tensions and contradictions playing out in the process. Here Cultural Historical Activity Theory (CHAT) is used as the lens to examine the cultural history of the revised ERM course and how the lecturers and students became intertwined in it as it was implemented as a developing activity system to produce ERM practitioners. This aspect of the research was not intended as a measure of the overall effectiveness of the course but is rather used as a means to probe how the course as an activity system is enabling the emergence of the intended ERM practitioner. An activity systems approach to the analysis of the course serves to allow the study to look at the ERM process in its broader sense as an emerging process of Education for Sustainable Development (ESD). The use of CHAT allows for a clearer grasp of how lecturers and students are interacting in a purposeful system that is training the ERM practitioner as a professional to support emerging ESD policy social change orientated processes in Kenya. The course is thus treated as a process producing professionals who will be responding to the need for ESD in Kenya. The chapter first explores the activity system drawing on data reflecting tensions and contradictions in the course development and implementation process and then examined the outcomes in relation to the need for ESD.

7.1 THE MEANING OF CONTRADICTIONS IN ACTIVITY SYSTEMS RESEARCH

In this research contradictions are understood as challenges or factors that do not allow activities to proceed as expected in this case in terms of the way the course was designed and in how it was intended to be implemented and played out to produce ERM professionals. Contradictions are hiccups in a system that constrains the running of the activity system and thus the intended activity system outcomes. According to Engeström (2001) contradictions are a key concept in activity theory and they are historically accumulating structural tensions within an activity system as well as between interacting activity systems. Contradictions generate disturbances and conflicts that may lead to failures in the system or innovative attempts to change the activity. Murphy and Rodriguez-Manzanares (2008) argued that tensions, disturbances and local innovations are the rule and can be an engine of change that has the system not function as anticipated.

The above description of contradictions makes it clear that these can exist in any activity system. These challenges as I first identified them in this research make the participants in the activity system reconsider activities and thus either impede or even improve the system so that the outcomes are or are not achieved. Contradictions are therefore important in an activity system to produce unanticipated effects that need to be examined. In my understanding there is no activity system that is devoid of challenges/contradictions that need to be examined to deepen understanding of how the system is operating to produce the desired and other effects. Participants in an activity system like my colleagues and I have to resolve the contradictions in order to move forward and in so doing produce further effects which might enable work from contradictions to improve the course into the future. Resolving contradictions is an ongoing process of learning and change in an activity system to bring about understanding and transformation. Some writers have referred to this as expansive learning (Cole and Russel, 2002, cited in Hardman, 2008).

According to Foot (2001, p. 11):

Contradictions are one central tenet of activity theory ... conflict and dis-coordination is inevitable in the functioning of any system... Activity theory uses the term contradiction to indicate a misfit within elements, between them, between different activities, or between different developmental phases of a single activity... Contradictions manifest themselves as problems, ruptures, breakdowns, and clashes... Activity theory sees contradiction as sources of development. (Section 3.8.3.1)

My purpose of examining the challenges that have emerged in the earlier chapters is to surface clear contradictions that can be worked on to understand and improve the course so that it might better produce ERM practitioners to respond to the pressing need for more and better ESD in Kenya.

7.1.1 The reasons for seeking out the contradictions in the ERM course

This research sought to surface the contradictions in the ERM course system to enable transformative learning and change. In this research the contradictions that the lecturers and students experienced had multiple roots and origins in the context, the course development process and its implementation as a course to produce ERM professionals.

In the activity system under review, some of the contradictions originated from the work environment whereas others were produced through external forces that interact within the institution. Engeström (2013) asserted that CHAT theory suggests that in order for an activity system to be expansive and allow for the attainment of the original outcome, contradictions must be surfaced to be resolved. Therefore this study undertook an analysis to identify contradictions that need resolving to enable the ERM training course to produce professionals who both experience and are able to facilitate ESD towards sustainable development. The resolution of the contradictions identified in this research will be reviewed towards enhancing learning and teaching for ESD in the site of the study, which in turn may have an effect in the wider contexts of Kenya in which the graduates will work. In the following section I describe and examine the activity system of the lecturers and students interacting in an ERM course.

7.2 AN ACTIVITY SYSTEM IN THE ENVIRONMENTAL RESOURCE MANAGEMENT SETTING

An activity system consists of elements, actions and tasks in an organisation to satisfy a specific need for a specific purpose (Section 3.8). According to Engeström (1987) the basic mediational structure of an activity system consists of **objects, subjects, tools, rules, a community** and a **division of labour** (Section 3.8.2). An object is the outcome of a set of purposes and motives that help define and focus the activities within the system and help direct the processes towards the goal (Dick & Williams, 2004). The purpose of the course is to train ERM personnel to work in the conservation sector to spearhead conservation initiatives in all sectors, a purpose motivated by the accelerated environmental degradation. The goal of the ERM activity system is to produce ERM professionals to enhance sustainable development by engaging citizens to be mindful of the environment and to devise better ways and means of sustaining themselves and their environment. The course emphasises Environmental Resource Management (conservation) as a process of restorative change towards sustainable development (UNEP, 2006a).

The ERM course activities identified and analysed in this research are: fieldwork/camping, industrial attachment and trade area projects (Sections 6.3, 6.4 and 6.5) which were taken as

the turning points or shaping processes for emerging ERM practitioners engaged in the course as an activity system of purposefully engaged lecturers and students. These activities were noted for how they shaped the conditions that produced the object (ERM practitioner), thus allowing an analysis of any challenges that produced contradictions arising in the unfolding activity system. Emerging challenges re-inscribed through activity system analysis as contradictions for expansive learning engagement align the conditions on the ERM course to enable learners become ESD practitioners. Change within these key processes of the activity system (turning points) is what I was striving towards to better allow the object of teaching and learning for sustainable development to be achieved. In this way, the modelling of the activity system with the data presented in Chapters Five (course development) and Six (course implementation) was intended to give the research a better grasp of the teaching and learning system intended to produce ERM professionals engaged in education to foster more sustainable development in Kenya. The analysis was undertaken towards allowing the possible readjustment of the processes of learning and teaching for ESD on the course as an activity system.

The tools are all the instruments and materials that facilitate the learners while in the institution to understand their trade; such as textbooks, the Internet, handouts, the laboratories (see Section 3.8.2) and so forth. The community consists of all the people that the student will interact with to facilitate learning over the period of interaction in the institution. In the activity system there are rules and regulations that must be adhered to for successful accomplishment of the course (Section 3.8.2). Finally the division of labour is determined by the institution on who does what.

Here, the research data can be examined for how the professionals coming out of Kenyan Higher Education Institutions (HEIs) are orientated and equipped to effectively engage in ERM now more broadly seen as ESD. The inclusions and exclusions in the ERM course activity system are looked at for any contradictions that might need to be resolved for the expected knowledge, skills, values, attitudes and perspectives for the students to engage in ESD. In this case it provided the research with a grasp of how learning was taking place in the ERM course and then for this to be contemplated as ESD.

In order to develop an understanding of the course as an activity system shaping ERM practitioners to work on the ESD priorities of the country, I focused on the activity system of the ERM course as this had developed at Technical University of Kenya.

7.2.1 An overview of the activity system examined in this case study

In this research I worked with the ERM activity system that came into effect at the Technical University of Kenya through an ERM course revision that was implemented to enable students to become practitioners in various technical areas of specialisation. The course is offered at the Department of Earth, Environmental Science and Technology (DEEST). The ERM course is designed to promote ERM through its learning units and the content that emphasizes environmental conservation, so the students learn how to manage environmental resources sustainably and the lecturers engage in training the students in environmental management practices specified for the course.

The ERM students learn through class lectures; these are the face to face experiences of students with the lecturers in various units. There is fieldwork, whereby the students visit various sites of interest to learn about specific aspects in the course. The industrial attachment involves the students working in an office/organisation in conservation and the student learns how the conservation skills and knowledge are applied. Finally the students engage in researching and writing a trade area project; here the students identify an environmental issue, collect data on that issue and analyse the issue to give suggestions on how such an issue can be mitigated. In writing a trade area project, the students engage with the professional and local community to collect data for their end of course engagement in becoming ERM professionals over year three projects (Section 6.6) where they carry out their research for their trade area projects as a final assignment for the course. An industrial attachment is also conducted among the stakeholders both in the vicinity of TU-K and various environmental conservation sectors in the country (Section 6.4). The stakeholders provide the space for work-place learning and finally job placement after graduation.

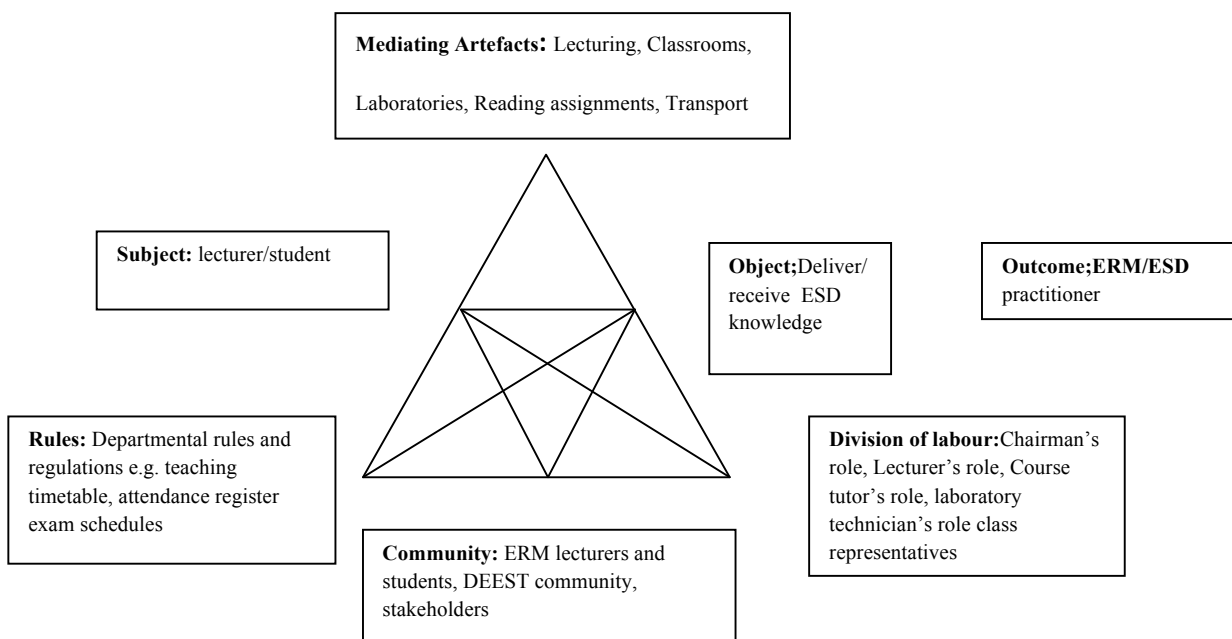
In the following section I will highlight the ERM activity system with the lens of the second generation CHAT approach and explore how it is functioning and any contradictions that might surface as its functioning is examined more closely (Section 3.8.2).

7.2.1.2 ERM activity system

The ERM course activity system is enacted in the department of Earth Environmental Science and Technology (DEEST). It is the role of the department to ensure that the students

admitted into the department successfully complete the courses as stipulated (Rules). The chairperson of the department foresees the technicalities of delivery of the course in the department. He/she allocates the various roles and responsibilities to the lecturers to make sure that the courses run smoothly. The chair of the department appoints the lecturer responsible for a given group of students as soon as they are registered to study in the department. The lecturer responsible is known as the course tutor. He/she is responsible for the class for the whole period the students are at the institution. Figure 7.14 is a summary of the ERM activity system.

Figure 7.14: the ERM activity system



The activity system emerged through an ERM course revision and was implemented in TU-K where the culture of the proposed course did not resonate with the prevailing practice within the institution. Many challenges were identified in how the course was developed and the manner in which some of the key elements were implemented.

7.3 THE OBJECT OF THE STUDY

In this research environmental resource management was regarded as the object towards an outcome of ecosystem resilience, a small component of the concept of sustainable development. The TU-K institution is meant to equip the students with the necessary knowledge, skills, values and perspectives to work in the conservation sector

In this case a student joins an institution aiming at acquiring the necessary knowledge, skills, values and perspectives to become a professional who carries out certain duties in the community in a specific area of specialisation. By being inducted into and completing the course of study, the ERM trainee aims at acquiring the necessary knowledge, skills, values and perspectives to foster awareness of conservation in all sectors and engagements to work in the sector of environmental resources conservation. In this case the student behaviour becomes the outcome as a practitioner in ESD.

Learning at TU-K presents contradictions for the student that need resolving so as to enable a practitioner in ESD to emerge. The data generated in Chapter 6 indicates that there were many challenges in how the TU-K student was exposed to the various perspectives and practices involved in environmental resource conservation. Notable here were tensions across examination and the competency based learning requirements in the course design (Sections 5.8 and 6.2), the campus-based course and the challenges in how the fieldwork experiences were conducted (Section 6.3), the management and scope of the practical learning on the workplace attachment (Section 6.4), the design and implementation of the trade area projects (Section 6.6), and the expanded scientific knowledge required as compared to the narrower disciplinary structure of the course delivery and the lecturer expertise.

Here the way students are being taught and the intentions of the course design are cut through with contradictions that would appear to need to be resolved so that the course might more effectively produce ERM professionals for the Kenyan conservation context.

The ERM course activity system will determine whether the learners achieve their expectations. The ERM activity system rules, community and division of labour are residual from the old course design but the system has not been realigned to the purpose of the revised course. The activity system should provide the right tools to enable the learners to be inducted into and to understand the trade. The system must provide the right community to

work with the student so that the student learns. Finally the roles for each person involved should be carried out appropriately to enable the smooth running of the activity system.

7.4 CONTRADICTIONS IN THE ERM COURSE ACTIVITY SYSTEM

In the prevailing activity system contradictions that were surfaced included:

- Contradictions in the development of the revised ERM course (Section 7.4.1);
- Contradictions between Competency Based Education and the examination system (Section 7.4.2);
- Contradictions in the diversity of students (Section 7.4.3);
- Contradictions between lecturer qualifications, the required courses, and the necessary tools of trade (Section 7.4.4);
- Contradictions between the lecturers and tools of trade (Section 7.4.5); and
- Contradictions within competing institutions of higher learning (Section 7.4.6).

7.4.1 Contradictions related to the development of the ERM course

Document analysis has been used to explain some of the contradictions emerging from the development of the ERM course (see Chapter Five) where lecturer involvement in the development of the ERM course was limited. For example the lecturers were not engaged from the onset of the programme; rather they were called upon at the stage of the workshop during the DACUM to prepare teaching materials for their units of specialisation (Section 5.2).

