

An Investigation of Education for Sustainable Development: Interpretation and Implementation at a Teacher Education Institution in South Africa

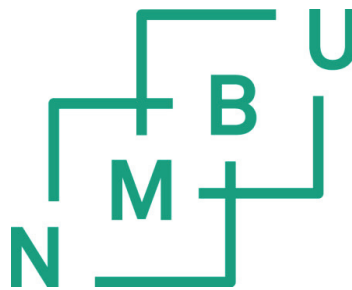
En undersøkelse av utdanning for bærekraftig utvikling - tolkning og implementering i en lærerutdanningsinstitusjon i Sør Afrika

Philosophiae Doctor (PhD) Thesis

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Preface

“There is a need to strengthen the capacity of educational leaders (at all levels in the system) to respond to the contemporary situation in southern Africa, where social, economic and environmental issues are affecting the lives and livelihoods of learners everywhere. There is a need for a new vision to develop around the role of schools and educational institutions in society, and this will not be possible without effective leadership.” (Lotz-Sisitka, 2006, p.27)

Acknowledgements

This is beyond a shadow of a doubt, the most difficult section to write. Not because I cannot recall who in this journey has been instrumental in its progress, but rather because my words of gratitude will always fall short of the true gratitude that I feel.

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knew if I didn't I would grovel in disappointment later. Your words and intentions have accompanied me like a close friend throughout.

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List of Acronyms

B.Ed	Bachelor of Education
CAPS	Curriculum and Assessment Policy Statement
DESD	Decade of Education for Sustainable Development
DoE	Department of Education
Efs	Education for Sustainability
ESD	Education for Sustainable Development
HESD	Higher Education for Sustainable Development
HEIs	Higher Education Institutions
RSA	Republic of South Africa
SD	Sustainable Development
TEI	Teacher Education Institution
UN	United Nations

PART I:
EXTENDED ABSTRACT

1. Introduction

This introduction serves to outline the main aims of the study and how my Masters study in the same field led me to constructing my four research questions. Throughout, I try to position myself as the researcher and reveal my prior affiliation with the institution that eventually was to become the case for this study. This chapter outlines the research approach and the level of in-depth analysis that was required as well as the methodological challenges and limitations that come with such an approach. I find it necessary to briefly contextualize the case by describing South African history and its impact on education holistically. Although the four articles are presented in Chapter 5, I also provide a short synopsis of each article (here also) in Chapter 1. I do this as it offers a meaningful overview of the research that has been engaged. Finally, I provide an outline of the chapters to come.

Although I am the chief researcher in this study and therefore often refer to 'I' in the report, the study was helpfully guided by my two supervisors who may be referred to as my co-researchers. Their roles included: reviewing and tailoring my initial research design ideas, offering advice regarding the data collection instruments, critically examining the validity of the data analysis process, and constantly reviewing, editing and critiquing written reports of the research itself. My role on the other hand, was to draft the initial ideas on the research design, execute the data generation and analysis process and generate ideas on how to present the report. In instances where 'I' alone am responsible for a particular activity in the research, this is clearly indicated. However, in many instances where the research relied on collaboration amongst the three researchers, 'we' is purposefully and repeatedly used.

1.1. The Main Aims of the Thesis

It has been noted that any hope for transformation in education lies in the hands of the teacher and/or teacher educator who inevitably must take on the role as implementer of policy innovation. It is, however, not only an issue of whether or not institutional policy has been interpreted and implemented appropriately within teacher education institutions, it is also a question of how institutional policy encompasses global and national initiatives. This study focuses on the Education for Sustainable Development initiative that has been formally adopted at a national and global level. It is pertinent that policy guiding teacher education institutions reflect this global and national responsibility. Having said this, it is not enough to formulate policy that is strongly ESD aligned. This research reveals that deep learning for sustainability at any Higher Education Institution (HEI) is only sustainable in of itself if first the institutional culture is understood and second if it is embraced in the model for 'change'.

This research study is four-fold. Firstly, this research aims to identify in what way(s) national education policy is aligned to the goals to educate for sustainable development. In order for

this to be determined, we designed an ESD framework. We developed the ESD framework after a thorough exploration of ESD related literature. Secondly, the research aimed to identify which competences teacher educators prioritised in their course delivery and what factors influenced this prioritization. In order to answer such a question, we chose one teacher education institution and interviewed the willing teacher educators. I shall elaborate on this briefly in a moment. Thirdly, this research aimed at determining to what degree 'key policy implementers' (According to the Decade these include all educators: teacher educators, Heads of Department, Heads of Schools, Dean of Research etc.) at this particular teacher education institution identified with the principles of ESD through their practice. We were able to determine this by comparing teacher educators mentioned competency foci against our newly-developed ESD competency framework. Finally during this research we employed soft systems methodology as a cooperative strategy for understanding the context for ESD implementation. It also assisted us in highlighting the implications for ESD in higher education. Soft systems methodology (SSM) is described in detail in the methodology chapter. However, I wish to briefly state that SSM involves a method of analysing the organisational situation in a way that provides opportunities and vision for change.

In the foetal stages of the study, we originally thought that data collection would involve a wide scale survey of teacher education institutions in South Africa. Originally, we were going to select two institutions and engage them in a more in-depth analysis. However, a poor response-rate to the national survey indicated that no significant findings could be gleaned. The reasons for a poor response-rate were given as teacher educators replied that the survey was not relevant to their discipline because they did not focus on ESD. Following this, we decided that we would then consider the institutions revealing the highest response-rate. There were two institutions that stood out for us due to responsiveness. One institution was located far away and would require a flight or 10 hour drive and the other institution was one with which I was very familiar. I had studied and worked there for 8 years and knew most of the staff. It was therefore decided that this institution would be easier to access more regularly. Due to my familiarity with many of the structures and teacher educators it made establishing a rapport easier and interpreting jargon more efficient. However this also made engagement with grounded theory most challenging. My knowledge of the organisational structure and dynamics needed to be repressed and only accessed when data confirmed the existence of certain phenomena. I found that teacher educators opened up to me as they took it for granted that I empathised with their situations and that I understood their logic. Consequently it was necessary that I posed many 'confirmation checking' questions and 'probing' questions to get them to elaborate on issues that they assumed I was familiar with. Another challenge was sticking to appointments. Owing to these teachers knowing me, if something more urgent popped up, they found it easy to shorten the interview or even reschedule altogether. This was not a huge issue, except that it made it difficult to reschedule appointments as they were already

very busy all the time. In some instances I had to follow up data analysis by emailing teacher educators questions for clarity on what they had said in an interview that they had rushed to finish.

The in-depth analysis with the chosen institution involved one-on-one interviews and a focus-group interview with willing teacher educators within the institution. We analysed course outlines and meeting-minutes to gain a holistic picture of the presented reality. We hope that the findings of such research will enlighten ESD activists and policy makers in general as to the institutional processing and destinies of policies for education.

To summarise through this study we aimed to examine the degree to which Education for Sustainable Development permeated the goals and objectives of policies and programmes that guide teacher education in South Africa. We explored teacher educators' perspectives, for time and again they have been identified as 'key implementers of policy'. It made sense then that we explore the competencies that they deemed pertinent for emphasis in their courses. We analysed teacher educators' perspectives in terms of: what priorities they reflected, how they were motivated (for) and to what degree they addressed ESD related principles. At the start of this study, we constructed an initial ESD framework from literature, in order to examine South African Education policies. Later, after we had engaged with the case-study, we constructed a second framework. In this second framework however, we considered what was learned about Higher Education structures to construct a Higher Education for Sustainable Development (HESD) Framework. This framework we feel, acknowledges the complexity of institutional culture and responsibilities in a model for HESD alignment. We hope that ESD stakeholders gain more constructive insight into the existing challenges and the complex net required to hold such an initiative together at an institutional level.

As a trained Biology teacher and a lover of nature, the environmental pillar has always been a personal concern of mine. Through my teacher training, I could identify so many opportunities in the Biology curriculum to explore and educate about environmental conservation and rehabilitation. However, as I started lecturing student teachers, over the years I found myself teaching other subjects, non-science related. I could literally feel myself drifting away from my love of the environment. It was at this point in my career that I remember thinking how strong the socio-economic emphasis was in other curricula and where was the environment? Since then I have been searching for a way to conceptualize a teacher education that inextricably intertwines the social, environmental and economic pillars.

Prior to my engagement with this study I had engaged a two year action research study exploring three Grade 9 teachers' understanding and practice of Education for Sustainable Development. My findings there revealed that teachers are not only baffled by the term but that they constantly refer to greening methods of teaching (i.e. recycling) when asked to apply ESD to their practice. Teachers found it easier to apply the ecological pillar without

the economic and social pillars and consequently resorted to greening. As a result, teachers never engaged learners with critical thinking and problem solving regarding sustainability issues because they themselves battled to conceptualise how this would be done. These findings led me back to the teacher education institution, where I found myself asking: 'What is being done here in the Bachelor of Education program that would contribute to developing teachers who are able to educate for sustainability?' This journey led me to pose the following research questions which would eventually guide my current study:

1. In what way(s) does policy guiding teacher education, promote the development of competencies in Education for Sustainable Development?
2. To what degree do teacher educators recognise and address ESD competencies within the teacher education curriculum?
3. Why do teacher educators provide this degree of ESD competency address within the teacher education curriculum?
4. What contextual factors influence teacher educators' attempts to effectively engage in ESD-oriented activity?

1.1.1. The Research Approach

I engaged in a process of in-depth interviewing at one Teacher Education Institution (TEI) in South Africa. I would classify my study to be a case study, whereby one department within the TEI represents my case. During this time I immersed myself in the TEI context, all the while being quite familiar with its culture. However, to ensure that my analysis of the data was not greatly biased, I also adopted a grounded theory approach to assist the meaning making of the data generated. Systems theory helped me to put all the data pieces that were identified from using grounded theory, together to paint a fuller picture of the situation on the ground.

According to Patton (1990), if one hopes to understand a particular phenomenon through the study of one case then the case must be carefully selected. It is for this reason that we identified an Institution that was not specifically ESD focused as a valuable learning tool. There exists a particularly ESD focused teacher education institution in South Africa that responded to the survey (as mentioned earlier it was further away), however we realized that this case would not provide insight into the factors and dynamics that need to be considered when sanctioning a teacher education institution as an ESD policy tool. The case was selected because this institution represented most institutions with regard to one detail (not specifically ESD aligned) and would provide more insight into the existing challenges, barriers and opportunities. This is not to say that one cannot take valuable lessons from institutions specifically aligned to ESD, this is perhaps another angle for the same plight.

A case study is a study that focuses on a particular example that has the ability to say something about a more general principle or theory. "It provides a unique example of real people in real situations, enabling readers to understand ideas more clearly than simply by

presenting them with abstract theories or principles.” (Cohen, Manion & Morrison, 2007, p.253) According to Robson (2002) case studies are less likely to provide grounds for statistical generalization and more likely able to provide support for analytical generalization whereby the study reveals ways in which similar cases can be understood or analysed. It is this intention that informed the use of a case in this research study.

1.2. Threading Together the Four Articles

The four article synopses are presented here and are presented in the order in which they were written and engaged in the research process. The first article is a theoretical paper exploring leading literature on ESD to develop an ESD competency framework. The second article uses the ESD competency framework developed in the first article, to analyse 6 teacher education related policies. The ESD-orientation of the 6 policies is reported on. The third article acknowledges the lack of ESD-orientation in teacher education guiding policies (findings from article 2) and uses this knowledge as a point of departure in the exploration of teacher educators’ competency foci. The third article also reports on themes that emerged from a grounded theory analysis of one-on-one interviews with the acting dean and teacher educators. The fourth and final article uses the themes that emerged in article 3, to construct a rich picture of the teacher educators’ reality, which serves as the point for discussion in the focus group interview. The article describes the Soft Systems Methodological (SSM) approach employed and further presents the findings from a focus group interview regarding the possible bridging to an ESD oriented Science and Technology teacher education.

1.2.1. Article I - Clearing the path that has been laid: A conceptualization of education for sustainable development

This article serves to explore the language and agenda of policies and recent literature on Education for Sustainable Development (ESD). The exploration aims to reveal how discourse around ESD has moved from a previous ‘ecological’ focus to a more modern ‘development’ focus and the reasons behind such a shift. The article makes a contribution to the field of ESD in the form of an ESD competency framework. We propose that this ESD framework may be used in designing new ESD oriented curricula and in determining to what degree existing curricula explore possible ESD competencies. The framework is informed by policy and current literature in the field of ESD and aims to diffuse the confusion embedded within the term sustainable development and furthermore what it means to educate for such a movement. The article reveals that leading authors in ESD are often advanced researchers whose jargon often clutters the path to practically understanding and implementing ESD. This article attempts to digest such advanced literature and to offer the novice a path towards understanding what ESD looks like.

The article identifies ESD as a transformative education that promotes critical and reflective thinking on assumptions and existing structures. This spirit of critique is maintained throughout the article. The article concludes its purpose by contributing an ESD framework that promotes, amongst other competencies, critical and creative thinking and most pertinently active agency. The reader is alerted to the reality that context plays a major role in the form that ESD can take in a curriculum. Varying contexts reveal varying social, economic and ecological needs and therefore varying ideas of what are to be considered sustainable development issues. For this reason, although an ESD framework is offered, it must be understood that it can only ever be a framework or guide, to allow for the contextual nature in which all education systems exist.

1.2.2. Article II - Exploring the priorities of Teacher education related policies: An Education for Sustainable Development perspective.

This article examines the degree to which major teacher education related policies in South Africa promote ESD. Policies guiding teacher education and development in South Africa were examined using the content analysis method. The ESD framework developed in the first article through an analysis of pivotal ESD literature was employed as a set of indicators assisting in the identification of policy discourse that promoted ESD competencies. The content analysis of the chosen policies, not only identifies instances where ESD is promoted it also highlights the instances where the policy discourse contradicts the plight for ESD implementation.

The main contributions of the article are revealed through the analysis process and in the findings of the study. The findings revealed that policy guiding teacher education and development: (1) barely promoted ESD teaching and learning approaches; (2) did not make direct meaningful connections between ESD skills and values and ESD issues/knowledge content; (3) did not reveal an understanding of the complex interactions that exist between economy, society and the ecological environment; and (4) focused mainly on social and economic development, neglecting the important role the ecological environment plays.

The article makes two major contributions. First, the article displayed how a content analysis process can be employed using the new ESD framework developed by Bentham (2013), to come about to meaningful conclusions about the orientation of policies. Second, the article revealed major inefficiencies in teacher education and development related policy that is supposed to prepare teachers to address the country's needs through the delivery of a relevant and meaningful education. The article posits that although teacher-education-related policies don't overtly demote ESD it also does not promote it, suggesting that sustainable development and its tenets may never be critically engaged within the education system. This article paves the way for understanding the policy context in which teacher educators work and function. The article therefore also offers researchers insights

into future studies that wish to explore teacher educators' conceptualizations and implementations of ESD.

1.2.3. Article III - Teacher Educators' competency development priorities: barriers and avenues to Higher Education for Sustainable Development

The article aims to explore which competencies teacher educators in the Science and Technology education department prioritize and what internal/external factors influence this orientation in their courses. The article advocates that the competencies teacher educators choose to focus on and develop in their courses tells a story about the probable future of Education for Sustainable Development in the current education system.

The article uses a grounded theory approach to analyse one-on-one interview transcripts with the acting dean and 8 teacher educators about their courses, the competencies they develop in these courses and the factors guiding their professional practice. The major findings that arose from the grounded analyses of data indicated that: (1) the reconceptualization of the College structure to a University structure affects professional roles and functions; (2) although the University promotes community engagement, it is not focused on in the curriculum; (3) research productivity and University research agenda is a strong professional focus and may explain many pressures and lack of time and support for innovations; (4) the National Policy Framework for Teacher Education and Development in South Africa (2007) is said to strongly guide teacher educators, although in Bentham (2014, Article 2) this policy document shows a clear lack of ESD orientation; (5) the national focus and thus the University focus on scarce skills guides competency development; (6) professional identity in terms of teacher educators' perceived professional autonomy and personal professional interests affects their competency focus; (7) ESD is important but not a focus, its degree of implementation often rests on the nature of the existing curriculum; and finally (8) discourse on ESD is varied, suggesting possible absence of the exposure to the term and its' implications for curriculum.

The article reveals that the current university objectives and foci as well as current teacher educator competency foci although they promote some crucial scarce skills, do not indicate an Education oriented towards sustainable development. In most cases issues of sustainability are either superficially covered or only covered owing to their suitability to the topic in the curriculum. There is little active attention being paid to ESD and little consensus on what the term means for Science and Technology Education. It appears that the main curriculum drivers (influenced by University priorities) need to incorporate ESD principles in order for ESD to be a curriculum focus for teacher educators who are strongly influenced by Universities' expected roles and functions. It is not ignored that professional agency plays a major role in the success of innovations such as ESD, however it is emphasized that this agency must also be supported and encouraged.

1.2.4. *Article IV* - A teacher education for sustainable development system: An institutional responsibility.

The article explores the key factors that affect teacher educators' (key policy implementers) willingness and ability to effectively engage in education for sustainable development. The article draws on soft systems methodology to create a picture of the organizational dynamics that directly affect teacher educators and their professional identities and practice. Data generated through one-on-one interviews was used to construct the initial rich picture which was presented to teacher educators in a focus group interview. The rich picture followed by a notional picture was used to spark discussion around the factors that teacher educators, as a group felt influenced their practice generally and more specifically their ability to incorporate an ESD.

The group dynamic added unique insight into the value that teacher educators placed on colleague support and shared vision for curriculum development. The major contributions of the article include: (1) the use of soft systems methodology for purposes of data generation in order to (a) reveal the nature of the activity systems at a teacher education institution and to (b) reveal teacher educators' collective perception of their professional environment; and (2) the main findings. The main findings include: (i) University activities are responsive to the country's needs, i.e. scarce skills; (ii) management's perceptions of professional autonomy differs from that of teacher educators; (iii) sustainable development is not a focus in curricula, however elements of it do exist in an uncoordinated manner; (iv) elements of sustainable development feature due to active agency and suitability to the topics covered in the curriculum; (v) time, class size and pressure to publish are major factors limiting teacher educators' ability to orient their curricula towards ESD and to redesign materials; (vi) there exist 7 relevant systems that influence teacher educators' priorities and practice; (vii) teacher educators saw their varying research interests as a barrier to ESD oriented research; (viii) opportunities for innovation are limited by expectations of what is to be included in the course; (ix) the focus group interview provided an avenue through which management could hear the perceptions of colleagues and address misconceptions, ultimately motivating colleagues to pursue their desires to redesign the curriculum; (x) teacher educators felt that research and leadership were the most powerful tools in supporting curriculum innovation and change; and (xi) finally and perhaps most importantly, ESD is not a priority for teacher educators, mainly because it is not a national policy concern of even a University driven focus. As long as ESD does not achieve teacher educator priority status, its future implementation remains bleak. The major thrust and argument of this article is, as long as Universities and Departments of Education refuse to acknowledge the importance of sustainability literacy, teacher educators and education generally will never make sustainability principles and principles of ESD a priority.

Finally, we realise that the articles are a contribution meeting the needs outlined by Karatzoglou (2013) which includes publishing more articles that are prescriptive and theoretical, as opposed to only descriptive.

1.3. Outline of Thesis

The thesis is divided into two parts. The first part consists of chapters one through to five including the references and appendices. This section serves to tell the story of the research process engaged. The second part consists of all four articles and is situated at the end of the thesis.

Chapter 2 explores the empirical context at a national and local level. The chapter outlines South Africa's History in order to provide the reader with an informed view into the education policy environment. The history also explains the transformations that took place in Higher education structures. The chapter concludes with a description of the case specific context, providing more detail of the site where the data generation took place.

Chapter 3 engages in a discussion with literature about the conceptualizations of ESD within documents like the UN Decade of ESD (UN, 2002) and Agenda 21 (UNCED, 1992). Through an exploration of sustainability education related literature the chapter explains how an ESD competency framework was developed. The chapter further contextualizes the study by exploring research based on ESD in Higher Education Institutions in South Africa. The chapter takes a critical stance pointing out the role that Higher education needs to assume in realizing the needs of South African society. The chapter suggests that a guiding sustainability policy for Higher education needs to be formulated and suggests some structures that should be considered. The ESD competency framework although a conceptual framework, is also described in this chapter as it was largely informed by an analysis of literature.

Chapter 4 exists as the methodology chapter and serves to describe the research process, the roles of the researcher, the major methods of data generation engaged, the process of data analysis, the methodological limitations and challenges and finally research credibility. The main methods described include: a web-based survey, document analysis, one-on-one interviews, focus group interviews and finally soft systems methodology. Grounded theory and systems theory are defined and described in more depth here than in the articles. These two theories informed our design of the data generation instruments as well as the analysis of the data generated from them and we therefore reported on it in this chapter.

Chapter 5 serves to engage in a discussion of the major contributions of the study. We do this in two ways. First we do this through a reflection on the policy formulation process whereby lessons learned during the research process are used to add meaning to the discussion on the potential ESD policy formulation process. Second, we lift the major

findings from the four articles and highlight what these findings imply for the future of ESD in South African Teacher Education.

2. The Empirical Context

The following chapter explores both the national and local context of the study. South Africa's History is briefly described to provide an informed view of the education policy environment. The history explains the transformations that took place in Higher education structures as well. The case-specific context is also described in order to provide a more detailed and faceted idea of the site where the data generation took place, as well as the backgrounds of the teacher educators who took part in the study.

2.1. Contextualizing Education in South Africa

The South African context plays a major role in the competency focus and policy priorities reported on. In order for this thesis to be read internationally, it is important to briefly introduce the political and educational impact that South Africa's past has afforded it. South Africa has a long history of racial violence, of which the effects are still being felt today. Comments made by previously disadvantaged (people of colour) citizens prior to the 2014 national elections still voiced the fear of voting for a party that 'might' bring back apartheid. More recent incidences of horizontal racism in 2015, between black South Africans and black foreign nationals have been incorrectly labelled 'xenophobia'. The effects of apartheid runs deep but perhaps the most affected cornerstone of South African society has been its education system. People of colour in the past have been exposed to a poor quality education that served to position and keep them at the lower rungs of society. Although apartheid and its government were banned in 1993 bringing about a democratic South Africa in 1994, the effects of a low quality education has been extrapolated as a ripple effect of both unequal distribution of resources and access to higher education.

2.1.1. *Teacher Education in South Africa*

Since the 1910 South African constitution, the responsibility for teacher education was divided between the provincial and national governments. Prior to the new 1994 government, governance over education and other systems was divided across the provinces. Students training to become primary school teachers were governed at a provincial level by the colleges. However students training to become Secondary school teachers received training through the Universities and Technikons and were thus a National responsibility.

Originally the colleges emerged as racially differentiated entities that were provincially governed. The function of the colleges was to train primary school teachers who could teach in the racially-segregated schools. So a 'white' college, located in one of the four white provinces would educate to a level that ensured a high quality school level education. However a 'black' college would prepare primary teachers to teach bantu education (an inferior quality education for black learners) as they were governed by the then Department of Bantu Education (Parker, 2003).

By 1993 there were “19 different governance systems controlling colleges of education, together with 32 partially autonomous universities and technikons offering teacher education.” (Parker, 2003, p.20) However the Apartheid government maintained a firm grip on all of these governance structures and tertiary institutions in terms of their finances, policies and curricula. What was lacking was attention to the supply and demand of teachers (with respects to the non-white schools particularly), quality assessment procedures for offered programs, as well as any stipulation of who was to be held accountable for the varying degrees of quality. What resulted was a variety of programs and qualifications, an oversupply of primary school teachers and an undersupply of secondary teachers specializing in Mathematics, Science and the Languages (Parker, 2003).

By 1994 there were around 150 Institutions that provided teacher education, however the Colleges of education that provided teacher education to at least 80 000 students were still under provincial governance. These 150 institutions in total provided teacher education and training to approximately 200 000 students (Parker, 2003). It was the new 1996 Constitution and the Higher Education Act of 1997 that later made Colleges part of the Higher Education system which was then deemed a National concern and no longer a mere Provincial concern. This shift in governance was to influence great changes in teacher education. In July of 1997, a program was designed to assist the transformation of Higher Education, it was called “Education White-Paper 3”. A task team was appointed to review the college sector and determine the degree of alignment and necessary re-alignment for the incorporation of the colleges into a holistic higher education system. By July 1998, a framework for the incorporation of the Colleges into Higher Education was drafted in the form of a report. The report identified that some colleges were able to function as autonomous higher education institutions as long as they could secure an enrolment of 2000 full-time students. Other colleges were earmarked for incorporation into existing universities and technikons. Colleges deemed suitable for incorporation into the Higher Education system, started restructuring their colleges to suit the labour laws of the Higher Education system as well as revamping their programs to suit the required standards and quality demanded by the South African Qualifications Association (SAQA) and the Council of Higher Education (CHE). The restructuring process led to mergers and in some instances the relocating of various departments.

Colleges of Education declined over time as it became too expensive to keep them running owing to low enrolments. Also, the quality of the education being offered was questionable and consequently the qualifications they offered, as teacher educators were often not qualified in accordance with Higher Education standards (Parker, 2003). Colleges were more like schools, with small numbers, teacher educators often knew all their students by name and worked closely with them. Classes were often practical, as time and numbers allowed for this sort of engagement. The mergers and restructuring threatened a change to all that. The under-qualification of teacher educators and therefore of teachers resulted in the major focus of teacher education during 2001 and 2003 being the reskilling and upgrading of

teachers and not the pre-service program. This focus was compounded by the change of curriculum to the OBE oriented Curriculum 2005 and the need for teachers who were equipped to implement this curriculum. According to Steele (2003) KwaZulu-Natal (one of the nine provinces) specifically, during the period of 1993-1994 had employed 45% of the total number of unqualified teachers employed in South Africa. The hiring of unqualified teachers occurred as a short term solution to the high demand for teachers in the rural areas.

Enrolments at Faculties of Education within Higher Education institutions declined owing to the decline of individuals that received an exemption pass in Grade 12. There was also a decline in enrolments at the Colleges due to the tightening of College subsidies and the number of governmental bursaries being offered, as well as the fast growing private sector. This occurrence further motivated the restructuring process. Due to the statistic that showed 20% of Higher Education enrolments were for teacher education, it was decided that it would be worthwhile to restructure Higher Education to incorporate the Colleges (Parker, 2003). At a meeting with members of the KwaZulu-Natal Organisation of Teacher Educators (KNOTE) prior to the restructuring, it was unanimously agreed that teacher educators should enter into the Higher Education system as an individual autonomous body that would decide its own curriculum and have its own structures. This proposal was turned down by the National Commission on Higher Education (NCHE) who wanted a single Higher Education system and also felt a pressing need to align existing education programmes with the National Qualifications Framework (Steele, 2003).

“The public higher education system had experienced ten years of financial constraints and many other challenges. [...] By 2000, only a minority of institutions were financially healthy and there were few institutions on an enrolment/economic growth plan. In addition, overall research capacity was weak.” (Parker, 2003, p.36)

The realization that research capacity was weak and that research productivity affected government subsidies to the institutions sparked a strong focus on research productivity, a culture that is still strong today in public higher education institutions.

By the end of 2000 the number of education colleges had declined from 50 (having 15 000 students) to only 25 (having a total of 10 000 students). There were also two distance learning colleges which trained a total of 5000 students. While the tertiary education system was undergoing drastic changes so was its curriculum.

2.1.2. Curriculum Change

Due to a strongly-divided history, the focus of education policy in South Africa has been towards attaining an education system and policy that promotes a democratic process of learning and an equal quality of curriculum delivery (Smit, 2005). The Department of Education (DoE) “..issued several curriculum-related reforms intended to democratize

education and eliminate inequalities in the post-apartheid education system.” (Jansen, 2006, p.321)

In order to address the divisions that permeated previous Christian National Education policy under the then-ruling Apartheid system, curricula were cleansed of all prejudiced slants, comments and materials. Shortly afterwards Outcomes Based Education (OBE) was introduced as a formal curriculum known as C2005 and began incorporation into the South African Education systems in 1997. This curriculum was intended to be fully infused in South African schools by 2005. OBE was an attempt to remove the previous teacher-centred pedagogy and content-focused curricula and make learning more cooperative and goal focused, bringing all learners to the finish line in an equitable way. However it was soon realised that due to “...existing inequalities and the realities of under-resourced schools which had large classes and teachers largely untrained in learner-centered education and making their own curricula.” (Chisholm, 2003, p.6) teachers needed more guidance. This led to the formulation of the Revised National Curriculum Statements (DoE, 2002), Grades R-9 and the National Curriculum Statement Grades 10-12. These statements aimed to create lifelong learners who were literate and numerate and therefore able to participate as informed and responsible citizens, ultimately contributing to the South African economy and social development (OECD, 2008).

There were further challenges experienced with the implementation of these two policies which therefore led to the 2009 curriculum review which concluded in the compilation of the Curriculum and Assessment Policy Statements (DBE, 2011). These statements were designed to explicitly outline the valued knowledge, skills and values meant to be developed through the content taught under each topic in the curriculum. The CAPS was developed for each subject in an attempt to address the weak knowledge and quality presented in the previous policies in retaliation to the apartheid content-focused curriculum.

It was not only the overhauling of school education that was taking place, Higher Education was having its fair share of policy changes and institutional mergers (Kruss, 2008; Reddy, 2009). For reasons of economic viability and democratization, teacher education colleges which were numerous and thus fragmented were no longer able to focus solely on the production of teachers. They were now forced by the Department of Education (depending on their student enrolment figures) to join existing universities, pooling their resources and adopting a university lecture-type culture. Teacher educators were often engaged in resource development, keeping up to date with the developments in their field. Upon the mergers however, teacher educators were also required to adopt new roles and responsibilities with regard to increased student numbers and therefore a higher workload, a lecture style of teaching and research productivity.

A thorough exploration of the policy developments and changes both in school education and tertiary education has been provided in Article 2. It is not my desire to explore it again here, but merely to introduce to you a taste of the issues that surround South African

education. Understanding the teacher education context provides insight into the challenges and changes facing teacher educators, and may also enlighten one as to why professionals prioritize the development of certain competencies in teacher education, however as stated in my articles, it is not assumed as a given.

2.2. The Context of the Specific Case

2.2.1. *Securing the Participants*

One Teacher Education Institution (TEI) in South Africa was selected as a case for this study owing to its high rate of response to what turned out to be a pilot web-based survey. More specifically, eight teacher educators were further selected from the Science and Technology Education Department at this institution. This was after the acting dean made reference to the department as probably the only department that was making active attempts to reorient their department towards Sustainable Development (SD). It was only upon meeting with the teacher educators of the department later that it was realized sustainable development per se was not a conscious focus of the department.

The Science (2) and Technology (6) teacher educators that eventually participated in the study represented a very mixed group. Diversity went as far as gender, race, expertise, age and experience. The head of the Technology group (also a trusted guide and mentor who has managed the department for many years) welcomed me into the department and arranged an initial meeting with my prospective participants.

The participants consisted of two males in their 40s, and six females ranging from their early 30s to late 40s. The group exuded a noticeable degree of enthusiasm about their subjects and roles as teacher educators, yet showed a particular degree of disappointment regarding their conditions, which was to be explored later. I would describe these teacher educators as inspirational and passionate about their areas of expertise, which ranged from HIV and gender education to Indigenous and alternate knowledge systems. Often teacher educators described how they incorporated their passions into their practice. Yet often this was followed by undertones of disappointment regarding their lack of freedom to further explore their passions owing to various limiting factors. Although teacher educators were most supportive and helpful during the research process, it was often difficult to secure meeting times, due to their busy schedules.

2.2.2. *The Teacher Education Institution*

The Teacher Education Institution selected according to response rate and willingness to participate is located along the east coast of South Africa. The institution, previously an independent college, underwent a restructuring process, commissioned by the Department of Education, merging with a local University and becoming redefined as a University based entity. This involved a reformulation of functions and roles, the accommodation of which is still a challenge experienced by academics today. As an example of such a challenge, teacher educators at the University are not only expected to design curricula and improve the

quality of teaching and learning, they are now also required to obtain higher qualifications and publish regularly (Reddy, 2009).

The institution is a previously white college of education however it has accepted people of all races since 1994. Many institutions from 1997 were directed to lower their enrolment numbers as a result of the outcomes of the Teacher Audit study in 1995 and the 1997 Teacher supply, utilization and demand projections which showed that there was an oversupply of teachers. This resulted in no more state bursaries being offered and the eventual incorporation of this college into a recognized Higher Education institution. This college of education, now known as a 'school of education' within an existing University has been, and still is, considered well-resourced.

This particular institution has well-kept gardens, entertainment and sporting facilities, residences for students, well-equipped laboratories and lecture rooms as well as a frequently updated Library which provides a variety of different journals, books, dissertations, CDs, DVDs and other teaching materials. Students have access to a number of different computer rooms which are equipped with current technology. Some lecture rooms are equipped with interactive boards and media. A large number of the students who attend this institution, however, do come from rural areas yet a large number are funded by bursaries that are available to assist those who cannot afford to fund themselves.

The School of Education runs a Bachelor of Education (B.Ed) programme as well as other post-graduate education programmes, involving both part-time and full-time students. Teacher educators' engagement in the Bachelor of Education Programme (B.Ed) formed the focus of this study however it does not comprise the total responsibility owned by the teacher educators, for many participants are also engaged in post-graduate modules.