Secondly, a needs assessment did not involve the lecturers from the start. Some of the lecturers that had already trained in teaching practice were not consulted by the Canadian experts regarding areas of uncertainty (Section 5.5).

Joyner (1994) argues that a course development process requires the following steps:

- Engagement of policy level institutions;
- Engagement of school administration;
- Engagement of faculty/teaching staff;
- Engagement of students;

- Engagement of parents;

-Engagement of the grass roots community.

This is reiterated by several writers, particularly on the development of sustainable development (McKeown, 2002; Siege, 2008; Jabareen, 2011). This research found that two factor areas of ESD were covered significantly during the development of the ERM course:

- Developing an institutional set-up of key partners to develop and implement ESD curriculum.

In this regard, six key partners were identified during the establishment of ESD course development. However, the ERM course development process only engaged with three of the identified partners who included policy level institutions, school administration, and faculty/teaching staff. The process did not engage with three other groups - students, parents and the grass roots community.

- Linking concept of ESD to the concept of competencies and standards.

The study found that the ERM course development process embraced the concept of competencies and standards comprehensively, covering all the seven identified factors (Appendix 1A, HD20) and Competency Based Education at SIAST (Appendix 1A HD10 and 11).

In respect of the outcome of the analysis, the researcher concluded that the ERM course was developed during a period when the global debate on ESD was still in its infancy and adoption of its principles was not considered during the ERM course which was orientated to a narrower field of conservation management. The existing course could not be measured against the identified ESD factors.

7.4.2 Contradiction between Competency Based Education and performance in the examination

The students and lecturers identified being competent and passing examinations as the main contradiction in the system. The lecturers were concerned with completing the course so that the students could pass the end of year examinations with little or no regard for how competent the learners ultimately became (Section 6.2.2). Passing the examinations was the only way to get the diploma certificate from the institution. This is so because the institution requires that the student passes the examination and this is the determining factor for the

student to gain a diploma certificate (Figure 7.15). As discussed in detail in Chapter Two the ESD principles support learning that is competency based (UNEP, 2006b). Therefore this is a major secondary contradiction between the student becoming competent and the institution's emphasis on passing the examination. The contradiction between passing the examinations and becoming competent in a given area seems to emanate from the country's education system that emphasises the final examinations at, for example, the end of the eight years of primary education and the end of the four years of secondary education (Section 1.4.2). This system looks at the final mark with no regard for the overall competency of a person or what the student has engaged in while in school (Appendix 4B).

The Competency Based Education approach to learning, envisaged at the planning of the ERM course, required the learner to become 100% competent in a given task (Section 5.8). However formal institutions offer examination oriented courses that does not promote competency learning as proposed by ESD (UNESCO, 2006). ESD principles suggest that HEIs need to emphasis active/participatory learning as opposed to cognitive learning. ESD advocates for the type of learning which enables an individual to become competent rather than simply own a certificate (Figure 7.2). The TU-K activity system aims at awarding certificates and diplomas to the learners.

According to this research there were efforts to enable the students to become competent in their trade with activities such as laboratory practices, fieldwork, industrial attachment and trade area projects (Section, 6.2.4, 6.3, 6.4, and 6.5). The laboratory practices were found to be insufficient as the department lacked an environmental laboratory and was required to share laboratories with other departments. This means that the time spent in the laboratory was limited due to the high demand for the laboratories for students taking applied sciences. The limited laboratory time means this aspect of learning was not adequately covered.

The fieldwork exercises were also limited to two main exercises at the end of first and second year (Section 6.3). This may not be sufficient for students expected to work in conservation. In addition, this aspect of the course was not awarded any marks towards a final examination so some students did not participate.

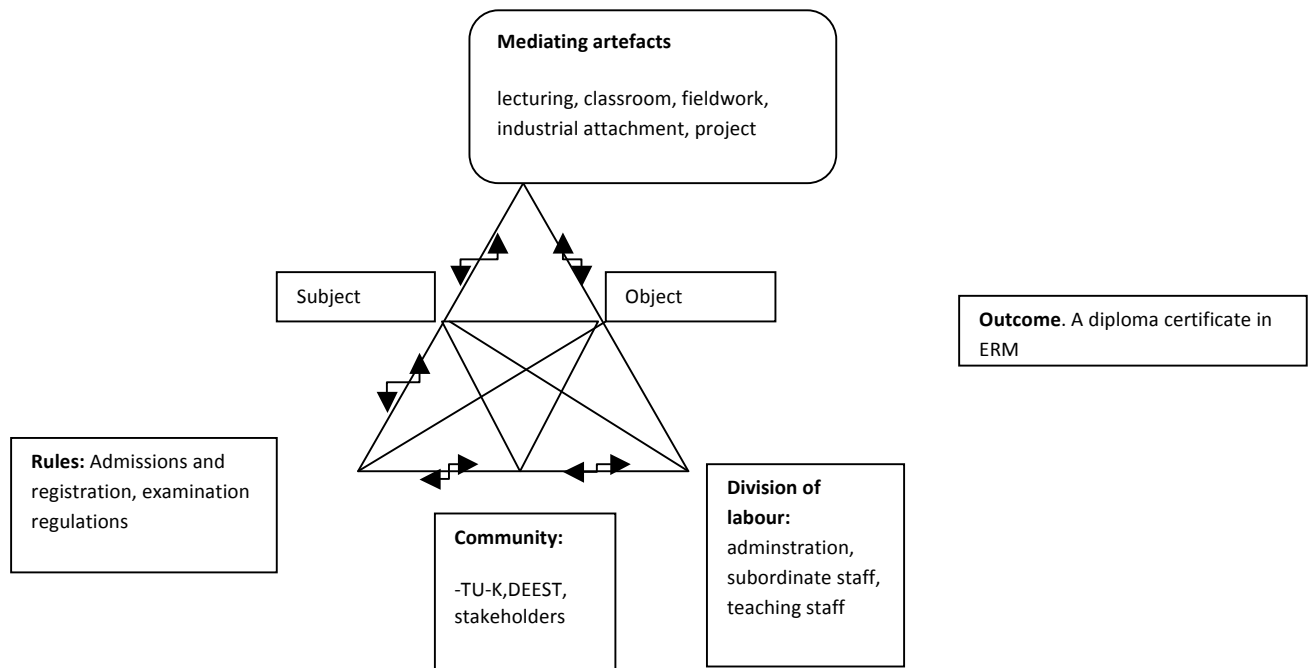
The industrial attachment was also not mandatory for all the students. In some cases students did not even find places for attachment and thus did not participate in the exercise at all. These students acquire their certificates regardless of their participation.

The trade area project was meant to be an opportunity for the students to engage with the community on environmental issues that were affecting them. However there are instances where students simply sat in the library and developed their projects. This was possible because the lecturers did not assess students in the field. The trade area projects did not seem to engage the students adequately with the community or with solving real life problems. The trade area projects seemed to be completed simply for examination purposes; there is no follow-up to the site of the studies.

Competence Based Education is therefore a major contradiction with the final year examination. Whereas the course was developed envisaging a competency education approach, the traditional mode prevailed due to the emphasis on the final examinations (Section 5.6).

To resolve this contradiction the institution's management needs to emphasise the importance of students becoming competent in their selected areas of specialisation rather than simply passing the examination. This will be a matter of policy change that emphasises the value of learners becoming more competent in their trade over passing examinations. I am of the opinion that the final examination should not determine whether a student deserves a certificate or not. Rather the student should earn the certificate from the activities that he has to undertake in the period at the institution to become a competent practitioner in his/her area of training. This is possible through grading all the activities carried out by a student. The standards for grading these activities should be determined by the department just like in the final examination that is given a grade by the institution. The ERM students should be exposed to a number of field excursions to support their developing competence in environmental conservation. Even if they do not become competent, they will have experience in environmental management that might encourage them to become advocates of good practices even if they do not get employment in the conservation areas. They should be given a number of projects to carry out in the community to become well acquainted with environmental matters and how to solve them. In other words, they need to be engaged in action research rather than concentrate on theory and examination. If this is done, good practices shall be enhanced.

Figure 7.15: Summary of the contradictions on examination and competency learning in the ERM course



7.4.3 Contradictions in the diversity of the students

At the element level contradictions exist among the students regarding age differences and aims of taking the ERM course. The classes are not homogenous because the course allows for registration by anybody who has completed secondary level of education with a minimum grade of C, regardless of age. Students have different aspirations and therefore learning varies. The various categories of students include:

- Those who are ‘fresh’ from secondary school;
- Adults already working and want to gain skills on conservation for promotion; and in their work places; and
- Secondary school leavers who completed some time ago and are not in formal employment.

These categories of students seek for admission in ERM for various reasons. The working adults may need a diploma for promotion purposes in their places of work; some may have been employed with lower qualifications or may not have relevant qualifications for their jobs. This category of students may have diploma qualifications in other areas but may have found a job in an environment related area and now need a diploma in environment to be promoted. This means that there are certain areas such as communication skills, entrepreneur

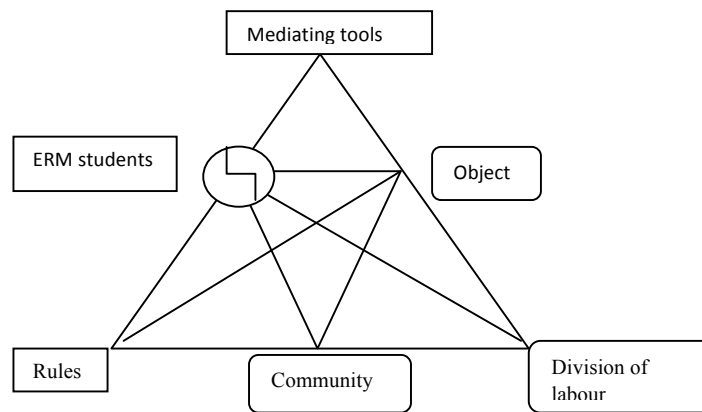
education, computer applications etc. which they may have covered in the other diploma course acquired earlier, but they have to study the same subjects for this particular course. Training such a person in all the units in ERM course is a waste of time and resources.

The mature students also have other responsibilities such as parenting, work responsibilities and other commitments in society that require their attention. These students are known to take their college work seriously and would like to spend the least time studying. My experience with this category of students is that they are very committed to their studies and willing to do all it takes to complete their studies in the shortest time possible. The discussion held with this group indicates that they are not comfortable with the younger students some of whom are their children's age. The younger students may at times pester the older ones for favours, because they are working and therefore expected to have money. A conversation with the older students indicated that they would prefer a class of their own. They also reported feeling embarrassed when they scored lower marks than the younger students in the ERM course.

Those who join the course straight from secondary school are young and most are single and thus being taken care of by parents or guardians. This category of students does not have responsibilities to push them to work very hard and some do not take their work seriously. The third category consists of those who completed secondary school earlier and have either been looking for jobs or could not join higher education earlier for one reason or the other. These students have often had a rough time and may take their studies seriously because they are much older and enjoy a more settled life. This scenario presents contradictions among the members of a given class. In this study there were students from all these categories.

In teaching computer studies, my experience were that the younger students embrace technology quicker and it does not present any major challenge to them as some of them were computer literate before starting the ERM course. Some may have worked with computers in secondary schools while others may have taken short courses on computing. Others in the class were lacking in even very basic computing skills. These mixed-ability groups can be frustrating to all involved. The difficulties are compounded by the restricted number of computers to be shared among the many students; in some cases ten students shared one computer. See figure 7.16 which illustrates the primary contradictions among the students.

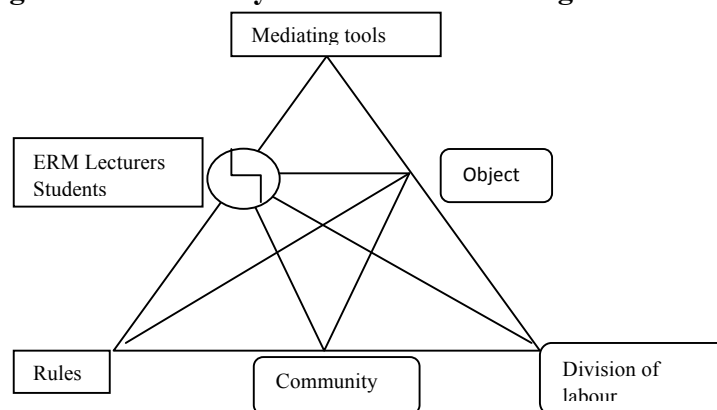
Figure 7.16: Primary contradictions among the students



7.4.4 Contradictions among the lecturers in the ERM course

The primary contradictions among the lecturers include: different levels of qualification, background and perception. In terms of qualification, there are feelings of intimidation especially in meetings where lecturers with different levels of qualifications antagonise one another. For example, Masters and higher degree holders feel frustrated and overqualified to teach at a diploma level. Lecturers with higher diplomas and bachelor degree feel intimidated or offended by this. See Figure 7.17 which illustrates the primary contradictions among lecturers.

Figure 7.17: Primary contradictions among the lecturers



For this contradiction to be resolved there is a need to recognise qualifications. The lecturers should be allocated duties according to their qualifications.

7.4.5 Contradictions between the lecturers and the tools of trade.

Secondary contradictions arise between the different aspects of an activity system. The main secondary contradiction that was surfaced in this research was between the mediating tools and the subjects (Section 3.8.3.1). The lecturers were frustrated with the lack of facilities for

teaching the ERM course. First and foremost, they did not have an environmental laboratory although the course required that they carry out experiments in the laboratory, for example, water quality analysis. They were frustrated in their attempts to get assistance from the other departments as the following excerpt from L1 indicates:

Researcher: Do you encounter any challenges teaching ERM?

L1: There are a number of problems teaching in this institution. We do not have most of the facilities. You know we do not have an environmental laboratory. I took the students to Lake Naivasha and we collected water samples but we do not have a laboratory to do the analysis. I have to rely on the chemistry laboratory for the analysis; this delays everything. You can imagine the samples have been sitting under my desk since last week. I am still chasing the laboratory person. It is a problem, even getting information from other places like UNEP you have to spend your own money the institution does not give support. We do not have most facilities.

Lack of the appropriate facilities in the institution was a major challenge. Due to the frustrations of lecturers, teaching became simply theoretical.

7.4.6 Contradictions of course between competing institutions of higher learning.

Quaternary contradictions occur between different systems; such contradictions occur when systems clash. In this research quaternary contradictions surfaced in the institutions offering the same courses and therefore competing for the same students. In this case there are several institutions offering natural resource management course in Kenya (see Section 1.4.2) and who thus compete for the same students. From Table 7.1 it is clear that there have been relatively few ERM course students over the years. In some cases the quality of education is compromised in order to get enough students to form a quorum as required by the institution. Tertiary institutions are in business and for them to remain in the business they decide to take students who do not meet the minimum requirements in order to boost student numbers.