The school of education trains students to become teachers ranging from Grade 0 to Grade 12. The Bachelor programme enables students to become generalist (foundation teachers) and specialist teachers in disciplines pertaining to Mathematics, Sciences, Technology, Languages, Travel and Tourism, Guidance, Arts, Accounting and Business Management. Science and Technology form one of the departments at this University and the department engaged in this study.

One can begin to understand the degrees of change that teacher educators at this teacher education institution have undergone when casting back to the challenge facing education colleges in 2000. Colleges were forced to close if they could not secure a minimum of 2000 students. Now the challenge is quite the opposite, where teacher educators are faced with increasing enrolments and therefore larger classes, sometimes 300 in a single lecture room. This has changed teacher educator's political identity from teacher to that of lecturer (Jansen, 2003).

3. Laying the Theoretical Foundations of the Study

This chapter begins by briefly outlining the steps that were made towards the development of the United Nations Decade of Education for Sustainable Development (UNDESD). The chapter goes on to define what this type of education aims to achieve. Findings from the 2010 halfway report on the progress of the UNDESD and the strategy for the second half of the UNDESD are presented here. These findings imply the persistent need for ESD in South Africa today.

This chapter also serves to lift sustainability-related concepts, define and discuss them and in some instances critically evaluate their value. As an example, sustainability literacy and sustainability competences are defined in an attempt to identify the knowledge, skills and values that are promoted through ESD. Through an exploration of various views on sustainable literacy a point is raised that one should not focus on trying to change behaviors, for fear of an autocratic education. Rather ESD should focus on the empowering process of encouraging critical reflection on sustainability issues. This is supported by a brief exploration of Action Competence.

Not only are concepts defined but roles also. The roles that educators need to play in realizing an ESD is also emphasized in this chapter. This role is defined through a brief exploration of Agenda 21.

This chapter substantiates the relevance of ESD in HEIs and highlights the current national ESD-oriented programmes that are in place. South African Higher Education and its seemingly complacent response to realizing sustainable development is questioned. The chapter describes a major southern African study that undertook to report on the implementation of the United Nations Decade of ESD goals in Higher Education. The chapter concludes by reflecting on the future of ESD in South Africa and by suggesting that a guiding sustainability policy be formulated. The structures that should be involved in such a policy are listed.

Finally this chapter explains how an exploration of literature on ESD assisted in the design of an ESD competency framework which was later used to analyse teacher education related policies. At this point readers may ask: 'Why was a framework developed prior to the exploration of the case, as opposed to emerging as a product of the exploration?' To recall, the institution chosen was not an ESD oriented institution, meaning ESD competences were not a focus of their practice. This meant that it was necessary to use extensive literature to construct an initial ESD competency framework which we could use as a benchmark to examine policies and practice. However, once engagement with the case had occurred, the data did lead us to constructing another useful Higher Education for Sustainable Development (HESD) framework. This HESD framework incorporated the new learned complexity of the organisation in a model for HESD orientation and is presented in chapter 5.

3. 1 Why an Education for Sustainable Development in South Africa?

It was at the United Nations Conference on Environment and Development (UNCED, 1992), also known as the Earth Summit, that the term 'Sustainable Development' was acknowledged and promoted. It was also at this conference that Agenda 21 was adopted. Agenda 21 is an implementation plan for achieving sustainable development in developing countries. The fulfillment of Agenda 21 is proposed by addressing specific relevant needs and challenges that various developing countries had put forward.

Chapter 36 of Agenda 21 is dedicated solely to education. Chapter 36 (UNCED, 1992) identifies the important role that educators play in promoting sustainable development. Educators are recognized as having the power to integrate relevant aspects of sustainable development into a more meaningful education.

It was after the adoption of Agenda 21 that in December 2002 the United Nations General Assembly adopted the United Nations Decade of Education for Sustainable Development (2005-2014). The United Nations Decade of Education for Sustainable Development is a plan that is led by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and started on 1 January 2005 and extends to the end of 2015. The goal of the UN Decade is to merge the principles, values and implementation of sustainable development into the education sectors (UNESCO, 2005a). The goal is that education orientated in this way will ensure a more sustainable society where environmental, societal and economic aspects are managed responsibly. South Africa forms part of the United Nations and is thus compelled to follow the aims and objectives outlined within Agenda 21 (UNCED, 1992) and the UN Decade of Education for Sustainable Development (UN, 2002).

Educators have been viewed as valuable and critical implementers of ESD outcomes in their practice. This claim is supported by UNESCO:

"We cannot imagine how the people of all nations could move toward a more sustainable world without the contribution of educators from around the globe." (UNESCO, 2005a, p.11)

It is not enough to see educators as mere implementers of policy but rather as designers of the delivered curriculum.

The attainment of such sustainable literacy is especially crucial in the developing countries of Africa. This is clear when analysing the 2010 report by the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2012). This report reveals what had been achieved within the first five years of the United Nations Decade of Education for Sustainable Development (UNDESD) as well as the strategy for the second half of the UNDESD. The strategy suggests generally that educators' pedagogical practice be developed by supporting educators with regard to how they might develop ESD teaching and learning strategies. The strategy also refers to Africa specifically.

In Africa, the re-orientation of education towards sustainable development requires the strengthening and boosting of the quality and efficiency of capacity development initiatives (education, training, community development and public awareness programmes) to address the relevance of education to development and poverty alleviation objectives. (UNESCO, 2010, p.5)

This suggested strategy revealed that five years into the implementation there was still an urgent need to provide guidance on re-orientating education towards sustainability. Having delved into a Teacher Education Institution during this study, I saw the need for guidance on how to develop ESD teaching and learning strategies is still a persistent need.

The potential contributions to enhancing the quality of education and, ultimately the quality of life in Africa are enormous as ESD can help address a number of key needs in the region. (UNESCO, 2010, p.6)

According to the South African Case Study that reports on Education for Sustainable Development in the South African teacher education system, "...the previously numerous efforts to strengthen environment and sustainability in Teacher Education have failed to make systemic impact." (ADEA, 2012) It is clear that a reorientation of education for sustainable development is a vital point for attention. This research attempts to shed light on the factors that contribute to such failure, providing a more informed entry point into the higher education system, suggesting possible avenues and strategies for successful participation.

On a personal level, over and above what national and international reports reflect, as a Life Orientation teacher at an all boys' secondary school, I can see the danger of 'business as usual'. I have spent 3 months (1 term) teaching boys from Grade eight right through to twelve without covering even a single reference to any issues of sustainability. Yes we have looked at social issues such as HIV, human trafficking and unemployment, but not a single reference is made in the syllabus about the interlink between us as a community, our economy and the environment. When I ask my grade eleven and twelve learners what they want to do one day when they leave school, responses mostly fall into the engineering and entrepreneurial arenas. One day soon these young men will leave and go on to shape both my own and my children's futures.

The school where I teach, requires that the boys perform community service (this is not a Department of Education specification) and occasionally they engage in beach clean-ups or assist in raising money for charities. These activities of community service, as important as they are, do not provide opportunities for the youth to come up with creative solutions to social, economic and environmental problems. As a teacher I am also at fault, for time limitations are not the issue. Rather it is because the incorporation of sustainability into the curriculum is not a school or department requirement that I can get away with being

complacent. From a personal standpoint, I can see that ESD in South Africa needs to claim more ground in subject curricula if we are to experience the fruits.

From a South African perspective, because poverty is a primary concern, it is understandable that education focuses on societal needs as opposed to environmental ones. South Africa due to its apartheid history is over-concerned with the equitable access and distribution of resources and less with environmental justice. It may even be tempting to resign oneself to the notion that sustainable development is relevant to South Africa, so long as it is realistic, tending to the pressing 'social' needs.

When referring to "learning for sustainability that is more realistic" (Summers, p.209) I feel one should be careful about taking Huckle's expression of a 'more realistic' sustainability that is focused on socio-political issues and interpreting this to mean that ecological issues are not as realistic as, or are even unrelated to, socio-political issues.

From a South African perspective I can reflect on the 'more realistic' socio-political issues and how these also concern ecological issues. For example, Rhino poaching and horn trade is a real concern. The future of the Rhino at this point is questionable. However I think it is important to understand that Rhino horn trade is a real source of income for locals who are unable to access income by employment in the public sector. Also consider the temptation to develop land in the hope of generating revenue and simultaneously creating jobs for the masses. Social and economic development only ever serves to sustain humans. Humans exploit their resources to secure wealth and a quality of life. Social inequity truly does restrict the equal distribution of and access to a quality of life. Yet if the natural environment is over exploited access to, and distribution of, quality living won't be a social decision, it will be nature's'. My point is, what is 'more realistic' to society does not concern what is probable in nature and seeing that we depend on nature and its resources, I suggest we stop compromising around a 'more realistic' learning for sustainability. This means using human resources, knowledge and skills to respond to ecological issues, consequently and simultaneously responding to social-needs. This implies that education needs to prepare citizens to engage in this type of critically reflective thinking and encourage creative solutions.

3.2 Engaging Perspectives in Education for Sustainable Development

3.2.1. *A Smorgasbord of Sustainability Related Terms*

This study uses terms such as sustainability, sustainability literacy, sustainable development, competency, action competence and Education for Sustainable Development interchangeably. All of these terms have been criticised for their lack of clarity, ambiguity and unhelpfulness (Jickling, 1994; Pittman, 2002; Barsan, Nastasescu and Barsan, 2011, Bentham, 2013). It is not my desire to reiterate the terminologies when article one presents an exploration of such terms. Article one also formulates an ESD framework that attempts

to capture the main principles of ESD. It is my intention to engage all of these terms in a merging discussion around sustainability education and what it possibly involves.

Wals and Jickling (2002) however put forward that sustainability is an important term. Its level of usefulness on the other hand is dependent on how much we are willing to admit to the concept's limitations. These limitations can then be acknowledged and even engaged as the conversation on sustainability and sustainability education evolves. Wals and Jickling (2002) highlight two such limitations. First the term "sustainability" or "sustainable development" means to constantly develop, yet the concept itself does not provide any indications as to how this could be achieved. The second limitation is that an education that promotes such sustainability (ESD) implies an education that promotes an inherently good ethos that is incontrovertible. The reality is that the term is neither uncontested nor is it clearly defined. By realizing these limitations, one is able to engage in discussions around sustainability in a manner that is critically reflective, informed and open to new ideas. These limitations were revealed to teacher educators during the study. This openness offered them confidence to reveal what they understood by ESD and how they felt their practice aligned with ESD. Otherwise teacher educators would have easily felt ignorant and hesitant to share this 'self-perceived' ignorance.

Wals and Jickling (2002) also refer to the unhelpfulness of being overly concerned about the ambiguity of 'sustainability' as a term and that rather it is more useful to focus on the known and agreed-upon attributes of sustainability education. Such attributes include the knowledge that the term "sustainability" has an evolving nature, it is contextually understood and applied and its degree of dissonance is a useful tool for igniting critical and creative thinking.

It is at this point that I find it necessary to take a brief moment to clarify what is meant by creative thinking, how it relates to critical thinking and ultimately how, collectively, they lead to action competence. These three terms will be used most popularly from this point on and so their brief introduction here is warranted.

Creativity is displayed through three components (Amabile, 1998): expertise (i.e. practical and intellectual knowledge), critical thinking skills (i.e. flexibility of thinking beyond the status quo) and intrinsic motivation (i.e. an inner desire to solve problems). Education for Sustainable Development encourages a critical reflection on paradigms that support current unsustainable development in the aim of understanding their supporting mechanisms. Through an understanding of the mechanisms that drive unsustainable development we can begin to understand how these same mechanisms can be reoriented to create sustainable solutions that address social, economic and ecological justice in communities.

According to Sterling (2003) most learning institutions engage in this transmission of knowledge whereby learners aspire to master the content. Sterling (2011) adds that this

level of learning is valuable however it poses a barrier in circumstances where transformative learning is needed for deep change.

The transition to the second order of learning may be seen as a challenge, calling upon a meta-level of analysis and learning (Sterling, 2011). This occurs when learners are encouraged to question the basis on which accepted principles and assumptions exist. Suddenly it is not most valuable to master the accepted knowledge of the field rather it is more valuable to be able to problematize knowledge, searching for creative possibilities. So rather than being only concerned with the efficiency of knowledge, one becomes concerned about the purpose and value of such knowledge (Sterling, 2011). This signifies a move from a technical way of learning to a critically reflective and creative way of learning. Jickling and Wals (2014) describe this process as moving beyond sustainable development to enabling ideas and action.

It seems that the very critical and creative nature of ESD is what makes it so difficult to implement. ESD is meant to be transformative, self-critical and most importantly not indoctrinating. This steers people away from defining ESD in their context for two main reasons. First one requires an advanced level of knowledge of local and global issues, how their discipline relates to such issues as well as a variety of skills to explore creative solutions for such issues. Second is the fear of designing a curriculum that is driven by personal professional interests/concerns which may run the risk of being seen as indoctrinating. We pose that as educators we must face our fear it is our duty and accepted role as life-long learners. As educators we need to consistently advance our discipline-knowledge drawing relevance to local and global issues. We need to create teaching and learning approaches that allow learners to draw on discipline tools (knowledge and skills) in order to formulate creative decisions and solutions regarding locally relevant issues. Learners need to be encouraged to reflect critically on the extrapolating consequences of their own and other's decisions. These consequences fall into three main spheres that interconnect: society, economy and the ecological environment. Teaching learners to understand and foresee the consequences of their actions and decisions and then to actually care about these is an emotional education, but it is also socially and environmentally just. Summers (2013) similarly referred to 'ethics of care' (p.211) whereby student teachers are able to connect their discipline to ESD principles, becoming active change agents. This is specifically where critical and creative thinking lead to action competence.

This translates into an education that encourages learners and students to reflect on how society and its ideologies have changed over time. Also to understand the effects that such changes have had on politics, the global economy and the ecological environment. It would also mean that curricula would have to engage learners and students in real life issues at a local level, developing their capacity to solve real problems and make meaningful decisions about issues that are not contrived. This means that educators need to be more than just positive towards the idea of ESD (Stevenson, 2006). Educators would also need to

consciously consider how they might link principles of an ESD to their professional lives, i.e. curriculum design and research. This sort of education would also encourage learners and students to identify how their local issues exist within a global community.

Simply, an education for sustainable development promotes the development of knowledge, skills and values oriented around an achievement of a more sustainable sort of development (Bentham, 2013). Naish (2009) writes about a culture of wanting more, which extends to every avenue of human existence. He adds that such dissatisfaction in what we already have sets the scene for anticipated ecological demise. It is due to a similar realisation that Sterling (2004) emphasised the need for a sustainable education.

Sustainability implies a change of fundamental epistemology in our culture and hence also in our educational thinking and practice. Seen in this light, sustainability is not just another issue to be added to an overcrowded curriculum, but a gateway to a different view of curriculum, of pedagogy, of organisational change, of policy and particularly of ethos. (Sterling, 2004, p.50)

Sustainable literacy has been described by Stibbe and Luna (2009) as a type of wisdom that encompasses any knowledge, skills, attitudes and values that assist in reducing the rate of negative impact on the world today and in the future. For it is when one engages in “*..self-reflection, self-directed enquiry, learning by doing, engagement with real life issues, and learning with communities of practice,*” (ibid, p.11) that one can meaningfully acquire the knowledge, skills and values that are in line with sustainable living.

According to Wals (2011) *sustainability competence* is displayed when one responds to sustainability issues having considered: (1) the past, present and future generations; (2) knowledge and perspectives from various disciplines; (3) multiple cultural perspectives; and (4) the local, regional and global implication of the issue. Education should promote an appreciation for multiple mind sets/perspectives (Wals, 2011).

For Parkin, Johnston, Brookes, Buckland & White (2004), sustainability literacy refers to the use of knowledge and skills to act in a way that recognises and favours sustainable development. However Wals (2011) warns promoters of ESD to be careful not to fall into the trap of using instrumental approaches to influencing human behavior. For education is not to be used as an instrument to attain a desired behavior. Education should rather be empowering, reflective and transformative. Instrumental approaches to ESD will only result in the development of a society that is unable to critically reflect on important issues later (Wals, 2011; Jickling & Wals, 2014).

ESD does not and should not focus on behavioural change, for it would be in danger of becoming indoctrination. Rather ESD should focus on developing individuals critical, reflective and participatory capacities in society, equipping future citizens to make informed decisions that impact futures. These informed decisions need to also be accompanied by

action. Action that is informed and purposive is what is meant when we refer to ‘action competence’ (Mogensen & Schnak, 2010). Action competence is an ideal ‘bildung’ not a single manifesting goal. Mogensen and Schnak (2010) substantiate the complimentary relationship they draw between action competence and education for sustainable development, for “ESD without a democratic action competence perspective very easily becomes dogmatic and moralistic.” (p.62)

One cannot refer to an action competence however one can refer to ESD competences that promote an action competence approach to teaching and learning. Similarly, ESD indicators are not meant to represent definitive measures of content or skills in teaching. Rather they represent an ideal (Mogensen & Schnak, 2010) or aspiration towards engaging in a type of teaching and learning that aims to develop beyond the measurable units of knowledge content. Indicators have become a popular way to evaluate the degree to which ESD is embedded in existing curricula (Reid, Nickel & Scott, 2006; Tilbury & Janousek, 2006). It was out of a desire for clarity, or at least a skeleton on which the flesh could be placed, that the ESD framework was designed from an exploration of literature (See article 1). This framework was used to add meat to a discussion on South African policy priorities and to identify in what ways they fell short of a realization of sustainability. This insight would later assist in identifying the repercussions these deficiencies would have on the attainment of sustainable development (See article 2).

It is only in Article 3 and 4 that the term ‘competences’ is preferred. The term ‘competency’ is adopted due to its neutrality. It does not presume knowledge of educational objectives for sustainable development and thus served as a better term to use during interviews with teacher educators. Competency development is a well-known and popularly referred to term in education and thus was deemed appropriate when other terms were not.

3.2.2. ESD in South Africa

Education for Sustainable Development combines earlier Environmental Education with UNESCO priorities. UNESCO identifies ESD as a way of addressing the Millennium Development Goals (MDG’s) with relevant impact (Lotz-Sisitka, 2006). With regards to the Sub-Saharan strategy for the implementation of the UNDESD goals, it has been emphasised that these be embedded within local African cultural and knowledge systems in order to be contextually relevant and meaningful (Lotz-Sisitka, 2006).

Heila Lotz-sisitka is a professor at Rhodes University in South Africa and she also serves on the UNESCO’s international reference group for the United Nations Decade on Education for Sustainable Development. Realising that UNESCO policies are developed and reported on by a global community, renders critiques of implementing western policies in Africa, inconsequential.

Lotz-Sisitka (2006) reports on the major findings from the SADC-REEP consultation process during 2005 to 2006, which reflected on the participation of southern African countries in the United Nations Decade for Education for Sustainable Development. The four major findings covered the following areas: (1) there is inadequate knowledge about and debate on sustainable development; (2) partnerships and networks are needed to engage in ESD practice meaningfully; (3) ESD practice and how it is viewed; (4) ESD practice needs to be supported through leadership, curriculum development, professional capacity building, institutions and policy. This study provides more insight into these findings.

Lotz-Sisitka (2006) reflects on the kinds of sustainability debates and discussions that stakeholders should be having. She comments on Rosenberg's (2004) observations that current economic growth in Sub-Saharan countries is not reducing unemployment rates due to many economic development models mimicking capitalist principles. A large portion of southern African wealth is attributed to its natural resources and not its skills, resulting in the export of its resources (the main source of commodity) even though joblessness is persistent. Another misconception that exists is that increased economic growth (GDP) assists in the reduction of poverty, however there is still no evidence to suggest this is the case (Rosenberg, 2004). Lotz-Sisitka (2006, p.14) posits that the view 'poverty is due to a lack of economic growth', is one that has shifted the focus of discussions in sustainable development from 'sustaining resources' to a focus on 'sustaining development'.

Hattingh's (2004) strong model of sustainable development helps to address the deficit of those views on sustainable development that emphasise one particular pillar by reducing the value of the other pillars. Hattingh (2004) suggests that all pillars are significantly linked.

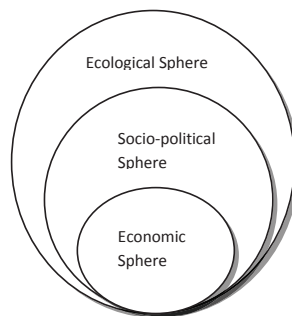


Figure 1. Hattingh's (2004) Model of Strong Sustainability

Lotz-Sisitka (2006) commented that the SADC-REEP consultation process reports popularly referred to the crucial contribution that partnerships and networking were identified to make towards ESD practice. Successful ESD implementation "...requires participatory, active and learner centred methodologies." (Lotz-Sisitka, 2006, p.20) However it is acknowledged

that a great challenge facing educators who wish to delve into ESD is the development of specialised tools. Tools pertain to the skills educators would need to develop in order to engage in multi-faceted issues with their learners/students (*ibid*). This finding re-emerges in this study.

The consultation process (SADC-REEP, 2005/6) pointed out the need for critical and creative thinking to be developed further in the types of learning activities that learners/students engage in. Lotz-Sisitka (2006) lifted from the SADC consultation reports some of the possible teaching and learning approaches that could be used to promote critical and creative thinking. These approaches included: case studies; role plays; debates; open-ended question posing; excursions; hands-on activities; dramas etc. (Lotz-Sisitka, 2006, p.22)

Jickling (1994) contested ESD during its inception years, commenting that an education ‘for’ anything was dubious and bordering on indoctrination. However since then efforts have been made to explain the critically reflexive nature of ESD (Wals, 2011) as ESD encourages the critique of knowledge, questioning the very foundations on which current curricula rest. Lotz-Sisitka (2006) touches on the critical nature of ESD through an appreciation for alternate knowledge systems, “Another significant area of discussion in the consultations centred on knowledge and its origins, its construction and how different ways of knowing (epistemologies) are to be accommodated and worked with in ESD practice.” (Lotz-Sisitka, 2006, p.22)

ESD practices will not be realised if support is not gained from institutions and policy (Lotz-Sisitka, 2006). This study provides evidence to suggest that teacher educators cannot be landed with the responsibility of orienting education towards ESD without support because there are many factors that work against their successful achievement of this task. The study also shows that in fact leadership and policy does make a difference to curriculum design and competency development. The study reveals that national policy for South African school education as it stands, is not equipped to make a difference towards ESD, even though Education Ministries stake claim to addressing the needs of the country.

Lotz-Sisitka (2006) reflected that one of the strongest points made about policy review within SADC consultation reports on the response to the UNDESD, was that a “..greater policy synergy..” (p.24) would need to be established. Lotz-Sisitka (2006) further elaborated that this would involve more than the aligning of policy objectives, but would also require a deeper insight into the “..premises of the policies themselves..” (p.24). She consequently pointed to the need for research in this area. Lotz-Sisitka (2006) also identified the need for research agenda that “..establish frameworks for conceptualising and evaluating quality in ESD practice and support mechanisms.” (p.30)

3.2.3. *ESD and Higher Education*

According to McKeown (2012) after 20 years ESD has become part of teacher education discourse. This is because globally the teaching community better understands that ESD is concerned with active participatory based approaches to teaching and learning. McKeown (2012) poses that, owing to more and more examples of good ESD practice, Education ministries are more equipped and motivated to write policy that requires ESD to be embedded in teacher education. There are programmes and projects in South Africa that are focused on providing examples of good practice in the attempt to influence policy (as in the National Environmental Education Programme (2001) and the Eco-Schools project) however these are yet to permeate teacher education programmes on a national scale (ADEA, 2012).

One of the things that has changed since 1992, according to McKeown (2012) is that ESD is included in conversations about 'quality education'. This is especially so in countries where the fundamental purpose of education is being re-evaluated and sustainability is being added as part of the focus. However the contextual nature of sustainable development implementation should not be forgotten. In South Africa, economic empowerment and social justice has priority. Although these aspects of Sustainable development are being considered, the greater unsustainable development trend is persistent as the capitalist-driven economy serves to degrade ecological systems. At a national curriculum level, although attempts have been made to embed principles of sustainable development (REMA, 2010), these are not explicit. Also the active participatory approaches to learning (i.e. ESD pedagogy) which need to support the conceptual development of SD issues is not developed in the national school curriculum.

According to Gadotti (2010), '...experiential and participatory social learning...' (p.206) must be engaged in order to successfully embed sustainability in the formal curriculum. One of the challenges of orienting education towards sustainability is overcoming the tendency of practitioners to resort to greening activities in the classroom, in the attempt to address sustainability. This means developing sustainability competence through the formal curriculum requires more than just greening techniques such as the 3 R's (Reuse, Reduce, Recycle), their value notwithstanding. It must also engage learners in critical and reflective thinking about current issues, consider the complexity of these issues, and encourage a pluralistic and active participatory pedagogy (Gadotti, 2010).

"Unless we are able to translate our words into a language that can reach the minds and hearts of people young and old, we shall not be able to undertake the extensive social changes needed to correct the course of development." (Brundtland, 1987)

McKeown (2012) comments that teacher-availability, coupled with teacher quality impacts heavily on one of the main thrusts of ESD, which involves securing access to a quality basic education. Teacher educators in this study revealed professional concerns relating to the calibre of students entering the Bachelor of Education Programme (B.Ed). These concerns

related to the lowered entrance levels which is a direct result of trying to address the issue of too few teachers in the country. This need relates directly to the satisfying of the millennium development goal which promotes an education for all. This issue of low calibre was to resurface when teacher educators reflected on why assessments did not engage students in community-based decision making or active participatory approaches to teaching and learning.

Universities in the United Kingdom and the United States have declared their interests in making *sustainability literacy* a compulsory component of their university programs, to ensure that graduates are equipped with a sustainability literacy competency (Rowe, 2007; De La Harpe & Thomas, 2009). The implementing of sustainability in higher education appears to be a global trend that is motivated by the observations of unsustainable development in all areas of advancement. It is popular knowledge that nation's most directly affected by unsustainable development are those labeled 'developing countries', such as those in Africa. This begs the question, should South African Universities not be at the front of this initiative, striving to ensure that South Africa and its populations (both fauna and flora) are protected from resource depletion and unsustainable forms of Multinational corporation development schemes?

It is recognized now more than ever that because higher education institutions prepare individuals to become influential people in society, such as business owners, decision-makers, property-developers, project-leaders and teachers, they therefore also carry the responsibility of influencing the course of societal development (Fien, 2002). This study supports the idea that Universities have a prime position in preparing society for responsible decision-making. Wals and Jickling (2002) pose that it is the fundamental duty of the university or any higher education institution to critically address and reflect on knowledge claims that influence society in some way. They draw direct lines from this responsibility to the needed contextualization of sustainability. The ambiguity applied to sustainability needs to be debated and reflected on by stakeholders of higher education platforms. Universities are meant to be the agents of informed citizenship. If sustainability is not being explored at this level, how can one expect citizens (smallest units of sustainability) to grapple with the concept? By engaging in the sustainability debate it offers a genuine opportunity for higher education institutions to reflect on their vision and mission statements. This HEI self-reflection should search to find ways in which they are contributing towards sustainability (Wals & Jickling, 2002). My study reports on this very activity in article two.

The need to orient higher education institutions towards sustainability was noted through the formulation of the Talloires Declaration (ULSF, 1990) which has been signed by hundreds of Universities around the world. It is however significant to note that only five South African Universities have actually agreed to its terms.

The Talloires (ULSF, 1990) sets out ten required actions for institutions to agree to, these include: (1) to increase an awareness of environmentally sustainable development; (2)

create an institutional culture of sustainability; (3) educate for environmentally responsible citizenship; (4) foster environmental literacy for all; (5) practice institutional ecology; (6) involve all stakeholders; (7) collaborate for interdisciplinary approaches; (8) enhance the capacity of primary and secondary schools; (9) broaden service and outreach nationally and internationally; and finally (10) maintain the sustainability movement. These are ten necessary and very useful steps to consider when consciously reorienting an institution towards an address of sustainability. However their contextual implications are complex and require an understanding of the higher education system.

Stephens, Hernandez, Roman, Graham, and Scholz (2008), suggest that higher education should contribute towards sustainability social change at three levels: strategic, tactical and operational. The strategic level involves the setting of long-term goals for sustainability; the tactical level involves securing and nurturing stakeholder participation and relationships for sustainability; and finally the operational level involves the practical implementation of change for sustainability through the taught curriculum, campus operations and research. Teacher education institutions would not specifically be equipped to make suggestions about how engineering, the economy and energy generation methods could employ sustainable measures. However, it should at least be exposing student teachers (and eventually their learners) to an awareness of how the environmental, societal, economic, scientific and technological changes impact sustainability. It should also challenge student teachers to consider how they can make a practical difference at a school level, with regards to HIV, poverty, resource depletion, individualist attitudes and values etc.

This study sheds light on the operational level. It does so by highlighting the existing sub-systems at play in a higher education institution and the importance of understanding these systems if sustainability is to be realized. These sub-systems needed to be explored, to better understand the existing attitudes towards change generally.

De La Harpe and Thomas (2009) suggest three important thrusts for successful curriculum change at the practitioner level. First the change-process needs to be understood, in that the context for change needs to be fully defined. This includes understanding where the stakeholders (teacher educators in this case) of the change process stand in terms of motivation, interest and perceived ability to participate in the innovation. It is also necessary to identify any external factors impacting their practice as these also affect willingness to participate in change. The interviews with teacher educators were engaged to understand teacher educators' attitudes towards change. This step was the foundation for successful change implementation in the future as it sought to understand the factors at play. Second, it is important to determine why change is needed. This requires stakeholders to be co-active with initiative drivers, in discovering what about current practice is insufficient to meet current needs. Therefore curriculum and university policies as well as teacher educators prioritized competency development were analysed. This analysis consequently revealed the need for a focus towards sustainability education. Finally the

third thrust requires an implementation of the suggested change. This requires an allocation of institutional priority and resources to the cause. I hope and believe that the implications revealed through this research (highlighted in the concluding sections of this extended abstract) suggest a way forward for implementing successful change.

Soft Systems Methodology (Checkland & Scholes, 1990) allowed a participatory discovery method whereby teacher educators were able to reveal their thoughts on the possible transition. Article four reveals the existing rich picture depicting their current situation. Article four also juxtaposes this rich picture against a notional picture of implementing sustainability through the Bachelor of Education programme. Brownlee (2000) notes one of the main reasons for change-resistance is when stakeholders are not involved in the change process. Rather change is approached from a top-down perspective, requiring staff to suddenly adopt their roles as implementers. It is for this reason that this study considered the stakeholders (i.e. teacher educators) throughout De La Harpe and Thomas' (2009) three thrusts for successful change.

De La Harpe and Thomas' (2009) survey study found that there exists no effective approach to ESD curriculum change that they could report on. They (De La Harpe & Thomas, 2009) suggested that "The task is now to design and implement change initiatives that take note of those conditions [that influence change success], thereby encouraging academics to develop an agreed vision that focuses on ESD curriculum change, which is both compatible with their professions and profitable to their teaching careers." (p. 83). This study therefore takes cognizance of this suggestion, by offering a participatory SSM methodology to defining the conditions for change.

According to Stephens, Hernandez, Roman, Graham and Scholz (2008), there are four views on how higher education institutions may promote sustainability oriented social change. The first refers to the higher education institution living by example by engaging in what has been referred to as 'campus greening'. This view on its own is insufficient to influence societal change as it is both institution-confined and limited in its ability to influence student attitudes and values. Lauren [participant] reflected on a campus environmental organization, noticing that firstly the organization was mostly science-staff-driven and secondly their initiatives failed to impact students' actions (E.g. recycling initiative was largely compromised).

The second view involves getting students to engage with both systems and futures thinking in order to address sustainability-related problems (Stephens et al.). It is not suggested how and where this would be done, however one might imagine that this would need to be implemented by academics at a module level. This is a useful view, if only it is acknowledged as valuable and a societal need. Although student calibre is always a challenge as well as student numbers and work load, academics might consider starting such thought processes on a smaller scale in their disciplines, perhaps even using the designed ESD framework (Bentham, 2013) to guide their design.

The third view suggests that academics should conduct research that addresses real societal-based sustainability issues and challenges. The reality of this occurring is dependent on how higher education institutions see such a research focus aligning with their existing recognized research agendas. Teacher educators are faced with the harsh reality of 'sink or swim' as their success and value is determined by Higher education institution performance criteria. The assumption that higher education institutions are those that promote and support transformative thinking is naïve if you are not going to delve into the types of agendas it supports.

The fourth view sets out that higher education can promote a transition towards sustainability if partnerships are forged. Partnerships may be developed between society and higher education institutions, and between higher education institutions themselves, in the spirit of cross-disciplinary learning and problem-solving. The forging of such partnerships can take time and owing to academics already feeling the workload pressures (as revealed and elaborated upon in this study) this may seem unappetizing at face value. Teacher educators revealed their desire to form partnerships and engage their students in community-based learning. However Teacher educators expressed that work load as well as insufficient experience and expertise on how to go about such a task, contributed to their lack of commitment to forming such partnerships. It would seem that in a competitive environment such as the University offers, partnerships and cooperation are not usually embraced. This is even the case when it comes to collaboration across departments within the same institution. This implies that Higher education institutions need to place more value on community engagement and partnerships, awarding academics more professional performance points to their portfolios, making them more promotable. Added to this, Higher education institutions would need to spend more energy informing academics on how to go about community engagement and continued professional development within professional learning communities. The intrinsic values of such activities should also be highlighted.

“In many higher education systems the current faculty promotion system fosters and rewards a narrow disciplinary focus and incentivizes the dissemination of research results primarily through publication in academic journals. The current academic system in most places does not reward public engagement,” (Stephens et al, p.327)

The Technology department in this study showed advances towards 'Industry as a context for learning' however this was largely motivated by the leader of the department. Leadership is valuable. This is not to denigrate the importance of individual agency but rather to caution leaders from reverting to 'individual academic agency' as the sole avenue for transformation (in the spirit of 'passing the buck'). Leadership is most important.

3. 3 Institutional Culture and Individual Identity

Within the articles and this extended abstract summarizing the study, the word “culture” is often used. It makes sense then that this term be explored briefly. When making statements such as: ‘the culture of the institution and the university tightly influences practitioners focus and expression of their curricula’, the term culture must be understood. It might be a good place to start by saying that culture has to do with the way a particular group similarly think, feel and behave (Senior, 2002). However it must also be acknowledged that these three attributes of culture are not at all simple to identify in an organization. According to Schein (1992) organisational culture refers to:

“The deeper level of basic assumptions and beliefs that are shared by members of an organization, that operate unconsciously and define in a basic ‘taken for granted’ fashion an organisation’s view of its self and its environment.” (p.6)

Owing to the unconscious nature of organizational culture it must be noted that it is deeply ingrained in everyday functions and systems within the organization (Senior, 2002). Consequently culture is very difficult to transform. However it is also not enough to define organizational culture as the group’s collective values, beliefs and assumptions regarding what is important. According to Johnson and Scholes (1999) organizational culture must be seen to be shaped by other functions of the organization as well, such as power structures, organizational structures and systems and organizational objectives and routines. All of these impact the tacit values, beliefs and assumptions about what is important.

Culture could be identified by listening to what the teacher educators, the acting dean and the policies told me was important. This understanding could then be held in mind when exploring the factors that influenced their competency development in their teaching.

Although the university can be described as a subsystem of greater society (Stacey, 1993) it should have a transformational culture in which it is able to do more than merely reflect the values, interests and perceived needs of society. A university must simultaneously engage a constant meta-analysis of society, identifying its actual needs and devising a plan to achieve short term and long term goals towards a more sustainable future. “...for HEIs to become sustainability-leaders and change-agents they must ensure that the needs of present and future generations are better understood and addressed.” (Lozano, 2013, p.8)

Merely understanding institutional culture was not enough to say the complexity of the organization had been considered. Part and parcel of making steps towards organizational change for HESD, is considering the agents and their identities.

Jansen (2003) suggests that education analysts and policy developers need to first grasp an in-depth understanding of individual teacher identities and what constitutes these identities. This is necessary before they suggest the problems needing attention in the education sector and their accompanied oversimplified solutions. Jansen (2003) suggests

that the pattern is predictable: there is a problem and teachers need to be trained to respond. I would add: training does not ameliorate the problem efficiently enough. Often the policies put in place, do not consult the teachers' professional identity or their input. This realization, with the help of Jansen (2003), alerted me to the need to consult teacher educator's personal professional identities and interests. This was considered when I questioned and probed teacher educators about what informed their competency development. This was necessary before attempting to describe the nature of ESD's existence at the Teacher Education Institution (problem identification) and the possible transition of their B.Ed programme to a more ESD-oriented teacher education curriculum (proposed solution). How could a solution be pre-empted if in fact I had not reflected first on the ways in which teacher educators felt they addressed ESD or the value they placed on ESD and the need to engage change for its cause.

I had not yet determined what personal and organizational factors influenced the teacher educators' practice and therefore had not yet determined whether there was a problem and/or where that problem lay. It is neither realistic nor fair to suggest role-changes when teacher educators' existing roles (not only consisting of written responsibilities) are not realized. I needed to understand teacher educators personal professional identities (via their personal professional concerns and interests) in order to understand what would be involved if the teacher education programme was to be reoriented towards ESD.

Drake, Spillane and Huffers-Ackles (2001) refer to educator identity as a picture that incorporates their self-image, knowledge, values, preferences, interests and attitudes to their work and to change. Jansen (2003) also synthesizes the contributions of Drake, Spilane and Huffers-Ackles (2001), adding that teacher identity can be understood by describing how they feel about themselves professionally, emotionally and politically.

With regard to the 'professional basis for teacher identity' (Jansen, 2003, p.119) this includes how educators feel about themselves in the profession, which is informed by their self-perceived level of subject knowledge and previous training and qualifications. More specifically this category refers to how educators feel about their ability to adopt a new idea or policy, given what they feel about themselves professionally.

Jansen (2003, p.120) also refers to 'The emotional basis for teacher identity' which he finds useful when attempting to describe educator identity. This category refers to how educators feel about the added responsibilities suggested by a new policy/initiative in the face of their existing responsibilities and pressures. This category places value on the emotional reaction that is sparked when educators are faced with pending change.

Finally Jansen (2003, p.120) refers to 'the political basis for teacher identity'. This refers to how educators view their authority in terms of the degree to which they feel obligated to make a change towards a particular new policy/innovation. The educators' level of

obligation and response to change is informed by the professionals' interests, values and background and we would add institutional push/priority.

I have added a fourth element since the data analysis, which I refer to as 'collaborative identity'. This refers to how teacher educators see their abilities and responsibilities for change as a group of colleagues as opposed to individuals. This category was added as findings suggested that teacher educators' level of autonomy increased when they felt supported by management and/or other colleagues towards a common focus.

Teacher educator identity was superficially considered when designing the interview questions yet emerged as important categories during the data analysis process. We realized during the data generation process that identities do not only reveal who we are but also why we do what we do. Jansen's (2003) categories of teacher identity assisted us in realizing that factors influencing competency foci in practice also influenced identity construction.

All this said it is necessary to note that the general images of educators portrayed during the Apartheid era was that of limited professional autonomy, for educators were simply political tools, tightly controlled by government. After Apartheid however, educators suddenly needed to adopt the role of 'Liberator' (Jansen, 2003). This involved becoming designers of transformational curricula materials that would encourage discussion and an empowering atmosphere in the classroom. The new roles and expectations did not take into consideration much of the previous controlled teaching culture from whence educators had come. Then only three years later the educators' role changed again to that of 'Facilitator' (Jansen, 2003). This role came with the introduction of Outcomes Based Education through the new 'Curriculum 2005' (C2005). Educators were no longer at the front driving liberation in the classroom rather they dissolved into the background as learners became responsible for their own learning and liberation. Educators were responsible for designing learning opportunities in which learners could take charge of their own learning, developing various skills and values that were deemed necessary for meaningful participation in society and economy. The educators' content knowledge was no longer priority but rather it was learner competency development. If this was not confusing enough for educators then there were the Norms and Standards of Educators (1996, 2000) which very clearly stipulated seven roles of an educator. These roles indicated that the educator was now a 'Performer' (Jansen, 2003). This referred to someone who could be measured by their ability to perform defined roles. The educator no longer blended into the background of the classroom but was now in the limelight. These images of the educator were reflected in policy and therefore the educator's political identity but not necessarily the educators' actual professional identity (i.e. practitioner's reality).

Through an understanding of teacher educator identity, in conjunction with institutional culture, a more realistic and informed view can be attained of the probable future of ESD in South African Teacher Education Institutions. Policies and innovations have been typically

de-contextualized in the past (Moletsane, 2003). This lack of contextualization is due to a lack of understanding that educational reform must not only consider organizational structures, policies and procedures, but it must also consider educator identity. This study views the teacher educators' interpretations of their organizational environment as key informers.

3. 4 The Future of ESD in South Africa

Sustainable development as a disputed term, offers a departure point and frame of mind for critically reflective and thus evolutionary discussions. For without the coining of such disputed terms as 'sustainability', 'sustainable development' and 'education for sustainability', the very reasons behind their contestation would not have been realized. Simply we would not have realized the need to evolve and redefine sustainability. It is therefore highly concerning in this study, that pre-service teachers have not been exposed to such a critical debate that concerns both their own and their learners' future. Of further concern is Orwell's (1989) 'doublethink' commonly referred to as cognitive dissonance, which is a concept that describes the ability to hold two conflicting conceptions at the same time, acting on either conception when it either suits them or seems appropriate to. This is also experienced when one's actions and conceptions diverge. Often doublethink is unconscious serving to perpetuate itself throughout one's life. This is a very real concern when talking on the topic of sustainability. If pre-service teachers are not encouraged to expose their contradictory meanings through conscious reflection and debate, to what extent is irresponsibility perpetuating ignorance?

In order to achieve a *more* sustainable society, it is first necessary to identify that the individual citizen is part of a societal system. This means that sustainability calls upon a systems approach to achieving sustainability, for the individual is related to, and affected by, many parts of the societal system. This notion of systems thinking, implicates Higher education as leaders in educating and impacting society (Sibbel, 2009). This point is further supported by the International Association of Universities (2006) who claim that Higher Education impacts society hugely. This impact stretches to the way professionals are trained and prepared for participation in the world out there and also in the amount of freedom that they grant academics to explore emerging ideas. A pressing question is 'what do Higher Education institutions perceive to be the educational needs of society and how far off are these perceived needs from the actual needs?' Although South Africa's pressing needs are more evidently socio-economic, these are not the sum of South Africa's societal needs. Higher education tends to focus on economic development as a remedy for social issues, when in actual fact increase in GDP has never evidently shown to decrease poverty (Rosenberg, 2004). A more sustainable address of South Africa's needs lies in our resource utilization, trade and export, skill-development and very importantly, how we see ourselves as part of the Global society. Higher Education may contribute to budding entrepreneurs but what does it afford community development and the sustainable use of resources?

Higher education that focuses on pure discipline-content that is disconnected from pressing societal and sustainability needs seems to promote individuality, less humanitarianism, and not to mention a dismal future. Teacher educators need to be extending their student teachers to grapple with real-life issues, so that one day in the future they might promote the same critical thinking in their learners at schools. The study reveals that teacher educators' reasons for not engaging student teachers in this type of activity vary. One reason is that students entering the higher education system and particularly the teacher training program are of a low calibre. Low calibre has been identified by lowered tertiary institution entry requirements, as well as low motivation displayed by students who are not willing to read or extend their own learning (only do the bare minimum).

A frequent reason for not engaging sustainability issues (as displayed through the original national survey) is it is perceived that the topic is one that should be covered in typical environmental education type courses (Sibbel, 2009). This misconception is persistent even today and reported on in the methodology section of this extended abstract. All that is required to challenge this misconception is a leader who is dedicated to showing the teacher educators of the particular discipline, how sustainability may be related to the discipline. This may be done using a participatory explorative approach (such as soft systems methodology), followed by recognition from the institution that such an exploration is a valuable research interest (i.e. will contribute towards the development of teaching and learning).

A number of implications for the re-orientation of educational programs have been listed: (1) a focus on competency development; (2) promotion of higher order thinking skills; (3) an early start, before students get to Universities; (4) reflexive teaching; (5) commitment and responsibility to the sustainability vision; (6) authentic problem-solving opportunities for students; (7) a respect for diverging values and ideas; (8) creativity and engagement with open-ended activities (Wals and Jickling, 2002). Teacher educators in this study showed evidence of reflexive teaching, promotion of higher order thinking skills (although this was experienced as difficult due to the caliber of students) and respect for divergent thinking. However teacher educators by reason of student numbers, administrative burdens and workload, showed either limited or no engagement with authentic problem-solving and development of open-ended activities that challenge students' creativity and higher order thinking application. Teacher educators showed a care and interest for sustainability however this was not affective due to its perceived misalignment with University research agenda and culture.

Universities and higher education institutions are meant to prepare students to become effective citizens (Wals and Jickling, 2002). This means they should be equipped to engage social challenges and issues that bear divergent values and perspectives. Students should be engaging with authentic problem-solving situations in the hope of developing their resilience for an uncertain future in which problems are not definitively defined. Any

education that does not endorse a sense of critically reflective thinking and socially responsible engagement can just as easily be labeled 'training' (Wals and Jickling, 2002).

The question is to what extent are students encouraged to do this? Are we stuck in a training mentality of education? Surely, trying to neatly define 'sustainability' and suggest a resolved method for its implementation is to slip back into a seemingly unproblematic definitive way of thinking which is incapable of addressing the needs of an uncertain future. Higher education is meant to challenge such thinking in the hope for transformation that is constantly evolutionary. Sustainability and a similarly aligned education offer an opportunity for transformative education.

Universities need to develop a guiding sustainability policy that outlines how sustainability is to be realized through: (1) undergraduate and postgraduate programme curricula; (2) pedagogies; (3) university research agenda; (4) desired qualities of graduates; (5) continuing professional development opportunities; (6) community partnerships; and (7) campus structures. This kind of policy would eventually, hopefully motivate for the development of Faculty-specific sustainability policies, ensuring cross-curricular attention to ESD.

Timmerman and Metcalfe (2009) in their analysis of higher education sustainability policy identified that it is not enough to mention terms such as 'sustainability' and 'society, economy and environment'. Policy must also explain why sustainability is important for inclusion and why these three elements are often presented together in excerpts of the policy.

Sustainability needs to be considered in University strategic planning, with specific reference to "future research developments and academic planning" (Timmerman & Metcalfe, 2009, p.56). Actors to be involved in such considerations of strategic plans should include administrators, academics, management, students, community members and stakeholders.

3.5 Developing an ESD Framework

From the analysis of the literature Table 2 was constructed as the analytical framework to later be used to analyze the six teacher education related policies. However two of the sub-categories: 'Considers society, economy and environment while problem solving' and 'Connects relevance of subject knowledge to society, environment and economy' were added to the analytical framework mid-way through the analysis as they emerged from the analysis of the policies as relevant themes. As a result the analysis process was repeated with the new sub-categories included.

It was necessary to first develop this analytical framework to provide a lens through which I could analyze the teacher education related policies. The ESD framework, developed from literature describing the main attributes of ESD, provided a reference point from which to

determine the degree of ‘ESD-orientedness’. It was important to analyse teacher education related policies first, before I entered the teacher education institution, for how could I claim to understand the teacher educators if I had not explored the political and historical context in which they were found? After analyzing teacher education related policy, I realized I had made an incorrect assumption that these teacher educators were familiar with the ESD dialectic. This informed the further development of the research design.

Table 1 An ESD Analytical Framework for Teacher Education Policy

Categories of ESD related themes	Sub-categories of ESD related themes
ESD Teaching and Learning Approaches (TL)	Development of Action Competence (AC) <ol style="list-style-type: none"> 1. Participation in decision making and community-based decision making (E.g. Debates and action plans) 2. Active learning approaches (E.g. Environmental Impact Assessments) 3. Learner-centered approaches 4. Engagement in community and social development activities 5. Participatory and collaborative learning activities
	Alternate Knowledge Systems approach to sustainability (AK) <ol style="list-style-type: none"> 1. Considers different knowledge systems as an important starting point for exploring issues of sustainable development
ESD Skills (S)	Critical and Creative thinking (CC) <ol style="list-style-type: none"> 1. Explores ways of solving local contextually relevant problems 2. Considers society, economy and environment while problem solving 3. Carries out critical analyses of current knowledge and situations and their implications for future decisions.

	<p>Systemic thinking (ST)</p> <ol style="list-style-type: none"> 1. Engage in looking for links to solve complex problems 2. Understand that systems are complex that usually involve more than the sum of their parts 3. Engaging in partnership building to address needs and solve problems
	<p>Future thinking (FT)</p> <ol style="list-style-type: none"> 1. Recognizing the need for change 2. Searching for a way to attain a sustainable future 3. Understanding the short and long term effects of current decisions. 4. The importance for renewing knowledge about evolving sustainability theory and models
ESD Knowledge Competencies (KC)	<ol style="list-style-type: none"> 1. Promotes an understanding of various sustainability issues both local and global E.g. Food security, economic and social justice, democracy, distribution and use of resources etc. 2. Promotes an understanding of how society, economy and the ecological environment play a part in these sustainability issues. 3. Promotes the sustainable use of and care for natural resources 4. Promotes the understanding that all disciplines can explore ESD through their subject knowledge 5. Connects relevance of subject knowledge to society, environment and economy.
ESD Values (V)	<ol style="list-style-type: none"> 1. Promotes an environmental stewardship 2. Promotes social tolerance and equity 3. Promotes collaboration in decision making and problem solving

Important to note is the list of Knowledge Content guiders that assisted me in identifying the sub-categories under the ESD Knowledge Content (KC) category. These analyzing guiders were adapted from Huckle (2001) and more specifically identify what may be considered as ESD related Knowledge Content. Any text that indicated the following was allocated to the KC category and given an appropriate sub-category number identifier:

- Developing student knowledge of biophysical systems, their potentials and limits
- Developing student knowledge of the technologies societies use to 'exploit' these bio-physical systems and the environments they create in the process
- Developing student knowledge of the economic systems that shape investment in environmentally appropriate or inappropriate technologies. Eg. Investing in automobile companies as opposed to the public transport sector
- Developing student knowledge of the political systems (local, national, regional and international) which regulate the social use of bio-physical systems and the environment. E.g. National coastal regulations on fishing and use of four wheeler vehicles on sand dunes
- Developing student knowledge of social systems (the economic, political, civil and private spheres of people's lives) which embrace the interests, power and strategies of different racial/gender/religious/economic/groups
- Developing student knowledge of the different cultural systems (technologies, beliefs and values), and how these may help or hinder people in understanding and/or improving their environmental predicament Eg. Traditional sustainable ways of cultivating indigenous medicinal plants.

3.5.1. *Describing how Literature Informs the ESD Competency Framework*

The category: 'ESD Teaching and Learning Approaches', is informed by literature on ESD pedagogy and Action competence. Jickling and Wals (2012) make reference to lifelong learning, social cohesion and collective action, alluding to 'participation in decision making' and 'community-based decision making' as well as 'Participatory and collaborative learning activities'. Parkin, Johnston, Brookes, Buckland and White (2004) refer to sustainably literate citizens as people who are able to understand the need for change towards a more sustainable way of doing things. Sustainability literacy is represented by the 'Future Thinking' category. Pittman (2002) refers to the contextual interpretation of the sustainable development concept and this is acknowledged in some way by the sub-categories that refer to 'learner-centered approaches' and 'alternate knowledge'.

Barsan, Nastasescu and Barsan (2011) emphasize the importance of understanding the strong model of sustainable development, in terms of the three pillars and how they are independent to different extents. This concept was captured in the sub-categories that

referred to 'systems thinking' and the 'interrelation of system parts'. The strong model is also represented through sub-categories referring to the understanding of how the three pillars play a part in sustainability; and in the sub-category: 'promotes the sustainable use of and care for natural resources'. Huckle's (2001) guidelines for attaining an ESD oriented curriculum provided guidance regarding the category: content knowledge of sustainable development issues. With regards to ESD skills, the Tbilisi Declaration (UNESCO-UNEP, 1978) mentions agency towards solving environmental problems using critical and creative thinking and problem-solving skills. ESD Values is related to this concept of agency as it reinforces an environmental stewardship.

The Tbilisi Declaration refers to the need to understand that local actions have global impacts. The Tbilisi Declaration assisted in constructing sub-categories 'Active learning approaches'; 'Environmental stewardship'; 'Understanding the short and long term effects of current decisions'; 'solving local contextually relevant problems' and 'carries out critical analyses of current knowledge and situations and their implications for future decisions'. Agenda 21 (UNCED, 1992) also mention the competencies that should be aspired towards. Agenda 21 makes direct reference to the need to realize that all disciplines should address sustainability issues. When addressing these issues one should focus on the inter-relatedness of society, the environment and the implications of development. This was captured in sub-categories; 'Systems are complex and more than a sum of their parts'; 'understanding that all disciplines can explore ESD through their subject knowledge' and 'Connects relevance of subject knowledge to society, environment and economy'. Agenda 21 also refers to skill competencies and the need for individuals to become agents of change who solve environmental and development problems using critical and creative thinking, this again supports sub-categories related to critical and creative thinking.

Finally, Agenda 21 refers to using indigenous and local knowledge, as well as Science and culture when addressing human development problems. This contributed largely to the sub-category referring to 'Alternate Knowledge'. The description of a 'quality education' in the United Nations Decade on Education for Sustainable Development provides a list of ESD principles that informed the ESD framework. The UNESCO ESD principle that refers to 'accommodating the evolving nature of the concept of sustainability' and 'lifelong learning' informed the indicator: 'The importance for renewing knowledge about evolving sustainability theory and models'. The UNESCO ESD principle 'is locally relevant and culturally appropriate' and 'is based on the principles and values that underpin sustainable development' (UNESCO, 2005a, p.30) was used generally to better define as many indicators as possible. The next UNESCO ESD principle: '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', assisted in forming a number of the indicators in the ESD framework. These indicators included: 'Engaging in community and social development activities'; 'understanding short and long term effects of

current decisions’ and ‘Understanding that systems are complex and usually involve more than the sum of their parts’.

The ESD principle: ‘addresses content, taking into account context, global issues and local priorities’ along with findings from the analysis of the CAPS policies, assisted in formulating the indicators: ‘Connects relevance of subject knowledge to society, environment and economy’ and ‘understanding sustainability issues both locally and globally’. The ESD principle: ‘builds civil capacity for community-based decision-making, social tolerance, environmental stewardship, adaptable workforce and quality of life’, along with Scott and Gough’s (2003) reference to Action competence, informed most of the sub-category ‘Action Competence’ indicators. They also informed the indicators that refer to: (1) environmental stewardship, social tolerance and equity; (2) the promotion of collaboration in decision making and problem solving; and (3) ‘engaging in partnership building to address needs and solve problems’. The category ‘Teaching and Learning Approaches’ was supported by the ESD principle: ‘uses a variety of pedagogical techniques that promote participatory learning and higher-order thinking skills’.

The ESD framework was used during the policy analysis process as well as during the coding of the interview transcripts as a form of *theoretical sensitivity* (Glaser, 1978). This is later described in the section exploring grounded theory.

3.6 Summary

Educators are identified as the key players in realizing an ESD. ESD is identified in this chapter as an effective tool for both the addressing and remediation of many sustainability issues in South Africa. The idea that Sustainable development is a contextually-relevant term, proved to be useful during the data collection process as teacher educators felt less pressurized to reflect a ‘correct’ understanding of the term ESD. The research confirmed that if the ambiguous nature of the term was explained, ambiguity could serve as a motivator for open reflection on how teacher educators thought they were implementing ESD in their courses. The inability to neatly define ‘sustainability’ is not and should not be a reason for why it is not engaged. Trying to neatly define something that is contextual and complex is to slip back into a close-minded definitive and uncritical way of thinking. This type of thinking cannot possibly meet the needs of an uncertain future.

Sustainability literacy and hence ESD should encourage critical and creative thinking, however that is of no use if learners do not apply these ideas to another level of application – action competence (Mogensen & Schnak, 2010). The analysis of curriculum policy in this study confirmed that much lip-service, regarding critical and creative thinking existed in policy. These aspirations were not supported by suggested action competence as problem solving was mostly contrived and not community based.

The chapter emphasized the role of Higher Education in the development of critically reflective agents of society who are able to address community based issues related to sustainability. It is raised that Higher Education Institutions need to emphasize community engagement and continued professional development by offering teacher educators support on how to engage in such activities in a meaningful way. If these tools and skills were available to teacher educators, this could remove a major hurdle in the effective implementation of ESD in HEIs. This study confirms Lotz-Sisitka's fears that ESD practices will not be realized if support is not gained from institutions and policy. This confirmation is found in the identification of the many factors that are identified to work against the successful achievement of ESD in HE. This study provides a snap-shot of the current foci of an influential University in KwaZulu-Natal, South Africa, and suggests the long yet attainable road towards a realization of ESD.

4. Methodological Design

The methodology chapter describes the methods used to generate and analyse the data in this case-study. The theories that support these methods punctuate the description of the research process engaged, offering reinforced credibility. The research process is presented from a personally engaged perspective. My roles as a researcher are defined and the sequence of data generation is presented, followed by a brief summary of which data-sets were reported on in which articles. The chapter continues by providing literary support and personal explanation of the major methods of data generation engaged. These methods include: a web-based survey, document analysis, one-on-one interviews, focus group interviews and finally soft systems methodology. Soft systems methodology is described at length to display in detail how a rich picture and notional system picture was developed. These pictures were used to generate further data regarding the future possibility of bridging to an ESD oriented teacher education programme. The double-lens analytical tool used during document analysis of the six teacher education related policies is also defined in this chapter. The rich and notional picture constructed using analysed interviews is also presented in the section exploring the focus group interview. Grounded theory informed both the data generation and analysis process and therefore is also raised at relevant points in the chapter. Finally the limitations and challenges experienced whilst engaging the methods are revealed, followed by a reflection on the research credibility.

4.1 The Studied Case

This study involves a single case, the case being the Science and Technology teacher education department at one teacher education institution in South Africa. According to Hitchcock and Hughes (1995) case studies have certain authentic characteristics. These include: (1) a rich description of events; (2) a chronological account of events; (3) a blending of description with analysis; (4) the desire to understand certain actor's perceptions of events; (5) a highlighting of certain events to display main points; (6) an involved researcher; and finally (7) the report aims to reveal the richness of the case. This study satisfies all of the seven characteristics described.

Case studies imply that there is something very context-specific or special that can be learned from the study, and usually this special thing cannot be generalized across contexts that differ to the one studied (Stake, 2000). Thus a limitation of case-studies is their limited generalizability. Case studies separate the "significant few from the insignificant many instances of behavior." (Cohen, Manion & Morrison, 2007, p.258). The researcher determines how big or small the case is and for how long they will study the particular case. This study identified one teacher education institution in South Africa as the particular case. The case was studied for almost a year, generating data from policies, interviews, meeting minutes and course outlines.

Case-studies have strengths, such as their rich descriptive and self-explanatory nature, however they also have weaknesses. The main weaknesses commonly referred to include: (1) their limited generalizable nature and (2) their limited ability to be cross-checked, exposing them to potential bias (ibid, p.256).

It is characteristic of a qualitative case study to spend an intense period of time submerged in the case, gleaning information about the context, its actors and the relationship-dynamics present. Not only did I spend a year collecting data at the selected teacher education institution, I had also worked there for a number of years prior to the study. In the year that I was in the field, however, I spent much time reflecting on the discussions I had had with participants as well as observing the institutional context (Stake, 2000). I found this quicker to grasp, being familiar with the context, however it was necessary to access the participants' explanations or further elaborations on these observations.

Although cause-and-effect is a relationship that is very complicated to identify, let alone monitor, case-studies, however, do allow the closest possible insight into such relationships. In this study the in-depth, one-on-one interviews allowed insight into respondents' interpretations of such relationships. My participants' interpretations were most valuable as it was their curriculum choices and their perceived reasons for why they focused on various competencies that was of interest to me.

With special reference to the nature of generalizing through case study research, it has been said that the way in which readers use and apply their understanding of the reported case, is strongly dependent on how different or similar the case is to theirs and other's cases (Campbell, 1975; Kemmis, 1980; Yin, 1989 & Stake, 2000). Stake and Trumbull (1982) have referred to 'naturalistic generalization' which is a process that the reader engages, whereby they adopt meanings of experiences as though they had personally experienced them and over time modify their meanings as they either hear others reflect on their meanings of the experience or as they encounter the experiences described themselves. Realizing that readers are able to adapt, alter and reshape the knowledge reported, in ways that add meaning to their own contexts, emphasized the need for me to be clear, descriptive and triangulating about the presentation of ideas herein.

Triangulation is a process of using multiple instruments and angles to ensure that the meaning deduced is the closest explanation or description of the observed instance. This is meant to do two things, firstly it is meant to reduce the occurrence of misinterpretation and secondly it is meant to "verify the repeatability [as much as possible] of an observation or interpretation" (Stake, 2000, p.443). I have tried to the best of my ability to ensure that the data generation and analysis heeds to triangulation. The following description of the research process will hopefully offer testimony to my efforts.

4. 2 A Reflection on the Research Process

I designed an initial web-based survey and sent it out to all teacher education institutions (TEI) in South Africa. The survey was designed to establish the degree to which teacher educators implemented ESD in their practice and the factors that influenced this. Unfortunately the web-based survey revealed some conceptual issues followed by a low response-rate. The conceptual issues are discussed further on. However the web-based survey indicated one TEI as a promising case for the in-depth portion of the study, as it reported the highest response rate overall, indicating promise for further willing engagement. Following this finding, I approached the TEI and proceeded to apply for research ethical clearance at the institution. Shortly after approval was gained from the Institution, I contacted the acting dean for an interview. At this point I was thinking that the acting dean would be able to provide me with some important information about the School of Educations' prior engagement with Education for Sustainable Development. The acting dean provided insight into the major traditions, culture and goals of the institution and referred me to the Science and Technology Education department for further engagement with my study. I further contacted a key person in the department who consequently set me up for an initial meeting with willing and interested teacher educators.

In the first meeting with potential participants, the purpose was to inform the teacher educators present about the nature and purpose of my research study. I reassured all present that I simply wanted to understand the department as a functioning system and how Education for Sustainable Development (ESD) was functioning both in their minds and their practice. I added that if it was not doing so (as I recalled what the acting dean had said), then we would further explore this and unearth the competences that they prioritized and why. I emphasized that there was no value in quickly trying to find out what ESD meant, because the study wanted to explore what was existent. Near the end of the meeting a letter of consent was handed out to each potential participant. This letter gave a brief summary of the research and the activities that a willing participant would be expected to engage in should they decide to engage in the research study. However the head of the department informed me that they had all gathered intending to participate in the research as it was their intention to learn more about how they could become more Sustainable Development (SD) oriented. A pressing aim was to compile a rich picture of the Science and Technology Education Department as a system with all its components. This picture would not only highlight the functioning relationships it would also highlight any gaps and opportunities for potential development and reorientation towards SD.

Two weeks after my initial meeting with participants, I sent an email out to each participating teacher educator in the hope of securing dates for their first one-on-one interview. I conducted an interview with each teacher educator, trying to find out more about each person as an individual and as a professional. The main purpose of this initial interview was to find out the competences that these practitioners valued and tried to

develop in their undergraduate students. From this elicitation I had hoped teacher educators' interests towards ESD principles and competencies would be identified. This was not a reality. Each interview ranged from an hour to an hour and a half. Many open ended questions were asked and the participants did a lot of talking. Participating teacher educators felt comfortable exploring themselves with me and this was evident in the amount of talking they engaged in. I realized at the end of these interviews that although I had not got to the crux of the objective I had intended (which was to identify the competences that they prioritized in their courses), I had established a rapport with each of my participants. This was more important to me and important for the future relationship we would have during other data collection sessions and for the elicitation of future ideas. All participants expressed their interest in the following interview and welcomed me to email them should I need some clarification during the transcription process.

On the occasion of making the second appointment for the second one-on-one interview, responses were slow. I inquired more deeply only to find that all my participants were inundated with examination preparation. I understood fully and gave teacher educators three weeks to focus on this before I would contact them again about possible dates for the next interview. I did send each of my participants a letter regarding the agenda of the next interview. The agenda showed a more narrowed focus on each participants' practice and what they understood by Education for Sustainable Development and possibly how they felt they were addressing ESD. I expected a degree of concern from my participants at this point as many felt that they needed to perform in a particular way, to show a sound understanding of SD and how they implement this in their practice. Thus in the letter to them, I reassured them that they only needed to bring their own understanding with them as this was what I wanted to explore and that potential for the development of their understanding and/or implementation may only come later as a result of the rich picture and notional system picture analysis during the final focus group that was yet to be scheduled. Participants were asked to bring with them their course outlines and a list of the assessments that they gave their students in each module. We would use these materials to explore the major competences that teacher educators developed in their modules and practice.

While I waited for my participants to complete their examination preparation, I pursued a lead that I had been given during one of my initial interviews. My participant had mentioned a strategy-planning meeting that they had all attended at the beginning of the year to plan for the activities for the year. I felt that it was important to understand the goals of the Science and Technology education department that I was studying, so I asked the head of the Technology department whether I could access the minutes. She indulged me and offered a short interview based on the minutes. I reviewed the minutes and noted a few clarification questions for the purpose of the interview. The interview lasted approximately half an hour but at the conclusion I had gained significant insight into the main goals of the department and changes that they had been planning for the last few years. This interview

brought me closer to understanding the organization/system that is to be named the ‘Science and Technology Education Department’.

After the first and second interviews had been engaged with all participating teacher educators, it was now possible to use the data to develop a rich picture and a conceptual model of a notional system for teacher education for sustainable development. These images were presented in the opening presentation of the final Focus group interview with the participants. Systems theory and how it was applied to generate the rich and notional pictures is discussed a little further on. During the focus group interview teacher educators engaged in a reflective discussion around the rich picture which displayed their current situation and the notional system picture which suggested what a system that incorporated ESD would look like. Teacher educators reflected on the challenges of bridging from the current system to a notional system and highlighted the factors that they felt limited their ability to transition. Teacher educators also reflected on the possibilities and desires for future transitioning. The following table provides an overview of the total data sets, when they were generated and in which articles these were reported on.