Table 7.8: Student registration in ERM course

2002	2003	2004	2005	2006	2007	2008	2009	2011	
10	11	15	12	36	15	14	31	14	

Source: KPUC registration records, 2011

Other courses such as business, applied sciences and engineering seemed more attractive and engaged more students. My interpretation of this is that there is less enthusiasm for environment related studies, despite there being global need to focus on environmental issues.

7.5 THE POTENTIAL FOR ESD THROUGH THE ERM DIPLOMA COURSE

According to Wals (2012) ESD is considered a key outcome of the Rio Earth Summit held in 1992, although ESD gained momentum across the globe when the UN identified the period between 2005 and 2014 as the UN Decade for ESD. In the UNESCO report on shaping the Education of Tomorrow, the essential characteristics of ESD are listed (see Box 7.1). From the list of the characteristics, it is clear that ESD is based on the values that underlie sustainable development. That means that ESD has emanated from sustainable development principles set up in the 1992 Summit. ESD deals with the well-being of all the realms of sustainability that is environment, society and economy. In this study I wanted to see whether all three were adequately addressed in the ERM course units. This would enable the course developers to identify the gaps in the course and be able to address them, so that the student is adequately prepared and trained to be an ESD practitioner. Because ESD also endeavours to promote lifelong learning, I was therefore interested in understanding how lifelong learning is promoted in the developed ERM course.

Furthermore I was interested in whether the course addresses local challenges and is culturally appropriate. I was interested in whether the local needs, perceptions and conditions were addressed and if this was looked at in terms of international effects and consequences. This was explored in a formal setting although ESD also deals with the informal and the non-

formal sectors. It was interesting to understand how those who are in the informal sector engage with these other sectors to promote lifelong learning. The final aspect that I was interested in was the pedagogical techniques that were engaged in the course to understand whether they promoted participatory learning and higher order thinking.

Box 7.7: Essential characteristics of education for sustainable development:

- is based on the principles and values that underlie sustainable development;
- deals with the well-being of all three realms of sustainability – environment, society and economy;
- promotes lifelong learning;
- is locally relevant and culturally appropriate;
- is based on local needs, perceptions and conditions, but acknowledges that fulfilling local needs often has international effects and consequences;
- engages formal, non-formal and informal education;
- accommodates the evolving nature of the concept of sustainability;
- addresses content, taking into account context, global issues and local priorities;
- builds civil capacity for community-based decision-making, social tolerance, environmental stewardship, adaptable workforce and quality of life; and
- is interdisciplinary: no one discipline can claim ESD as its own, but all disciplines can contribute to ESD;

Adopted from Wals (2012)

These characteristics indicate that there is no one subject that can claim to ESD as its own, but all disciplines can contribute to ESD. In this research my interest was to understand the extent to which ERM contributes to ESD and the possibility of enhancing the course to contribute more. In the next section I outline the ERM course against the ESD pillars.

The extent to which the course addresses each of the pillars need attention as in the past environmental courses have tended to address the ecological aspect more than the economic and the social. In the next section I discuss the course according to the three pillars of ESD.

7.5.1 Ecological pillar

The ERM course covers twenty two units on ecological aspects as shown in Appendix 2 Table 5.2. This may be a result of history because in the past the focus of environmental education was on ecological studies, especially that of the countryside (Zolho, 2008). At the

inception of the course more emphasis was on how to conserve the environmental resources as the world was getting to grips with environmental degradation (Appendix 1A HD 1). The education system in the country was also only just becoming aware of the global environmental crisis (Section 2.6).

In the first year of study the ecological units enable the student to understand the interrelationship of the environmental elements. Units include environmental ecology, animal and plant taxonomy, an introduction to environmental resources, land use practices, conservation, greenhouse techniques and plant breeding. In the second year of study the management of these aspects is introduced. This is done through wildlife and forestry, management, environmental impact assessment and environmental law. The third year of study focuses on the management of specific resources: water resources management, energy management, rangelands management, soil resource management, urban planning and landscape design and ecotourism.

Through the above mentioned units the student learns how environmental resources in the world, and particularly in Kenya, are threatened and how they can be managed in a sustainable manner. Jones (2008), commenting on ESD argues that geography as a subject enhances ESD in the various units covered such as energy, but needs to be more hands on in terms of strategies used with a greater emphasis on the global dimension. The units in ERM such as energy, forests, water etc enhance ESD but only at a very theoretical and superficial level. This research found that there were no particular field exercises for the specific ecological subjects except for the field trips to the coast and highland areas of Kenya at the end of first and second years respectively (Section 6.4).

7.5.2 Economic pillar

Four units in the course relate to economic aspects: entrepreneurship education, business planning, and project planning and administrative procedures. In the first year of study the students take one unit of Entrepreneurship Education to enable them to think of entrepreneurial activities in their core business. In the second year they do a course in business planning, to enable them come up with a business plan. This is mandatory as they

are supposed to submit a business plan for examination at the end of the course. The business plan course is graded on its own with a maximum score of 100%. In the third year the students take two units on economics i.e. project planning and management and administrative procedures. This teaches the students to manage a project and an office. It was noted that there are many factors requiring attention before a student of ERM can become well equipped in terms of creating ways of sustaining themselves economically.

7.5.3 The social pillar

The social realm is addressed in four units; in the first year the students learn communication skills to enable them communicate appropriately in the community and be able to relate to other people both formally and informally. As environmental resource managers, the students are expected to create environmental awareness in the society. They also learn computer applications to help them remain relevant and literate in information technology because the world is becoming a global village through information communication technology. It is important for these students to embrace technology for quick and efficient information accessibility. In the second year of study the students are introduced to a community development unit because they are expected to work with the communities in environmental conservation. This unit therefore enables them to relate with people in the community with an understanding of their culture. It also helps them understand disaster preparedness and management. In the third year they study ecotourism or urban planning. This means that a student selects an area of interest. In ecotourism the students explore how society benefits from tourism and how tourism can be used to conserve the environment. In urban planning the students are introduced to the various aspects of urban planning.

World trends show that social conflicts on resources abound, pointing to the importance of the social perspectives in curriculums. Kenya has a number of examples of conflicts among its ethnic groups on resources such as land and water. Some of the conflicts on land are politically instigated as seen in the chaos that rocked the country after the general elections of December 2007 (Kenya Daily Nation, 2008) an indicator that natural resources sustainability depends considerably on a peaceful world. As Sachs (2005) rightly argued “scientific problems use scientific experiments but social problems need dialogue.” Tertiary institutions therefore need to reorient their curriculum towards teaching for peace, among other subjects,

to enable harmonious living and sustainability. Social turmoil leads to refugees who put a strain on the natural resources (UNEP, 2006a) and therefore graduates need the knowledge and skills to tackle such social challenges.

The next chapter wraps up this research discussion with synthesis, reflections, conclusions and recommendations.

CHAPTER EIGHT: SYNTHESIS, REFLECTIONS, CONCLUSIONS AND RECOMMENDATIONS

8.0 INTRODUCTION

This chapter discusses the ERM course development and implementation, examining the possibility of changing and strengthening the process towards producing competent ESD practitioners. The goal of this research was to examine an ERM course that was developed on an Agenda 21 sustainability basis (Chapter Five) and implemented at TU-K (Chapter Six) to understand how the course was producing ERM practitioners. The contradictions in the course as an activity system were then analysed (Chapter Seven) to understand the aspects of the course that may require change or attention if it is to respond to the current need for ESD in Kenya.

The research opened by examining the planning of the ERM course and the proposed learning practices, pointing to some challenges that were inscribed in the course design and production by an expert team. It then probed how the programme was implemented, pointing to further challenges in the teaching and learning practices within the course and the significance of the course to the teaching staff. Design and implementation challenges were also found in the manner in which the community partners provided fieldwork opportunities for students, industrial attachment, space for research for their trade area projects and finally job placements for the course graduates. The analysis was centred on how the course is contributing to the participants becoming ERM practitioners. The overall research question was directed at examining how TU-K as a Higher Education Institution might better deliver sustainability studies courses so as to enable students to become ESD practitioners.

The objectives of the study were to examine emerging challenges in how the ERM course was developed at TU-K and then to analyse the pedagogical practices in its subsequent implementation. The study then went on to explore emerging challenges noted in the course design and implementation by conducting an analysis to surface contradictions in the ERM course as an activity system. The three stage analysis of the development, implementation and functioning of the course as an activity system to produce ERM professionals highlighted numerous aspects of the course design and delivery that merit attention if Kenya is to respond to the pressing challenges of ESD. The outcomes of the study are now examined to make

recommendations for strengthening of the course as a process producing ERM practitioners to respond to the need for ESD in Kenya.

8.1 ENVIRONMENTAL RESOURCE MANAGEMENT COURSE DEVELOPMENT

The ERM course was prepared through jointly funded programme by the Kenya and Canadian government to support the enhancement of environmental studies in Kenya (Section 5.2). The course was jointly prepared by the staff from TU-K and SIAST in collaboration with other stakeholders. According to the findings, Competence Based Education (Section 5.6) was the core to reorient the course from traditional, teacher centred to student centred education. According to the findings, the ERM course was developed using the DACUM approach (Section, 5.5) and this was organised involving Kenyan environmental agency representatives and SIAST experts to define areas of competency for entry level. The competencies were further divided into tasks and rated according to their significance in the DACUM process. The course thus prepared was implemented in 2002 with a mandate of training for sustainability in environmental resource management in the country.

The results show that the development process was managed by the Canadian experts who incorporated the TU-K lecturers as learners in the process. There were few opportunities for the TU-K lecturers to make the essential contributions that would enhance its implementation. The delivery off course therefore continued with the traditional methods and thus CBE was not implemented as envisaged (Section 6.2).

Secondly, the results indicate that the development process did not include all stakeholders such as students, parents and guardians (Section 5. 5.1). ESD proposes that all stakeholders be involved at all the stages (Section 7.4.1) and this should be the case in the preparation of a course that is teaching for sustainability (UNESCO, 2006). The development and the implementation of the ERM course encountered a range of challenges. In the following sections I critically assess the course delivery to understand the challenges in the implementation process with the aim of suggesting approaches to enhance the course design and delivery in response to ESD.

8.2 ENVIRONMENTAL RESOURCE MANAGEMENT COURSE IMPLEMENTATION

The ERM course that was reviewed by the Canadian and Kenyan experts at TU-K was implemented in 2002. The implementation stage did not involve the experts from SIAST, therefore the TU-K staff carried the activity forward with the knowledge and skills learnt from the SIAST experts.

8.2.1 Teacher-centered learning methods in ERM

The ERM course development envisaged CBE, an approach to learning that is student centered (Section 5.6). However, this research established that the mode of ERM course delivery was mainly traditional classroom teacher-centred education (Section 6.2). Muro and Jeffrey 2008 writing a critical review of the theory and application of social learning in participatory natural resource management processes argued that there is no right or wrong form of learning. All learning contributes to cognition in one way or another; therefore there is no specific way that learning for natural resources should take place, rather there should be an amalgamation of a variety of ways of learning.

According to the ESD quality criterion (Section 2.7.1), experiential learning and practical activities are encouraged to enable linking of the concepts of development and theory construction (UNESCO, 2006). The traditional lecture method favoured by the majority of the lecturers as the main means of delivering the course content is not satisfactory (Section 6.2.2). There is a need to emphasise that action or hands-on activities should be embraced and proper linkages with the community encouraged to enable a community of practice in natural resources management. I am of the opinion that this approach will enhance ESD considerably more than academic theoretical knowledge.

The use of modern technology such as computers was found to be minimal as the institution was lacking in equipment (Section 6.2.4). This meant that the students mainly relied on the lecturers' notes and handouts, doing little research on the Internet on their own. This coupled with the education policy in the country emphasising examination (Section 1.4.2), which is time bound, contributes to the use of lecture method in an attempt to cover the syllabus by the expected time. Such a scenario means that the students simply pass through the system by rote learning without addressing the real life issues with critical engagement. The aim is to earn an extra certificate as opposed to becoming economically sound, socially understanding

and ecologically aware to contribute meaningfully to sustainable futures. The learner should embrace life in a more economically sensitive way to engage in activities that will generate income. Learners also need to be socially cooperative to be able to live in the community peacefully with neighbours and contribute positively towards sustainable development. The learner should be ecologically informed and active to engage in environmentally friendly activities.

8.2.2 Problem Based Learning

In this study the use of PBL was found to be popular in assignments whereby most of the lecturers (9/12) indicated using the approach (Section 6.2.1). According to the ESD guidelines PBL should be encouraged among students so that the students are better engagement with local communities. The use of PBL is perceived to have many advantages: it gives better understanding of research area, develops the students from a practical point, is easy to understand, is fast and effective and sparks the students to critical thinking. The use of PBL was found important in students' final year projects (Section 6.2.1)

According to ESD principles, the use of PBL is encouraged as a medium of instruction in Higher Education Institutions (UNESCO, 2006). As explained in Chapter Two, a paradigm shift in learning is recommended from teacher centred to student centred approaches to encourage students to engage in problem solving by identifying and solving local problems.

According to the results the lecturers reported that the disadvantages of using PBL were that it limits the scope of learning since it is geared towards solving a particular problem, it makes students lazy because they may engage only with an immediate problem, it requires constant monitoring and guidance and theoretical constructs may be ignored (Section 6.2.1). However the global trend is that we try to be more active in solving real environmental problems at the local level in collaboration with the international guidelines (UNEP, 2006b). To enhance PBL, the students and the lecturers of ERM engaged in fieldwork/field camps, industrial attachment and trade area projects in their learning process as explained hereafter.

8.2.3 Fieldwork/field camping

As observed in the field there was little hands-on experience by the students even during the main educational field trips to the coastal region (Section 6.3.2) and to the Kenya highlands

(Section 6.3.3). During these field trips the focus was on landscape studies and sightseeing adventures as opposed to collection of real environmental data for scientific analysis. According to the course outline the field camps were envisioned to help the students engage with the community and learn through observation and engagement with real situations to accomplish a list of items for each of the sites mentioned above. However according to my observations, as reported in Chapter Six, sightseeing was dominant. Actual measurements of resources and engagement with the community were limited. Although landscape and sightseeing is important, institutions of higher education should engage more in informing the government and concerned bodies on the status of the environment. This is possible if the students in these institutions engage in the actual studies by collecting real data. This means that the students and lecturers in these institutions should play a pivotal role in informing the government about the status of the environment. This, if done professionally, could be used by the government to make accurate decisions on environmental issues. This requires students to do more than sightseeing they need to engage with the community in solving the real environmental problems forming a community of practice in solving environmental, social and economic problems. The field exercise shall then comprise engaging with the communities in tackling the environmental challenges in the local area. In addition these field excursions, the ERM students engaged in an industrial attachment for a period of three months in the course of their study (Section 6.4). In the next section the industrial attachment exercise is examined as observed during this research and suggestions for improvement forwarded.