Table 2 Sequence of Data Generation

1st Data Set	2nd Data Set	3rd Data Set	4th Data Set	5th Data Set	6th Data Set
Content analysis of 6 policies related to teacher education in South Africa	One-on-one interview with the Acting Dean	1 st One-on-one interviews with 8 participants	One-on-one interview with head of department regarding meeting minutes	2 nd One-on-one interviews with 7 participants	Focus group interview with all participants.
September 2011	February 2012	March – May 2012	April 2012	June – Sept 2012	September 2012
Data reported on in article 2	Data reported on in article 3	Data reported on in article 3	Data reported on in article 3 .	Data reported on in article 3	Data reported on in article 4
<i>All Data sets were used to contribute towards the development of the rich and notional pictures</i>					

The web-based survey is not included as a data set here, for the data collected was not used to help tell the story of the current status of ESD in South African Teacher Education Institutions. Rather the web-based survey was used to indicate the case to be studied as well as to confirm the prevalent misconception amongst educators, that SD and ESD is relevant only to science-based disciplines. Article one was solely a theoretical paper exploring current and relevant literature in order to generate an ESD competency framework. To recall, this was presented in chapter three.

4.2.1. *Positioning the Researcher in Relation to the Researched*

As the researcher in this study I took on the roles of listener, friend, colleague and in some instances informer. These roles were straddled delicately and called upon in times of participant need. I could never claim complete objectivity and outsider status, nor was this desired.

Researching within an education institution or organization involves at times an environment that is pressured and competitive, an environment where its employees are expected to be ahead of the times and on top of current concepts, terminologies and initiatives. However the reality is these very same institutions provide limited room to do so, when the work-load is experienced as being high. Considering, and consequently observing this, it was decided that I needed to be a *friend*. Someone who understood the pressures, the work-load and the challenge of attending appointments/meetings/interviews that took up hours at a time. This was not a contrived understanding for in this case I was quite familiar with such an environment, having spent eight years in such a context. However, at the time of data analysis, it was important to control this 'general knowledge' and this was why grounded theory was necessary and helpful in the analysis of data.

I also embraced the role of *colleague*, Science and Technology education being my field of expertise. This area of familiarity offered opportunities for communion as the respondents and I engaged in many conversations (off topic) on discipline-related themes. During interviews the respondents described their work environment and classroom practice in a way that reflected their confidence in how I related to their jargon and examples. Some respondents embraced me to such an extent as a colleague that they even asked me to consider commenting on resources that they had developed and research they were writing. All of this was unrelated to the research topic that was being explored in this study.

I also needed to be an attentive *listener*. Not in a way that was false or overplayed, but rather in a way that was interactive and reflective, showing deep thought and consideration for what the respondents were in actual fact reporting. This sort of listening enabled a number of things. First it enabled me to clarify their understanding of what had been said, by briefly jotting down a clarification question that could be followed up later. These sorts of clarification questions serve not only to validate the data reported but also to probe and engage respondents further. In addition, my respondents tended to appreciate this sort of listening which resulted in a lot more being offered up in future discussions. Secondly, this sort of listening and thus mental note taking, allowed key ideas to be imprinted on my mind and taken up later in future interviews with the same and different respondents. These mental notes would also serve as 'memos' during the grounded theory data analysis process, making analysis more thorough and triangulated. Finally, this sort of active listening also provided leads for future data generation methods. For example, an interview with one respondent revealed that all teacher educators had attended a discipline strategy meeting. It was upon intent listening that this meeting was picked up as a potentially valuable

information source as it resulted in me later accessing the meeting minutes and interviewing the head of the Technology department based on its contents. The meeting minutes proved insightful towards understanding the objectives of the discipline.

Finally I also engaged the role of *informer*. This role was revealed during the focus group interview but withheld during the first two interviews, taking care not to potentially intimidate teacher educators. Teacher educators initially did ask me to define ESD however I informed them that what I understood about it and how it is to be applied in a context are quite different. I further explained that it was rather their contextual understanding that was of value to the study. I engaged a notion of interpretivism that Schwandt (2000) referred to as 'empathic identification' in which the researcher aims to access the thoughts of the researched from their perspective. This notion implies that human action must be understood from the perspective and intentions of the actor if it is to have any meaning at all. For without the actor and their intentions, the action is meaningless. This notion strongly guided the interview questions as it was most important to understand how teacher educators viewed their practice within their institutional context.

During the focus group interview I presented some ESD principles as well as the rich picture that I had formulated based on what teacher educators revealed to me. I then suggested a notional system picture based on the ESD knowledge I had gained from reading and the knowledge I had recently acquired from the teacher educators about the institutional environment. Although at this meeting I presented myself as an informer, during this final focus group interview this was short-lived as I turned the tables asking for input, implying that respondents would know best whether or not a bridging to such a notional system would be possible or not and what the challenges might be.

Interpretivism and constructivism informed my understanding of what kind of data I needed to generate and therefore what role I needed to adopt. Interpretive theory informed me that teacher educators' interpretations of their experiences, was most important. Constructivist theory told me that individuals often construct their meaning and experiences in a social manner. How teacher educators experienced institutional factors as a group could provide emergent understandings of the intensity of some of the institutional factors at play. Interpretive and constructive theories supported my methodological choices regarding the interviews and the role I needed to be taking at any point in the research process.

In some instances I took a back seat during discussions while in other instances I took on the role of prober, clarifier and informer. The toggling between roles called upon my 'researcher intuition' that is not clearly definable. My roles however, were always driven by the genuine care for my participants and the desire for credible and meaningful information.

4.3 A Web-based Survey

I designed the first draft of the web-based survey with significant assistance from Rosalyn McKeown in 2011. McKeown (2000) had written an article on a study that explored Environmental Education in the USA. The study surveyed 715 teacher education institutions. McKeown (2002) had also devised an ESD toolkit for practitioners. Knowing that McKeown has significant experience and expertise I engaged in email and telephonic correspondence. McKeown's assistance guided many of the questions stipulated in the web-based survey.

The Survey aimed to answer the following questions:

1. To what degree do teacher educators recognise and address ESD goals within the teacher education curriculum?
2. Why do key teacher educators provide this degree of ESD address within the teacher education curriculum?
3. What contextual factors influence teacher educators' attempts to effectively engage in ESD-oriented activity?

The questionnaire constituted ten questions that accumulatively served to address the survey aims. Questions 1-3 focussed on biographical information. Questions 4a to 4o aimed to identify which ESD indicators and competencies teacher educators focus on. It also aimed to identify the level of attention that teacher educators gave to recognizing ESD principles in their teaching by use of a rating system. Finally question 4a to 4o also served to identify whether there was a difference between the level of importance academics applied to ESD and the level that the Institution applied to ESD foci. Question 5a to 5o served to understand what factors drove teacher educators' address of ESD principles. Question 6 aimed to find out if the institution ran any environmental based courses. Question 7 asked respondents to identify whether they felt their institution employed sustainable development foci. Question 8a to 8b required respondents to identify whether they implemented aspects of SD and further asked them to identify how they did so. Question 8c recognized that even though teacher educators may place some degree of importance on ESD principles in their practice, it was important to establish to what extent they encouraged their student teachers to perpetuate this importance? Question 9 aimed to understand how Educating for Sustainable Development is commonly understood by academics at various Education Faculties. Finally question 10 asked for permission to use the preceding data in a research study report.

In a study by Cobanoglu, Warde and Moreo (2001) three methods of sending and receiving surveys and their responses were mail, fax and web-based/e-mail. Of the three methods web-based/e-mail received not only the highest response rate but it also received the fastest response rate. We concluded that in this technology age, where individuals are becoming busier yet more advanced, the web-based/e-mail method would be more

convenient, accessible and cheaper to manage for both researcher and teacher educators (Babbie & Mouton, 2001). I reformulated the questionnaire (see Appendix 1) into Google's gmail-based survey application and sent it out to teacher education institutions across the country.

A limitation of the survey method is that questions within the questionnaire itself may use terms that when applied to a vast population of people from different contexts result in misinterpretation and ambiguity and thus elicit unreliable responses (Cohen, Manion & Morrison, 2007). We considered this by taking care to provide examples of what was being referred to. For example a question asking teacher educators to indicate the degree to which they, "Develop student knowledge of the political systems (local, national, regional and international) which regulate the social use of bio-physical systems and the environment" was accompanied by an example of what this could refer to: "Eg. National coastal regulations on fishing and use of four-wheeler vehicles on sand dunes"

We heeded the many guiding rules for the construction of questionnaire questions, however what we had not predicted was the limited and clichéd perspectives regarding sustainable development held by multiple teacher educators. It was soon apparent that, terms such as 'biophysical systems' and 'sustainable development' would serve as a deterrent right from the start. Many replies indicated that sustainable development was not relevant to their discipline and consequently they could not participate in the study. This was not including those who may have concluded the same thing about SD and their discipline yet did not email me to inform me of their reason for not responding. This prolific misconception is raised in Sterling's (2012) Future Fit Framework in which he assists academics in understanding and engaging with sustainability education: "Sustainability relates to just about everything, so if you think 'it has nothing to do with me and my subject area', we invite you to suspend judgement..." (Sterling, 2012, p. 2)

Over and above the misconception of the term 'Sustainable Development', Babbie and Mouton (2001) identify that receiving 50% of your questionnaires back from respondents is adequate to analyze and report back on a particular topic or case. The response-rate we received did not even touch on 10% and so we decided that the web-based survey would rather be used to locate the teacher education institution that showed the most promise for engaging in the study. This was indicated through the comparative response rates across the institutions. The next step was to understand the context in which the teacher educators functioned. Thus we found document analysis quite useful as we could use it to analyze teacher education related policies (which govern teacher educators) as well as course outlines and meeting minutes (which offered a point of departure for discussion).

4. 4 Document Analysis

According to Rubin and Rubin (2012, p.27) “Documents are most useful when combined with in-depth interviews that allow you to discuss with their creators what they contain and how they were prepared.” This idea was engaged both when course outlines were discussed with their creators (teacher educators) and when meeting minutes were explained by the head of the technology department. The head of the technology department was interviewed about certain meanings or events that were represented in the meeting minutes, which further assisted in putting these events into context.

Document analysis took place on three levels. At the first level, leading research on Education for Sustainable Development was analysed informing the construction of the ESD competencies framework (See Chapter 3). At the second level of document analysis, policies strongly guiding teacher education in South Africa were analysed using the newly developed ESD competencies framework, to highlight the degrees to which policy discourse considered ESD (refer to article 2). The 6 policies analysed are presented in Table 3.

Table 3. Six Teacher Education Related Policies

Policy Name & Year	Policy Scope
Education White Paper 3 (1997)	A program for Higher Education Transformation. Outlines the program for change.
National Policy Framework for Teacher Education and Development in South Africa (2007)	Describes the context of teacher education. Specifies the procedure and requirements for teacher education program recognition. Describes the conceptual and pedagogical needs of the new continuing professional teacher-development system. Describes the joined responsibility of the Department of Education and South African Council of Educators in implementing the policy by providing support structures.
Higher Education Qualifications Framework for Teacher Education (2011)	Outlines the minimum requirements for teacher education qualifications, which involves the description of the different qualification types, their purposes and a set of minimum set of agreed-upon competencies.
Integrated Strategic Planning Framework for Teacher Education and Development in South Africa, 2011-	Addresses major issues such as: (1) adequate training of teachers; (2) teacher demand, supply and utilization; (3) strengthening support structures for teacher professional development; (4) policy alignment ; (5) need for resource centers.

2025	
Curriculum and Assessment Policy Statement (2011)	Elaborates on the valued knowledge, skills and values to be developed in the curriculum and how this may be attained through suitable assessment activities.
UMALUSI (General & further education & training framework) (2012)	Provides the broad purposes for National Qualification levels 1-4 (Grade R-12) in the attempt to ensure quality.

Finally minutes to meetings and course outlines were analysed in a more informal manner, to inform questioning during interviews and to inform the rich picture that was to be drawn-up of the Science and Technology Education department. The rich picture would later be referred to during the focus group interview and used to spark conversation (See article 4).

4.4.1. A Double-Lens Analytical Process

Referring back to the second level of document analysis, this involved the application of a double lens analytical framework to policies that varied in purpose and style. It was decided that owing to policies showing stark differences in their format and purpose, that a first lens, which lifted the policy priorities (i.e. policy goals and values), was needed. Once the main essence of each policy was extracted and highlighted it was then possible to apply the second analytical lens. This second lens employs the use of the ESD competence framework (developed in article 1) to further scrutinize the findings from the first lens analysis. This is done by identifying the degree to which the various policy priorities address any of the ESD principles. The following figure represents a simplistic model of the double-lens process of analysis.

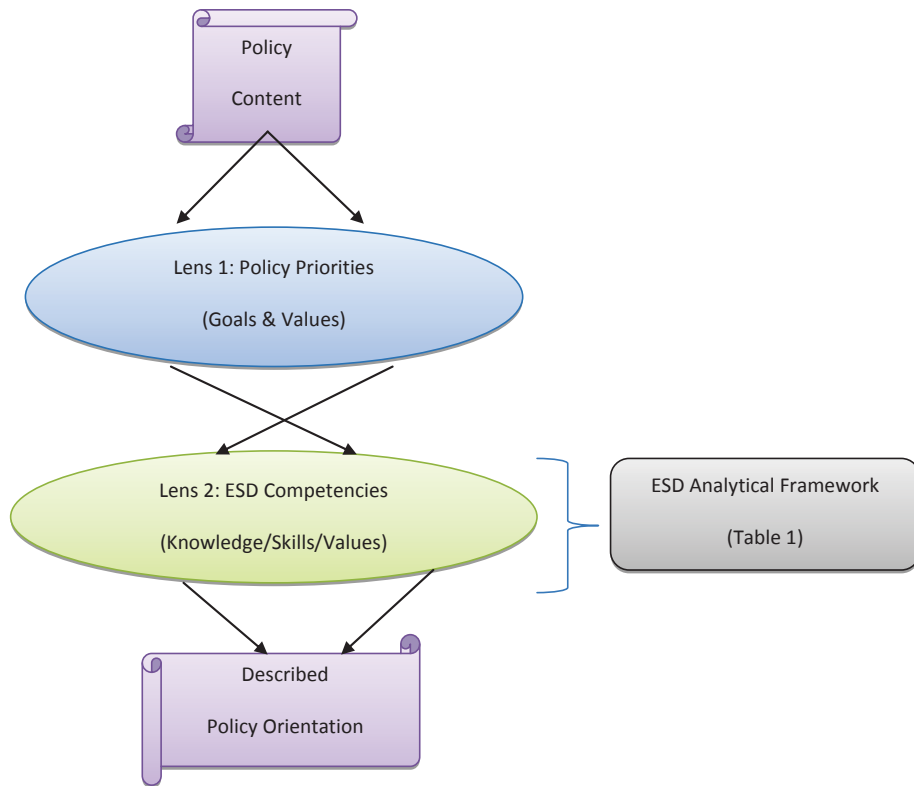


Figure 2. A Double Lens Analytical Tool

The second lens on its own constituted the ‘theoretical sensitivity’ concept that was called upon during engagement with grounded theory later on during the analysis of the interview transcripts. The concept of applying theoretical sensitivity to data analysis is explained further on. Policies themselves are both transparent and aims-driven, thus it did not make sense to use grounded-theory to analyse such documents. Policies guiding teacher education needed to be analysed for their degree of ESD-orientation and thus the construction of the ESD framework was most beneficial for this step. However the interviews themselves would require a different analytical method entirely.

4. 5 Interview Data Analysis

Before the interview method used is described, I find it necessary to explain how grounded theory was used to analyse the interview data. Although at first this may seem backward, the reasons for this decision are twofold. First, data was analysed on an ongoing basis and informed the second one-on-one interviews as well as the focus-group interview. Second, data generated and analysed using grounded theory and soft systems methodology

generated the rich and notional pictures that served as the point of departure for the final focus group interview. None of the presentation on interviews in 4.5 will make sense if the analysis process is not briefly presented first.

Near the beginning of this study, I thought that Cultural Historical Activity Theory could be used to guide data generation and interpretation. Activity theory allows one to view human activity as a system that involves interactions between the individual/s, the rules that regulate these individuals, their motives and the tools they use to attain their goals (Yamagata-Lynch, 2010). Humans are seen as social beings interacting with and altering their environment according to various motives and goals. Activity theory offers a tool to analysing the interactions within a particular activity system. Activity system analyses also offer a way forward for individuals to pinpoint the areas needing improvement to ensure that particular goals and outcomes may be attained.

It was later in 1984 that Engeström further developed activity theory to include a more structured 'activity systems analysis'. Here the activity is seen as a system that can be analysed from many interacting points. These points include interacting individuals and a variety of components of their environment. By analysing the system of activity a more comprehensive picture is painted about the major players/aspects of the system and how they interact and change to develop the desired outcome. Using such a system of analysis when identifying how Education for Sustainable Development is implemented at a teacher training institution, may be beneficial and enlightening. However, it was only after the initial interviews with the acting dean and the teacher educators, that I realized that object-oriented activity was not going to be possible. CHAT would be perfect to analyse human activity towards a particular outcome or objective. Originally I had thought that I was going to be able to observe how ESD was being incorporated into the curriculum or at least observe how teacher educators tried to make such a transition. After a short while I began to realize that Higher Education for Sustainable Development was not a priority in this institution as each teacher educator had their own priorities. The reality was my willing participants did not sign up to be converted rather they wanted to share their practice and share their views about what informed their practice.

I admit that I felt disheartened. However, I also realized that I was encroaching on their environment. Who was I, as an outsider, to come in and demand object oriented activity towards ESD? It was at this point that I decided on a much more considerate and participant-oriented research method. I decided that this study was going to embrace my participants' realities, as it would search to identify both what competencies teacher educators prioritized in their practice and the factors that influenced this prioritization. Therefore, we decided that grounded theory and soft systems methodology would be most suitable in unpacking my participants' realities, in a manner that revealed the complexity of the case.

4.5.1. *Using Grounded Theory to Analyse Interview Data*

Owing to my previous affiliation with the institution, it was necessary to lean on grounded theory as it afforded me the opportunity to view my data through untainted lenses. My role was to be neither judgmental nor colluding with participants' views.

“The basic idea of the grounded theory approach is to read (and re-read) a textual database (such as a corpus of field notes) and “discover” or label variables (called categories, concepts and properties) and their interrelationships.” (Borgatti, 2013)

After I had transcribed, word for word, all the initial one-on-one interviews, I engaged in the reading and re-reading of my raw data and I applied codes to what I read. In this way grounded theory offered me a way to analyse my data in bite-size pieces. I used a degree of theoretical sensitivity to identify what utterances were important, but thereafter used repetitions and contradictions across the data-sets to develop initially codes and then categories.

Each of the teacher educators' responses was read in its own capacity and then re-read considering all of the data. These interpretive ways of knowing can also be said to be constructed hermeneutically, meaning that in order for one part (such as a comment, story or action) to be understood, one must first aspire to understand the whole (for example the context, jargon, institutional culture etc.) in which the part exists. In the case of this research, the institution could only be understood through an exploration of the parts (lecturers, policies, university mission and vision, common practices and courses), however a scrutiny of teacher educators' feedback and stories needed to be set against the framework of the institutional context in order to make meaning of them. Geertz (1979) explains this process better as a “Hopping back and forth between the whole conceived through the parts that actualize it and the parts conceived through the whole which motivates them.” (p.239)

Substantive codes were generated from the data incidences and these codes effectively captured the empirical substance. Once substantive codes had been identified, the theoretical coding occurred (Glaser 1978, 2004). Theoretical codes i.e. categories, were generated as I tried to identify hypotheses that explained how the substantive codes related to one another. This process of generating theoretical codes however did call upon my theoretical and conceptual knowledge (i.e. theoretical sensitivity) which was relevant to making meaning of how the substantive codes related to one another. Eventually I could begin to say something about what all these hypotheses implied about the future of Higher Education for Sustainable Development and what informed teacher educators' competence development.

In 1967, Glaser posed that any theoretical categories that were to be reported on when using the grounded theory approach, needed to emerge from the analysed data. The idea was not to look for disciplinary-related concepts or phenomenon within the data but to

rather look at the data much in the same way as a new-born looked at every new experience. However this degree of objectivity changed in the latter years when it was realized that perhaps some sort of analytical lens (Theoretical sensitivity) was needed in order to first identify what data was useful in the first place for analysis (Glaser, 1978, 2004). The inductive process itself, however, ensures that the more data the better, for it will either remove previous assumptions or consolidate them.

The codes and categories needed to appear frequently before they could be deemed significant enough to report on (Charmaz, 2000). In addition to this any relationships drawn between codes and categories were only deemed important to report on if they could be shown in many instances. This meant that a link could only be made once codes appeared together frequently enough in different instances of data generation.

Glaser (1992, 2004) explained that categories emerged after comparing coded incidents. Initially I engaged an open coding process, whereby I analysed interview transcripts sentence by sentence, applying codes to the events within each sentence. However my constant application of the comparative approach (Glaser, 1978) ensured rigour and validity. The relationships or lack of relationships would emerge once codes were compared with each other. During the analysis of the coding incidents, constant comparison was engaged. For example in this study incidents that reflected teacher educators' interests were coded as 'personal professional interests'. Incidents that reflected the competences that teacher educators felt should be developed in their courses, was coded 'Ideas on Teacher Competence'. Only once these were compared did the category 'Professional Identity' emerge. I realized that when teacher educators spoke about their ideas on competency development, their roles, interests and experience, all the while they were referring to their 'Professional Identity'. This was useful when it was noted that codes from the 'Professional Identity' category often appeared when codes from the 'Education for Sustainable Development' category came up. Through this comparison it was possible to notice that when teacher educators spoke about 'ESD' they also spoke about their professional identity (what they deemed valuable and how they saw their roles) and not so much 'Institutional roles and responsibilities'.

The constant comparative method allowed for the eventual generation of hypotheses. I engaged in constant comparison on three levels: (1) Incidents in the data were compared to other incidents, developing concepts/codes; (2) concepts/codes were then compared to more incidents in order to determine whether more concepts/codes needed to be identified or whether more elaboration needed to be added to the already identified concept/code; (3) and finally concepts/codes were compared to other concepts/codes to generate theoretical codes/categories in order to hypothesize about their relations to one another (Glaser, 2004).

This process of constant comparison provided grounds for triangulation: first when data generated from the same individual at different points in the research process was

compared; second when different respondents' accounts were compared with each other. This was done as a natural part of the coding process when incidents were compared to assign codes, however it also served to triangulate views, stories and accounts of events.

After data had been coded and a rough picture of the organizational context had been developed, I soon came to realise that perhaps this information could serve a greater purpose. It was at this point that I realized that one sure way to understand the probable future of ESD at this teacher education institution would be to present the teacher educators with their existing scenario juxtaposed against a notional one. The discussions that would arise from this comparison, would allow me to see how the group viewed change for ESD. This was where Systems theory and with it, Soft Systems Methodology, would serve to push this study one important step further. Simply, these two methodologies worked together to fully explore the future of ESD in teacher education.

4.5.2. Using Soft Systems Methodology to Generate Insightful Data

In many ways the research engages constructivist methods to generating data (e.g. constructing a rich picture and notional system) and interpreting data. Schwandt (2000) reminds us that we are constantly creating models, frameworks and concepts to make sense of how we understand our experiences, yet common paradigms and jargon influence these designs by identifying their value against the status quo. Simply, any interpretation and representation of interpretation is valued by the paradigm in which the interpretation exists. This research, does strive however, to generate interpretations that are not only agreed upon by the participants themselves, but also offer insight to the field of ESD in Higher Education.

A system consists of various parts that are linked in some ways but not necessarily causally so (Waring, 1996). A system consists of more than just the components that are initially apparent. Some components are emergent, meaning they are more than the sum of the components of the system itself, however they can only be realized upon analysing the interconnections of various components within a system. Systems have generic components as well as specialized context specific components.

Through understanding the structure of a system and its processes and control-structures it becomes possible to predict how a system would respond to various changes and implementations within the immediate system and within its environment (Waring, 1996). This is exactly why systems theory was deemed an important methodology for this study. We wanted to understand what aspects of the teacher education system inhibited and/or promoted a move towards Higher Education for Sustainable Development. However it should be noted that the more complex a system is, the less possible it becomes to make accurate predictions, especially in the case of social systems (Waring, 1996). Therefore the complimentary application of grounded theory informed data analysis and assisted in removing preconceived expectations and getting back to the roots of the data.

Soft systems involve people and their activities that are shaped by their values, beliefs and attitudes. As a result soft systems are highly unpredictable. A teacher education institution is a soft system. "Oshry and Senge both argue that failure to read system dynamics traps us in a cycle of blaming and self-defence. The enemy is out there somewhere, and problems are always caused by somebody else." (Bolman & Deal, 2003, p.30)

Waring (1996) provides a summary of Soft Systems Methodology (SSM) adapting it from Checkland (1981). What is striking about SSM is that it does not have the intention of finding a solution to an already defined problem, rather this methodology has the intention of finding out more about the situation and thus problem-finding and solving only comes at the end of the process. CHAT would not have been suitable for such a purpose as it focuses on object-oriented activity (problem-solving) from the beginning. SSM is about identifying the nature of the problem/situation (such as the future of ESD in a particular TEI) more in-depth. Consequently it is a methodology that favors change. The seven stage process is described below.

SSM begins with stage 1 which involved accessing information about the situation. This required me to collect information about the mess/situation. It was crucial to interview key figures at this stage of the process. Often these key figures are able to highlight the culture and governing structures of the organization (Waring, 1996). It was important that I pay special attention to expressions of concern and frustration about organization structures and processes for example as these offered clues about problem situations and the greater situation in general (Waring, 1996).

Interviews should not be leading but should rather ask open ended questions that require the actor or key figure to explain at length about the situation. To a large extent I had to rely on what teacher educators deemed important or relevant information (Checkland, 1981). After I had conducted all of the one-on-one interviews, I had sufficient data to make a rich picture for stage 2. A rich picture is constructed when the researcher or systems analyst draws the image that they have in their head of the organisation that they are currently investigating. Simply, the rich picture involved my own interpretation or 'snap-shot' of the situation.

An important step in stage 2 of SSM is to identify the parts that contribute to the situation (in this instance the Science and Technology education department). This may be done by identifying the main issues and primary tasks of the system of the Science and Technology Education Department:

Issues	Primary task-related areas
Curriculum change from C2005 to CAPS	New orientation to module delivery
Research Productivity demands	Research and publications
Qualifications	Attain a PhD
Workload	Development of Teaching and Learning, informed by research
Academics as curriculum designers	Curriculum design and development
Community Engagement	Student engaged community outreach
Promote Scarce Skills	Curriculum to address needs of the country
Encourage professionalism	Encourage students to read
ESD is not a curriculum focus	ESD principles are taught according to their relevance to the module

The rich picture displays the main issues and primary task areas important to the situation.

Stage 3 and 4 had to do with mapping out a *notional system* of “What might be” (Waring, 1996, p.91) and not what was there or ought to be there. So this is where I used my logic to determine what would need to be in place within the system in order for the system to be functional towards its primary tasks including ESD. SSM requires that these logical inclusions are not written in the form of ‘practical choices’ but in the form of ‘functions’. It was important that practical solutions not be on my agenda when drawing up the list of issues and primary tasks (Waring, 1996).

Stage 3 involved naming the ‘relevant systems’ within the bigger system/organization and devising root-definitions for these systems. For example in the Science and Technology Education Department one ‘relevant system’ was ‘a quality science and technology education system’ the root-definition for this was: ‘A system to produce students who are efficient in teaching science and technology concepts and skills according to the National Curriculum’.

An example of a root-definition for an ‘education for sustainable development oriented science and technology education system’ could be: ‘A system owned by the University and

run by the Head of the Science and Technology education department and the teacher educators, which aims to deliver a *good education* to Bachelor students that is in line with university and greater education policy as well as incorporating principles of ESD in an infused manner.’

The fourth stage involved identifying what the notional or hypothetical system needed to comprise in order to function. In this conceptual model there is no mention of how certain actions should be worked into the existing system towards realizing a solution. Rather only typical system-features such as ‘Decide about objectives’ and ‘Monitor progress’, were included in the hypothetical system. No explanation was provided about how this may be done by the Science and Technology department. The ‘how’ and ‘if’ was for the actors to decide, for they know their structures the best and would therefore be able to assign detail to the notional system.

Stage 5 required me to return to the real world. This stage involved a comparison of the analysed situation from stage 2 (the rich picture revealing the issues and primary task related areas) with the conceptual model of stage 4, in the possibility of moving towards what could be. Simply put, this was a comparison of ‘what is’ with ‘what might be’. According to Waring (1996) there is no one best way of carrying out this comparison, however some methods are more formal than others. Usually it is the ‘systems analyst’ who carries out this comparison to develop an agenda for discussion for stage 6 with the actors. However, I decided (owing to the developmental nature of the study) that this comparison should be casually engaged during the focus group interview by the teacher educators themselves. It was my role, therefore, during this stage, to ensure that teacher educators did not attempt to provide real-world solutions relevant to their context. The point of stage 5 was to simply compare.

Stage 6 was concerned with that of discussion and debate. This discussion occurred in the form of a focus-group interview, which is described in more depth further on. The purpose of this step was to get the teacher educators to critically examine my notional system or conceptual model. Here I asked teacher educators about what was missing and whether certain components should be there at all. My role was to get teacher educators to reach an agreement about which activities in the notional system were missing/different/inefficient in their own system/situation. I constructed three focus questions (see 4.6.2) to assist in generating discussion around teacher educators’ thoughts about the presented notional system.

Stage 7 involved action for change. This is where actors discuss how they plan to implement the agreed list of changes discussed in stage 6. This stage was not engaged with teacher educators as they made no request for engagement with this final stage, even though it was offered.

4.5.3. Memo Writing

Memo writing was a very important process that I engaged whilst coding the data for the first time. This process of memo writing allowed me to identify how small excerpts may be seen against the holistic contextual picture. I provided myself with memos throughout the data analysis as they served many purposes. I wrote reminders to myself to follow up certain leads in future interviews. I wrote notes about what I thought was being said but an added note to remind myself to check up with the teacher educator next time. Memos allowed my assumptions to be voiced in a conscious way, to avoid their possible covert influence later during the analysis process. Memos also assisted me in the constant comparative process of identifying and refining categories and the potential relationships between these categories. "Through memo writing, we elaborate processes, assumptions, and actions that are subsumed under the codes [...] aids us in linking analytic interpretation with empirical reality." (Charmaz, 2000, p. 517)

4.5.4. Theoretical Sampling

The first interview revealed a lack of in-depth reflection and concrete examples of the competences that teacher educators prioritized in their courses and why they did so. I therefore decided that fewer, yet more open-ended questions needed to be posed in a second interview. The second interview, because it was a lot more focused, allowed me space to clarify previously identified codes in order to make sure that emerging categories and the relationships drawn between them were, in fact, accurate. As we analyse our first set of data we can sometimes realize that there exist chasms either in clarity or explanation of a sought-after understanding (Glaser, 1992). As a result I engaged theoretical sampling, whereby I designed a second interview schedule that specifically addressed the gaps (Charmaz, 2000).

4.6 Interview Method

At first the acting dean was interviewed, at this point I hoped he would provide an informed view into the institutions' overall orientation towards ESD, which he did. This was followed by a number of one-on-one interviews with teacher educators and a final focus group interview.

According to Kvale (1996) qualitative research calls upon professional conversations such as qualitative research interviews. One type of qualitative research interview includes the semi-structured life-world interview which is defined as "an interview whose purpose is to obtain descriptions of the life world of the interviewee with respect to interpreting the meaning of the described phenomena." (p.6) According to Kvale (1996) an *inter view* is literally the exchange of views between the interviewer and the interviewee as they talk on a particular theme or topic.

My role as interviewer required me to be an active listener who not only cared about generating data for my own purposes, but who acknowledged her participants as individuals needing to express themselves. According to Rubin and Rubin (2012) “qualitative interviewing requires intense listening, a respect for and curiosity about people’s experiences and perspectives, and the ability to ask about what is not yet understood.” (p.6). At times my participants discussed at length on topics that were irrelevant to the question that had been asked. I needed to know when to allow this to happen for the sake of my participant. I felt driven to ensure that our relationships were always mutually beneficial.

It was also most important that the way I posed questions, did not place my participants under pressure either to look good or feel the need to perform (Babbie & Mouton, 2001). For this consideration, questions were as unbiased and open-ended as possible. Referral to ESD was limited in order to avoid alienating the teacher educators as the acting dean had informed me that this institution didn’t really focus on ESD. Questions across both one-on-one interviews with each teacher educator were iterative (Babbie & Mouton, 2001), working their way towards a credible conclusion about teacher educator’s competency-priorities and the factors influencing these.

There was a level of consciousness applied to the possible multiple interpretation of terms used during the interview, such as: competences, sustainable development, and education for sustainable development. Thus shared meaning was not taken for granted, considering the differing socio-historical backgrounds of individuals. Furthermore, the researchers’ bias (understanding of ESD and the dynamics of Universities) was acknowledged. This bias ‘for want of a better word’ has also been referred to as ‘theoretical sensitivity’ in this chapter. However, these ‘biases’ were cross-checked with teacher educators’ accounts of institutional dynamics and its influence on competence development in their courses. To ignore any pre-conceived notions of the researcher is to risk influencing data interpretation in a sloppy way but also to deprive the possible use of a carefully managed intuitive tool (theoretical sensitivity). As the researcher I took care not to impose my assumptions and preconceived notions of Institutional dynamics on teacher educators’ accounts and explanations.