8.2.4 Industrial attachment

The industrial attachment exercise in ERM is carried out at the end of the second year of study. During this time the students engage with the community of practice in conservation to get an experience of work in their area of specialisation. The industrial attachment is a three month exercise running from the beginning of January to the end of March. The students are expected to carry out duties delegated to them by an industrial supervisor. The academic lecturers are expected to visit the students while on attachment to observe their work experience (Section, 6.4). The students engaged with the industry and learnt from the periphery how their anticipated work is carried out (Section 6.4.3). This was found to be very

useful for the students as they experienced a real life situation of their chosen field. This is a very good learning experience as reported by the students during this research (Section 6.4.5).

In this research it was noted that no marks or grading were attached to this exercise and also some students did not even do it. This was seen as a considerable weakness in the course. Those who did not secure places for attachments missed out because this exercise becomes a gateway for securing employment or linkages with the likely employers.

The students reported a number of challenges during the exercise such as;

- Being overworked without pay
- Working under difficult conditions
- Having problems with the nature of work that they had to carry out etc. (Section 6.4.4).

These challenges are not unique for the ERM students because studies conducted in various places have indicated that learners face a myriad of problems the attachment periods. A study conducted in Ghana on organisational issues and challenges of a supervised industrial attachment of a TVET programme indicate both social and financial challenges (Donkor et al., 2013). Another study on challenges facing industrial attachments in hospitality highlighted the financial and social challenges (Luu, 2013). Therefore industrial attachment challenges are experienced in all workplaces and the attaché needs to learn how to overcome these challenges.

I suggest that there should be a mark allocated so that the exercise is taken seriously and meaningfully as it can enable the students to understand expectations in the workplace. It also enables the students to get to know those in industry and may help to secure jobs. By understanding the areas that challenge the students, the lecturers can improve on their course methods and content.

8.2.5 Trade area projects

The trade area projects for the final year students in ERM is mandatory (Section 6.5). Ideally this exercise is meant to enable the student to engage with the community in identifying and solving a local environmental challenge. Students had to suggest sustainable approaches to manage the challenges. However, this research discovered that, although the students were

meant to engage in real life situations, the exercise was not carried out as expected. The study established that the majority of the students engaged in writing good projects for examination purposes. According to the scores on a tool developed during this research to assess the projects, the performance was good and it showed that the students understood local problems and gave workable suggestions on how to solve the local problems (Section 6.5.2, Table 6.3).

Further probing of the students indicated that students engaging in reality with the community to solve the challenges they wrote about was none existent. The study realised that, after marking the projects for the end of course examination, the projects were put in the library to become reference material for the others taking the course later. Therefore it appears that the projects were done for the purpose of examination only. There was further revelation that some of the students simply copied work already done by previous students. This means that the research does not, in most cases, add to improving resource conservation, it is a way of completing the expected course for the sake of examination, a practice that HEIs should look into for improvement.

The major advantage of these trade area projects carried out in the third year, is the exposure they provided to the student on local problems thus enabling them to become more critical in theoretically solving the problems. I am of the opinion that the trade area projects should be supervised closely and linked to the affected community. In so doing the course will enable real life problems to be tackled by the institutions.

To make the trade area projects more realistic, the students should engage in writing the trade area project during the industrial attachment exercise. Identification of the research area should be made in advance to enable data collection on attachment. During this time they should identify and study a real life environmental problem under the supervision of both the college supervisor and the field supervisor to develop projects for real life solutions.

8.3 CONTRADICTIONS SURFACED IN THE ERM COURSE

This research realised that the ERM activity system was struggling with contradictions/challenges that affected full realisation of a conservation practitioner who could become an ESD practitioner. These contradictions are highlighted and discussed as follows:

- Contradictions related to the development of the ERM course;
- Contradictions between Competency Based Education and performance in the written examination;
- Contradictions in student diversity;
- Contradictions related to lecturer qualifications;
- Contradictions between the lecturers and the tools of trade; and
- Contradictions of the ERM course between competing institutions of higher learning.

CHAT theory enabled the assessment into the ERM activity system to understand the contradictions that emerged in the implementation stage of the course. The foregoing contradictions that emerged from this research offer an opportunity for course re-assessment and the creation of institutional policies to understand how best to change the systems to allow an ESD practitioner to emerge from sustainability courses in HEIs.

8.3.1 Contradictions related to the review of the ERM course

The ERM course review took place when Kenya was gearing towards addressing the global and local environmental issues (GOK, 1994). The review was made possible through CIDA funds for the *Support Environmental Education program in Kenya*. The ERM course was reviewed to become more market oriented and hands on through Competency Based Education (Section 5.6). However this study established contradictions in the review process that contributed to the course being implemented piecemeal and therefore not engaging the CBE approach fully as was envisaged during the review process (Section 6.2).

According to Joyner (1994), McKeown (2002), Siegel (2008) and Jabareen (2011), a course review should go through six fundamental steps (Section 7.4.1). These steps enable a course to be all-inclusive. The major contradiction in the review of the ERM course was that the TU-K staffs was not being fully engaged from the start of the programme and also they were involved as learners and not decision makers (Section 7.4.1). Due to lack of immersion of the TU-K staff in course development, the envisaged results of CBE for the course were not realised (Chapter Five). The engagement of TU-K staff in the programme began later into the programme and this affected its implementation (Chapter Six). According to Jabareen (2011), development of such programmes needs to engage the local people who will be concerned with implementation right from the start; as they are the main drivers in the implementation stage implementation will become easier if they are involved.

The TU-K staff were involved as learners and therefore did not participate in contributing to the decision making process which paradoxically expected them to implement the envisaged course. Since the experts TU-K was not adequately involved in the course preparation, the implementation process experienced difficulties and continued with the traditional mode of teaching. A community of practice was not established in the institution that could enable implementation of the programme as expected because the lecturers did not work together as in a COP due to diversity in areas of specialisation. According to the Communities of Practice theory (Section 3.3), the lecturers at TU-K should have been treated as newcomers in CBE so that they could learn from the SIAST experts. This did not happen and therefore they were ill prepared and the methods of teaching reverted to theoretical course delivery or the status quo prevailed. In a COP people work together towards a common goal using a common language. The SIAST experts should have worked with the TU-K lecturers to allow them to learn from the periphery as in a Community of Practice (Wenger, 1991) in the implementation of the course. The lecturers at TU-K will in turn teach the new members such that if some members left the institution, the enterprise continues through new members working from the periphery.

It was also realised that some of the stakeholders such as the students the parents/guardians and the grassroots communities were not engaged. This exclusion may have impacted on the course negatively because such stakeholders play a significant role in the progress of a course as pointed out by Wals (2012); ESD should engage multiple stakeholders and they should

play an active role. This suggests that all the stakeholders play a significant role in the development of a course at HEIs.

8.3.2 Contradictions between the lecturers and the tools of trade

The data indicated that some of the mediating tools necessary for learning ERM were missing. The missing tools include; an environmental laboratory and a vehicle for fieldwork (Section 7.4.5).

An environmental laboratory is of paramount importance for a learner in ERM to enable the carrying out of environmental measurements. This will enable the learner to monitor the status of the environmental resources: accurate determination of the concentrations of environmental contaminants in the air, water, and soils etc. allows for regulatory ecological decisions (Miller, 2005). ERM students ought therefore to engage in generating this information for their localities to enable informed decision-making. It is especially important for the environmental students to create a reliable data bank on the status of the environment in the institution locality.

The second main challenge in teaching and learning ERM was the limited number of field excursions. This was said to be a challenge as there was no vehicle assigned to the department for fieldwork. Frequent fieldwork excursions are necessary as environmental studies are to do with what is happening in the field. The course content requires engagement in the field for sample collection and analysis.

8.3.3 Contradiction between Competency Based Education and performance in the written examination

The ERM course revision envisaged Competency Based Education (CBE). A system of education that measures learning through ability to do rather than time spent in the course. Learners' progress is determined by the learners demonstrating the competence in the various skills taught regardless of how long it takes. While more traditional models can and often do measure competency, they are time-based and students may advance only after they have put in the set amount of time (Section 5.6). This is true even if they could have completed the coursework and passed the final exam in half the time. So, while most colleges and universities hold time requirements constant and let learning vary, competency-based learning allows one to hold learning constant and let time vary. (Mendenhall, 2013)

The system of education in Kenya is examination oriented and thus a contradiction to competency based education as emphasis on final examinations at a specified time over rides the aspect of being competent in specific skills and knowledge. The examination orientation does not give room for students to learn at their own pace to master competencies before moving to the next stage. Although the revised ERM course was prepared for CBE, the old traditional system persisted, as this was better understood in the country. The CBE system did not receive the necessary support to succeed in an examination oriented system. A change of system requires a shift from the traditional methods and this will require a change in policy in terms of the approach that should be used in HEIs. This kind of change may require having to train the lecturers afresh to enable them embrace the concept. This research realised that in teaching and learning for ERM, both traditional methods and competency learning on particular topics were useful. At the time of this research there was more theory work than engaging in the real world to solve real problems with hands-on activities. Since the ERM system is part of the TU-K system, which in turn is part of the country's system it may be difficult to implement such an approach to learning without coordination of all the systems involved. The employers in the country understand certificates showing the various units covered and the time taken. If another system such as CBE is adopted the employers will need to understand how the new system works. The emphasis in learning in the country currently is on passing the examinations at specific levels.

8.4 COLLABORATION WITH STAKEHOLDERS

The research institution works in collaboration with various institutions particularly those that provide for attachment for the students. The linkages with other institutions of higher learning were found to be weak. This should be strengthened because college-community cooperation and networking activities enhance participation and serve to link the 'sustainable natural resource management communities of practice' to other communities of practice. This potentially promotes exchange of knowledge, ideas, experiences as well as resources in some instances (UNEP, 2006b).

There are often important relationships between teaching, research and community engagement work. ESD innovations emphasize the relationships between teaching, research, and the broader community (the environment, society, the economy and current and future generations). Community engagement work is an important dimension of ESD as engagement with communities often raises sustainability questions, helps universities to 'situate' their contributions, and provides a forum for applied research, and opportunities for students to engage in service learning programmes, which provide them with 'real-life' experience. Community engagement work includes opportunities for working with business and industry to ensure sustainable production, consumption patterns and improved corporate governance. Community engagement also encourages universities reflexively to review their relationship with the broader community, and their place and role within that community teaching research community engagement (UNEP, 2006b). It was observed that there was limited engagement of students and the community during the field exercises (Section 6.3). Engagement with the community of practice in conservation mainly took place in field attachments when the students were attached to industry for three months at the end of second year (Section 6.4). Therefore there is need for more collaboration with the relevant communities of practice to enable the students to have more experience with the concerned communities.

8.5 SUMMARY AND RECOMMENDATIONS FOR THE EXTENT TO WHICH ERM INCORPORATES ESD

The Environmental Resource Management course addresses the issues in education for sustainable development directly and will contribute a great deal to sustainability by training people who will directly respond to the issues in Agenda 21. In this research content analysis was the principle method for data generation. The key findings are summarised below:

- The course addresses the issues in Agenda 21 to a great extent, the conservation and management of resources has been addressed adequately, followed by the social economic issues and thirdly, strengthening the role of major groups (Chapter Five). More attention is required in areas, such as social and economic aspects that have not been addressed adequately.
- The course is an example to be emulated in the country as it addresses most of the issues affecting the country. Training more personnel in Environmental Resource

Management will ensure that there are personnel to work at the grassroots level on sustainability matters.

- The methods of teaching that are used in this course are diverse and this is in accordance with ESD principles. However there is need to enhance the practical aspects as environmental studies is largely a practical course.

8.6 BECOMING A PRACTITIONER IN ESD

Environmental Resource Management students are trained to work as environmental technicians, resource officers and supervisors in national parks, forestry, community development projects and non-governmental organizations dealing with environmental issues (Section 5.7). The ERM course specific objectives are intended to enable the trainees to engage in natural resource management capacities.

Planners of the Environmental Resource Management course envisaged CBE (Section 5.6) could enable the students become sustainability practitioners. However, delivery of the course remained traditional and teacher centred, was largely theoretical with limited fieldwork and hands-on experience at the implementation stage. Active learning strategies involve participation of the learner in ways that generate an action orientation (Tilbury 1995, p.204). In the ERM course, lecturers could balance between lecturing or show and tell methods with opportunities that allow learners to actively search for ERM information from books, newspapers, journals and the Internet (KPUC, 2002). This can be supported by allowing the students to critically examine and question issues and suggest better management and lifestyle choices. It can also involve some fieldwork and experiential exposure where learners can explore the environment, identify environmental issues, problems and risks and investigate them further. The students can be encouraged to develop stories for a writing competition or to tell their colleagues. However, the process of searching for information and exploring issues and problems is more useful if it can lead learners to taking critical action in order to bring about change (Murdoch, 1993; Jensen & Schnack, 1997). The involvement of the learners in the active learning process that leads to taking action makes learners feel ownership for the projects and value the environmental resources as theirs. They can also develop motivation and confidence that their knowledge is valued and that they can take control of their local environment.

The concept of active learning for sustainable living allows the possibility of many small and diverse solutions to environmental problems at a local level. These solutions are developed together (co-constructed) between experts and ordinary people including teachers and learners (Janse van Rensburg & Shongwe, 1994). The learners are subjected to many questions about the local context that entail social, economic, ecological and political aspects regarding resource availability, access, use, threats and how to take action to conserve them (KP, 2002).

8.7 ADEQUACY OF THE CURRENT PEDAGOGICAL PRACTICES OF THE ERM COURSE.

The course is examination oriented and lecturer aim at covering the syllabus in theory at the quickest time possible (Section 6.2.2). Therefore the competency of students to handle environmental problems was not seen as significant as long as the student passed the examination. This scenario contributed to there being little direct linkage to the community for action on the environmental matters with the community except for fieldwork, industrial attachment and trade area projects. The research discovered that there were a few superficial practical exercises carried out which means that there is little hands-on experience. The field exercises are treated as sightseeing experiences (Section 6.3). In this regard a community of practice does not exist as the link between the students and the community was found to be weak.

Attachment results indicate that the majority of the students found it challenging to learn on the job as most practical aspects had not been not been covered during the course. They acknowledged having the theoretical knowledge have no hands-on experience; for instance, students attached at NEMA struggled to accomplish practical assignments, such as water quality assessments (Section 6.4). After graduation some students find it difficult to get jobs and do not have a community of practice to fall back on. A graduate of the institution currently studying for a degree course at a local university claimed that the ERM course at TU-K does not prepare the students sufficiently enough to easily engage in a community of practice in natural resource management. This means that the institution enabled the student to acquire book knowledge but there is little skill to enable them to engage with the community of practice. A diploma qualification is useful but it does not equip the student

fully to face life's challenges. A community of practice assists the students to engage more with what they are trained to do.

The practical exercises were found insufficient as the students reported doing very little during the fieldwork. Environmental studies are one of the subjects whose laboratory is in the field with hands-on activities. Engagement in the field was minimal as the lecturers raced to complete the syllabus theoretically for the students to pass their end of semester examinations. The problems they cited included: lack of the relevant laboratories, lack of motivation, being too busy and attitude.

8.8 CONCLUSIONS AND RECOMMENDATIONS

The objectives of this study were: to establish how the ERM course was prepared in a tertiary TVET institution in Kenya to address ESD practitioners, to analyse the pedagogical practices of an ERM course, to find out how the course enables or constrains the students to become ESD practitioners, to understand the extent to which ERM is addressing ESD in relation to local and global sustainability issues, and give suggestions to enhance the course pedagogical practice and the emergence of ESD practitioners. The research has indeed achieved the objectives as stated in section 1.5.3 as explained in the following sections in accordance with these objectives. The sections also outline the research recommendations and highlight its limitations.

8.9 THE DEVELOPMENT OF ENVIRONMENTAL RESOURCE MANAGEMENT COURSE

The Environmental Resource Management course was developed within sustainability principles to enhance environmental conservation in Kenya (Chapter Five). This created an opportunity for young professionals to be trained in sustainability through, Competency Based Education. However the results indicate that CBE approach of instruction was not implemented as expected (Section 6.2). ERM course instruction continued to use the traditional approach of instruction because the education policies in Kenya put considerable emphasis on examination from primary right through to university. This emphasis leaves little room for becoming competent in the area of specialization rather the student aims at making sure that he/she has attained the expected grades to take him/her to the next level.

The examination gives a restrictive time frame and a person is judged by the examination grades as opposed to what the person is able to do, or his/her competencies. ESD emphasises a hands-on approach to learning rather than a traditional theoretical approach. This calls for a study into CBE to see whether the method can be used effectively in ESD in TVET institutions in the developing countries.

In developing the ERM course, the DACUM approach was used (Section 5.5). This approach brought together a number of stakeholders who developed a range of units (Section 5.8). The units and topics were too many (even overlapping in some cases) to cover in two years and therefore each lecturer covered what he/she could within the limited time. This obviously compromised the quality of education and mode of delivery in ERM. The lecturers thus taught for the examination, which denied the students practical experience and limited interaction with the community (Section 6.2.2).

8.10 THE PEDAGOGICAL PRACTICES OF THE ERM COURSE AND THE EXTENT TO WHICH IT IS ADDRESSING ESD IN RELATION TO LOCAL AND GLOBAL SUSTAINABILITY ISSUES

The study established six pedagogical practices in the course: theoretical coursework coverage, camping/fieldwork, attachment, trade area project, business project and examination. Coverage of the course content through theory and examination were found to be the most important because the examination grades are all that mattered at the end of the course (Section 6.2). This indicates that engaging with the community to solve environmental problems was not a matter of concern for the lecturers and students in ERM.

The projects were not under strict supervision by the lecturers (Section 6.6). The lecturers often did not engage with the actual problem that the students were researching. All that seemed to matter was a well-written piece of work to pass the examination and which thereafter would remain on the shelves for future reference by other students. This encouraged some students to copy previously done projects and many got away with this. The projects were rarely, if ever, implemented.

There was little emphasis on fieldwork/camping and the attachment, as this did not attract any marks for the final examination. Some students reported that they did not get places for attachment whereas others did not make it for the trips (Sections 6.3 and 6.4). The pedagogical practices are limited because of lack of emphasis on fieldwork and attachment. The Community of Practice does not seem strong enough in engaging with the stakeholders.

8.11 HOW THE COURSE ENABLES THE STUDENTS TO BECOME ESD PRACTITIONERS

The production of sustainability literate graduates in ERM from TU-K was faced with a number of challenges that need to be addressed. An ESD practitioner is one that will care for the environment, fit in the community socially and be in a position to engage in sustainable economic activities (Wals, 2012). The study established constraints at various levels of the activity system in the process of becoming ESD practitioners (Section 7.4). These contradictions need to be resolved for the smooth instruction in the ERM course. The contradictions at the object level can be resolved by sieving the students coming into the course. Those coming from high school can be taught separately from those entering as mature students already working. The mature students have considerable working experience and there are certain things they may not need to learn. The course should simply enhance what they are already practising. The contradictions between the objects and other systems also need attention.

The course equipped the student with most of the knowledge required to manage the environmental resources sustainably. This was done theoretically with very little practical training on the job. There was a general lack of competency in the practical areas. The economic part was not fully covered leading to many jobless youths. Although trained in ERM, they were unable to sustain themselves with enterprises in conservation.

8.12 RECOMMENDATIONS

8.12.1 Suggestions to enhance the course syllabus pedagogical practice and the emergence of ESD professionals

The ERM course should embrace the economic and the social parts of ESD as it is currently biased towards ecological studies. This will enable students to explore resources in a more

holistic way. At present the course has too much content on the ecological aspects. The economic and social pillars are as important and engaging Communities of Practice principles as an approach for learning sustainability courses may enhance ESD professionals/practitioners. This will enhance environmental conservation and it will also aid in linking up with the community in a much better way.

8.12.2 Course development and stakeholders

This research realised that the course developers did not engage the lecturers from the beginning of the planning stage. However development of a curriculum should involve the consumers of the product and graduates from the project. Environmental Resource Management is a very wide subject and multidisciplinary and should therefore engage the relevant shareholders right from the beginning. The lecturers concerned also need to be involved right from the inception of a programme. This will make implementation easier and reduce friction.

8.12.3 Engaging in a community of practice

In this research I have shown that the students engage in peripheral participation in communities of practice in the course of their study for ERM. They engage peripherally through fieldwork, industrial attachment and trade area projects (Sections 6.3, 6.4 and 6.5). Fuller, Hodkinson, Hodkinson & Unwin (2004), in a study on learning as peripheral participation in the UK, underscored the importance of peripheral participation of workplace learning and showed that peripheral participation does not only involve new comers learning but also the old timers learning from the newcomers. In this research the students learn from the conservation practitioners and also, as seen in their trade area projects, they develop new ideas to share with the old timers in natural resource management.

The main shortcoming in the course is the fact that the projects are carried out specifically for academic purposes. I suggest that the projects need to be implemented. This will enhance resource conservation as the students will work closely with the practitioners and this will be an easier way for the students getting themselves into workplaces. Trying to make the projects practical may have its own hindering factors, but as Jickling (2012) suggested in

‘Normalising catastrophe: an educational response’, education must enable the young people (older ones, too) to grapple with issues critically and creatively and find ways to do things that currently appear impossible. In this study therefore I argue that the students should be in a position to try to make their projects real and implement them.

8.12.4 Training of trainers in ESD

This research shows that at the implementation stage, the lecturers at the institution were not prepared to handle the units according to course plans. This means that although they tried to work according to the course recommendations, they lacked the skills, knowledge and technical know-how. The result was that none of the lecturers had been trained specifically for ESD as the concept is relatively new.

The institution at the time of this research was a government institution, the teachers posted here for environmental resource management were not necessarily trained to teach environmental studies. Among the twelve lecturers interviewed, only three were specifically trained in environmental studies. The rest were trained in other areas such as meteorology, agriculture, survey and mapping, graphic design biology, etc. It was therefore apparent that the concept of ESD was quite new and ESD professionals are required.

8.12.5 Competency Based Education

This research discovered that Competency Based Education was not used as anticipated in the planning stage. A study in environmental resource management at a diploma level requires personnel that understands fully the environmental issues and can engage with confidence in finding solutions for environmental issues. CBE’s approach to learning may achieve this because it is based on the principle of being 100% competent in the area of practice.

8.12.6 Linkages with stakeholders

This research shows that linkages with other institutions were minimal. For the students to become ESD practitioner’s linkages between the institution and stakeholders must be

strengthened. For instance, the institutions of higher learning should strengthen the linkages so that they can engage more in conversation with each other. This will enhance sharing of knowledge and skills and also reduce duplication of activities and research. The stakeholders who engage the students will also have better opportunity to interact with the students from the various institutions with an understanding of each of the institutions requirements.

8.12.7 Field excursions

It was found that the field excursions were limited to two major ones. This is not sufficient and students need to be exposed to more field activities. For the students the main purpose of the field exercises seemed to be sightseeing. I suggest that these field excursions ought to be more practical and should involve real data collection that can be used for decision-making on resources in the country. Sustainable resource management requires sustainable monitoring. The institutions of higher learning could play a crucial role in collating such information and if done continuously and consistently, the result will be enable better environmental care.

8.13 SUGGESTIONS FOR FURTHER STUDIES

This study focused on just one sustainability course in an institution of higher learning. It is important that similar studies be carried out on other courses in higher Education Institutions to see how they enhance sustainability. ESD is multidisciplinary and at such the experiences of all the disciplines in formal institutions is essential to understand the challenges and level of incorporation of the concept in each.

This research has indicated that although the ERM course is ESD oriented, its delivery does not reflect the expectations of ESD. It falls short in terms of engagement with the community and does not emphasize competency as envisaged for sustainable development. Therefore there is need for a study into how policy matters affect learning for sustainability in formal institutions so that more emphasis is on being competent rather than passing examinations.

Future research could target the stakeholders as the main respondents to their expectations on the calibre of graduates they receive from such institutions. This will shade light on how the stakeholders, who are the main beneficiaries of such training, expect the students to be trained to meet their requirements so that the stakeholders do not need to train the students again when they start working.

Although gender was not the aim of this study, it was realized that female enrolment was small as compared to male and yet women are increasingly becoming agents of good practices especially in the rural areas where men have migrated to the urban centres to work in industry. Future studies should be carried out to understand why TVET institutions have a small enrolment of female students in their courses to come up with ways of improving their enrolment. According to the new constitution in Kenya, every sector should have one-third women representation. Gender studies in ESD will therefore go a long way in contributing to sustainable development.

8.14 LIMITATIONS

This study by its nature was designed for a special context therefore its results are restricted. The limited number of participants inhibits generalisation of the findings. The reader has the freedom to determine if the results of this study can be transferred to their own situation. The reader also has the freedom to decide on the use of the methodology for other similar cases. The study focused on one institution in Kenya and the reader can decide on whether the findings are similar to other institutions. The study was conducted away from the Rhodes University study environment and this may have limited me from engaging seriously with the culture of Rhodes on research.

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APPENDICES

APPENDIX 1: PERMISSION LETTER TO COLLECT DATA

The Kenya Polytechnic University College
a constituent College of the University of Nairobi

Tel: +254 (020) 343672, 2249974,
2251300, 341639
Fax: 2219689
Email: polymis@swiftkenya.com
Website: www.kenyapolytechnic.ac.ke



Haile Selassie Aven
P.O. Box 524
Nairobi, 002

Principal:

Your Ref: _____ Date: 6th April 2009

Our Ref: _____

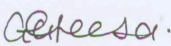
Rhodes University
Environmental Learning Resource Centre
Education Department
P.O.BOX 94, Grahamstown, 6140
SOUTH AFRICA

RE: PROPOSED RESEARCH ENTITLED: EXPLORING AND EXPANDNG COURSES DELIVERY INNOVATIONS IN EDUCATION FOR SUSTAINABLE DEVELOPMENT IN HIGHER EDUCATION IN KENYA CASE STUDY OF ENVIRONMENTAL RESOURCE MANAGEMENT AT KPUC

I endorse the proposed study entitled: EXPLORING AND EXANDING COURSE DELIVERY INNOVATIONS IN EDUCATION FO SUSTAINABLE DEVELOPMENT IN HIGHER EDUCATION IN KENYA. A CASE STUDY OF ENVIRONMENTAL RESOURCE MANAGEMENT AT KPUC as a way of improving the environmental studies in the institution and indeed the country. This course at a time the institution is transiting into a university and the findings of this study will go along way in reorienting our courses to embrace Education for Sustainable Development.

We fully endorse the research project and are willing to provide any support that Jane Oteki may require. We would be glad to receive the findings from the research so that they strengthen our efforts in curriculum development and implementation.

With many thanks.


Gladys Kitui
Ag. Chairman Environmental Science

APPENDIX 2: THE ERM COURSE UNITS

Environmental Studies and Environmental Resource Management units.