A strength of interview methodology, is the ability to present rich and detailed data (Rubin & Rubin, 2012) Richness was aspired to by encouraging teacher educators to expand on their responses through the provision of examples from their experience. Many excerpts from interview data support the main ideas and themes identified and where possible were included in the report writing of the articles. Interview transcripts were analysed using grounded theory coding techniques, to the point of code saturation.

However any contradicting ideas were also valued and reported on. “What may have initially seemed straightforward and simple immediately becomes richer and more lifelike when you see it through the eyes of two people who have different perspectives on the

same matter.” (Rubin & Rubin, 2012, p.69) This indicates that contradicting, overlapping and complementary views all add richness to conclusions drawn from the data. An example can be found when David states ‘leadership’ is necessary for innovation and curriculum development, whereas the head of the department voices that it is ‘agency’ that drives innovation and development. By displaying these contradictory views, an emerging idea is revealed, that as long as actors have opposing views on what is needed for innovation and development, the necessary dialogue and actions may never be engaged.

4.6.1. One-on-One Interviews

When it comes to framing an interview if a researcher finds themselves cornered by the interviewee who requests the researchers’ point of view or opinion, the researcher can either state that their opinion is irrelevant, or state that they are too ignorant to provide insight. Another option is, depending on the rapport and context the researcher may level with the interviewee in an attempt to build a closer relationship that may offer up richer data later (Fontana & Frey, 2000). I adopted a combination of leveling and irrelevance, stating that I was more interested in finding out how teacher educators understood ESD and that really ESD was quite contextually applied so it was possible to define it in many ways. This revealed to my participants that although I had an idea of what ESD meant, it was really quite irrelevant outside their applied context. It became quite evident after that point that teacher educators indulged their understandings in a more confident manner, not worrying about hiding any perceived level of ignorance. Teacher educators even embraced their ignorance by admitting when they were unsure yet continued to attempt to construct meaning.

I tried my best to remove the ambiguity from my questions yet there is always a margin for alternative interpretation. Despite this, accessing information through the spoken word (interviewing) is still considered the most popular and powerful way to access meaning from individuals (Fontana & Frey, 2000).

“..qualitative researchers are realizing that interviews are not neutral tools of data gathering but active interactions between two (or more) people leading to negotiated, contextually based results.” (Fontana & Frey, 2000, p.646) It is necessary to acknowledge that the questions asked of participants often require them to construct responses on a reflective level that they may never have engaged before. This means that although my participants may have been able to provide seemingly succinct responses, their response was constructed when my expectations required them to have a sound thought about something where previously there may have been no thought at all. Of course this was not always the case. Even these constructed thoughts and expressions must be allowed to change and develop over time as I provided more opportunities for the teacher educators to alter and add to their responses through triangulating questions. Triangulation assisted as I tried to fine-tune and cross-check my interpretations of the teacher educators’ utterances.

Correspondence received during the web-based survey indicated that terms such as 'sustainable development' (SD) and 'education for sustainable development' (ESD) for that matter were not commonly familiar to teacher educators and/or without misconception. Therefore I decided that instead of approaching teacher educators asking them to identify what principles of ESD they recognized and applied in practice, it would be more valuable and later credible to ask about the competences they valued and promoted in their practice. Identifying which ESD principles featured in these descriptions could be determined later during analysis and would serve to avoid alienation.

My very first interview was held with the Dean of the School of Education in the attempt to gain insight into the institutional factors governing the B.Ed (Bachelor of Education) program. Added to this intention, was the aim of finding out more about the complexity of the teacher educator professional environment including those aspects guiding their practice and competency focus. I posed the following questions to the acting dean:

1. Could you tell me a little about yourself? (This was asked after I had introduced a little about myself)
2. What are some of your professional and research interests?
3. What are your personal goals for the School of Education in the next five years?
4. What areas in Education do you think need attention/priority?
5. What policy guides teacher educators in the design and delivery of their courses to students?
6. What type of Education does the School of Education promote?
7. What type of teacher does the School of Education aim to produce?
8. What factors do you think play a significant role in how teacher educators design and implement their courses?

This interview provided me with a glance at the general occupational and professional atmosphere in which teacher educators within the Science and Technology department exist and function.

The second set of in-depth interviews took place with the eight willing participants from the Science and Technology Department. These interviews constituted the first one-on-one interviews with teacher educators as I attempted to find out more about each teacher educator on a more professional basis, with specific reference to their values and practice. The open-ended questions that guided the interview, with an expected degree of variation for a semi-structured interview, included:

1. Could you briefly tell me about the courses you teach?
2. What competencies do you emphasize in your module or teaching?
3. Why do you emphasize these competencies in your teaching?
4. Are you and your students involved in any type of community engagement? Why?

5. What are your main priorities or goals as a teacher educator and Academic?
6. What factors guide your practice?
7. In what way do you understand the term Education for Sustainable Development?

The above questions assisted me in understanding (1) the main competency priorities of the teacher educators' modules within the science and technology department; (2) the teacher educators' personal and professional concerns; (3) the factors influencing these priorities; and (4) whether teacher educators understood and/or even promoted ESD or at least principles of ESD.

I conducted a second one-on-one in-depth interview with all the participants. In this second interview I asked questions that required specific reflection on the taught modules in that semester. The first interview assisted in finding out about each participant, their personal and professional values and concerns. The second interview was more fine-tuned towards investigating teacher educators' practice and how it does, or does not, orient toward Sustainable Development as well as how they see their practice in terms of ESD.

I posed the following questions to each participant:

1. Could you tell me a bit about each of your modules and the competencies that you promote through each of these modules/courses?
2. How do you address these competencies in your modules? (Could you please refer specifically to your course outline and assessment activities in answering)
3. Why do you address the competencies mentioned?
4. What is your understanding of Education for Sustainable Development?
5. What competencies would you imagine are promoted through ESD?

The data from the interviews was transcribed and analysed using the grounded theory coding and constant comparative methods. Theoretical sensitivity was applied in the form of the second lens, otherwise identified as the ESD competencies Framework which was constructed through an analysis of current literature. The interview data assisted me in constructing an informed rich picture of the current situation in the Science and Technology Education Department as well as a projected hypothetical notional system picture of 'Science and Technology Education for Sustainable Development'. These two images that I constructed were based on interview data and literature that I analyzed and would serve as the topic for discussion during the focus group interview.

4.6.2. Focus Group Interview

Group interviews involve the posing of questions to a number of individuals either in a very structured manner or in an informal manner. In either instance, the interviewer's role is to negotiate the interaction between participants' responses and conversation to ensure that the interview remains on-topic and remains productive (Rubin & Rubin, 2012). Group

interviews may be used for different purposes, for example brain-storming and developing emergent ideas, or to corroborate stories shared during individual interviews, as well as to provide a context for participant responses, which could serve to add meaning to already shared ideas (Fontana & Frey, 2000). Group interviewing was used for all three of these purposes mentioned.

The group interview, however, began with a presentation in which I revealed a summarized picture of the main findings thus far. The findings and three follow up questions served as the direction and focus for the remainder of the group interview.

The first slide representing the findings from the initial interviews was presented as a rich picture of the organizational context and is displayed below. This process of revealing a rich picture of the participants' context and working environment back to participants for discussion employs Soft Systems Methodology.

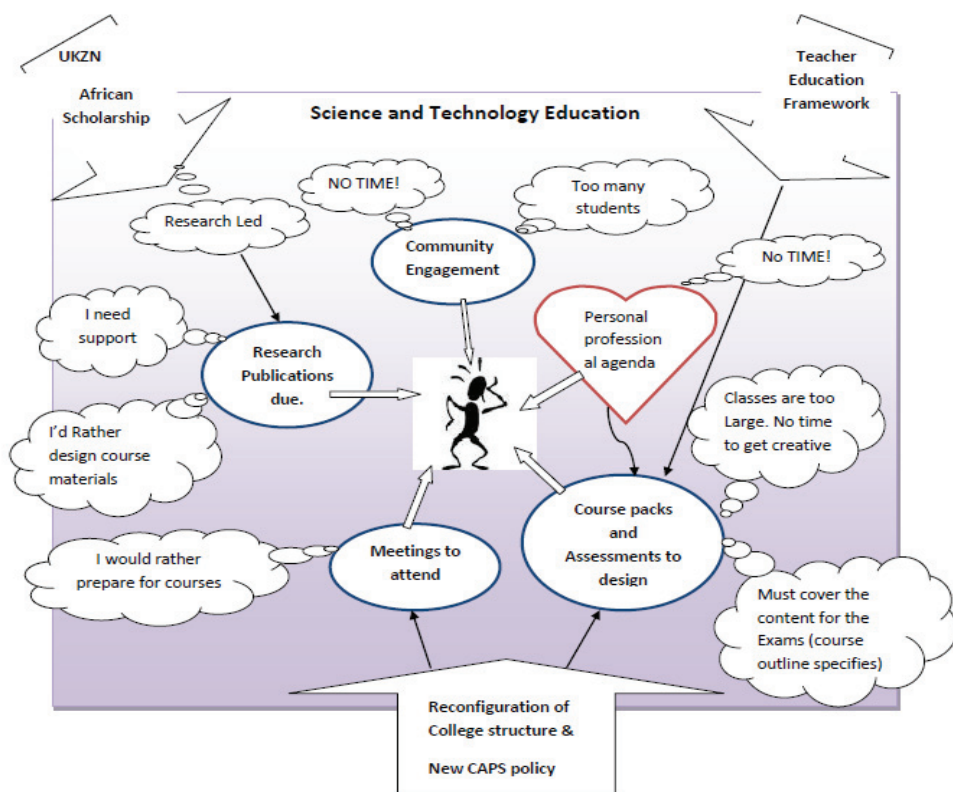


Figure 3. Slide of Rich Picture

The second slide presented to the group for discussion, incorporated the identified relevant subsystems within the organizational context into a notional system picture, using the steps of soft systems methodology proposed by Waring (1996).

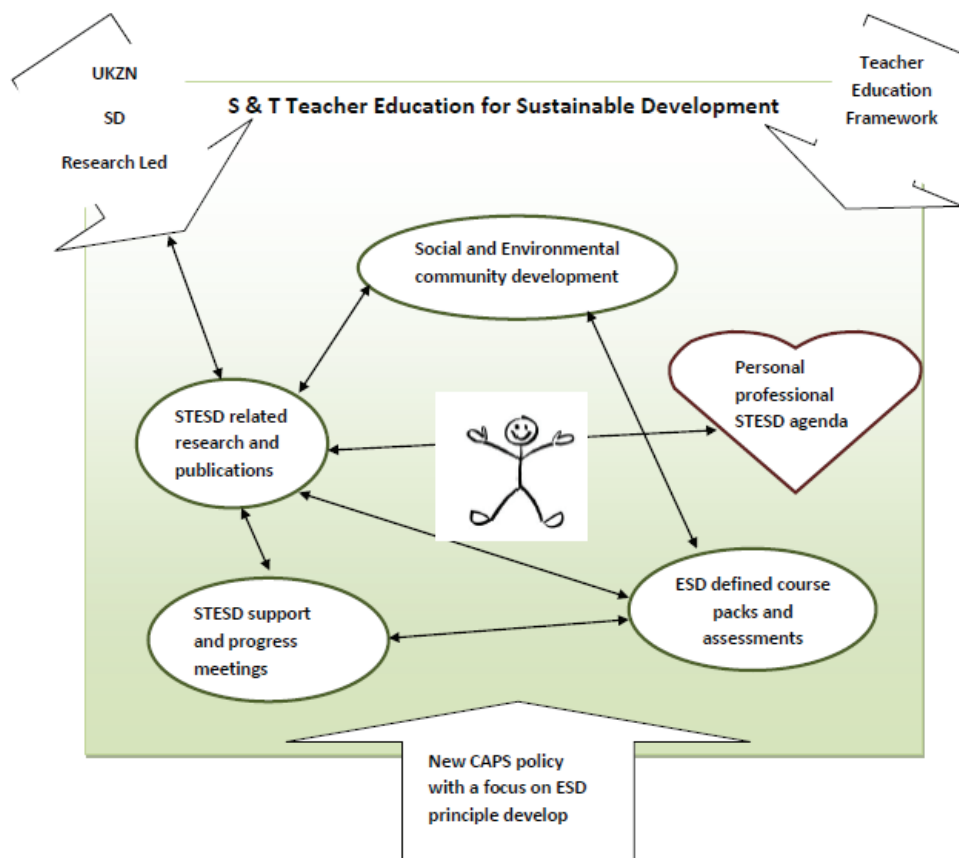


Figure 4. Slide of Notional System Picture

After these two slides had been displayed and explained, teacher educators engaged in the following focused discussion:

Considering the Rich Picture (situational analysis) and the Conceptual Model (notional hypothetical system), do you:

1. Have any comments regarding these two representations?
2. See any need/opportunities for a bridging across to the Conceptual model?
3. See any problems/challenges with bridging across to the Conceptual model

Teacher educators not only brainstormed about the possibilities of engaging the ESD initiative, they also reiterated and added stories and descriptions of factors they found to limit or challenge their ability to buy-in to the ESD initiative (see Article 4).

As the group interviewer I needed to address the three problems that commonly occur during group interviews (Fontana and Frey, 2000). First I made conscious attempts to avoid some participants from dominating the discussion. Consequently, second I encouraged those that were more silent to offer up their opinions and responses to ideas. The third and final problem I addressed was the accessing of responses from all participants in the group to ensure that the focus and topic had been covered to its end. In addressing these three problems, I had to negotiate a happy medium between my role as a manager of group interaction, my role as an interviewer with a particular set of foci and my role as an interested listener.

The strength of such an interview was that participants themselves got to pose questions to their colleagues and have them respond to new points raised. This allowed for new questions and points to emerge that I did not anticipate (Rubin & Rubin, 2012).

Group interviews are advantageous over individual interviewing in that they are able to generate extensive descriptive data and provide a context that participants find exhilarating as they discuss common problems, challenges and sharing ideas. The group interviews can also yield a wider range of responses. They can also encourage emergent discussion or ideas once group members hear what other members think. Finally they can provide an opportunity for group members to hear what other members think about a topic that has never been discussed before (Cohen, Manion & Morrison, 2007).

However group interviewing can also offer problems that individual interviewing does not, such as the possibility for a dominant participant to enforce their ideas in a manner that makes other participants feel obligated to adopt and endorse. This very real danger was why I decided that individual interviews should be conducted first. I also provided multiple opportunities to triangulate responses and this was done by conducting more than one interview with teacher educators. Another challenge of group interviews is that, individuals who bear different opinions to that of the group may be muted as they lack the confidence to pose an antagonistic idea or opinion. It was my responsibility to create an atmosphere where my participants felt comfortable being different within the group. In this study, however, what helped was that the group of respondents shared a rapport that both allowed for and encouraged the differences in opinion and therefore promoted further discussion around these areas.

“Focus groups are contrived settings, bringing together a specifically chosen sector of the population to discuss a particular given theme or topic, where the interaction with the group leads to data and outcomes.” (Cohen, Manion & Morrison, 2007, p.376) The contrived nature is seen as both a weakness and strength, for although it does not offer a natural setting, it does provide an opportunity for discussion on a topic that may never have previously been entered into. Interviews, owing to their dialogical nature, are conducive to the construction of knowledge as interviewees interact with one another on a particular topic (Kvale, 1996). The participants of each interview are not simply interrogated by the

interviewer but rather as they engage in a dialogue they begin to construct their own meanings of their world. Owing to the personal nature of the interviews often the explorative dialogue can lead to a process of development and even an improving of the current situation. During the Focus group interview a particular degree of clarity was established between the Head of the department and the other teacher educators as they voiced their varying views of their own autonomy. Also one science teacher educator, who previously felt a lack of support in her own discipline, began to find collegiality amongst technology teacher educators.

In this report I have tried to be as objective as possible (keeping with the interpretive paradigm) yet at the same time I acknowledge that the hermeneutic process involves an interpreter who does influence interpretation of human meaning. In much the same way readers alter and adapt what they understand and take from the research. The object of meaning cannot be entirely external to the meaning-maker, when in fact the meaning is defined by the meaning-maker. In fact, as a researcher, I found myself often in a dilemma between aiming for objectivity yet at the same time trying to acknowledge myself as the subjective interpreter who possibly influenced the meaning through my meaning making process. I wish to be transparent about this process and do not attempt to claim complete objectivity but rather aim to acknowledge how and when interpretation is open to subjectivity. Attempts to limit the degree of subjectivity have been revealed (E.g. rewording questions, paraphrasing responses and proof-reading transcripts) yet I realise that even this does not ensure total objectivity for even the report-writing is a creative process. This research report is intended to indicate the limitations of the study but simultaneously serves to limit the impact that these limitations have on the contributions of the study.

4. 7 Methodological Limitations and Challenges

Throughout the method chapter I have tried to reveal some of the challenges and limitations experienced during the data generation process. Here I attempt to touch on some issues that have not been mentioned as well as further elaborate on some that have been.

With regard to the web-based survey, we discovered that the term 'Education for Sustainable Development' posed as a barrier for many respondents. We were of the notion that the web-based survey itself served the purpose of exploring what ESD principles teacher educators recognized in their practice as well as through institutional culture. The challenge however was more in the detail provided through the email to potential respondents (naming sustainable development and ESD as the focus). This was potentially also the case within the survey itself, where ESD principles listed (although carefully explained to ensure clarity) may have still appeared foreign to teacher educators within disciplines that had not traditionally been linked to Environmental Education in the past. We

soon realised that the web-based survey results could therefore not be used and would rather serve as a tool for selecting the participating institution, through response rate.

We present a second broader limitation as only the Science and Technology Department was involved in the study. A study that was well resourced and funded, could have further engaged all departments within the School of Education within the particular institution. However due to the limit of one researcher and the desire to engage the chosen department in an in-depth manner we decided on a thorough analysis of the Science and Technology Department alone. Bearing this limitation in mind, it should also be remembered why we chose this department to begin with. First it owed to the acting dean of the school of education referring me to this department as the only department that even came close to incorporating principles of sustainable development within its programs. Second, because science and technology are at the fore, driving development, it is these two disciplines that have contributed to development at a rate that has now created concern. We realized that science and technology are in a key position to formulate solutions to problems that they have created. Therefore science and technology are most traditionally linked to issues of sustainable development and consequently an exploration of this department would provide meaningful clues as to the future for ESD in this teacher education institution.

A most pertinent limitation to this study is its inability to make generalizing statements about the future of ESD in higher education institutions. More on this is discussed in chapter 5. Originally we thought two higher education institutions would be analysed however when questioned on what two cases would allow me to claim that one case would not, I was unable to answer. When it became clear that two cases would bring me no closer to making justifiable generalizations than what one case would, I decided rather to spend all my energy in understanding the single case. Perhaps what could be gleaned from this intense process was potential methodological insight into how other cases may be explored in the future.

Finally a major challenge was presented to me as the researcher who had eight years prior experience in such a context. This prior knowledge, although it served useful in establishing rapport with the respondents, needed to be repressed during data analysis. It is not certain where this embedded knowledge may have emerged, however it was the fear of bias that led me to engage grounded theory. Wherever possible, my assumptions and expectations were consciously noted and reprimanded. This was backed up through the triangulating process of the constant comparative method offered in the coding process of grounded theory. Where my preconceived ideas have crept into the data analysis can never be known completely, however it is the evidencing of codes with quoted incidents in the data analysis process that has kept my conscience satisfied thus far (See Appendix 3).

4.7.1. Reflection on Research Credibility

The strength of the interviews, besides their ability to ensure balanced and thorough data, was their ability to ensure the data was accurate and credible. This is evident when every conclusion made is strongly supported by evidence (expressed through utterances and examples elaborated upon). Accuracy was attained by ensuring that the interviews recorded were accurately transcribed, word for word, and that interviewees had been given an opportunity to read through the transcripts to ensure that their meaning had been portrayed accurately. Accuracy was also achieved when quotations selected to tell the story, are representative of the interviewee's experiences and that quotations have not only been selected to prove a preconceived argument. Rather the interview data was what indicated what the main argument should be.

In reporting the findings from the interviews, it was important for me as the researcher, to make sure that the data was credible. This was achieved by ensuring that what teacher educators claimed to be their truth was supported with evidence. This evidence took the form of similar stories shared by other teacher educators, serving as a type of confirmation. "Credibility comes not just from who you interview and how well you check what they say; it also comes from showing readers how carefully you have carried out the research." (Rubin & Rubin, 2012, p.67)

Evidence was also attained when truths claimed by teacher educators were compared against both their shared examples of practice and their actual course materials. As an example, during the first one-on-one interviews, some teacher educators revealed interest towards ESD and SD and suggested a focus on some of these issues in their modules. However, upon the second one-on-one interviews where teacher educators showed their course outline and discussed their assessment methods, it was clear that ESD and SD was not a significant focus. This provided me with the opportunity to probe further to find out why even though teacher educators showed interest for developing the concept they still did not indulge in it further. Ideas and themes emerged until eventually a saturation point was reached, bringing forth no new information.

In order to ensure that the research was transparent, it was pertinent that I backed up every major conclusion with sufficient quotations from interviews. According to Rubin and Rubin (2012) you should enable the reader to hear the voices of the interviewees and thus enable them to follow your logic about the major conclusions drawn from the data. Care has been taken to ensure as far as possible, that data analysis is both transparent and representative.

4.7.2. Reliability and Validity

During the coding process, as the constant comparative process was engaged, it was important to ensure the codes and categories had reached a saturation point. When different questions and interviewees (intersubjective reliability) reveal the same ideas or themes, this becomes an indicator of reliability of the findings (Kvale, 1996). Codes were only deemed significant for inclusion if they reappeared across participant data sets.

The clarification of meaning during the interviews was constantly engaged through the use of follow-up and clarifying questions. Teacher educators were also given the opportunity to proof-read the interview transcripts to ensure that their meaning was truthfully captured. Care was also taken in the phrasing of questions to remove as much ambiguity as possible and triangulating questions served to double check respondents meaning, stories and accounts of their reality. In these ways the true representation of the knowledge/findings generated was aspired to. Validity was also ensured by providing readers with the example/premises of deduced meanings and interpretations. "A valid argument is sound, well grounded, justifiable, strong, and convincing." (Kvale, 1996, p.236)

4.7.3. Generalizability

It is felt that this case study offers a limited degree of generalization. The case shows how an innovation such as ESD has been largely ignored due to multiple factors. These consistent and dominant factors suggest that any other curricular innovations with similar characteristics to that of ESD and of similar foreignness to HEI culture, policy and priority, will experience the same fate.

Generalizability has been valued because it tells us that based on one particular example it is possible to know what to expect in a similar case. This view of generalizability according to Kvale (1996) originates from behaviorist psychology and is opposed by the humanistic view. The humanistic view poses that every case is unique and requires contextualized logic to make meaning of it. A postmodern approach to social research thus shifts value from generalization to contextualization, as is done in this study.

This study does not and cannot claim statistical generalizability for the sample was self-selected due to both its accessibility and responsiveness (Kvale, 1996). However the study does propose analytical generalizability in the sense that any case that bears similar contextual factors to the case represented by this study, can safely make the same predictive conclusions made in this study. This is owing to the fact that analysis considers the organizational context and its influence on teacher educators' decisions.

4.7.4. Research Ethics

The academic code of ethics, since 1980, stipulates four guidelines that serve to steer social researchers towards a consideration for the individual and their rights (Christians, 2000). First, informed consent specifies that research participants have the right to be properly informed about the nature of their involvement and the possible consequences of their participation. The point is to ensure that participants receive transparency regarding the nature of their involvement in the research as well as the purpose of the research itself. Participants in this research had to agree to participate without being coerced, by the head of the department in this case. There was one teacher educator who later decided to drop out of the research for personal reasons and she was not chastised for doing so. Rather she simply permitted the already collected data to be used, without any further data collection. I provided information to all teacher educators in the form of an introduction presentation. I

followed this up with a detailed email, specifying how many interviews would be required, the nature of each interview and the entire duration of the data collection process. Although many researchers may be hesitant to divulge the purpose of the research for fear of swaying the responses of the participants, I did not find a need to withhold any information as I assured the teacher educators time and again that it was acceptable to 'not know' about ESD. In fact I assured teacher educators that their lack of knowledge about the term ESD was not an issue and that we would continue to talk about competency development instead. Teacher educators' initial concerns dissolved as they began to divulge their practice, their practical knowledge and their real experiences. Soon the interviews became the participants' opportunities to vent, explain and even in some instances justify themselves.

The second guideline is to avoid deceiving the participants during the research. Deception refers to the intentional misguiding of the research participant to assist them in drawing incorrect assumptions regarding the purpose, methods or outcome of the research. As Bulmer (1982, p.217) put it, deception is "neither justified nor practically necessary, nor in the best interest of sociology as an academic pursuit." This is why I did not find a need to mislead my research participants about my level of knowledge regarding ESD. I could have claimed ignorance to make them feel more comfortable when giving their own interpretations of ESD. Rather I chose to not flaunt what I knew and preferred to ensure teacher educators that any meaningful understanding of ESD was one that was subject to contextual interpretation. Teacher educators soon realized that it was up to them, using their expert knowledge of their subject, to identify when or how and if they addressed ESD principles in their practice.

The third guideline refers to the need to ensure both privacy and confidentiality. It is impossible to ensure absolute confidentiality, due to pseudonyms and fabricated locations being easily identified by insiders who may be working at the same institution. However I did my best to protect the identity of the participants as well as the research site (Christians, 2000). All names have been changed in this research report and information that could identify the participants was removed as best as possible. Participants were given their transcripts (anonymized) to read and were asked to make any comments for changes or parts that they felt should be omitted from the research. There were no complaints about the data and so I was given the clearance. However even when writing the articles I rechecked the manner in which the contexts were written about to ensure that the location was not revealed.

Finally and very importantly, the fourth guideline speaks to accuracy. Research methods were carefully chosen and designed to ensure respondents revealed their real meaning, experiences and feelings. Teacher educator's responses were compared against one another when common issues or incidences were described. This comparison method assisted in cross-checking the accuracy and validity of the stories being told. Data analysis underwent a

grounded theory approach, meaning that the only data that was excluded was that which did not contribute to any meaning-making of the identified categories and codes. These excerpts of data were often off-the-topic chatter. All other data was included in the data synthesis process. Yet, even the off-the-topic chatter was transcribed and included in the transcripts given back to the participants to check.

Access to the research location and its professionals was permitted by the specific Institutional Review Board at the University. I completed a Research Ethics application, whereby I outlined the purpose of the research, the methods and intentions of my research process and findings as well as enclosing my proposed data collection instruments. A month later I received clearance from the institution and was allowed onto their site to begin data collection.

Another ethical concern was interpretive sufficiency, understanding that data can be interpreted in multifarious ways due to context, language and culture (Christians, 2000). It is owing to this reality that thick description was sought and more than one interview was engaged with each participant. Interpretive sufficiency also drove the decision to have up to eight participants' version of their institutional situation. Stories that corroborated and stories that did not, served as a point of attention. Individual interviews implemented triangulating questions to double-check meaning. Triangulation also occurred across the two one-on-one interviews and the focus group interview at the end. This was engaged when comments or themes were checked with other participants to identify whether they agreed with the phenomenon or had anything to add. These themes were represented in the rich picture at the final focus-group interview, providing an opportunity for teacher educators to comment on how the situation had been interpreted. Interpretive sufficiency was ensured through triangulating methods. "research is not the transmission of specialized data but, in style and content, a catalyst for critical consciousness" (Christians, 2000, p.148)

5. A Discussion of the Major Findings

In this chapter I attempt to highlight the unique contribution of this research by discussing the UNESCO (2005b) document's guidelines and recommendations for reorienting teacher education for sustainability. I also explain about the policy formulation process and try to address the popular assumption that many researchers hold regarding the contribution of their research towards future policy formulation. I point out that researchers need to be more specific about the contributions of their research to the policy formulation process by first understanding the phases involved in the process and second by making direct reference to how their research could influence these phases. I attempt to use some of the major findings from this study to engage in a specific conversation about the possible ESD policy formulation process.

Finally I summarize some of the major contributions from my study. The major contributions are grouped according to the four articles referred to. In addition to the major contributions from each article, a Higher Education for Sustainable Development Framework is offered. Throughout this chapter I highlight the implications of my findings for the future of ESD in teacher education. I engage one last conversation of the role of the University as a learning organization and the pressing need for TEIs to take up their responsibilities for transformative learning.

5.1 Guidelines and Recommendations

UNESCO (2005b) put together a document outlining guidelines and recommendations for reorienting teacher education to address sustainability. This document was put together through survey responses from teacher educators at 18 member institutions of the International Network. The International Network consists of teacher education institutions and teacher educators from 30 different institutions and countries who have chosen to be promoters of ESD. The guidelines and recommendations (UNESCO, 2005b) cover all aspects of teacher education, such as: curricula, policy, pedagogy, research, partnerships, funding and reward systems. The report is optimistic, showing many instances of how individual satellites have made an impact at their various institutions. During the research process, given these guidelines and recommendations, I found myself in constant search of how we could ensure more sustainable systematic reorientation towards ESD. It was important for me to find out what it would take for typical institutions (institutions not traditionally aligned to the environmental cause – not many) to inspire reorientation. I needed to understand the barriers and how they played out at a particular institution. Although bottom-up, individual action is so valuable and has shown much success (UNESCO, 2005b), I cannot shake the feeling that we need to, on top of this, put in place more sustainable measures that won't fade with the times. It would be ideal if most Teacher Educators in most TEI's were persuaded to rally to the ESD cause, however this is far from reality. We

need policy and supporting TEI structures that can drive for Teacher Education for Sustainable Development (TESD) where there are not enough project leaders to do so.

This document (UNESCO, 2005b) inspired the start of this research process, however once I had reached the end of my research I was faced with the question of, 'what could I possibly have to add to such a comprehensive document?' At first it felt as though everything I had found out through my research had been reported on already in the UNESCO (2005b) document. However as I read it again, I realized that I had a deeper understanding of the implications of the barriers that were reported on in the document. The many recommendations made of how to address the barriers were individual and disconnected albeit spot on. I began to realize that what we needed was an understanding of how all these barriers and recommendations finally fit together within one institution. I therefore attempted to use this understanding I had gleaned to construct a Higher Education for Sustainable Development Framework that could help to guide the change process.

The UNESCO (2005b) document focuses on the role that Teacher Education Institutions (TEI's) should be playing in reorienting teacher education to address sustainability.

"Institutions of teacher education fulfill vital roles in the global education community; they have the potential to bring changes within educational systems that will shape the knowledge and skills of future generations. Often, education is described as the great hope for creating a more sustainable future: teacher-education institutions serve as key change agents in transforming education and society, so such a future is possible." (UNESCO, 2005b, p.11)

This excerpt from the 'Guidelines and Recommendations' above provides a strong rationale for Teacher Education for Sustainable Development (TESD). However the ability for TEI's to make changes in the education system, is limited when teacher education is strongly decided by: the taught curriculum (which is decided by the ministries of education through conversations they have with other ministries regarding societal imperatives); promoted research agenda; and a traditional university paradigm (UNESCO, 2005b). One may ask what sort of power do TEI's have to promote ESD, when the South African government has clearly shown that social and economic justice are the only two pillars worth promoting. I don't believe South Africa is unique in this dilemma.

According to UNESCO (2005b, p.15) "faculties of education must decide which themes to emphasize within their curriculums, programs, practices, and policies to ensure that teacher-education programs fit the environmental, social, and economic conditions and goals of their communities, regions and nations." The issue is that Higher Education Institutions (HEI) have already decided on their themes and these are strongly motivated by what society deems important (Bentham, Sinnes & Gjøtterud, 2013).

According to UNESCO (2005b) it is hoped that funding would free teacher educators from their traditional responsibilities long enough for them to engage in critical debate and change. At the Higher Education Institution where this research was engaged, it quickly became clear that money flowing in was not sufficient. The push for publication output is priority and academics wishing to free their time from traditional responsibilities need to apply for funding from NRF (National Research Foundation) and other external sources. The reality is financially speaking it is not in the power of these institutions to simply relieve academics of their duties. This accentuates the need for research foundations and other potential funders to offer funding for research in the fields of sustainability. What may be in the HEI's power however is to make available posts of professorship in the field of sustainability. A lot of the budget allocated to the departments within the faculty of education is allocated to 'extra help', that being tutors, markers, lab assistants and contract lecturers. Student numbers have increased in the hope of securing tuition fee inflow, turning classrooms into lecture rooms. This 'extra help' is employed to carry the work load burden teacher educators are faced with. The result, teacher educators spend much of their time managing part-time employees and students all the while trying to meet their research publication demands, leaving very little time for curriculum re-design.