CODE	ENVIRONMENTAL STUDIES UNITS (OLD COURSE 1984)	CODE	ENVIRONMENTAL RESOURCE MANAGEMENT COURSE (NEW REVISED COURSE 2002)
	YEAR ONE UNITS		MODULE 1
ES 01	Human ecology and land use	110	Introduction to Environmental Resources
ES 02	Environmental Ecology and Soils	111	Communication and Personal Competency
ES 04	Principles of Environmental Management	112	Computer Applications
ES 04	Quantitative Methods	113	Animal Taxonomy and Anatomy
ES 05	Maps and Images	114	Plant Anatomy, Taxonomy and Anatomy
ES 07	Entrepreneur Education	115	Environmental Ecology
ES 08	Computer Applications	116	Principles of Equipment Handling, safety and Wilderness Survival
	YEAR TWO UNITS	117	Green House Techniques and Plant Breeding
ES 06	Entrepreneur Education	118	Entrepreneur Education
ES 07	Environmental Information Dissemination	119	Contemporary land use practices

ES 08	Computer	120	Camp
ES 09	Environmental Law		
ES 10	Environmental Planning and Management		MODULES 2
ES 11	Pollution and waste management	210	Technical Communication
ES 12	Water management	211	Community Development
ES 13	Forest management (option)	212	Administrative Procedures
ES 14	Wildlife management (option)	213	Wildlife Management
ES 15	Energy Resource Management (option)	214	Geographical Information Systems (GIS)
	YEAR THREE UNITS	215	Geographical Positioning System (GPS)
ES 06	Entrepreneur Education	216	Maps, Photography and Remote sensing
ES 07	Environmental Information Dissemination	218	Energy Development & Management
ES 09	Environmental Law	219	Environmental Law
ES 10	Environmental Planning and Management	220	Camp
ES 11	Water Management		
ES 12	Pollution and waste management		MODULE 3

ES 13	Forest Management (Option)	310	Pollution and Waste Management
ES 14	Wildlife Management (option)	311	Environmental Impact Assessment (EIA)
ES 15	Energy Resource Management (option)	312	Water Resource Management
ES 16	Project	313	Industrial Attachment (3months)
		314	Forest Management
		315	Range Lands Management
		316	Soil Management
		317	Project Planning and Management
		321	Environmental Seminar / Workshop
		322	Trade Area / Business Plan
			ELECTIVES
		318	Eco Tourism
		319	Aqua Culture
		320	Principles of Urban Planning and Landscape Architecture

FIRST YEAR OF STUDY

Unit Code	Unit Title	STATUS	Course Hours	No. of Units
SSEE1101	Introduction to Environment and Its Resources	old	48	1
SSEE1102	Introduction to Computer Science	old	48	1
SSEE1103	Animal Taxonomy	old	48	1
SSEE1104	Plant Taxonomy	old	48	1
SSEE1105	Applied Chemistry	New	48	1
SSEE1106	Communication Skills	Old	48	1
SSEE1107	Green house Techniques	Old	48	1
SSEE1108	Mathematics	New	48	1
Total	Semester I		384	8

YEAR ONE SEMESTER TWO

Unit Code	Unit Title	STATUS	Course Hours	No. of Units
SSEE1201	Environmental Ecology	Old	48	1
SSEE1202	Applied Physics	New	48	1
SSEE1203	Environmental Health and Safety	New	48	1
SSEE1204	Land use Planning and Management	Old	48	1
SSEE1205	Environmental Laboratory Practices	New	48	1
SSEE1206	Geology	New	48	1
SSEE1207	Wildlife Ecology	New	48	1
SSEE1208	Information Communication Technology	New	48	1
Total	Semester II		384	8

Total No. of Course Units for the year I = 16

SECOND YEAR OF STUDY

Trimester I (Internal Attachment) (12 Weeks)

Unit Code	Unit title		Course hours	No. of unit
SSEE2100	Industrial Based Learning (IBL 1)	New	384	8
Total			384	8

SEMESTER ONE

Unit code	Unit Title	STATUS	Course Hours	No. of Units
SSEE2101	Probability and Statistics	New	48	1
SSEE2102	Environmental Designs	Old	48	1
SSEE2103	Energy Resource Management	Old	48	1
SSEE2104	Atmospheric Science	New	48	1
SSEE2105	Geographical Information Systems (GIS)	Old	48	1
SSEE2106	Community Development	Old	48	1
SSEE2107	Fisheries Resources Management	New	48	1
SSEE2108	Entrepreneurship Education	Old	48	1
Total	Semester I		384	8

YEAR TWO: SEMESTER TWO

Unit Code	Unit title		Course Hours	No. of units
SSEE2201	Remote Sensing and Photogrammetric.	Old	48	1
SSEE2202	Forest Management	Old	48	1
SSEE2203	Principles and Practice of Management	New	48	1
SSEE2204	Environmental Impact Assessment and Auditing	Old	48	1
SSEE2205	Resource Management in ASALs	New	48	1
SSEE2206	Business Plan	Old	48	1
SSEE2207	Research Methods	Old	48	1
SSEE2208	Field Course	renamed	96	2
Total			432	9

Total No. of Course Units for the year II = 17

THIRD YEAR OF STUDY

Trimester I(External Attachment) (12 Weeks)

Unit Code	Unit Title	STATUS	Course Hours	No. of Units
SSED2209	INDUSTRY BASED LEARNING II	Old	384	8
Total			384	8

YEAR THREE: SEMESTER ONE

Unit Code	Unit Title		Course Hours	No. of Units
SSEE3101	Global Navigation Systems	Old	48	1
SSEE3102	Environmental Pollution	Old	48	1
SSEE3103	Water Resource Management	Old	48	1
SSEE3104	Project Planning and Management	Old	48	1
SSEE3105	Environmental Economics	New	48	1
SSEE3106	Soil Management	Old	48	1
SSEE 3107	Disaster Management	New	48	1
SSEE3108	Research Project I	Old	48	1
Total	Semester I		384	8

YEAR THREE: SEMESTER TWO

Unit Code	Unit Title	STATUS	Course Hours	No. of Units
SSEE3201	Cartography	New	48	1
SSEE3202	Wetlands Management	New	48	1
SSEE3203	Wildlife Management	Old	48	1
SSEE3204	Waste Management	New	48	1
SSEE3205	Environmental Law	Old	48	1
SSEE3206	Research Project II	Old	48	1
SSEE3207	Business Plan	Old	48	1
SSEE3208	Ecotourism	Old	48	1
TOTAL			384	8

Total No. of Course Units for the year 3 = 16

Total Number of Units for the Three Years = 49 units

**Appendix 1A: HISTORICAL DOCUMENTS FOR ERM course review
1998 - 2002**

No	Name of document	Index/ code
1	Environmental Studies Curriculum 1984 to 2002	HDI
2	Supporting Environmental Education in Kenya, the goals. DEPARTMENTAL REPORT ON THE DEVELOPMENT OF ERM CURRICULUM	HD2
3	Recommended plan of action by HOD of ILS-24/9/1999	HD3
4	Program for opening Kenya Polytechnic Green house nursery and Environmental Resource Center	HD4
5	Agenda for a meeting scheduled for 10/11/1999	HD5
6	Instructional design elements for CBE programs a checklist of critical characteristics	HD6
7	DECUM facilitator	HD7
8	Developing Competency Based Assessment tools: Curriculum notes and ideas for Kenya Polytechnic	HD8
9	Competency Based Education and factors influencing its implementation in traditional institutions (notes)	HD9
10	Competency Based Education at SIAST Woodland and Wascana campuses, Program research, evaluation and development. SIAST Woodland campus- September 1999	HD10
11	CBE program planning process at SIAST Wascana and Woodland campuses (notes) Program research, evaluation and development. SIAST Woodland campus- September 1999	HD11
12	Competency profile of environmental studies	HD12
13	Agenda for the visit by the Canadian experts-28/1/2000	HD13
14	Annual Environmental awareness day-the program 8/3/2000	HD14
15	Minutes of environmental section meeting 24/5/2000	HD15
16	ERM course Outline	HD16
17	The development/ selection of instructional materials for developing learning guides	HD17
18	Checklist for developing a learning guide	HD18
19	Environmental Resource management modules	HD19
20	Summary report on curriculum development and revision project by the Canadian expert David - 17/3/2002	HD20
21	Notice of a meeting to review David's report	HD21
22	Environmental Resource Management Curriculum 2002 to 2010 (Kenya Polytechnic, 2002)	HD22
23	Environmental Resource Management Curriculum 2010 to present	HD23

APPENDIX2A : A QUESTIONNAIRE FILLED BY ERM LECTURERS.

This questionnaire addressed the first objective on ERM course development and how the lecturers teach for ESD. This was the first interaction with the lecturers for this study and was conducted between June and December 2009.

1. Were you involved in the design of the current ERM course?

YES

NO

If yes, to proceed to question 1(a). If no, proceed to question 1(d).

a) The current ERM program was designed in collaborations with the Canadian government, at what stage were you involved?

b) What role did you play?

c) The course design involved stakeholders, what was their expertise?[
geographical coverage, government, universities and college academicians]

d) What background knowledge do you have about ESD? [EE,SD]

e) Where did you learn about ESD?

f) How was ESD defined for the course?

5. What aspects of the ERM course do you think need improvement? Why?

6. Do you think the ERM course prepares the students well enough to operate within the field of ESD?

7. Why do you think that way?

8. What factors may affect sustainable living?

9. What factors that affect sustainable living are included in the course/unit?

APPENDIX 3A: QUESTIONNAIRE ON PROBLEM BASED LEARNING (PBL) FILLED BY ERM LECTURERS.

This questionnaire addressed the second objective on pedagogic approaches in ERM conducted between June and December 2009.

1. What is PBL?

2. Do you use PBL in your classes?

3. How do you use it?

4. Do you think it is better for teaching ESD?

5. Are you aware of colleges or schools where it is being used? YES / NO

6. Do you think it has been successful in those areas? Why?

7. Can you recommend its use in the ERM course? Why?

8. What do you think are the advantages of using PBL?

9. What do you think are the disadvantages of using PBL?

APPENDIX 4A: QUESTIONNAIRE FOR LECTURERS ON COURSE IMPLEMENTATION FILLED BY LECTURERS IN ERM.

This questionnaire addressed the third objective on how the lecturers understood ESD and how they were teaching for ESD. It also tries to understand how a practitioner in ESD was emerging. This was conducted between July and August 2010.

1. What do you hope students to take away from participating in this course?
2. Who or what supports you in the design of your teaching?
3. What benefits or costs have you seen in the use of technology in the classroom?
4. How would successfully designing and implementing your teaching affect your goals as a lecturer?
5. What types of professional development would be beneficial to you in helping you design and implement similar courses in future?
6. What limitations do you foresee that you would consider if you were to teach the course according to ESD perspective?

12. How do you attempt to raise your student awareness with regards to these three elements?

13. Could you identify and describe some curriculum activities you use to have your students achieve these goals?

14. How did you learn about these activities?

15. What are your current obstacles in teaching environmental studies?

16. What would prevent you from teaching the way you want if you did not have the current obstacles?

17. What are your suggestions to overcome your predicted obstacles?

18. What kinds of resources do you need to become a more effective educator for sustainable development?

19. How encouraging is your institution in your efforts to teach for sustainable development/environmental resource management?

20. What support do you require to enable the students become practitioners in natural resource management/ (ESD)?

21. Please give suggestions on how the course can be more sustainability/ESD oriented.

**APPENDIX 5A: STUDENT UNDERSTANDING OF ERM. A
QUESTIONNAIRE FILLED BY ALL STUDENTS IN THE ERM
COURSE**

This questionnaire addressed the fourth objective on how the students were becoming ESD practitioners and their understanding of ESD and how they were taught for it. (June to December 2009)

INTEREST QUESTIONNAIRE

N.B this questionnaire is anonymous, do not write your name.

Please check accordingly: Male

Female

1. a) What do you understand by the term ESD?

2. Were you specifically taught about ESD?

3. In which areas (units) were you taught about ESD?

4. What methods of teaching were used?

5. Please identify what you consider unsustainable practices in your home community.

6. Can you suggest ways of solving the unsustainable practices in your community?

7. Please identify unsustainable practices at college.

8. Can you suggest ways of solving the unsustainable practices in your college?

9. Please identify unsustainable practices in the place where you live when college is in session.

10. Please identify ways of solving the unsustainable practices.

11. Are there any ways the ERM course could be improved? Please explain.

12. Is there anything else you want to tell me about ESD?

APPENDIX 6A: QUESTIONNAIRE FILLED BY STUDENTS ON THEIR PERCEPTION OF THE ERM COURSE

Background information

Which year are you?

Gender

1. Are you finding this course challenging? Please explain your answer.
2. What have you learnt from it so far?
3. Has the course changed how you've thought about environmental issues? Please explain your answer.
4. If you could change anything about the course that would allow you greater understanding of environmental issues, what would you change?
5. Why did you think the approach you have suggested is currently not being employed in the course?

**APPENDIX 7A: A QUESTIONNAIRE FILLED BY STUDENTS ON
FIELD/CAMPING EXPERIENCE (THE MOMBASA TRIP)**

This questionnaire addressed the third and fourth objectives on how the students were becoming ESD practitioners using the field camp experience.

1. Identify all the activities at the coast, according to the three pillars of ESD; ecological, economic social cultural. Use the table below to categorize the activities.

Table 9: Ecological, economic, social cultural activities at the coast

ESD/NO	ECOLOGICAL	ECONOMIC	SOCIAL/CULTURAL
1			
2			
3			
4			
5			
6			
7			

2. Which of these activities do you consider unsustainable?

3. For each of the unsustainable activity suggest ways of making them more sustainable.

APPENDIX 8A: A QUESTIONNAIRE FILLED BY THE FRESHERS IN THE ERM COURSE.

This questionnaire aimed at understanding the level at which the students entered the ERM course.

Part 1 Respondent personal information

Name

Age

Were you on formal employment?

Yes no

If yes, for how long?

Did you resign to take this course or are you on study leave?

Are you straight from secondary school?

Part 2 Expectations

Why are you taking this course?

What do you understand by ESD?

What do you understand by sustainable development?

List unsustainable activities in Kenya

List sustainable activities in Kenya

Outline ways of dealing with unsustainable activities

What do you expect to gain from this course?

Appendix 9A : QUESTIONS THAT GUIDED THE INTERVIEWS WITH THE LECTURERS ON ESD (2010 - 2011).

1. Please tell me the units that cover aspects of the ecosystems.
2. Which units address the economic aspects?
3. Which units address the social cultural and political issues?
4. How does problem based learning take place?
5. What do the students feel about PBL?
6. Does the ERM course cover all aspects of ESD?
7. Are the projects selected for research all inclusive in terms of ESD?
8. Which aspect of ESD is most popular among the students?
9. How do the lecturers balance between the ESD aspects?
10. What aspects of PBL do the lecturers engage in delivery of information on ESD?
11. How do the students and teachers engage with the community?
12. Do the students/lecturers fully understand ESD?
13. What challenges do you encounter teaching ERM?

Appendix 10A: INTERVIEW SCHEDULE FOR THE STUDENTS WHO COMPLETED THE COURSE IN DECEMBER 2009 (JANUARY TO APRIL 2010)

The exercise was conducted between January and April 2010 to understand the students take on the course after completion.

- a. Why did you decide to study this course?
- b. How did the course enhance your knowledge, skills and values in ESD?
- c. What challenges do you have in your place of work?
- d. Are there any skills that you had to learn before starting the current job?
- e. What would you like to do in future?
- f. Why do you think environmental concerns are not taken seriously in Kenya?
- g. If you are in the decision making position, how would you handle the natural environmental resource problems in Kenya?

APPENDIX 1B): SUMMARIES OF THE INTERVIEWS WITH THE LECTURERS

SUMMARY OF THE INTERVIEW WITH LECTURER 1 (L1)

THE CATEGORIZATION OF ERM UNITS INTO ESD

The lecturer said that the subject on the ecosystem includes; Introduction to environmental resources, there is also a course on environmental ecology that covers much about the basic principles on ecology and assists in development, community Development has some element of human ecology. It is quite expansive

The economic aspects are covered in community Development which covers about human aspect of human relations to the environmental resources and how communities participate. Like community Livelihoods and environmental conflicts.

The area of socio-cultural is covered in Community Development again.

My understanding of ESD is the development that focuses on the three aspects and the negative impacts.

I have done ESD at masters and I have been teaching community Development.

HOW ERM IS ENHANCING ESD

There are many factors contributing to unsustainable resource use. It is coz of multiple issues, education is only one. Other aspects like illiteracy, the governing systems, and poor policies. Education is one of the main things but for us to achieve we have to improve systems. Sustainable development can be achieved through, Civic actions, democratic processes. Satellite department that sits down and decides, it should be the community that participates in this. The reason people are not involved in management.

To increase awareness in schools the challenge has not been in putting up policies but implementation aspect. That is where the mistake is. We have so many practitioners but very little into implementing. It has something to do with actualizing. We talk more. We need to look at strategies and methodologies that will enhance this. Not only education

My role in the institution is to conduct research on technologies, passing knowledge and establishing linkages to become more practical.

TEACHING METHODS FOR ERM

The innovations I have implemented, I am in the process of developing a process, especially in including the community's Participatory management of resources. I use problem based learning through developing a problem by identifying thru a participatory process, diagnose the problem and suggest possible solutions. For example Forest

degradation: What are the causes of forest degradation? The students do not like PBL too much. They feel like you are asking too much. They prefer the lecture way and not any personal method. To get the students from that is not easy but we are trying. I personally involve and raise issues such as climate change, global warming, and food security. We set up a discussion where they read and come up with the negative effects and what should be done. Sometimes they do a write up.

Our primary to secondary education affects the learning in such an institution seriously in terms of shaping their opinion. The real issue is changing the way of thinking. We need to start from primary through secondary such that by the time they get here they have learnt to chew things on their own.

THE RELATIONSHIP BETWEEN ERM and ESD

All aspects are not covered, there is little on education It needs capacity training, literacy of resources (the issue of resources is an economic debate and most teaching staff are not literate in it. The balance between resource demand, supply (allocation) and technologies have not been philosophized in the curriculum therefore the broad objectives of economic equity, social justice and ecological sustainability are not achieved) it is not adequately covered. We need to review the syllabus.

Appendix 2B A SAMPLE OF THE RESPONSES BY STUDENTS

4. S4

1. Why the course?

{Smiling} going with the current job market and due to the global climate crisis offers opportunity for employment. And also due to climate changes, pollution ozone depletion the course offers broader climate opportunities with people having conservation skills.

After also finishing form four I looked at my subject combination environment resource management was the best career to choose.

It was also my passion before I did my K.C.S.E exam I took it as one of my career choices. I loved biology, geography, chemistry and agriculture.

I wanted to also to be an ambassador of the environment to champion the cause of environment protection, pollution control and to enlighten the society on the importance of conserving the environment.

{Laughing} my parent didn't force me to do the course they only supported me financially the origin of the decision was from me.

Aahh... also a friend from home by the name professor out of being an environment scientist I admired his successes in the field.

2. Were you working before?

I have been a member of a community based organization {CBO} by the name Nairobi waterfalls conservancy organization which specifically deals with environment conservation whereby we did activities like establishing nurseries, cleaning the environment, planting seedlings and I also organized community clean up exercise, collection of waste, domestic wastes from houses, planting seedlings along Nairobi river.

We also made organic waste from bio degradable organic waste materials.

I had only knowledge about the environment from televisions documentaries, programs in TVs e.g. planet in peril, leonardo escapiro {the 11th hour} how the ice melts and expands to the ocean.

I also worked with a student from Kenyatta University who gave us more information of environmental conservation, recycling organic waste.

Age-26 years old

3. How did the course enhance your knowledge skills and values on ESD?

{Silence} it gave me depth knowledge on sustainable development.

I can say... it was an eye opener on the fact that environment degradation was a reality what else can I say... {a moment of silence}

The course gave me the leverage to participate in environment conservation and sustainable development with regard to {thinking} natural resource management conservation.

I don't know how to put it but it is difficult to tell someone to stop deforestation but after studying ESD it enabled me to tell one to use natural resource but in a sustainable manner for e.g. if you cut one tree plant two.

ESD had a lot of sense to me for us to use natural resources in a manner we do not deplete them in the coming future.

{smiling and charming} one thing that I really have most about ESD is the definition of ESD itself. Since it encourages us to use the natural resources sustainably.

{scratching his head} ESD has no limit for sustainability {apart from its misinterpreted leading to over exploitation}

4. What challenges do you have in your place of work?

Mmh.. I have worked for three months in forest action network it is a non-governmental organization that deals with forest management, community capacity building for resource conservation. They were also teaching people about advocacy work.

Mmh... things like {moment of silence}. The only challenge was mobilizing the community for resource conservation e.g. soil, water and forest they expected money/ payment on return for environment conservation {that was a big challenge}

I worked as an intern and I got no pay so I was fatigue.

There was also lack of sufficient resource e.g. jembes, spade

Lack of manpower was also a challenge.

5. Are there any skills that you had to learn before starting the job?

{Paused abit} resource mobilization in conservation of matters, community capacity building through advocacy lobbying, forest management, green house techniques

I have also started nurseries planting avocados, mangoes and also doing activities like grafting which I learnt from green house techniques and plant breeding. I am also using milk packs instead of using sheeves in nursery plantings to minimize the cost of buying containers {the avocados I have planted are almost... fifteen and I have also planted 20 indigenous trees at home}

The types of trees are Mokindori, Prunus Africana, two types of acacia species debanotobom, penitete. I was planning this trees to get income apart from it was also a passion.

I also plan to plant bamboo species that I know but I don't know their names that I collect in Ruai, Kasarani, I also intend to go to Karura

I am currently planting them in the milk packs in the backyard here Nairobi and I also plan to take some the upcountry and the rest sell to the ongoing project of Nairobi river.

6. Why do you think environmental concerns are not taken seriously in Kenya?

{Laughing} people just are ignorant on environmental management. But they know about environment protection and conservation.

The Kenyan laws are not enforced regarding environmental conservation for e.g. EMCA laws are not followed e.g. water act forest act, agriculture act they are not forced.

{Showing a sign of amazement} I don't know whether the government provides enough funds to sustain the project put in place for environmental matters.

{Bitterly saying} NEMA body has to get only one personnel per district as compared to other ministries hence labour is insufficient and this makes people to have negative attitudes regarding environmental issues.

For instance, Mau issue where people are invading forest land to sustain themselves due to ruthless eviction by the government offices this people develop negative attitude towards conservation when mmh... I say conserve the environment, it is difficult to quantify the success of conservation itself.

6. If you are in decision making position how would you handle the natural resources/ environmental problems in Kenya

{Coughing sarcastically}

Natural resources

In a nutshell I will handle it with seriousness it deserves. Bearing in mind that environ is a source of livelihood for e.g. areas eeh... also against natural disasters and also a source of income.

Encourage people participation in conservation, community clean up exercise.

People to develop a culture of reducing, re using, recycling this will reduce the burden of exploitation of resources.

I would also burn use of toxic materials e.g. chemicals and pesticides.

I would also promote the use of renewable source of energy like geothermal, wind energy, solar energy to also eliminate the crisis we are facing now in Kenya of energy shortage.

Encourage noise control/ reduce sound pollution in industries.

Encourage cleaner source of energy e.g. electricity, vehicles, motorbikes this will reduce pollution.

Lastly encourage our country to partner with other countries in environmental conservation e.g. the Kyoto protocol, Vienna convention.

If our country does not do that this laws does not tie us but by signing it helps the country participant in protecting the environment.

I will ensure that I will involve all stakeholders on conservation orders e.g. politicians, local leaders, CBOs, non-governmental organizations e.t.c to help participate in conservation activities.

Environmental issues

I will start by listing the environmental problems

- Over population
- Security
- HIV/AIDs
- Climate change
- Soil erosion
- Poverty
- Pollution

Over population- I will encourage family planning because studies have shown that highly populated areas are associated with environmental degradation e.g. Kibera slums Nairobi river. The population over burden the resources leading to over exploitation of the resources. I will also advocate use of contraceptives to control the population of a country.

Security- {thinking and scratching his chin} some of them... due to insecurity eeh... that is generally insecurity e.g in Kitangule National Park there is conservation going on but due to insecurity the environmental conservation cannot access the national park to help them in the protection of the mountain gorillas hence insecurity is intertwined with environmental conservation so being in the decision making position I would advocate for employment of more security personnel also employ more forest guard, game wardens, forest officers. To help in the protection of natural resource.

HIV/AIDS- educate people on the impact of HIV/AIDS on the population, I will encourage faithfulness, use of contraceptives to reduce cases of death of people who could have been involved in conservation e.g tree planting.

APPENDIX 3Ba STUDENTS TRADE AREA PROJECT (STAP)

Each student has to present a trade area project at the end of the course.

Appendix 3Bb SUSTAINABILITY ASSESSMENT TOOL FOR TRADE AREA PROJECTS (SATTAP).

The trade area projects were marked using the following criterion to rate the student's projects and see how far they addressed ESD.

Assessment Criteria

Rating

- | | | |
|---|---|--|
| 1 | = | None. There is total lack of evidence on the indicator |
| 2 | = | A little evidence show poor understanding of the concept |
| 3 | = | Adequate evidence show that the student has an idea |
| 4 | = | Substantial evidence show that the student is good at ESD |
| 5 | = | A great deal of evidence show excellent performance in ESD |

Table 10: Sustainability tool for Assessing Trade Area Projects

Code	Indicator		1 None	2 A little	3 Adequate	4 Substantial	5 Great deal
P1	To what extent does the title reflect ESD					✓	
P2	Has the student explained the concept of sustainability in detail?			✓			
P3	Does the project show that the student understands the unsustainable practices in the community?						
P4	The degree to which local sustainability issues and challenges form part of the project						
P5	The degree to which global sustainability issues and challenges form part of the project						
P6	The extent to which the student exhibits critical thinking skills.						
P7	Does the student make informed conclusions on the researched problem?						
P8	The capacity to make informed recommendations						
P9	How comprehensive/cohesive is the project						

A Modified unit's assessment tool by Togo (2009)

Appendix: **PROJECT TITLES**

1. Community participation in wildlife conservation
2. Impact of private vehicles on the environment
3. Role of agriculture towards rural poverty alleviation
4. Factors contributing to forest degradation
5. Effects of agrochemicals on the environment
6. Impacts of wildlife conservation efforts on pastoral communities
7. Impact of local slaughterhouses wastes on environment
8. Environment implications of highway transport
9. Challenges facing rehabilitation of Kenya forests
10. Community participation on water hyacinth management
11. Social and economic implications of water scarcity in Nairobi slums
12. Effects of agro-chemicals on fish
13. Effects of shamba system in Aberdare forest
14. Implications of forest degradation in Kenya
15. Beekeeping, wild silk moth farming and forest conservation among groups in Mwingi
16. Effects of wetland degradation on women
17. Environmental and social economic impact of quarrying
18. Impact of forest conservation and poverty alleviation
19. Environmental effects of poor solid waste management
20. Impacts of wildlife and livestock populations on the ASALS and their resulting conflicts
21. Impacts of quarrying on the environment
22. Impacts of land demarcation on wildlife corridors and dispersal areas
23. Effects of water pollution to wildlife
24. Wood fuel, unending conservation problem in Kenya

KEY

Blue – economic pillar (3)

Green – environmental pillar (14)

Red - socio-political pillar (7)

APPENDIX 4B: FOCUS GROUP DISCUSSIONS WITH THE LECTURERS IN ERM (LFGD1)

ERM lecturers' discussion on the way forward for the course:

DISCUSSION TOPICS

- The ERM syllabus
- ERM course design
- ERM course implementation and problems associated
- ERM students identity

A departmental meeting held on 9/9/2010 for the ERM lecturers to discuss syllabus review for the ERM course noted that the current diploma course was far too wide to be covered at the scheduled time. One of the lecturers argued thus; *“if anybody was serious about covering any of the units in the time allocated, it was not practical”*. They felt that over the years the lecturers have not been genuine in what they taught. The lecturers concurred that teachers covered just what they felt will be in the examination. *“As long as the syllabus is covered for the students to pass in the examinations I do not really care.”*

It was suggested that the current diploma course be upgraded to a degree course and scaled down to a diploma by the ERM lecturers in their areas of specialization. It was also suggested that the course should become more practical. It was also noted that the course was too wide as it was mainly prepared by degree and masters holders. It was essential to involve diploma and bachelor degrees holders particularly those from technical institutions to make it more practical.

It was pointed out that the teaching of the course was theoretical and never addressed the practical aspects. The lecturers also pointed out that the way the course was taught was completely inappropriate to enable the students to become practitioners in the area of ESD. They suggested that the course be more practical and the students be encouraged to participate in environmental projects within and around the institution. The lecturers noted that the main challenge was in getting transport for fieldwork. The stages that one has to go to

get transport to take the students out were too long. They felt that as long as they covered the course and prepared the students for examination it was fine.

They felt that the students were not being innovative as they were not encouraged to engage in action research. It was suggested that the students be encouraged to come up with projects that could be used for competition, for example, at the Nairobi International Show. This is an annual event and the students can start working on innovative projects from the beginning of the year.

The lecturers felt that they were innovative because they were trying many ideas with the students. Although some felt that they were not well equipped to handle certain areas for example the lecturer for computer indicated that although she has been teaching computer for a long time she only had a certificate qualification. This is very basic because it is just an introduction. They suggested that the teachers need to be facilitated for training as some of them felt that they needed to be proficient in some areas.

The major hindrance noted in the course particularly for such projects was lack of funds to entice the students. The students will be encouraged if, for instance, they were awarded scholarships. This is a very strong economic perception.

The environmental students were seen as not having an identity in the institution in terms of engagement in environmental related activities. They were not engaged in any serious activities that could identify them as environmentalists. This was seen as a challenge that the students needed to work on for identity as in a community of practice. Something that could distinguish them from the rest of the students in the institution was necessary. They should be seen engaging in environmental management activities, such as planting seedlings or recycling waste papers.

Appendix 5B FOCUS GROUP DISCUSSIONS WITH THE STUDENTS ON THE FIELD CAMP TO THE COAST (2/5/2011)

The discussion with the students began with an overview of the course. The students reported that they got information about the field exercise from their admission letters. They also discussed this with the other students in the institution. Especially the EPEC group. During the EPEC meetings they discussed many things including how they are taught and how they can make their club more popular and active. We particularly engaged in looking at what the students covered when they went out on field work. This discussion was guided by the course outline.

The course outline (see HD 22) indicates that the coastal trip covers the activities listed below. These were used to guide the discussion on this trip.

- Collection & identification of marine algae/sea grasses, marine invertebrate and vertebrates
- Collection of plants specimens
- Collection of seeds & propagation materials
- Seed extraction
- Trapping fish
- Identification of fish
- Fish processing
- Identification of fish breeding sites
- Identification of mangroves species, habitats and adaptations
- Roles of fisheries in erosion control

The students reported that they Identified marine algae & sea grasses but did not collect the same as the course required, this was due to lack of proper guidance on what was expected of them, time was also limited because the field work was required to be covered in one week i.e seven days but it took only three days.