Engagement in this research study confirmed some major barriers reported on in UNESCO's (2005b) document. These major barriers refer to: lack of professionals trained in or knowledgeable about ESD; inadequate national policy to support ESD; inadequate institutional climate to promote and support exploration and creativity regarding ESD; and the lack of awareness as to the importance of ESD. However what my engagement with this research was able to illuminate further, was the impact that such barriers had on teacher educators and what teacher educators felt they needed in order to begin to reorient their practice for ESD. Teacher educators were able to speak from inside the web, showing how factors were connected for them, revealing lines back and forth between management/policy/institutional culture and academics and their practice. This engagement allowed me to resist speculation about 'major inhibitors of ESD' and to rather rely on direct feedback about which barriers were experienced as more influential on their practice. Simply listing barriers would not indicate which barriers needed more urgent address or what it would take to address these. This research highlights major competency influencing factors identified by practitioners.

Furthermore this research journey also helped me to better understand the ultimate challenge facing Teacher Education for Sustainable Development (TESD). This barrier lies at the societal level and what we believe to be the true pressing needs warranting space in the curriculum. This is the ultimate catch twenty-two that ESD itself is trying to address – how to encourage critical thinking to break the cycle of socialization. Societal needs have always shaped education and so we need to admit that society does not yet see the need for sustainability. In my country, burdened by our Apartheid past, society believes that the only way to readdress these past societal injustices, is by providing the majority (previously

disadvantaged) with equal access to economic development. Socio-economic justice is the order of the day, with no understanding as to how this relates to our limited ecological justice. Socio-economic foci were repeatedly promoted by teacher educators, who were supported by University (ultimately societal) imperatives. Therefore scientific research needs to focus on exposing the direct causal links between specific human actions and ecological ills and how these ills contribute to social injustice. Once these direct causal links are established and exposed it may become more apparent why government should spend more time targeting societies' commodities when they (we) engage in ecological crimes. Although one may have been under the impression that my agenda was to shift the responsibility from education, rather I believe that the constant and numerous efforts to promote the concept SD and ESD is exactly what is needed to encourage critical awareness. This popularization will assist in eventually creating a trend and sparking interest in all sectors, not just environmental and education sectors.

It is possible that the Ministry of Education in South Africa pushes for socio-economic educational priorities, simply because officials also have a limited understanding of sustainability. The constant push for economic growth under the misconception that this will directly reduce poverty and thus social injustice is erroneous and damaging to our hope for ecological justice and a sustainable future. There is nothing wrong with pushing socio-economic agenda however these also need to envelope sustainability in relation to the ecological environment. An example of such incorporation could be found when exploring 'Consumerism' in a Business Economics class for example. When exploring such a topic it would be beneficial to introduce the idea of sustainable consumerism. This could be displayed by reflecting on the skills and traditional knowledge of the masses and incorporating these with natural and recycled materials (avoiding damaging industrial processing) to generate products/ideas for sale or immediate use. Such entrepreneurship invites sustainable consumerism and encourages subsistence living in poverty stricken areas. It is not realistic to say that top private businesses directly assist in resolving poverty. This is not the only sort of development we should be focusing on in education. What opportunity are we providing, through our education, for the poverty stricken to turn to subsistence living when survival via employment is not an option? This is how I understand sustainability to apply to life in South Africa.

Initiatives undertaken by the International Network (UNESCO, 2005b) show that curriculum and program development towards sustainability has been successful and therefore is definitely achievable. We therefore need to focus on how we can create Higher Education Institution (HEI) culture that is complimentary to promoting ESD. In order for TESD to be sustainably intertwined in teacher education, we must support it with a complimentary institutional culture. So although Professional Learning Communities (PLC's) are necessary and effective means of reorienting teacher education to address sustainability, they also need to be supported by institutional culture (communicated through the vision and mission

statement) if they are going to make systematic impact. I hope the HESD framework illuminates this.

At the end of it all, one may say that we have great insights (UNESCO, 2005b) as to what it will take for an effective reorientation of TEI's towards sustainability. Requiring further research is: how might all these key players and institutional structures interact to drive this successful reorientation process at a TEI? There are a lot of informative suggestions for agents who would like to reorient towards ESD, however due to traditional institutional culture and contradictions in institutional values and agenda it is no longer a question of how to reorient towards ESD, but rather a question of how to merge institutional culture and agenda with ESD values. This is needed for ESD to make a systemic impact in Education in South Africa.

5.2 Influencing Policy through Research

According to Rist (2000) the policy analysis process over the years has produced a wide array of methodologies and conceptual frameworks that policy researchers now use to analyze the interpretations and implementation of policy. This reality has led to much criticism about the actual progress of the field of research focusing on policy and policy development. However it has been posed that diverse approaches to the field offer a variety of lenses of analysis into a very complex field (Rist, 2000).

Analysing the History and discourse of policies as well as the policy environment can assist in providing a more informed view of policy meaning and application. It is for this reason that education policy was explored simultaneously alongside an exploration of the teacher education institution academic environment. Existing policies and dialogue about these policies and their application in actual Teacher Education institutions as well as discussing ideas around why competencies are prioritized assisted in understanding both policy context and policy future.

My study does not try to foresee how policy impacts practice. The research also does not attempt to identify how ESD and other Education policies impact practice. Rather the research aims to understand the policy environment and what factors may offer a challenge to the realization of ESD and related policies.

“We are well past the time when it is possible to argue that good research will, because it is good, influence the policy process. That kind of linear relation of research to action simply is not a viable way in which to think about how knowledge can inform decision making.” (Rist, 2000, p.1002)

According to Rist (2000) there is still a relation between knowledge generated by research and the decision-making process, however it is not a direct correlational relationship that can be assumed. Researchers rationale for many a research project includes influencing the policy process and a faith that this will occur on its own. All the while showing little

connection between their research and the policy-making process and where exactly their research will influence the process.

In order to truly affect the policy making process with research, one must understand that policy formulation engages a particular process that does not wait for research findings to guide it. However policy formulation may be informed by research if policy researchers work closely with policy writers (Rist, 2000). Over the years policy decisions have been made using insufficient research to inform these decisions (Rist, 2000).

The policy cycle according to Rist (2000) has three phases: policy formulation, policy implementation and policy accountability. My research implies implications for all three phases. It indicates the shortfalls in existing teacher education related policies (see article 2) as well as identifies what factors influence teacher educators' competency priorities in their courses (see article 3). Finally my research uses this knowledge to imply the possible future for ESD in teacher education institutions (see article 4). My research identifies that the DESD is not consciously implemented and therefore no one could be held accountable for its implementation. However teacher educators do implement and hold themselves accountable for addressing certain Decade of Education for Sustainable Development (DESD) principles. This is purely because they are either supported by other already enforced policies, or owing to personal professional interests and institutional agenda. The research also notes that some aspects of Curriculum policy and institutional agendas also work against the fulfillment of important DESD policy principles. This implies that the policy context for DESD is already a challenging one, even before DESD policy has been recognized.

I would propose another phase be added, referring to policy interpretation. This phase would precede the policy implementation phase as implementers of policy need to interpret not only the policy, but also the context in which it will be implemented. Context refers not only to the physical and cultural/institutional context, but also what I call the greater 'policy-web context'. What other policies are involved and do they serve to support or contradict the new policy that needs to be implemented?

One needs to be realistic when implying that their research will affect policy. Therefore it is important to understand how policy is formulated. According to Nakamura and Smallwood (1980) there are policy actors who are given the authority and resource to decide policy priorities, they are usually formal leaders in the governmental sphere. They do not formulate policies in response to a pressing problem. Rather they identify a problem, reflect on what has been done in the past to deal with such a problem (in other countries for example), determine the success and flaws of these previous attempts, consider their context and resources and formulate a best possible policy to address the problem (Rist, 2000).

A key consideration for the policy formulation phase is deciding who will be the instruments of the policy implementation phase. It is this audience for whom the policy is formulated. A

question addressed in my second article is, “should education be used as a tool to address sustainable development issues and furthermore is it the responsibility of education to realize such policy?” Even though government leaders may agree that education institutions are viable tools for policy realization, this research reveals that they are not consciously equipped or responsive to meet the need. Rist (2000) comments that research exploring policy tools (i.e. education institutions as policy implementation tools and national curricula) require a lot more attention. Rist (2000) adds that the time spent on policy formulation is very limited. I would add all the more reason for readily available research that explores policy tools. It is not the task of supplying research during the small window of policy formulation that is crucial, rather it is a constant revision of research on policy tools that is more pertinent. This study explored a policy tool (i.e. Science and Technology teacher education) and identified the various factors that are at play in such a context. This study points out that these factors need to be realized before ambitiously assigning an institution and its programs as policy tools for the realization of the DESD. It is not to say that this policy tool should not be assigned, but rather that the dynamics of an institution be fully understood in order to adequately prepare and equip the selected policy tool.

Although policy change and renewal occurs in a very short time frame, depending on who the policy makers are and what research they have available to them, research can assist them in answering questions about reasons for policy failure, poor policy buy-in and policy misinterpretation.

Policy implementation is the second phase whereby policy principles are translated into programs and practices, or in this case, national curriculum and course competences (Rist, 2000). This phase is concerned with the functions of the policy tool. Although in this research national curriculum is in itself a policy, I also identify it as an ESD policy tool. I do this for a particular reason, some ESD principles, albeit insufficiently, are addressed through the national curriculum (see article 2). The national curriculum is of interest to all educators and the only way any ESD principles have managed to reach the school level, has been through an interpretation of national curriculum, and teachers’ personal interests. At the teacher education level, the course competences focused on and developed shed light on how institutional policy and national curriculum policy have been interpreted and implemented.

Most vital for any successful policy implementation is to first identify whether or not the policy tool is adequately equipped to interpret and implement policy in an appropriate and efficient manner. This requires an exploration of the structures and principles that govern/impact the policy environment. It appears that the most efficient way to ensure the DESD and its principles are implemented in education, is by positioning context relevant ESD principles within existing teacher education institutions structures and guiding policies.

A very relevant question that may be posed is ‘Does the institution interpret the policy idea/initiative in the way in which it was meant?’ Firstly, the teacher educators themselves

were not conscious of the DESD and its principles, however they had heard of the term 'sustainable development'. When they reflected on its meaning originally, the answers varied. Secondly, the institutional policies reflected a context-appropriate concern about social and economic development, resulting in the constant reflection on these two types of development. An argument could be posed to say that South Africa faces a dangerously high poverty rate and therefore education should respond to that need, focusing more on economic and social development. However many more arguments have been presented, motivating why environmental development is an equally important sustainable development concern to South Africa (see article 1) and therefore equally important for consideration in higher education related policy.

Within my research there exists a grey area in the way in which I explore the attention given to ESD at a teacher education institution, because in fact there is no formal ESD in education policy in South Africa. This means when I do explore it, it is done so as a 'policy idea'. Therefore, when I try to identify the policy context for the ESD initiative, I am actually exploring the 'policy idea context'. I do this in an attempt to explore and reveal what structures and principles (within a teacher education institution) will serve to challenge, contradict and promote the implementation of any upcoming ESD policy in South Africa. This research could be said to be laying some ground for the future ESD policy formulation, implementation and accountability.

Policy accountability is the third phase and the indicating stage regarding the potential success of any policy. It is at this stage where one determines the level of buy-in and responsibility that is harbored by the intended policy implementers. Qualitative research can offer great insight into the degree of policy success at this phase. Due to ESD only being a *policy idea* at this institution, there was no way of engaging qualitative research for the purposes of identifying the level of success and implementation of the policy. Rather qualitative research was used here to determine the likelihood of policy accountability, had there been one. The research reflected on what competencies teacher educators promoted and what influenced this. Research revealed that they were strongly influenced by institutional research agenda and priorities as well as their own personal interests and curriculum. There was a strong indication that if ESD principles permeated institutional research agenda and priorities as well as school curricula, then they would get more attention and focus. It was noticed that teacher educators' research interests influenced their competency development through their courses. This indicates that even though ESD principles do not sufficiently permeate school curricula, if teacher educators were encouraged to explore ESD related research agenda, it could still impact their competency foci in their courses.

The level of accountability for initiatives is strengthened by the degree of leadership provided by management (Rist, 2000). Management and heads of department let employees and in this case teacher educators, know what is valuable and important. The

first interview held with the acting dean, revealed that sustainable development and ESD were not of major priority at the institution. This reality was reiterated many times through the remaining interviews with teacher educators. The head of the Technology department (a leader) revealed great interest and drive in extending the Technology education learning experience to industry. The leader showed interest in a socially responsible Science and Technology education and this was mirrored in strategy meetings for the reconceptualization of the Bachelor of Education program and particularly the Technology education programs. This revealed that what leadership deems important is likely what will influence the course design process. Policy, or in this instance, 'policy idea' accountability also needs to be integral to leadership in order to be realized on the ground.

When deciding to allocate a teacher education institution as a policy tool, one first needs to determine the 'institutional capacity' (Rist, 2000). Institutional capacity refers to the institutions ability to carry out the duties that an initiative or policy has allocated to it. The ability for an institution to carry out these duties may be influenced by factors such as staff accountability and morale, work load, resources, leadership, institutional priorities, other policy initiatives and the emergent issues that arise from a combination of these factors. It is this institutional capacity and the methods that can be used to determine institutional capacity that this research aims to offer comment on.

5.3 Summarizing the Main Contributions of the Research

Article 1: An ESD competence framework

Through the analysis of ESD policy and literature, an ESD competency framework was designed. The framework identified a number of core themes that need to be addressed through any education program that intends to claim a successful ESD reorientation. The core themes include: Action-competence, alternate knowledge systems, critical and creative thinking, futures-thinking, systems-thinking, as well as specific ESD knowledge and values-competence.

This framework acknowledges that ESD is a process that involves the ecological, political, economic and societal dimensions which are interactive and displayed through educational processes and not merely content to be incorporated. It requires a particular cultural change that has sustainability at heart (Tilbury, 2002). This process of cultural change needs to be engaged in a democratic manner, involving learners, educators and community members alike (Sterling, 1996).

The ESD competence framework aims to provide enough room for contextual interpretation yet as little ambiguity as possible. The historical exploration of the shift from an eco-centric type of EE to a development oriented education can assist in removing the misconception

that ESD should be taught within environmental education-type courses or as a separate subject on its own.

A specific recommendation highlighted by UNESCO's (2005b) document on reorienting teacher education for sustainability is to engage the ESD debate and add to the understanding of ESD. I have tried to achieve this through this article (Bentham, 2013) where I explore ESD literature to construct an ESD framework. It is hoped this framework may be used by practitioners as a yard stick to identify the degree to which they have managed to reorient their practice towards ESD. This ESD framework of course, is intended to be used with flexibility and added creativity. I have also heeded to another recommendation within the UNESCO (2005b) 'Guidelines and Recommendations' by publishing this article in a journal not traditionally aligned to ESD. It is hoped that the discussion and debate within this article (Bentham, 2013) may reach a different audience altogether and inspire expanded interest.

Article 2: Teacher education related policy – implications for ESD

The ESD competence framework was used as the second lens during the double lens analytical process during the scrutinizing of teacher education related policies. The findings that resulted from the double lens analytical process revealed various policy inefficiencies. Mainly the analysis revealed that although policy documents guiding teacher education and development do not actively prevent teachers and teacher education from focusing on ESD, they also do not provide sufficient objectives or guidelines towards its realization and implementation.

An analysis of school curriculum documents revealed that sustainable development issues are over simplified as the three pillars of sustainability are not engaged convincingly in the covering of these topics. This is compounded by the finding that teaching and learning approaches or activities also do not support transformative learning for sustainability. This is evident as learners are rarely required to engage in creative and critical thinking, authentic problem-solving and meaningful decision-making. Consequently the question was posed: If ESD is not a convincing curriculum focus, in what way can we even hope for teachers to identify this area as a shortfall in their practice, thus qualifying further teacher development?

The neglect of action-competence in the selection of teaching and learning approaches hinders citizens from applying their learning to a variety of contexts in order to solve relevant problems and engage in collaborative decision making. Tilbury (2002) states that educators do not see ESD as a process of learning as they mostly reduce it to content that must be incorporated into relevant subject specializations. Therefore it can be said that curriculum policy that also fails to support ESD as a process of learning, makes the realization of an adequate ESD that much more challenging.

Teacher education and development policies showed frequent referrals to a 'quality education' and 'higher order thinking skills' however at the same time these were often left undefined, leaving much open to interpretation. Throughout the policy analysis process, reference to social tolerance and equity was fore-grounded. The complex interrelationship between society, environment and the economy and this relationships' role in considering an Education for Sustainable Development is never discussed. A casual look at the policies may create the illusion that all three pillars are being addressed when in actual fact there is an imbalance in foci, resulting in an anthropocentric orientation. It is suggested that it is not enough to design and implement an ESD oriented program when the very policies that guide teaching and learning in South Africa are contrary to a holistic realization of South Africa's current sustainable development issues. An ESD program becomes sustainable within an education system when it has complimentary supporting educational structures.

The Higher Education Qualifications Framework for Teacher Education focused on: developing critical and creative thinking in order to solve social problems; the promotion of social equity and tolerance to deal with diversity and respect others; and implementation of learner relevant teaching and learning approaches that considers learners' knowledge systems. The policy did make a brief mention of the development of a critical understanding of community and environmental issues. However when it came to defining the Knowledge mix that the teacher education program was expected to have, there was no mention of the integration of any ESD related knowledge, skills and values. Considering South Africa's harsh Apartheid History and high rate of HIV/AIDS and poverty, it is not surprising that there is frequent emphasis on social equity and economic development. However this study proposes that this is all the more reason for an Education for sustainability, one that focuses on understanding and addressing the complexity of such issues. The lack of ecological discourse in policies is an indicator of its lack of priority and status in the implemented environment. The ecological pillar needs to support and be supported by the social and economic pillars within policy discourse.

It is acknowledged throughout article 2 that much may be lost between the intended and enacted curriculum. There exists a gap between the rhetorical and implemented policy (Smit, 2005) and just because certain principles of ESD are not present or convincingly evident in educational policy, does not mean that these principles are not in fact implemented. However for ESD principles not to be considered consciously and/or even considered indirectly in educational policy is to crush the seed before it has been planted. This would mean denying ESD any opportunity to manifest itself in a way that is sustainably supported by policy structures.

Article 3: Teacher educators' competency development priorities

One-on-one interviews with teacher educators were analysed using the grounded theory approach to formulate codes and categories. These codes, categories and the relationships between the categories were discussed in the third article. The findings revealed

information about the competences that teacher educators prioritized as well as the clues that teacher educators offered regarding the factors that they felt drove their competency-focus. Not all of the influencing factors were overtly identified by the teacher educators rather many were located throughout the coding process and through the constant comparative method.

The major findings revealed that an ESD curriculum innovation is unlikely to be realized if it is not supported by national curriculum; institutional research agenda and professional identities. Contextual factors, such as increasing professional responsibilities, student calibre/expectations and university culture offered major barriers to teacher educators showing willingness to reorient curricula towards ESD.

The interviews revealed Teacher educators focused on five areas of competency development: (1) students' knowledge about education; (2) students' knowledge about the content of their teaching subject; (3) students' knowledge about how to teach the subject in schools; (4) about the general practice of a teacher; and (5) about oneself as a professional. Analysis revealed that some competency foci mentioned by teacher educators are seen to be ESD-oriented despite the fact that teacher educators did not mention ESD as a competency area. The presence of ESD-related competencies was found not to be owing to a conscious orientation towards ESD, rather it was attributed to other factors such as: (1) ESD competency alignment with national curriculum objectives; (2) ESD competency alignment with personal professional interests/concerns; (3) promotion of ESD-related competences through institutional research agenda/culture; and (4) the re-curriculation process as a catalyst for innovation.

Factors that limited general curriculum innovation and ESD competency address included: (1) pressure to complete the curriculum in preparation for examinations; (2) insignificant recognition of meaningful ESD competence development through national curriculum and institutional culture and research agenda; (3) insufficient time for teacher educators to exercise their autonomy through curriculum design, owing to high student numbers and increased professional demands to publish; and (4) student expectations and calibre.

The competences that teacher educators focused on in their courses were found to be hugely influenced by institutional culture and research agenda as well as by the national curriculum. Consequently teacher educators' courses prioritized: (1) the development of science and technology content and skills; (2) linking national policy to practice in the classroom; (3) and the contribution science and technology makes to economic and social development. It was also found that ESD competencies were more likely to be developed if they related to teacher educators personal professional interests. Professional collaboration and supportive leadership proved to be a good vehicle for the promotion of personal professional interests and therefore also proved as a good avenue for ESD competency promotion.

Although the findings show that some ESD competences have been addressed, the findings also identify some major gaps in ESD address. It was revealed that insufficient attention and priority is paid to the development of action-competence, for example. Although teacher educators reflected on the importance of learner-centered approaches to teaching, these did not involve learners in the much-needed participation in community-based decision making. ESD teaching and learning approaches are centered on the ideal for 'action competence' in citizens, developing individuals who are able to make informed decisions towards addressing current issues and needs in an inter-generationally considerate manner.

Findings also revealed that critical and creative thinking skills were not being sufficiently developed. Although teacher educators emphasized the importance of developing critical and creative thinking, their lack of engagement with action-competence-based teaching and learning approaches limited this realization. Owing to student numbers and thus time, problem-solving opportunities were rather contrived, lacking the open-endedness that is characteristic of authentic problem-solving. However teacher educators did give a lot of attention to systemic and future thinking as they encouraged students to consider the impacts of Science and Technology on society and the environment. It was however commented that observing the impacts of Science and Technology on society and the environment needed to also be engaged through authentic and not contrived problem solving opportunities.

The reconfiguration of the College and reconceptualization of the Bachelor of Education programme placed pressure on teacher educators who felt that their revised roles and responsibilities added to their workloads. These roles add administrative burdens and research productivity on top of huge teaching loads, leaving the teacher educators feeling overloaded. This overloading was identified to serve as a possible deterrence in engaging in the extra activity of reorienting course curriculum towards ESD.

Teacher Educators were seemingly given the professional autonomy to change the course design, yet it was soon clear that this was within limits. As part of the system, changes need to be approved by the Examinations Board. But over and above this, should teacher educators finally decide to make changes and implement them, this could still depend upon student numbers, student expectations and calibre, pressing deadlines, administration and pressures to produce research publications. However findings suggest that supportive leadership may motivate to overcome these barriers, through meaningful collaboration. This suggests that the development of 'professional learning communities' oriented towards developing teaching and learning resources that promote ESD, could be successful if faculty management recognized and supported this as meaningful continuing professional development.

It was also revealed that institutional endorsed research agenda drives the research that is embarked upon at the Institution, becoming a motivation for teacher educators to also address research related ideas in their practice. Such research agenda include: scarce skills,

relevant education, indigenous ways of knowing, HIV/AIDS and health and gender education. Formal University research agenda are identified according to what is declared to be the current needs of the country. If research agenda drive competence-development in this way then an implication for ESD realization is to deem it significant enough to feature as a formal research agenda at Teacher Education Institutions.

From this analysis it was revealed that teacher educators' prioritized competence development was strongly influenced by the national curriculum taught in schools. Teacher educators' ideas on teacher competence was linked to the curriculum as teacher educators developed competences that they believed student teachers would need when they entered the school system. This means that teacher educators promote what they perceive to be in the national curriculum. If ESD is not a significant focus in the curriculum, which is identified by Bentham, Sinnes and Gjøtterud (2014), consequently it won't be a focus for competence development. Higher Education must share responsibility when it comes to an effective realization of ESD. If research informs both policy and National curriculum development, then Institutional research agendas should promote an ESD orientation. University research agendas inform professional interests which ultimately impacts on competence development.

Article 4: Exploring a Science and Technology teacher education for sustainable development system

Teacher educators were engaged in a focus group interview whereby they were presented with a rich picture of their current situation and a notional picture of a hypothetical Science and Technology Education for sustainable development system. Teacher educators were asked to compare the two, identifying any barriers, challenges, gaps and possibilities for bridging to the notional system.

An analysis of this group discussion revealed that: (1) managements' perceptions of professional autonomy differs from teacher educators' perceptions; (2) there exist seven relevant sub-systems that influence teacher educators' priority and practice; (3) teacher educators felt that research and leadership were powerful tools in supporting the suggested ESD curriculum innovation; and finally (4) although ESD is deemed important, it is not a priority for teacher educators owing to various reasons.

An analysis of teacher educators' interviews and application of soft systems methodology revealed nine basic issues that teacher educators deemed priority in their practice. These issues covered areas pertaining to: the change from the old curriculum 2005 to the new CAPS curriculum and the impact this had on their course design; the demands to get a PhD and to publish articles; the promotion of University-valued scarce skills and professionalism; the increasing workload due to student numbers and changing academic roles; and the

need to engage in community engagement (which they felt they never have time for). These were issues that the teacher educators identified.

During the development of the notional system for teacher education for sustainable development, it was identified that the University and, more accurately, the Science and Technology Education Department consisted of seven relevant sub-systems, these are: professional development, Science and Technology teaching and learning, research, national curriculum, academic qualification, curriculum design quality board, and the institutional culture. It was further found that these seven relevant sub-systems would need to be incorporated into the notional system if it was to be deemed achievable. The notional system would need to consider the existing contextual concerns in order to gain acceptance.

The focus group discussion further revealed emergent challenges and barriers to bridging across to a notional system. These included: (1) if collaborative research was engaged by the Science and Technology education department, owing to ESD not being recognized by the University policy and culture, it is unlikely that academics would receive much support from the Institution; (2) academics felt they needed leadership from the head of department to guide them through the unfamiliar territory, however the head of department felt that academics should be their own agents of change (who would make the first move?); (3) Academics express the idea that they have the ability to design curricula and affect change, however they are careful not to offend previous lecturers of the course, or they find the process to apply for the rights to make changes to existing courses, too monitored and complicated; (4) also factors such as student expectations and calibre, time availability, student numbers, lecturer experience and status, as well as national curriculum foci, all impact and restrict their autonomy; (5) Finally ESD curriculum innovation was deemed important yet due to the nine issues and task-related areas mentioned earlier, it was not a priority focus. However teacher educators did express that if ESD was recognized in existing institutional culture and policy as well as in the national curriculum, it would serve as a greater motivation for collaborative research and course curriculum design.

In order for education to be equipped to address sustainable development challenges in South Africa, ESD needs to become the culture of more and more Higher Education Institutions and more specifically, teacher education institutions.

A Higher Education for Sustainable Development Framework

Upon completion of the interviews with the Acting Dean and the Teacher Educators and once the coding process had been engaged, the major themes and concepts (as well as the barriers to implementing any innovation such as ESD) were revealed. Research, education, learning, outreach and assessment are major priorities of this institution even if in some instances they are poorly satisfied through teacher educator competency foci. The initial findings led to the further development of this framework.

Findings revealed that teacher educators' roles and functions are somewhat fragmented as often teacher educators felt torn between delivery of the curriculum and producing research. The need to use ESD as a unifying force, pulling together Teacher Educator roles and functions in a logical way, soon became apparent. Authors in HESD and Organizational change, as well as a number of HESD policies (elaborated further on) were reviewed and informed both the structure of the framework and the actions stipulated within. Knowledge of the major barriers and importantly, how they play out in an interconnected way in teacher educators' professional reality, informed the actions listed within the HESD framework. UNESCO's (2005) Guidelines and Recommendations for Reorienting Teacher Education to Address Sustainability are also discussed to illuminate the unique contribution of this research.

The UNESCO (2005b) document leaves it to "faculties of education to create their own guidelines and design criteria that will steer their efforts to reorient teacher education to address sustainability." (p.16). The question naturally follows: 'How do faculties of education do this in a way that addresses multifarious barriers and therefore considers Higher Education structures?' The document (UNESCO, 2005b) also reports that limited progress has been made at all levels of the change process and that this is as a result of barriers stemming from many sources. This research aimed to both identify what these sources were and create a clearer picture as to how these barriers fit together within a given institution. In this way it is hoped that the HESD framework offered, provides a useful fulcrum from which to begin the journey of institutional change for sustainability. The UNESCO (2005b) document also makes many valuable recommendations regarding how to involve faculty, students, staff, academics and management in the reorientation process. This research however, begins to reveal the systematic implications of such recommendations. It is our hope that the construction of such a HESD framework would help to provide a comprehensive picture of the degree of institutional change that would need to occur. Any policy designed to implement ESD into HEI's and TEI's should at least consider the key players and structures and functions highlighted in the HESD framework.

The HESD Framework (Table 4) was compiled using a number of key informers, namely Senge (1990); Sharp (2002); Calder and Clugston (2003); Wright (2004); Roorda (2010); Lozano (2013); Lambrechts et al. A review of some of the major goals of the Talloires, Swansea, Lüneburg and Turin Declarations was engaged. The valuable contributions of these sources were merged into a framework using the practical understanding gleaned from this study regarding the TEI and its' major structures and functions. Furthermore, the core and peripheral barriers identified in article 3 have been considered in the listed 'actions' within this HESD framework.

Table 4. Higher Education for Sustainable Development Framework

Key Higher Education Functions	Key Higher Education Stakeholders			
	Managers	Faculty/Lecturers	Students	Administrators
ESD Research	<ul style="list-style-type: none"> Create ESD pilot projects to support faculty research projects making them more likely to succeed Encourage SD oriented research by highlighting the urgency of this sort of research and by increasing the level of financial support allocated to such research (i.e. supported by multiple journals) 	<ul style="list-style-type: none"> Gain support from management and back this up with action and commitment Engage in SD oriented research and link to improving the quality of teaching and learning Form an ESD research group, supported by management due to detailed planning and vision. 	<ul style="list-style-type: none"> Student partnerships are forged as committed students, displaying great potential, are mentored to engage ESD research projects 	<ul style="list-style-type: none"> Able to share knowledge on how structures and processes of the organization are interconnected in order to inform change agents on avenues and opportunities for embedding ESD in HE Engage in constant informal communication with channels of influence and are therefore in a position to provide change agents with useful contacts and avenues for further communication regarding embedding ESD in HE
Education for Sustainable Development	<ul style="list-style-type: none"> Share what has been learned about ESD— this will boost the initiatives profile within and outside the university Capture and present information using information systems in order to make lessons learned more meaningful for all levels. Motivates for an ‘Environmental Literacy for all, across the disciplines. 	<ul style="list-style-type: none"> Share what has been learned about ESD – this will boost the initiatives profile within and outside the university Capture and present information using information systems in order to make lessons learned more meaningful for all levels and to gain support from management Design curricula relevant to current needs Ensure the continual review & updating of 	<ul style="list-style-type: none"> Engage an education that is guided by ESD competencies (Bentham, 2013) Encouraged to criticize definitions of SD and weigh up the pros and cons of its fundamental principles. Engage a values clarification process with regards to the real and perceived needs of society 	

		<p>learning materials to reflect latest scientific understanding of SD</p> <ul style="list-style-type: none"> Constantly engage ESD knowledge, skills and value competencies in practice (Bentham, 2013). 	
<p>Learning to respond to the true needs of society</p>	<ul style="list-style-type: none"> Encourage learning at all levels as well as freedom to access and engage all levels of the organization Understand the system components of the organization in order to identify internal & external drivers for & against change re. ESD Design learning opportunities to better understand trends, drivers and barriers re. ESD Be willing to accommodate a particular degree of low level risk in order to work towards a well -defined vision of change Form partnerships with NGOs, business sectors, public citizens and government departments, to better understand needs 	<ul style="list-style-type: none"> Reflect continuously on practice and its alignment to current SD needs Form partnerships with NGOs, business sectors, public citizens and government departments, to better understand needs Network with faculty members of other institutions to brainstorm and learn Regularly reflect on what SD implies for education and the future Engage in interdisciplinary partnerships in order to better define local and global needs of society and to better respond to them 	<ul style="list-style-type: none"> Engage policy making Engage in problem identification and problem solving in local communities Develop an understanding of how societal issues are interconnected and how solutions need to consider a variety of interlinking factors
<p>Outreach to address</p>	<ul style="list-style-type: none"> Engage Forums to gain 	<ul style="list-style-type: none"> Engage Forums to gain 	<ul style="list-style-type: none"> Identify needs of society,

<p>SD needs</p>	<p>participation and contribution from the wider community</p> <ul style="list-style-type: none"> Forge a variety of partnerships to support and ensure wider felt effects of embedding SD in HE Design opportunities for students and colleagues to come together to identify and address community based SD needs. 	<p>participation and contribution from the wider community</p> <ul style="list-style-type: none"> Forge a variety of partnerships to support and ensure wider felt effects of embedding SD in HE Design opportunities for students and colleagues to come together to identify and address community SD needs. 	<p>take decisions regarding the address of these needs and finally act on these decisions in an attempt to solve real community problems</p>	
<p>Assessment of ESD competency development</p>	<ul style="list-style-type: none"> Identify short term and long term goals and complementary indicators for embedding SD in HE Self-reflect on one's own levels of influence Reflects on the Institutions culture and values and how these align with ESD...as well as the opportunities for alignment. 	<ul style="list-style-type: none"> Promote SD in HE through student assessments that develop ESD competences Self-reflect on own work and actions Identify a moral obligation to overcome unsustainable practices Identifies themselves as accountable to society Student assessments are analyzed to inform research on ESD in HE 	<ul style="list-style-type: none"> Engage assessments that develop ESD competences and their relevant application to local issues. Reveal the value of developing ESD competences in HE curricula (E.g. how ESD competence better equips students to identify and address SD issues) 	

The generic key Higher Education Institution functions include: Research, Education, Learning, Outreach and Assessment. This HESD framework reworks these functions to include SD as their common core purpose as, we believe, this is what is needed to successfully embed SD in Higher Education. The framework further assigns roles and functions under the four major stakeholders (Sharp, 2002) of any HEI in an attempt to add more purpose to ESD as an innovation in Higher Education. This research identifies that in order for ESD to be willingly and meaningfully embedded in organizational culture, it would need to consider and involve its functions and therefore its culture and values. Another finding considered in this framework is informed by Sharp (2002) who comments, that the isolation of research from teaching and from campus operations has served to inhibit universities from functioning as learning organizations. It is recognized here, that in order for ESD to be meaningfully embedded in this TEI and HE generally, the institution would need to function as a learning organization.