They identified the marine Invertebrate & vertebrate, but could not collect the same to fulfil the course requirements due to lack of proper guidance from lecturers. Plant specimens were covered in class theoretically but they did not collect the specimens during the field camp.

Seed and propagation materials were taught in class but they did not do it practically in the field, because they did not have the required equipments for seed propagation.

'We were taught in class about seed extraction but were not able to do as practically as the course content require.'

The students reported not to have trapped any fish nor identify their types, fish processing and their breeding sites because they did not get proper guidance from the lecturers.

The students were able to identify the Mangroves ecosystem and their uses but not the different species types, so they just know what a mangrove ecosystem looks like.

The students were confident in identifying the various human impacts on the environment such as mining and tourism as observed in the field.

APPENDIX 6B: FOCUS GROUP DISCUSSION ON FIELD CAMP TO THE KENYA HIGHLANDS

The activities to carry out at the highlands are listed below according to the curriculum (HD 22) I used this to guide the discussion on this trip.

- Participate in pitching tents
- Construct flood checks/controls around the camping site
- Fire control practices
- Identify animals and plants taxonomically
- Identify poisonous/harmful plants and dangerous animals
- Identify geological features
- Identify the interactions between different animals species and between animals and their environment
- Observe and evaluate the impact of human activities on the environment
- Demonstrate emergence response techniques
- Demonstrate communication systems in the wilderness

The students reported that the fieldwork and camping at the Kenya highlands was not carried out as stipulated in the curriculum. They did not carry out pinching of the tents and even flood check controls as outlined. They claimed lack of knowledge of what was expected until the time they participated in this study. As one of them reported during the focus group discussion.

‘The course outline for this unit was not given to us beforehand. We were not told.’

The fire control techniques were learnt theoretically e.g using dry CO₂ fire extinguishers, use of a blanket whereby the fire is covered to reduce the rate of oxygen gas and finally the use of smoke for communication, but this was never done during the field camp as expected..

The focus group discussion revealed that the student covered animal and plant taxonomy adequately. *“We also identified animals and plants taxonomically both in class and in the*

field whereby we classified plants according to their nomenclature; we managed to identify poisonous animals and their habitation in the biology laboratory.'

The interaction between animal species and environment was covered in class but not in the field. The students also managed to observe and evaluate the impact of human activities on environment under ecology and land use management the students made a report on the field exercise.

The aspect of food preparation in the wilderness was handled in class in units such as survival in the wilderness, but the students did not practice this in the field because the students did not prepare their own food rather they stayed in hotels and lodging in the areas they visited.

Identification of geological features was well covered both practically and theoretically because the students were able to identify the different geological sites and vegetation cover such as savannah grasslands, bamboo forests and moorland. However the students reported lack of technical discussions in the field on specific aspects such as soils and water quality.

The students learnt in theory on emergence response but did not demonstrate this in the field.

'we learned about food chocking, snakebite and minor injuries like cuts in theory'.

The students reported that they were unable to cover most of practical work in the field due to; limited time, inadequate camping tools and equipments, ignorance and lack of qualified personnel.

Appendix 7B FOCUS GROUP DISCUSSION (FGD 1) 30/1/2009 ERM 1ST YEARS.

The researcher met the first year students and had a discussion on the ERM course on teaching methods and the students' future plans after the course.

METHODS OF TEACHING

Researcher: How does teaching take place in your class?

Students: It is mainly lecture but we prefer lecture and problem based learning. The style seen around in the polytechnic is mainly lecture method. This makes us lazy and we do not engage much in research. Field work is minimal because we rarely go out. 'We do not understand why we are never out to study environment.'

Researcher: What do you intend to do in future?

Students: Some said that they will like to go for further studies in environmental management; others will like to get into the work and or start some business.

Appendix 8B FOCUS GROUP DISCUSSION ON THE TRADE AREA PROJECT

The following questions guided discussion on the trade area project to understand how the students came up with the topics for research for the trade area projects, the process and problems encountered.

1. How did you come up with the area of study
2. Is the problem you are researching on from your local area?
3. What methods did you use to collect data
4. How long did it take you to collect data?
5. Were you doing any chemical analysis, how did you do that?
6. What challenges did you encounter
7. How often do you meet with your supervisor?
8. What challenges did you have so far in carrying out your study?

The students informed the researcher that it was not easy to come up with the trade area project title. The unit on research methods helped them to understand how to go about research but they had to get a topic from their own areas of interest. Some students said that it took them a long time to get a topic. Some said that they were unable to settle on a topic until third year.

All the students conducted case studies and used questionnaires, interviews and observations for their research. The methodology used is positivist mainly as the students are not experienced in research.

The students reported that they met with their supervisors on agreed times and not necessarily the time indicated on the time table.


They reported constraints such as lack of funds to conduct the research. Some said the community was hostile and others cited language as a hindrance. Those who carried out research that required the use of a laboratory complained of lack of the facilities in the institution and thus had to seek for help elsewhere such as the government ministries. Some had difficulties in gathering data from distance places.

APENDIX 9B : INDUSTRIAL ATTACHMENT

At the end of the second year the students go on industrial attachment to gain experience in their trade area. They fill up a log book and a form for attachment.

i) A SAMPLE LOG BOOK

**INDUSTRIAL AND INSTITUTIONAL LIAISON CENTRE
(CENTRAL ZONE)**



P. O. Box 52428-00200 NBSI
Tel: 020243672 341639 2251300
Fax: 0202219689

Email: polymis@yahoo.com
Website: www.kenyapolytechnic.ac.ke

INDUSTRIAL ATTACHMENT LOG-BOOK

A. Personal Details

Last Name: JULIE NJOKI WANJA

Other Name: JULIE NJOKI Female Male

Identity Card No. 27197965 Date of Birth: Date 11 Month 12 Year 1987

Course Environmental Research^{ms} Level Diploma Year Module III

Home Address: 1240, Nyeri Telephone _____

Next of Kin Name: Anne Wanja Wazuri Relationship Mother

Postal Address: 1240, Nyeri Postal Code 10100 Tel. No. 0728012639

B. Training Institution

Name: KENYA POLYTECHNIC UNIVERSITY COLLEGE

Postal Address: 52448 Postal Code 00200 Tel. No. 219670

Fax: 0202219689 Email: Polymis@yahoo.com

Name of Head of Institution: Ms. Masese

School: EARTH & ENVIRONMENTAL SCIENCE

Dean: _____

C. Details of Attachment Place

Name of Organization: National Environment Management Authority

Postal Address: 00200 Postal Code 00200

Tel. 605522126/27 Fax: 608997

D. Industrial Attachment Trainer

Name M.W. MWAI / A.W. MACHARIA / S. MARIKA

Position Designation: DIRECTOR GENERAL

ii) ATTACHMENT FORM

ASSESSMENT CRITERIA FOR THE STUDENTS ON ATTACHMENT

Assessment Criteria

Rating

4-Excellent

3-good

2-Fair

1-Poor

Table 11: Assessment Criteria for the Students on Attachment

Assessment areas	Excellent	Good	Average	Poor
Punctuality				
Adherence to regulations				
Workmanship				
Work out put				
Adaptability				
Communication				
Reliability				
Teamwork				
Active involvement in sustainable elements				
Compared with other graduates from other universities				
Total				

Source: KPUC Industrial Liaison Office (2005 - 2010)

This form was filled up by the student supervisor during attachment to enable us analyze problems

iii) ATTACHMENT REPORTS

The students wrote a report on attachment guided by the following questions

1. What challenges did you encounter during attachment?
2. How did you solve the problems you encountered?
3. How relevant is the ERM course to the work you engaged in during attachments?
4. What activities did you carry out?

Appendix 10B: A SAMPLE OF THE STUDENTS ATTACHMENT REPORTS

The following are reports from the field for 10 students who were on attachment between January and April 2010. The reports are an extract of the activities the students engage in during the attachment exercise. ATTACHMENT REPORTS (AR)

AR 1

Place of attachment: Athi Water Service Board, Nairobi.

ACTIVITIES

- i. Revision of EIA reports
- ii. Inspection of boreholes in Nairobi area
- iii. Attending public compliance meetings
- iv. Training on EIA writing
- v. Binding and photocopying EIA reports
- vi. Field survey on N'gong sewer line
- vii. Data collection
- viii. Report writing on Kiambu Dam
- ix. Arranging files
- x. Development Assessment
- xi. EIA project submission to NEMA
- xii. Community awareness creation

Appendix Lecturers Responses (LR)

CHALLENGES IN TEACHING DIP ERM: by lecturer 1

In the process of implementing the curriculum for Diploma in ERM at TU-K I have faced enormous challenges that eventually inhibits production of graduates in ESD.

Among the many challenges faced includes:

- **Teaching Materials and Resources:** the institution lacks modern and functional equipments for teaching. These include equipments for teaching GIS, GPS, AutoCad and soil, water and air analysis. The institution totally has no equipments for teaching meteorology and modern statistical packages for wildlife population analysis. Teaching manuals and modules on ESD are lacking.
- **Time Constraints:** some units like community development, wildlife management and water resources management have very wide scope with limited time to cover content adequately. Therefore sometimes you either do not complete the content or you compromise on scope.

- **Manpower:** the institution lacks trained personnel in implementing sustainable development courses in the institution. Areas such as Resource Economics and Resource Conflict Management are lacking. Staff in ESD are also lacking
- **Theory and Practicals:** the department implementing the program has no laboratories (physical, biological, chemical and technology/IT) laboratories. The program therefore takes a theoretical approach instead of hands on approach.
- **Field work and industrial work:** the program has no industrial exchange program and the time allocated for field work and trips is inadequate. Adequate resources to implement an effective and practical field work are lacking. This inhibits development of data collection skills among the learners. The department lacks a field work manual and technicians to instill practical skills in the field. The concept of ESD therefore becomes very theoretical.
- **Linkages and Networks:** though the department's works with many players in the industry, there are no formal collaborators and partners in the field. Therefore the students partly participate in conventions, conferences and seminars in ESD. No exchange programs with other foreign and local universities implementing ESD programs.

Appendix 11B: student's electronic mails (SE)

The former students of ERM were requested to respond to the following questions concerning the course:

- The teaching methods used and their effectiveness
- The fieldwork experience; how many , where
- The laboratory experience and which subjects , stating how effective this was
- The trade area project experience, how did you choose the topic, how did you collect data, what were the challenges?
- The general experience in the institution
- Environmental Activities during my study other than class work

SE2.LEARNING EXPERIENCE AT KENYA POLYTECHNIC UNIVERSITY COLLEGE

Teaching methods used:-

Class lectures were common in every unit (subject) except for the external field or industrial attachment session which was about 3-4 months outside the college.

Field work involved field trips which helped one to understand better what had been taught in class.

Major Field trips were:-

Mount Kenya trips:-

- This covered a good view of the rift valley escarpments.
- A visit to the lake Nakuru national park which is home for thousands and thousands of flamingoes, warthogs , baboons, white and black rhino, and beers among other animals. It is important to note that it is protected under **Ramsar convention on wetlands** it lies about 164km north of Nairobi.
- The trip covered the leeward side of Mount Kenya including Nanyuki town and finally Mount Kenya itself where we climbed as a team led by Mr. Mucura from the base and through different types of forests with a variety such as the podocarpus, prunus Africana, Cypress and Cedar among others up to the last bushes from where finally we could see the moorland.

Mombasa trip

- In this trip we visited the Mzima springs which taught us a lot about animal taxonomy especially the fish as well as conservation of resources such as water among others.
- We had site seeing of the Shetani lava and the vast Tsavo East National Park
- Other places visited were; mangrove forests, Marine Park and the other obvious animal species found in that area.
- The Arabuko sokoke (and its rich variety of trees, bushes and butterflies)

Rhino cement trip

- We saw the raw material used to make cement.
- Production of cement.
- Solid and liquid wastes disposal methods.
- Health and safety measures.

Ruai sewerage systems

Methods used for recycling

We learnt about the methods used for recycling waste water and this includes Biological, aerobic and anaerobic methods of microbial removal from sewage waste water until finally the treated water is emptied into Athi River.

Other teaching methods used were the research project writing which helped a lot and compelled one to read widely whereas this made one acquire broadened knowledge.

Practical in the laboratories was inadequate and in most cases it was poorly co-coordinated leading to inadequacies and making people half baked in some aspects e.g

In laboratory practice subjects we were taught methods to cut glass and to make different finished products such as pipettes and droppers but we were to visit Ruraka Bottles manufacturing industries which was never to be.

In physics we were supposed to practice how to make a thermometer which was never to be despite the good theory learnt on the same, however in plant taxonomy making a herbarium was a real experience of the environmental activities.

In animal taxonomy understanding of different species of animals and how they adapt to different environments was a real experience of the environmental activities as well.

Trade area

My trade area (project) was real fun to find out which harmful organisms can be found in waste water from Kenya meat commission.

Having a good background in meat inspection and having worked at the Kenya meat commission before it was easier for me to collect samples of waste water at different points from the wastewater disposal lines and with the help from the staff from the government central water analysis laboratory the exercises was done although I met several challenges e.g.

- You go for a sample of large animal (cattle) waste water only to find that the slaughter taking place is for small stock (sheep goats) there for, on that day you cannot collect samples.
- You get to the laboratories late and then you are forced to keep the samples there over night until the next day.
- Sometimes you can't use the laboratory facilities because the staff is too busy with the equipments that you want to use at the same time
- Sometimes you need assistance but the personnel there are so busy with their work and you can't do it alone because you are not an expert in laboratory work therefore you go and come the next day.

The whole exercise is time consuming.

The general experience observed is that when you have a mixed class of those fresh from high school and aged people the lecturer will assume that everybody has gotten the concept of the lesson which is not always true, while the freshers' will sometimes think that the aged students are dragging them behind .

Another observation is that business plan was so much on assumption and this area need to be improved so as to be more realistic.

Appendix RJN: Research Journal Notes (RJN)

19/3/2009

- Teaching is mainly by lecturing
- The students take notes as the lecture goes on
- Fieldwork is minimal
- Students are not happy about this but they do not seem to have a voice

22/11/2009

- Field excursions have little on hands on activities
- Coordination for field work is a tedious job for the lecturers
- Limited transport constrains the exercise out of college
- Finances both for the students outing is a major challenge

4/4/2010

- The contradictions in the activity system seems to come from the way the system is managed
- The processes are too long pitying the lecturers against the students
- The lecturers are not adequately enabled some are not trained on how to conduct the field exercises.