5. 4 Universities: Leaders in Organizational Change

From the various findings discussed thus far, what is needed is quite clear. Universities need to be leaders in change and more specifically leaders in change for sustainability. This requires a better understanding of the needs of the present and future generations (Lozano, Lukman, Lozano, Huisinigh & Lambrecht, 2013) However there is an even more pressing prerequisite to such change: University faculties should be given the autonomy to create new paradigms and with them new curricula that are responsive to the current and local needs with consideration of long term needs (Lozano et al.)

“Implementation of an innovation, such as SD, is more troublesome when the adopter is an organization rather than an individual, (Rogers, 1995), especially if the innovation is an abstract idea.” (Lozano et al., p. 11) An innovation is a process or action that applies knowledge in a new way to satisfy particular needs (Online Business Dictionary). This means that innovation is hardly something that is merely adopted. Its principal ideas should rather be remodeled and embedded into existing structures and processes so that the institution might engage in addressing their own society’s contextually relevant needs. SD is developmental by nature and this is why it is often referred to as ‘a learning process’ (Rieckmann, 2012). Education and Education Institutions therefore need to be centers of innovation and not merely centers of knowledge reproduction. The major driving factor for Education institutions adopting such a traditional paradigm as knowledge reproduction has been the current methods of assessment in schools and thus TEIs. The assessment foci are decided by the Department of Education who are informed by the business sectors with regard to the competences that new graduates need to display in order to be productive in the working sectors. Ultimately I fear the curriculum is still driven strongly by economic development with little consideration for the sustainability of such a system in the long run.

According to Fadeeva and Mochizuki (2010) universities can contribute significantly to reorienting future society towards sustainable development by addressing SD through its major foci: education, research and outreach. However, the address of certain SD competences will always be coincidental effects of the education system (albeit insufficient) if the education system and curricula never consciously and actively situate SD as their intention for education (Sleurs, 2008).

Lozano et al. claim that in order for SD to become an integral part of universities' structures and procedures, it must be practically implemented by enough stakeholders over a long period of time. Sharp (2002) describes the sort of bottom-up approach to institutional transformation that does not work. He reflects on a popular attempt to gain institutional change buy-in by forming an environmental committee that is tasked with making decisions. Usually these environmental committees rely on one driving leader who implements certain solution-based programs. Sharp (2002) problematizes such an organization and its capacity to institutionalize change as it is based on a number of assumptions. Two of these assumptions being that: (1) organizational goals and objectives are clearly definable and that (2) these individuals will be able to effectively explore the nature of apparent problems and implement appropriate solutions. Sharp (2002) draws our attention to the reality of the complexity of the organization itself, adding that these once-hopeful environmental committees are soon forced to realize the complexity of the university structures and processes. They soon realise their own level of influence as they, "shift their focus from broad reaching systemic transformation to well-bounded projects with lower levels of participation, losing significant momentum and breadth in their organizational impact." (Sharp, 2002, p.130).

Sharp (2002) reflects on the need to replace the myth that the individual has no power to influence the university system with the truth that the individual in fact is the very source of systemic change. However Sharp (2002) supports this truth with a clear definition of purposeful approaches to institutional change and the competences that such change agents would need to display. Therefore poorly-organized forums that lack a careful and informed vision for change are likely to reinforce the myth. That been said, Senge (1990), Lozano (2013) and Kotter (1998) do provide avenues forward.

It has been said that in order for SD to become fully infused in University systems, it needs to be practically implemented for long enough and by more and more stakeholders throughout the universities (Lozano, 2013). Senge (1990) identifies the great need for professionals to master team-learning as he reflects that individual learning in an organization is irrelevant if it remains at the individual level. Senge (1990) identifies the team as a unit of learning and a microcosm of the organization. Therefore when learning takes place at a team level it represents the ability for it to take place at an organizational level. It is also not enough for an organization to learn in an adaptive way, in other words in a superficial way whereby new ideas are simply adapted to fit into existing structures and

procedures (Senge, 1990). Rather learning organisations need to engage generative learning, whereby newly developed structures and processes are formed to respond to current pressing needs (Senge, 1990).

Kotter (1998) identifies 8 critical stages involved in the process of change, the failure of any one of which can lead to overall failure. These stages have been slightly adapted to appeal to the focus on Higher Education for Sustainable Development and have been added to assist the application of the HESD framework offered.

Eights steps to Organizational change for ESD

1. Establish a sense of urgency

- Identify the need for a reorientation of Higher Education towards ESD
- Communicate this need in a way that alerts people at all levels to the expanding benefits of embedding SD in HE
- Demonstrate the meaningful link between global issues and local action

2. Form a powerful guiding coalition

- Form a team that has enough power, leadership expertise, broad experience and/or connections to lead change for ESD
- Support and grow the team as a group of individuals who have a shared vision and commitment to ESD and who are willing to WORK together towards that goal

3. Create a vision or HESD

- Create a vision that provides direction for the reorientation of HE towards SD. This requires a vision that is clear, appealing and realistically ambitious. *E.g. We as a higher education institution want to embed sustainable development into our research, education and outreach functions as well as in our campus operations. We also want to involve every stakeholder at every level of the university system to ensure the sustainability of this vision. Once this is complete in 5 years, this higher education institution and all its stakeholders may make their claim to equipping students in identifying and addressing current and future needs in a sustainably considerate way and this will be easily visible in the numerous publications that will result from such transformation engagement. The HEI will also become recognized for engaging cutting edge research and elevating itself as a learning organization. Lecturers and academics will finally experience what it means to be 'true professionals'.*
- Develop strategies for achieving that vision, together.

4. Communicate the vision

- Use every vehicle available to communicate the new vision (more than communication via speeches and text)
- Ask yourself: 'What can I do to show the benefits of HESD and the form it takes in practice? The more action oriented your communication the more

convincing your message.

5. Empower others to act on the vision for HESD

- Identify and remove obstacles/barriers to achieving HESD E.g. lack of understanding of ESD, poor time management, content-oriented curricula, compartmentalization of disciplines and lack of community outreach
- Change university systems and structures that serve to undermine the HESD vision
- Encourage individuals to take risks and to think differently

6. Plan for and create short-term wins

- Plan for improvements that are visible in the short term. E.g. Embedding sustainable development in certain portions of curricula which can be assessed using a newly constructed ESD competencies framework and then writing an article about it.
- Recognize and reward any stakeholders that have been instrumental in achieving these short term improvements.

7. Consolidate improvements and produce more change

- Use this newly gained credibility to change systems, structures and policies that do not promote the vision for HESD
- Promote and develop employees that can contribute to the attainment of the vision
- Constantly refresh the HESD initiative using new themes, stakeholders for change and projects

8. Institutionalize approaches

- Provide clear connections between the new improvements and the success of the Higher Education institution in achieving its' functions
- Develop policy and structures that support leadership, development and sustainability of HESD

All being said, if an institutions' culture and values do not align with the values of SD, or at least do not actively dedicate attention to the principles of SD, then there is no motivation for academic educators to reorient curricula to this cause. True professionals on the other hand are self-motivated (Maister, 1997). ESD promotes innovative and creative thinking whereas, from what I have experienced, South African Teacher Education Institutions particularly promote the reproduction of the Government approved curricula. This is supported by the assessment methods employed at these teacher education institutions which are limited to measurable outcomes. The reality is our education institutions currently serve a particular reproductive function (Lozano et al.).

Scientific knowledge is not being generated in TEI's with regard to sustainable development for this is neither its core function nor its expertise. Therefore it is pertinent that TEI's

collaborate with professionals in the fields of environmental, political, business and economic sciences, to assist in making TEI curricula and programs more relevant and SD-responsive. Rieckmann (2012) reflects on challenges that sustainable universities need to meet, these include: creating an awareness of and positive attitude towards environmental issues, developing institutional sustainability policies, including sustainability in research foci, and inclusion of SD in the curricula. These challenges that universities need to address must be seen as linked and not dealt with individually, for once it is understood how inextricably linked these challenges are, one can begin to identify and address the fundamental core barriers to HESD.

5. 5 What is Management's Responsibility to HESD?

Managers need to promote and support creativity. One suggestion is to challenge employees in a way that requires them to apply their creative thinking skills and expertise to new situations. However Amabile (1998) cautions managers against over-stretching their employees, emphasizing the time and consideration needed to make a 'perfect match' between employee abilities and challenging activities. If the employee is challenged at just the right level, this will boost their intrinsic motivation to solve the problem (e.g. re-orienting the curriculum towards ESD).

Management needs to provide academics with a degree of freedom and autonomy regarding how they might go about achieving a set of clearly-defined objectives (Amabile, 1998). It is thought that if the objectives are clear it will assist employees' shared vision and therefore both their intrinsic motivation and ownership of the innovation/objective (Amabile, 1998).

Time and money are both resources that need to be provided purposefully. Managers must consider the deadlines that they set, for if deadlines are constantly changed employees begin to doubt managements' greater insight and if deadlines are too short, this can cause heightened stress, both of which kills creativity (Amabile, 1998). Nevertheless owing to academics busy schedules, deadlines are both a motivator and an indication that the innovation is an important one.

Encouragement from management is a strong intrinsic motivator for continued engagement with new ideas. It is easy to forget to praise employees for the smaller achievements, which are often the most crucial ones to acknowledge towards the greater final success. This includes embracing all sorts of results, for failures can often inform about how to do things better and so managers should not only note the successes but also the trials (Amabile, 1998). To make the shift to a 'learning organization' these shared stories of successes and failures certainly serve to facilitate team development.

Finally, organizational support can be one of the strongest motivators of creativity. If an employee is made aware that the leaders of an organization value creativity highly, this will provide employees with the confidence to try out new ideas. How these employees are acknowledged for their ideas (success or failure) will determine the employees' likelihood of engaging the creative process in future (Amabile, 1998). Often small initiatives go unnoticed and worse, unsupported by management. The more management rewards/acknowledges academics efforts towards sustainability the more likely it becomes for other academics to join the cause.

5.6 A Professional Values Framework

It is difficult to introduce new values that promote transformative learning in a climate where professionalism and professional autonomy is very volatile (Martin, Summers & Sjerps-Jones, 2007). Hargreaves (2000) reflects on how difficult it becomes to define professionalism and the autonomy that goes with it, when the policy context is constantly changing and with it roles and responsibilities. On first glance it would appear that educator roles, constantly changing and therefore seemingly 'flexible', would be complementary towards embedding a transformative ESD in a teacher education programme. The reality though is that a volatile policy environment in South Africa at least, has left teacher educators overloaded with additional responsibilities which they are still working to master. The constant top-down reformulation of roles has translated into the questioning of individual professionalism and autonomy. This has filtered down to teacher educators beliefs that they are unable to fight for curriculum space and to influence curriculum much at all. It is difficult to be creative and exploratory in one's field when one is still trying to gain one's balance from the frequently-shaken grounds.

Higher Education institutions not only need to work on promoting values that support transformative learning, they also need to pay attention to how they might define and promote a professional autonomy complementary to this (Martin et al.). I propose that this may be done by emphasizing the value of Continuing Professional Development and professional learning communities.

I am very critical of the hidden deep-seated assumption that educational achievement will somehow be compromised by a focus on sustainability education. Rather sustainability education encourages critically reflective thinking, raising learning to a higher level (Sterling, 2011). If I manage to convey transformative learning in the manner in which Mezirow (2000) and Morrell and O'Connor (2002) intended, the value of ESD in Higher education will be undeniable.

Transformative learning involves modifying one's consciousness, moving from a position of habitual actions to a level of critical reflection on such robotic thinking. Such reflection involves "a deep structural shift in the basic premises of thought, feelings and actions [...]"

Such a shift involves our understanding of ourselves and our self-location: our relationships with other humans and with the natural world.” (Morrell & O’Connor, 2002, p.17). Most Higher education institutions claim to be striving towards a transformative teaching and learning reality. How is this true in those institutions that do not engage significantly in the debates of current local and global issues? Furthermore, how is this true when policy that defines teacher education is also not promoting such engagement? Finally how can teacher education promote transformative learning when professionalism is defined by performativity? (Martin, Summers & Sjerps-Jones, 2007)



Figure 5. Pyramid of Higher Education Institution Structures

This model, which I have developed, is inspired by the engagement with my study and the data generated. The pyramid talks to a number of elements. Firstly, the pyramid depicts the defining components of higher education generally. Second, it shows the degree of influence that various components have on HEI culture and values. Finally, the model suggests that the very components (bordered in blue) that are meant to disseminate social ideologies and needs can often serve as barriers to this achievement at the practical level.

Higher education is shaped by the perceived societal needs and Ideologies. One must consider that societal ideologies (E.g. capitalist individualist motivations versus socialist collaborative motivations) can influence what policy writers at the next level identify as a priority social need. This further implicates the responsibility of policy writers. Policy writers need to be critically reflective on the ideologies that they intend advocating. Policies that intend on addressing current perceived needs (E.g. Economic development) also need to understand the long term needs (E.g. social and ecological development) and whether the mechanisms of their short term address will also contribute to future long term benefits.

The institutional and educational policies that are brought forward are intended to shape both functioning and structures in Higher Education. Often financial support is linked to projects and research that align with the objectives stipulated within these policies. This would be the case as institutions would receive both private and government funding more easily if research that is produced appears beneficial to industry and society. Therefore the next level, defined as the policy context is directly reactive to the priorities of such policies. Also shown in the findings of this research is that education policy in the form of national curriculum policy, strongly guides what practitioners deem priority foci in their courses. This understanding of tight correlation can help drivers of curriculum innovations (such as embedding ESD in HE) to see how coming into the pyramid at the policy context level can be most challenging and unlikely to be well-received. However, should significant funding be received and/or tight links be established with corporate and international bodies, such support would be well received at the practitioner-reality level. Practitioners who are supported in the pursuit of their personal professional interests (E.g. in ESD) are more likely to be able to link this to their practice, boosting their morale and professional autonomy. The task for ESD stakeholders would be to elicit teacher educators' buy-in to the principles advocated within ESD. This would pave a way for a redefining of policy context and eventually a reinterpretation (at a policy level) of the long term social needs that education should address. Although curriculum innovation in this way may seem top-down initially, it inevitably empowers practitioners to locate themselves within the proposed innovation (E.g. identify what focus within ESD interests them). This further assists practitioners in developing personal professional empowerment (i.e. success supported by research) needed to influence their policy context and the policies that define it.

At the practitioner-reality level, practitioners show an ability to engage cognitive dissonance, i.e. hold two views about their practice. The priority view (i.e. often translates to practice) involves covering the module content and preparing students to teach the curriculum and the values promoted within. The more subsidiary view that seldom emerges in the actual course, due to curriculum alignment, student numbers, time and workload (policy context factors) is their view of what is important in education and the messages they would like to convey to their students. Practitioners revealed an interest in ESD yet often used their priority context factors to deliberate on obstacles that stood in their way.

5.7 Final Thoughts

The university is a complex system due to the intricate interconnections that exist between its system components. That is to say, even though the system components may be possible to definitively define, it is still not possible to anticipate from these components the interactional (emergent) behaviours (Colucci-Gray, Camino, Barbiero & Gray, 2006). Colucci-Gray et al. liken this complexity to the weather system. In order for higher education to reorient towards sustainability, all structures and stakeholders would need to be involved in

the process and provide willing support (Sibbel, 2009). This would also require that space be provided for academics to develop the knowledge and skills needed to assist students in working towards sustainability. It has been suggested that the focus of future research should involve establishing how higher education might go about such a reorientation process (Sibbel, 2009). The findings of this study suggest a multiple of 'how' factors.

Engagement with this study has opened my eyes to the complexity of the Higher Education system and the magnitude of the challenges that face any hope for transformation at a system level. I was so driven for the ESD cause when I first embarked upon my journey however I soon realized that this would not serve me adequately to understand my participants' stories. This study taught me to listen openly and reserve judgement.

It would have been far too easy early on in the study to start blaming the teacher educators for their lack of enthusiasm regarding ESD. It would be even easier to put sole responsibility on policies for their lack of curriculum orientation towards issues of sustainable development. As the study unfolded I began to realize that other factors, such as perceived societal needs, university culture, student calibre and professional interests were also large players in the teacher education that was being delivered. As the study progressed, clear lines became more dotted and dotted lines became more solid. Things that seemed to be unrelated turned out to be more connected than I originally thought. The clarity that arose from the deepening complexity was that it was most important that I understand the factors that influenced one's practice (and therefore their likelihood to embed ESD). This would be the only way to become more responsive and less resigned to their effects on one's practice. It is hoped that this study, through an engagement with the complexity that exists within one department at a particular teacher education institution, has begun to reveal the angles from which HESD can be embedded. What is needed from all stakeholders within the institution is open-mindedness. Individually, no one person can be blamed for a lack of ESD within a teacher education programme, yet one individual institution can be responsible for its successful embedding. Understanding how a Higher Education institution functions and what factors impact teacher educators' practice, is an important starting point for understanding what is needed to turn an ordinary institution into a learning organization.

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PART II:
THE ARTICLES

Article Synopses

- Article I: Bentham, H. (2013). Clearing the path that has been laid: A conceptualisation of education for sustainable development. *Journal of Teacher Education for Sustainability*, 15(2), 25-41. DOI: 10.2478/jtes-2013-0009.
- Article II: Bentham, H., Sinnes, A., & Gjøtterud, S. (2014). Exploring the priorities of teacher education related policies: An Education for Sustainable Development perspective. *Journal for Critical Education Policy Studies*, 12(1), 321-360.
- Article III: Bentham, H. Sinnes, A., & Gjøtterud, S. (submitted). Teacher educators' competency development priorities: barriers and avenues to Higher Education for Sustainable Development. *Journal of Teacher Education for Sustainability*,
- Article IV: Bentham, H. Sinnes, A., & Gjøtterud, S. (2015). A teacher education for sustainable development system: An institutional responsibility. *International Journal of Higher Education*, 4(4), 158-177

7. Article 1

Clearing the path that has been laid: A conceptualisation of education for sustainable development

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ABSTRACT

Education for sustainable development (ESD) has become so crucial that we have tried to smear it on anything and everything that's teachable. The consequence is that almost everything we do may be said to contain weak attributes of ESD even if we know nothing significant about it. This paper attempts to reveal an understanding of ESD that is informed by an exploration of policy language and agenda and recent literature in the field. The exploration of policy reveals the possible cause for previous inadequate implementation of ESD. An exploration of policy and literature reveals some key competencies that are advocated for through ESD. Insight into how policy has shifted from an ecological to a development focus and substantiation for why this shift is important in addressing current sustainable development issues serves to inform the interpretation of ESD. Finally, the analysis of policy and literature is triangulated to develop a framework that may assist ESD stakeholders in identifying ESD competencies in policy and practice. It is hoped that through this engagement with selected texts a more informed and complex insight into ESD and its features may be developed.

Key words: education for sustainable development, sustainable development, competencies, action competence, sustainability literacy

INTRODUCTION

Sitting in the shade of an acacia tree on a hot day deep in the Umfolozi wilderness area, which is totally devoid of any human structure, our ranger and guide Colin Johnson handed each of us boys our lunch ration. It consisted of a sandwich and a

hard-boiled egg. Colin asked us not to break the egg, but just to hold it and look at it. He held up an egg and asked us the question: 'If this egg is our Earth, what part of it would be the air that surrounds us?' We all said 'the shell'. He was silent for a moment, before cracking the egg on his head. He carefully and slowly peeled the shell away, exposing the thin, delicate membrane that lay beneath. Lifting a piece of the opaque skin away from the egg, he held it to the light. 'This is how fragile our planet is' he said slowly. 'This thin membrane is the only thing protecting us from whatever lies beyond. This is our thin layer of atmosphere and we must protect it at all costs.' [...] Even then so long ago I felt frightened at the vulnerability of our planet. After the silence Colin asked a simple question, a question that changed my life: 'You are privileged to be here', he said calmly, 'on this course and on this Earth. What are you going to do to make a positive difference to our Earth, when you get back to school?' He did not say 'when you finish school', or 'when you retire one day' but 'when you get back to school.' He was not giving me the escape that so many people use: 'one day, when I have time'. He meant now! (Malherbe, 2010, p. 31)

Education for sustainable development (ESD) not only calls upon educators to teach about ESD, it also requires educators to involve children and students in activities that contribute towards sustainability. In many policies, education has been dedicated the responsibility of tending to the environmental crises of today. Many environmental and sustainability policies have been developed, such as the Tbilisi (United Nations Educational Scientific and Cultural Organisation-United Nations Environment Program [UNESCO-UNEP], 1978) and CRE-COPERNICUS (Copernicus, 1994) Declarations, Agenda 21 (United Nations Conference on Environment and Development [UNCED], 1992), the Earth Charter (IECC, 2000) and the United Nations Decade of Education for Sustainable Development (United Nations [UN], 2002). All advocate for the promotion of a sustainability literacy which is hoped to offer an avenue for sustainability understanding and action, a sense of citizenship that promotes a liberal and sustainable society (Huckle, 2009). However, it is still unclear exactly what an education that promotes sustainability should look like. What should one understand by the term 'sustainability literacy' which is intended to realise the greater plight of sustainable development (SD) locally and globally?

A sustainability literate person is able to: understand the need to change to a more sustainable way of doing things; have sufficient knowledge and skills to decide and act

in a way that favours sustainable development; and recognise and reward other people's decisions and actions that favour sustainable development (Parkin, Johnston, Brookes, Buckland, & White, 2004, p. 30).

It appears that the key to identifying sustainability literacy lies in initially understanding what SD means in the realm of education. The main goal of education for sustainable development (ESD) is to promote sustainability literacy through the taught curriculum. In the attempt to define and simplify sustainability literacy, it is inherent that one also looks at the key concepts underpinning ESD.

At this point, the paper moves on to explore relevant ESD related policy and literature. It is from this exploration that key concepts and competencies are highlighted and discussed. The major challenges and criticisms of ESD are also presented as an attempt to provide a more informed understanding of ESD. This analysis of policy and literature is corroborated to develop a framework that may assist ESD stakeholders in identifying ESD competencies in policy and practice.

A conceptual analysis of ESD

ESD has been criticised for its lack of clarity and thus difficulty to incorporate into an already crowded curriculum. The following analysis of literature and policy serves to identify how policy has been and can be interpreted to assist in the conceptualisation and realisation of ESD implementation which is the responsibility of the educator ultimately. The intention is not to simplify or reduce ESD but rather to embrace its complexity through an exploration of various texts. It is hoped that, through an exploration of these selected texts, a more informed and complex insight into ESD and its features may be developed.

SD – a key concept

The terms 'sustainability' and 'SD' for that matter bares a particular degree of ambiguity and qualitative meaning as it represents a *Shangri-la* that cannot possibly be identical for all (Pittman, 2002). Pittman (2002) further argues that the term 'SD' is a less appropriate term than 'sustainability' as its definition documented in the World Commission on Environment

and Development (Brundtland, 1987) is highly anthropocentric focusing only on satisfying human needs now and in the future. Such a focus stands the risk of promoting development in a socially equitable manner even if it is ecologically unsustainable. This goes to show that there is not only contention about the definition of such terms, but also about the agenda behind their historical use.

Jickling (1994) raises his own concerns about the term 'SD' and its practical implications. Firstly, he explained that the term 'SD' is a vague term that may be manipulated in either an eco-centric or techno-centric manner. Secondly, because 'SD' persists to be an abstract conception in individuals' minds, it is largely open for interpretation meaning that there is no one overall agreed goal for SD. Jickling (1994) specifically highlights the argument that the term 'sustainable' juxtaposes the term 'development'. He further concludes that, if 'development' becomes the main agenda of economists or those policy planners and implementers who are not concerned with the ecological environment as main priority, then the term 'sustainable' will be left to mean sustaining development at a cost to the ecological environment. Jickling (1994) offers a critical insight to the anthropocentric ways in which the term can be viewed, warning that this term in the wrong hands can bring about the opposite affect than what is hoped for. Barsan, Nastasescu and Barsan (2011) attempt to clarify such ill or 'weak' interpretations of SD, as that put forward by Jickling, in their description of the Strong Model of Sustainable Development, which involves three concentric circles. The inner most circle represents the economy, the second circle represents society and the outer most circle represents the ecological environment. This model illuminates the dependency of the economy on society and society on the environment. However, even after the presentation of this Strong Model of Sustainable Development, Jickling in a discussion between himself and Wals stated:

I'm doubtful that the idea of sustainable development is adequate to the task of enabling thoughtful and effective responses to local and global issues (Jickling & Wals, 2012, p. 51).

Jickling (1994) refers to the need for contextualised action, something more than a conceptual understanding of what SD means. Considering the strong model definition of SD, it is now possible and necessary to look at how ESD has been conceived and conceptualised in terms of the three and now more recently the four pillars of SD. This exploration assists in bringing the paper closer to the presentation of an informed ESD framework.

ESD – a holistic education

Much has been written and said about the nature and implications of implementing ESD. However, it has been suggested that, amidst all of this, educators still want to know one thing.

Perhaps the greatest obstacle to reorienting the world's educational systems toward sustainability is the lack of clarity regarding goals. In simple terms, those who will be called upon to educate differently want to know, what am I to do differently? What should I do or say now that I didn't say before? (Hopkins & McKeown, 1999, p. 2).

To clarify what is not being implied is that we need more content added to the curriculum as even the most highly educated countries in the world live unsustainably. Rather what is being suggested is that perhaps we need a different type of education, one that aims to develop knowledge, skills, attitudes and values that are geared towards achieving a sustainable global society and future (Hopkins & McKeown, 1999). Education functions at a local level, addressing the competencies that support the regional and national context. Therefore to provide an example from two very different contexts, education in South Africa, for instance, may focus on providing learners with competencies that equip them to contribute towards social and economic development in the attempt to reduce poverty. However, education in Norway, for instance, may focus on providing learners with competencies that equip them to contribute towards the management of natural resources in relation to agricultural development. ESD suggests that these contextually based SD issues are important to address through the curriculum. Also, local issues should be linked to global issues in order for learners to realise the implications or significance of local action.

Before listing the attributes or principles of ESD, a glance at mentioned challenges and criticisms of ESD can provide a more informed perspective of the type of education that is being defined here. This chosen format may seem disagreeable to some however, in many ways it acknowledges readers' assumptions and criticisms upfront, laying everything out on the table opening the way for an uncluttered engagement with the remaining text.

Tilbury (2002) points to a common misinterpretation of ESD whereby educators do not see environmental education for sustainability and ESD for that matter as a process of learning. As a result, they often reduce it to content that must be incorporated into relevant subject specialisations. To reiterate ESD is not about adding content to an already crowded curriculum. ESD is not only to be seen as a process of learning knowledge and skill

competencies, more specifically the learning process itself should empower learners. It should encourage critical and creative thinking that allows for an eventual critique of the ESD worldview itself and the assumptions it is supported by (Tilbury, 2002). To clarify what Tilbury (2002) means by this, I turn to one of Jickling's (1994, 2012) well quoted criticisms of ESD.

... education is concerned with enabling people to think for themselves. Education for sustainable development ... or education "for" anything else is inconsistent with that criterion (Jickling, 1994, p. 5).

For Jickling (1994), an education *for* anything is one that trains one's mind to think in a predetermined way for a predetermined end.

The very idea that education should be for something like sustainable development remains as questionable as ever (Wals & Jickling, 2012, p. 51).

This is unacceptable when attempting to transform society and its thinking. Semantically this argument is sound, however, due credit should be given as the intentions and implications of ESD go beyond this, as noted by Tilbury (2002). Surely, all education involves educating for some type of curriculum. The question now should be: *Would you like that curriculum to perpetuate the way things are currently?* or *Would you prefer a new paradigm all together?* I believe ESD is trying to acquire that new paradigm, not in the way suggested by Jickling (1994), but in the way promoted by Tilbury (2002). An education where the very methods of learning encourage learners to be critical about the foundations on which their education and SD is based. ESD is a transformative education that promotes critical and reflective thinking on assumptions and existing structures.

This constant transformative agenda will assure that ESD is not only relevant, it is also current best practice. It is also important to recognise that, although ESD has a transformative agenda, it also has a purpose towards SD change. This requires that learners' capacity to identify the need for changes and enforce changes in terms of appropriate and sustainable decision making is developed (Connor & Dovers, 2002). ESD, so far, has been described as having good intentions, intentions that promote a holistic education. The competencies that teachers would need to develop to ensure a holistic education, at this point, are still unclear.

ESD – a type of quality education

ESD should be seen as a process of learning competencies that may be applied and taught across all disciplines and, thus, maintain its relevance to all educators and their specialisation subjects (Mogensen & Schnak, 2010). This will be touched on further along in the paper. First, we need to understand how ESD has been conceptually defined by current leading researchers in the field. We also need to explore how these definitions serve to clarify or in some instances mystify understandings, thus motivating for the development of a comprehensive ESD framework.

Defining ESD is something that challenges us all (Pigozzi, 2010). Pigozzi (2010) attempts to define the educational aspect of ESD by stating that it is fundamentally ‘quality education’ that also “includes the range of ideas and concerns that emerged out of the World Summit on Sustainable Development (WSSD)” (Pigozzi, 2010, p. 258). Pigozzi (2010) further defines a quality education.

A quality education understands the past, is relevant to the present, and has a view to the future. Quality education relates to knowledge building and the skillful application of all forms of knowledge by unique individuals who function both independently and in relation to others. A quality education reflects the dynamic nature of culture and languages, the value of the individual in relation to the larger context, and the importance of living in a way that promotes equality in the present and fosters a sustainable future (Pigozzi, 2010, p. 258)

This sort of clarity is not much help to any educator who wishes to know how ESD fundamentally changes their practice in the classroom. However, we have been provided with some sort of solace as we were warned right at the beginning that defining ESD is a challenge for all.

Gadotti (2010) offers a critical insight into the ESD concept, consequently adding confusion to the beginner who is searching for the meaning and implications of ESD. Gadotti (2010) from the start claims education for sustainable living and education for sustainability as preferred concepts to ESD. He takes this stance as he finds that ESD does not recognise the ambiguity in the term ‘sustainable’ and ‘development’ and thus starts with a premise. One may argue that the pedagogy of ESD encourages the critical reflection on the meaning of SD

as mentioned previously, however authors such as Gadotti (2010) can complicate matters when they largely focus on the semantics. In a further attempt to define ESD, Gadotti (2010) in one instance throws together a series of terms and principles, unexplored or defined further and, in this way, unintentionally clutters the path to understanding sustainability. It is important to acknowledge here that an advanced reader on the subject may not concur with these beginner difficulties. Gadotti (2010) may appear absolutely clear to many advanced readers in the ESD field. However as an educator and beginner who is just trying to grasp the concept in order to implement it practically, descriptions such as the one below, provide a very broad guide that stands the danger of being implemented incorrectly or just as vaguely.

Education for Sustainable Development is an integrative (it integrates education, health, jobs, sciences, and so on) and interactive concept. Despite its ambiguity, ESD is a positive vision for a humane future, a consensus supported by a broad majority. With the global warming issue, ESD is very up-to-date, and it can contribute to the understanding of the current crises. ESD requires changing the system, respecting life, caring for the planet and for the whole community of life. That means to share fundamental values, ethical principles and knowledge: respect Earth and life in all its diversity; care for life with understanding, compassion, and love; build democratic societies that are fair, participatory, sustainable and peaceful. ESD is a central point to the educational system facing the future. However, it is not enough to change individual behaviours; we need political initiatives to set standards.[...] ESD is more than a collection of knowledge related to the environment, economy and society. ESD should take care of the way to learn new attitudes, perspectives and values that guide and impel people to live their lives in a more sustainable way (ibid, 2010, pp. 225–226).

This description serves to make one wonder what is this *way of learning* and how does one guide people to live in a more sustainable manner? Interesting is the major emphasis on the ecological perspective of sustainable development, implying that ESD would be focused on the ecological aspects of SD issues. Less emphasis is placed on the societal pillar, no mention of the economic pillar and very little to suggest that the important interconnection between these pillars be engaged with. It would be important for Gadotti (2010) to explain to novices that ESD needs to be grounded in context and that development can include more than ecological development. In many undeveloped countries, SD issues such as poverty and access to education implies a focus towards socio-economic development. Albeit not to the

neglect of the ecological pillar, rather to the consideration of social, economic and ecological aspects and how these all need to be considered when an SD issue concerns socio-economic development needs.

Thus far the importance of the three pillars of SD has been emphasised yet the fourth political pillar should not be forgotten as it runs across the other three in interconnected ways. However an exploration of how policy developed reveals how rising SD issues changed the focus of education over the years. This shift in focus reveals the needs based nature of education, supporting the newer ‘development’ emphasis inherent in defining ESD.

Defining ESD: A historical perspective

When trying to adequately define ESD, one cannot ignore the definition of SD which ultimately serves as the foundation on which ESD rests. The previously mentioned strong model of SD is supported in two documents crucial to ESD, Agenda 21 (UNCED, 1992) and the United Nations Decade for Education for Sustainable Development [DESD] (UN, 2002). However the Tbilisi Declaration is briefly reflected on to reveal the change in orientation from an ecological focus to a more socio-cultural focus in Agenda 21 and the DESD. The Tbilisi declaration offers an insight into the first movements towards understanding education as a process that involved an education in, about and for the environment.

Agenda 21 was informed by the recommendations of the Tbilisi Declaration, which focused on the then phrased ‘environmental education’ (EE) with a much stronger ecological justice focus. A more recent application of EE is what we now refer to as ESD, with a stronger development focus, in the interest of human rights and equity. Perhaps this is where a lot of confusion has crept in as far as applying ESD is concerned. An opening statement in the report of the Rio+20 Conference in June 2012 stated, “Eradicating poverty is the greatest global challenge facing the world today and an indispensable requirement for SD. In this regard we are committed to freeing humanity from poverty and hunger as a matter of urgency” (UN, 2012, p. 1). It is therefore not so alarming to notice the shift in policy from the ecological justice focus to the stronger development focus. In a world where poverty and hunger is a global problem, how can we justify an education that focuses on ecological justice and ignores the socio-cultural and socio-economic issues that are rife? It is also important to mention that science and technology hold the innovative power to promote and develop

‘environmentally sound technologies’ that not only serve to address socio-economic needs but also ecological needs (UN, 2012). Development is inevitable, therefore it is crucial that we understand the implications of development and consider them in future development. An education that only focuses on promoting ecological needs is not effective in preparing decision-making citizens for a developing world. For it is a global reality that major SD issues concern socio-economic needs, and, if learners are not exposed to an education that engages all four pillars of SD (social, economic, ecological and political), then they will remain unequipped to make informed decisions that assist SD locally and globally.

At the other extreme, many institutions and educators have resorted to a ‘greening’ focus of ESD as just mentioned this was the major previous orientation of EE. As a result, this has left many educators feeling that either ESD should be delivered as a separate subject on its own, or that perhaps their discipline is not suited for the inclusion of ESD altogether. A recent survey sent out as part of my doctoral study, received many replies from teacher educators in the mathematics, languages and education studies department, who felt that SD was related to the sciences and thus irrelevant to them. They apologised profusely for not being able to take part in the study and wished me well for its further progress. Perhaps then it is our misunderstanding of ESD and previous weak knowledge of EE that restricts us from making the necessary paradigm shift.

A closer look reveals that the Tbilisi Declaration poses that environmental problems may be better understood and resolved by bringing together the knowledge from different disciplines. This was to pave the way for the implementation of the strong model in education. Instead of seeing EE and ESD as something that needs to be incorporated into a crowded curriculum, the Tbilisi Declaration suggests that it be looked at differently. The activity of EE and ESD, according to the Tbilisi Declaration, should be seen as the using of knowledge from different disciplines to address SD and environmental issues.

A basic aim of environmental education is to succeed in making individuals and communities understand the complex nature of the natural and the built environments resulting from the interaction of their biological, physical, social, economic, and cultural aspects, and acquire the knowledge, values, attitudes, and practical skills to participate in a responsible and effective way in anticipating and solving environmental problems, and in the management of the quality of the environment (Tbilisi Declaration, 1978, p. 25).

What is implied is that an EE or ESD should not only impart knowledge competencies about SD, but rather that skill competencies be developed through active learners' engagement in order to address SD issues.

In analysing the Tbilisi Declaration, the main principles of EE are highlighted. These principles mention competencies that both the educator and the learners need to aspire towards. A few of the knowledge competencies include the understanding that nature is a complex system that involves the interdependence of the physical, social economic and cultural spheres; a realisation that local decision making has global impacts; and socio-economic growth directly influences the biophysical environment. Skill competencies include the demonstration of agency towards solving environmental problems using critical thinking and problem-solving skills. Value and attitudinal competencies involve those related to environmental agency. These principles can be identified further on in the ESD framework that has been constructed using the key principles from major policy and literature on ESD. An educator who has previously been exposed to the ecological thrusts of classical EE would interpret the term 'environmental problems' to mean ecological problems. It is for this purpose that the ESD framework was developed.

As mentioned earlier, it was out of the recommendations of the Tbilisi Declaration that chapter 36 of Agenda 21 was formulated. In analysing Chapter 36 of Agenda 21, the main principles of ESD are highlighted. These principles, like those in the Tbilisi Declaration, mention competencies that both the educator and the learners need to aspire towards.

The knowledge competencies mentioned include the understanding that all disciplines should address the biological, socio-economic and human development needs as well as an insight into how environment and development are integrated in all disciplines, revealing local issues. Skill competencies include teachers and learners becoming agents of change who solve environmental and development problems using critical and creative thinking. Value and attitudinal competencies involve those related to social agency using indigenous and local knowledge as well as considering science and culture when addressing human development issues.

Yet words such as 'development', 'development issues', 'human development' and the constant referral to human rights and needs prioritises the anthropocentric focus of ESD. This is the major difference in focus between the Tbilisi Declaration and Agenda 21. This is not to fault Agenda 21, but rather to explain how we have shifted from the 'green' concept of EE to

a more socially ESD to address the current pressing issues relating to poverty and unemployment. At this point, I find it necessary to note that if Agenda 21 is not viewed through the lens of the strong model, there is a chance of misinterpretation.

With this in mind, when analysing the list of knowledge principles listed under the Tbilisi Declaration and then within Agenda 21, one can begin to see that not only the social and economic aspects are considered within the natural biophysical environment, but also human development is seen as important when considering sustainability of the natural environment. A strong human focus is introduced in Agenda 21 where humans must gain from sustainability actions. This notion is reinforced under the list of ‘Attitudes and values’ as social needs are emphasised before the needs of the environment. Education policy makers should understand and be critical about the shift in focus and how it impacts on the focus that education needs to take. Agenda 21 does not promote a piecemeal green education because it comprehends the tri-complex (societal, economic and biophysical aspects) nature of SD and the current need for a development oriented education. Agenda 21 would serve as the supporting policy to a pivotal policy for ESD, 10 years later.

ESD – the United Nations Decade

It was in 2002 at the WSSD where it was recommended that the DESD be developed and implemented. Later the DESD international implementation scheme (UNESCO, 2005) was developed.

The DESD international implementation scheme report begins by stating in seemingly specific and clear language.

The overall goal of the DESD is to integrate the principles, values, and practices of sustainable development into all aspects of education and learning. This educational effort will encourage changes in behavior that will create a more sustainable future in terms of environmental integrity, economic viability, and a just society for present and future generations (UNESCO, 2005, p. 6).

This definition reveals the outright acknowledgement of the four pillars of sustainability accompanied by an understanding that education should promote action towards the address

of SD issues. A deeper look into the document will guide ESD stakeholders in finding a more practically applied meaning.

Understanding and addressing these global issues of sustainability that affect individual nations and communities is at the heart of ESD. These issues come from the three spheres of sustainable development – environment, society and economy. Environmental issues like water and waste affect every nation, as do social issues like employment, human rights, gender equity, peace and human security. Every country also has to address economic issues such as poverty reduction and corporate responsibility and accountability. Major issues that have grabbed global attention such as HIV/AIDS, migration, climate change and urbanization involve more than one sphere of sustainability. Such issues are highly complex and will require broad and sophisticated educational strategies for this and the next generation of leaders and citizens to find solutions (UNESCO, 2005, p. 7).

The shift in focus from mainly ecological needs to developmental needs, not only mirrors the current pressing global needs related to society and economy, it also allocates responsibility to every member of society to take action in a socio-economic and ecologically considerate manner. It seems clear also that knowledge of sustainability issues is pertinent for meaningful action taking and decision making to occur. Huckle (2001) offers a list of concepts that education should develop about SD, which consequently offer a better understanding of what is meant when referring to SD issues:

- developing students' knowledge of biophysical systems, their potentials and limits;
- developing students' knowledge of the technologies societies use to 'exploit' these bio-physical systems and the environments they create in the process;
- developing students' knowledge of the economic systems that shape investment in environmentally appropriate or inappropriate technologies, for instance, investing in automobile companies as opposed to the public transport sector;
- developing students' knowledge of the political systems (local, national, regional and international) which regulate the social use of bio-physical systems and the environment, for instance, national coastal regulations on fishing and use of four wheeler vehicles on sand dunes;

- developing students' knowledge of social systems (the economic, political, civil and private spheres of people's lives) which embrace the interests, power and strategies of different racial/gender/religious/economic/groups;
- developing students' knowledge of the different cultural systems (technologies, beliefs and values) and how these may help or hinder people in understanding and/or improving their environmental predicament, for instance, traditional sustainable ways of cultivating indigenous medicinal plants.

SD issues are innately contentious. When looking at ESD, it must be understood that it is an education that engages learners and students in dealing with contentious issues. Such engagement ultimately requires critical and creative thinking, relevant and meaningful decision making and problem solving in the interest for a more sustainable future, whatever that may mean to various contexts. The shift from an ecological focus of EE to a development focus of ESD becomes substantiated as current contentious SD issues constitute the educational focus. SD issues, for instance, land conservation versus job creation touches on the types of contentions that exist between the four pillars of SD.

The DESD not only refers to the knowledge competencies that learners should develop through an engagement with SD issues, but it also makes a reference to the kinds of skills and values that should accompany such exploration.

With sustainable development comes valuing biodiversity and conservation along with human diversity, inclusivity, and participation. In the economic realm, some embrace sufficiency for all and others equity of economic opportunity. Which values to teach and learn in each ESD programme is a matter for discussion. The goal is to create a locally relevant and culturally appropriate values component to ESD that is informed by the principles and values inherent in sustainable development (UNESCO, 2005, p. 8).

This excerpt suggests a specific type of teaching and learning as it makes a reference to *human diversity, inclusivity and participation*. This suggests that learning should not only involve knowledge about complex sustainability issues, but also the diverse knowledge that various cultures bring and the important role individuals should play in their attempt at participation.

More clarity regarding a suggested ESD teaching pedagogy is offered when the declaration clarifies ESD as a kind of *quality education*. As one reads the list of characteristics of quality education, words such as socially just education, responsible citizenship, active participation, ESD values and attitudes, indigenous knowledge, problem solving, community development spring to mind. Social development is clearly important here, yet reference to responsible citizenship and community development also makes clear links to the importance of the economic and ecological pillars. Finally, the last two pages of the DESD (UNESCO, 2005) offer a long list of ESD principles, with the acknowledgement that there exists no universal model of ESD, as educators in each context will interpret the principles slightly differently according to the values, needs and priorities of their particular context. However, it appears that there exists a general set of ESD principles (UNESCO, 2005).

Education for sustainable development:

- *is based on the principles and values that underlie sustainable development;*
- *deals with the wellbeing of all three realms of sustainability – environment, society and economy;*
- *promotes life-long 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 for its own, but all disciplines can contribute to ESD;*
- *uses a variety of pedagogical techniques that promote participatory learning and higher-order thinking skills [critical and creative thinking].*

These essential characteristics of ESD can be implemented in myriad ways, so that the resulting ESD programme reflects the unique environmental, social and economic conditions of each locality (ibid, pp. 30–31).

On a journey to defining and essentially understanding ESD, it has not been enough to merely look at the leading document that guides ESD. Important and crucial to its conceptualisation has included a historical glance at its development and an engagement with other leading researchers' thoughts on the challenges and limitations of ESD. An insight into how policy has shifted from an ecological to a development focus and substantiation for why this shift is important with regards to current SD issues serves to inform the interpretation of the ESD principles listed here. ESD is not easy to define and, due to its contextual application, is not uniformly defined. It is at this point that I suggest one more concept be introduced and considered for a meaningful address of ESD.

Action competence: Promoting a development oriented education

Action competence has been introduced recently as a compatible concept with ESD even though the concept itself has been around for more than thirty years. Action competence may be the key to understand how knowledge about SD issues may be implemented in a meaningful way.

According to Mogensen and Schnak (2010), action competence is concerned with “liberal education, democracy, human rights, sustainable development and equal (*herrschaftsfrei*) communication” (p. 60). Considering this, it becomes helpful to recognise that action competence is very closely aligned to cultural theory (Scott & Gough, 2003) and the concept of *Bildung*. *Bildung*, much like action competence and the ideal of sustainability education, values the development of the reflective individual who has the power to question assumptions, ‘facts’, agendas and opinions about current living conditions and activities. *Bildung* “emancipates people to become political subjects – and not just the objects of control and guidance exercised by other people” (Hellesnes, 1976, p. 18). In an ecology focused curriculum, a human development orientation to education such as this one would more than likely not serve the purpose of the curriculum. However, in a SD focused curriculum, it would promote the core principles.

It is important to note that the action competence approach promotes the democratic element that avoids the dogmatic *educating for* component that Jickling (1994) protests. The educational context does not involve a private or personal attainment of knowledge and skills. Rather it is defined by a learning organisation of critically reflective people who make

decisions that impact the community. Action competence can contribute to the implementation of ESD as it emphasises context, critical discussion and responsible action.

The action competence approach to ESD is a worthwhile and well-suited approach (Mogensen & Schnak, 2010). Instead of trying to iron out the complexities of SD and ESD, action competence embraces the complexity. It does this as it focuses on the democratic action that might result when trying to address these complexities. However, this does not make it any easier for practitioners to understand and implement ESD. What it will do is to place practitioners in the correct frame of mind, a paradigm of thought that is critical and reflective in its stance to education.

ESD principles, as mentioned earlier, have been identified as an attempt to define ESD and not as an attempt to provide a conclusive set of indicators that need to be ticked off when implementing an ESD-oriented curriculum. Therefore the suggested ESD framework presented next must be viewed for what it is, a guideline or accompaniment to the professional intuitive knowledge of the learners/students and their context.

A suggested ESD framework

An analysis of the literature and major policies on ESD has suggested a workable framework that practitioners and even policy makers may refer to in an attempt to determine whether or not their practice or policy is aligned to the greater intentions of ESD. The first category is explored to demonstrate specifically how literature informed the design of the associated sub-categories or indicators.

The first category of ESD principles are related to ‘teaching and learning’ and can be classed into two main groups: (1) action competence and (2) alternate knowledge systems. Action competence sub-categories pay attention to active learning, learner centeredness, community engagement and decision making. Connor and Dovers (2002) referred to developing learners’ capacity to identify the need for change in terms of sustainable decision making. Also, the Tbilisi Declaration (UNESCO-UNEP, 1978) spoke about the need for citizens to “participate in a responsible way” (p. 25). Huckle (2001) highlighted the importance of various knowledge competencies in order to engage in meaningful decision making. Tilbury (2002) encouraged critical and creative thinking and learner empowerment.

The sub-category ‘alternate knowledge systems’ is further informed by Agenda 21, UNESCO (2005) and Huckle (2001) all of which refer to the importance of local and indigenous knowledge when engaging in debate around SD issues.

Table 1. An ESD framework for analysing practice

Categories of ESD related themes	Sub-categories of ESD related themes
ESD teaching and learning approaches	Development of action competence: <ul style="list-style-type: none"> participates in decision making and community-based decision making (for instance, debates and action plans) engages in community and social development activities active learning approaches (for instance, environmental impact assessments) learner-centered approaches participatory and collaborative learning activities
	Alternate knowledge systems approach to sustainability <ul style="list-style-type: none"> considers different knowledge systems as an important starting point for exploring issues of sustainable development
ESD skills	Critical and creative thinking <ul style="list-style-type: none"> explores ways of solving local contextually relevant problems considers society, economy and environment while problem-solving carries out critical analyses of current knowledge and situations and their implications for future decisions.
	Systemic thinking

	<p>engages in looking for links to solve complex problems</p> <p>understands that systems are complex that usually involve more than the sum of their parts</p> <p>engages in partnership building to address needs and solve problems</p>
	<p>Future thinking</p> <p>recognizes the need for change</p> <p>searches for a way to attain a sustainable future</p> <p>understands the short and long term effects of current decisions</p> <p>the importance for renewing knowledge about evolving sustainability theory and models</p>
ESD knowledge competencies	<p>promotes an understanding of various sustainability issues both local and global, for instance, food security, economic and social justice, democracy, distribution and use of resources etc.</p> <p>promotes an understanding of how society, economy and the ecological environment play a part in these sustainability issues</p> <p>promotes the sustainable use of and care for natural resources</p> <p>promotes the understanding that all disciplines can explore ESD through their subject knowledge</p> <p>connects relevance of subject knowledge to society, environment and economy.</p>
ESD values	<p>promotes an environmental stewardship</p> <p>promotes social tolerance and equity</p>

	promotes collaboration in decision making and problem solving
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Exploring the creation of the category ‘Teaching and learning approaches’ further (Table 1), Jickling and Wals (2012) made a reference to lifelong learning, social cohesion and collective action, alluding to ‘participation in decision making and community-based decision making’ as well as ‘participatory and collaborative learning activities’. Pittman (2002) referred to the contextual interpretation of the SD concept, and this is acknowledged in some way by the sub-categories that refer to ‘learner-centered approaches’ and ‘alternate knowledge’. The Tbilisi Declaration (UNESCO-UNEP, 1978) also referred to the need to understand that local actions have global impacts. The Tbilisi Declaration also assisted in constructing the sub-category ‘active learning approaches’. According to UNESCO, ESD “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” (UNESCO, 2005, p.30-31). This understanding assisted in forming the indicator ‘Engaging in community and social development activities’ for this framework. For purposes of tediousness the other categories shall not be similarly dissected. However, it only takes a glance at the other categories to identify the knowledge, skill and value competencies that have been engaged with throughout the paper.

This framework is not an isolated tool rather it is a guiding framework that needs to be informed by the presented understanding of the historical and locally relevant perspectives of ESD, as well as the perspectives offered by researchers in the field. To reiterate the main argument, an understanding of how policy has shifted focus from an eco-centric (ecological) perspective to a development perspective can assist in interpreting the objectives and thus implications of ESD. Education is geared towards local and national needs. Understanding that SD issues engage these social, economic and ecological needs and that these are interconnected and complex is a key to successfully understanding ESD and its implications in practice.

Paving a clear path for ESD

In paving a clear path for a sustainable ESD, it is clarity that is sought. De Haan, Bormann and Leicht (2010) pose it is important to avoid the relativist tendency to label almost everything ESD. They suggest that most authors and researchers in the field have accepted that anything to be labelled ESD should at least integrate the three pillars of SD (environment, economy and social/socio-cultural) with a participatory component. Once again, it is not ignored here that the fourth 'policy' pillar runs throughout these three pillars. Such a definition, although simplifying things drastically, manages to assist in an inductive approach to making meaning of ESD in practice. ESD is a process that involves political, economic and societal dimensions and is not merely content to be incorporated. It requires a particular cultural change that has sustainability at heart (Tilbury, 2002). The process of cultural change needs to be co-operatively engaged in and involve a democratic space for change towards sustainable development, even involving learners, educators and community members alike (Sterling, 1996).

From the exploration of policy and literature, it is my notion that ESD, when correctly understood and engaged, has the potential to transform education and society in a socially responsible manner. It must further be said that a historical exploration of the shift from a classic eco-centric type EE to a development oriented education can assist in making meaning of ESD, removing ambiguity. Development is inevitable and should not be contested for development in science and technology serve as crucial instruments for attaining sustainable social, economic and ecological development.

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8. Article 2

Exploring the priorities of Teacher education related policies: An Education for Sustainable Development perspective

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Abstract

Education for Sustainable Development (ESD) for many is considered to be a 'quality education' in its own right. There also exist many debates around the semantics and implications of such an education, however this study acknowledges the greater intentions of ESD and thus deems it necessary to analyze to what degree teacher education related policies promote ESD. The study carried out a content analysis of the major policies that guide teacher education and teacher education development in South Africa. An ESD analytical framework which was developed from an analysis of pivotal ESD literature was used. The analyses vary from a subtle to a very potent operationalization of the developed framework due to the varying policy structures. Direct and indirect applications of ESD principles were identified across policies revealing major inefficiencies with regards to meaningful ESD address. The main findings of the study refer to policy inefficiencies with regards to: (1) the promotion of ESD teaching and learning approaches; (2) the connection of ESD skills and values to ESD issues/knowledge content; (3) understanding the complexities of the interactions between the three pillars of sustainability (economy, society and nature) in covering sustainability issues/concepts; and finally (4) the policy focus on societal and economic development. These findings reveal that although policy documents guiding teacher education and development do not actively prevent teachers and teacher education from focusing on ESD, they at the

same rate do not provide sufficient objectives or guidelines towards its realization and implementation.

Keywords: Education for Sustainable Development, sustainability, quality education, teacher education related policy

1. Introduction

South Africa has a thirty decade history of racial violence and social inequality that has contributed most significantly to South Africa's challenges today. South Africa as a democratic state is only 19 years in the making and faces the harsh challenges of remedying the legacies of the past. One of these legacies includes the effects of the apartheid education system. The low quality 'black education' and high quality 'white education' systems of the Apartheid times, have engraved society with issues of unequal access and distribution of resources. The sustainability issues most pertinent to South Africa today include: food security, water scarcity, HIV/AIDS, and poverty, which mostly affect the previously disadvantaged population.

According to the United Nations Educational, Scientific and Cultural Organization [UNESCO] (2010)

In Africa, the re-orientation of education towards sustainable development requires the strengthening and boosting of the quality and efficiency of capacity development initiatives (education, training, community development and public awareness programmes) to address the relevance of education to development and poverty alleviation objectives. (p.5)

We add that these capacity development initiatives also need to be supported by ESD oriented policies that guide teacher education. "ESD affects all components of education: legislation, policy, finance, curriculum, instruction, learning, assessment, etc" (UNESCO, 2012, para. 2) Teacher Education related policies should highlight the complexity of the interrelatedness of all the pillars of sustainable development. Pigozzi (2010) reveals the interrelatedness of the pillars of sustainability, for example a country with a high HIV rate requires increased funds from the Government budgets as the reduced labor force population further impacts the greater economy of the country. A reduced economy results in fewer resources, such as those relating to food, health and water.

South Africa's education system has undergone numerous curriculum changes since 1994, however throughout those changes each curriculum has attempted to pay attention to pressing sustainability issues and principles to some degree. One can only imagine that this has been spurred by both the Tbilisi Declaration and Agenda 21 which place a certain amount of responsibility for the social, economic and biophysical environment on the shoulders of educators. As a result two major programs were developed to assist in realizing this responsibility in education. The National Environmental Education Program (2001) which looked at building teachers' capacity to implement sustainability principles into education and the South African Eco-Schools project which focused on creating sustainable schools that reoriented all aspects of schooling towards an environmental focus. However it has been noticed recently that these two programmes "have not been able to provide for a sustainable system of teacher professional development (or Teacher Education and Development/TED) for environment and sustainability education/ESD in South Africa." (Association for the Development of Education in Africa [ADEA], 2012, p.9)

ADEA currently carries out a national case study looking at Teacher Professional Development with an ESD focus. The case study reviews the history and development of environmental education and ESD in South Africa and uses this review to visualize a different approach to realizing ESD considering the new school and higher education policy environments. The study's main purpose is to develop a national network, curriculum framework and resources for teacher education, with focus on inclusion of ESD, within this new curriculum policy environment. This is a relevant and much needed study. The point of view adopted here is that in addition to this, one need also review what aspects of teacher education policies contradict the ESD cause. The ADEA report uses policies such as Education White Paper 3 and the new 'Integrated strategic planning framework for Teacher Education and Development in South Africa' (Department of Higher Education and Training [DHET] & Department of Basic Education [DBE], 2011) to motivate for their study and thus as a point for departure. Our study however reviews those two policies as policies that guide teacher education and development in the country and thus aims to reveal their priorities, commenting on how this aligns/misaligns with the realization of ESD. The policy content analyses that this paper engages with, not only aims to identify exactly where and how the policies are/are not oriented towards an ESD focus, it also highlights the ways in which these policies contradict the greater plight for ESD

implementation. The paper uses a methodological tool (Bentham, 2013) as a technique for reviewing the ESD relevance of policies and curricula.

Teacher education institutions in South Africa are guided by national school curriculum statements as well as by higher education policy and more specifically teacher education and development policy. Although teacher education institutions display a degree of autonomy, there are fundamental policies and reports that ensure that all graduating teachers are adequately prepared for the teaching and learning environment. Understanding policy priorities can be attained through an analysis of the policy language and general discourse. The focus of this paper is to determine: ‘What are the main priorities of Teacher Education related policy texts and how do these align/misalign with Education for Sustainable Development priorities?’ When identifying whether ESD priorities have been implemented in policy it is necessary to note that this may occur in a direct and indirect manner. Direct implementation refers to examples where the ESD principles are written overtly in the language of the policy as clear objectives. Indirect implementation refers to examples where carrying out certain objectives of the policy may or could lead to the satisfaction of ESD principles. Now ESD itself as a construct is deemed necessary to explore, as this meaning provides the foundation for the analytical framework used during the document analysis process of this study.

2. Education for Sustainable Development and Policy

Understanding what is meant by sustainability and its related issues can be an intricate matter as the social, economic and ecological aspects are tightly interwoven making linear causal predictions less possible (Sleurs, 2008). The need to strike a balance between the three pillars of sustainability is stressed by UNESCO (2010) as this insight offers an in depth and complex understanding of the causes, effects and possible actions that need to take place when addressing issues such as climate change for example. Policy, as a fourth pillar, cuts across all three pillars, and serves as the analytical substance of this study.

The mere definition of an Education for Sustainable Development is met with much contention. However there is general agreement that ESD is a model of education that attempts to offer an avenue for empowerment, encouraging people to take responsibility for their role in achieving sustainable development (Rwanda Environment Management Authority [REMA], 2010). It can

be said that by considering the environment, society and the economy during the pursuit of development and quality living, sustainable development will be achieved (REMA, 2010). Besides the long standing concern regarding its ambiguity of definition and its challenging implications for adequate implementation, there exists an entirely separate yet fundamental issue regarding implementation of ESD. According to Jickling (1994) any education should promote empowerment whereby learners can ‘think for themselves’. In Jicklings’ (1994) opinion an Education for Sustainable Development or ‘for’ anything is one that threatens indoctrination thus undermining the greater aim of a quality education. Perhaps an over-simplified response to such criticism would be to say that surely any education involves an educating for something, whether it is for empowerment or for a chosen curriculum. Perhaps the intention is what should speak loudest and not so much the semantic arguments. However there is great possibility that ESD might be delivered in a manner that ignores relevant accompaniment of empowering ESD pedagogy and for this Jickling’s criticism should be considered seriously. A more specific concern expressed by Jickling (1994) refers to the danger of obscuring the “understanding of the economic, political, philosophical and epistemological roots of environmental issues, and adequate examinations of social alternatives.” (p.2). Such a concern manifested itself 18 years later in the National case study conducted by the Association for the Development of Education in Africa (ADEA, 2012) whose specific aim was to report on the practical implementation of ESD in the South African teacher education system. A major critique of the many observed programs was the “over-emphasis on activities, projects and experiential learning, an under-emphasis on quality environmental content and concepts, and a failure to make links between issues and concepts”. (ADEA, 2012, p.18)

In May 2005 the secretariat of the Southern African Development Community (SADC) joined the Regional Environmental Education Programme (SADC-REEP) in outlining guidelines for the countries participation in the United Nations Decade on Education for Sustainable Development (UNDESD, 2002). The consultation report that resulted from this collaborative effort reveals the desire to promote the inclusion of environmental education and education for sustainable development into local and national education policies and structures. The SADC consultation report on the Decade of Education for Sustainable Development also revealed a major concern. Under the area of ‘Knowledge, Curriculum and Pedagogy’ it was found that there was a distinct lack of knowledge regarding sustainable development and sustainability issues in most

educational contexts. It was suggested that teaching and learning would need to become more learner-centered and involve participatory as well as activity-based approaches to learning about these issues. Finally teachers would need to engage with different knowledge systems as they display positive and negative impacts on sustainability (SADC, 2012).

We think an analysis of supporting teacher education policy can inform future avenues towards a realization of ESD implementation. The fact that even good policy development does not ensure that the policy is in fact implemented in an adequate manner (Timmerman & Metcalfe, 2009), is not ignored here, however it is a beginning criteria for efficient ESD address.

There exists a relevant debate around the role and responsibility of policies for practice in general. In a discussion with colleagues it was asked: ‘Are policy papers meant to provide support for ESD implementation, or should this be developed by the institutions as a response to the focus of the policy papers?’ It was suggested that perhaps policy needs to be seen as a challenger of current practice but not in a manner that is so different from current practice that people are unable to see how they might make that shift. From this discussion it can be concluded that policy provides guidelines and direction for transformed practice and the question in actual fact becomes whether policies relevant to South African teacher education provide enough valuable direction for ESD attention and/or address? Before this discussion is entered into it is important to contextualize educational policy formulation and implementation in South Africa.

The focus of South African education policy for almost two decades since the transition from the apartheid system has been towards achieving an education system that educates South Africans in a democratic and socially equitable way (Smit, 2005). Social development is only one principle of an ESD, however significant this principle, an education system that focuses solely on this principle of ESD cannot be said to address a holistic approach to an Education for Sustainable Development and thus a quality education. This paper explores the goals and values of six major types of policies guiding teacher education and the degree to which these goals and values motivate for or support an Education for Sustainable Development.

2.1. Policy guiding South African Teacher Education

After a survey of many school based and higher education based policies, six policies in particular were found to be most appropriate for the content analysis for this study. These policies were deemed appropriate as they offered the most insight into the web of policies guiding teacher education and development in South Africa. These policies guide the levels of competencies that teachers and teacher educators should develop as well as the competencies that teachers and teacher educators are expected to develop in their learners/students. The policies also elaborate on qualification levels and the type of knowledge mix that higher education programmes, such as the Bachelor of Education programme, needs to display. Table 1 identifies and briefly describes each selected policy.

Table 1. Teacher Education related policy in South Africa

Policy Name	Year	Policy Audience	Policy Scope
Education White Paper 3	1997	Higher Education stakeholders	A program for Higher Education Transformation. Outlines the program for change.
National Policy Framework for Teacher Education and Development in South Africa	2007	Department of Education; South African Council of Educators (SACE); Higher Education stakeholders (staff)	Describes the context of teacher education. Specifies the procedure and requirements for teacher education program recognition. Describes the conceptual and pedagogical needs of the new continuing professional teacher development system. Describes the joined responsibility of the Department of Education and South African Council of Educators in implementing the policy by providing support structures.
Higher Education Qualifications Framework for Teacher Education	2011	Higher Education stakeholders (staff and	Outlines the minimum requirements for teacher education qualifications, which involves the description of the different qualification types, their purposes and a set

		students)	of minimum set of agreed-upon competencies.
Integrated Strategic Planning Framework for Teacher Education and Development in South Africa, 2011-2025	2011	Initial Teacher Education stakeholders; Department of Education & all educators	Addresses major issues such as: (1) adequate training of teachers; (2) teacher demand, supply and utilization; (3) strengthening support structures for teacher professional development; (4) policy alignment ; (5) need for resource centers.
Curriculum and Assessment Policy Statement	2011	Teachers and Teacher Educators	Elaborates on the valued knowledge, skills and values to be developed in the curriculum and how this may be attained through suitable assessment activities.
UMALUSI (The general and further education and training framework)	2012	Teacher Educators and Teachers.	Provides the broad purposes for National Qualification levels 1-4 (Grade R-12) in the attempt to ensure quality.

The documents listed will be elaborated further in the coming section.

2.1.1. Education White Paper 3 reveals the ‘new’ South African Higher Education system

It is stated within the basic rights of the South African Constitution that everyone has a right to a safe and protected environment that offers benefit to present and future generations (Republic of South Africa [RSA], 1996). It was from this constitutional mandate that the South African National Environmental Management Act (NEMA) was developed in 1998. NEMA integrates a legal clause that binds all governmental departments, such as the Department of Education (DoE) to implement sustainability at a policy and implementation level (RSA, 1998).

With the adoption of the new South African democratic constitution by the newly elected African National Congress (ANC), the establishment of new structures, commissions and task teams was permitted. The 1996 constitution made tertiary education a national competence and

the Higher Education Act (1997) made all teacher education, and therefore colleges of education, part of the Higher education system. The Higher Education Act governs Universities in South Africa however it is Education White Paper 3 that really reveals the intended Higher Education transformation process and thus highlights the major goals and values of Higher education. This Education White Paper has assisted in shaping all Higher Education programmes, including teacher education programmes and all institutional policies today and for that reason has been deemed valuable for analysis in this study.

2.1.2. Three pivotal South African Teacher Education Policies

Three teacher education policies have been purposefully selected for the policy analysis process and have further been described here.

The main aim of ‘National Policy Framework for Teacher Education and Development in South Africa’ (2007) is to prepare the teaching profession to promote a democratic society. The policy elaborates on the recruitment of teachers, their retention and further professional development. The policy lists the principles that it is underpinned by and explores the context of teacher education in South Africa. The policy also identifies the structures of the various teacher education programs and the different avenues for obtaining these degrees.

The ‘Higher Education Qualifications Framework for Teacher Education’ (DHET, 2011) mainly brings the teacher education qualifications and the Higher education qualifications framework together, merging them into one policy. This policy outlines the minimum requirements for Teacher Education Qualifications. The policy amongst other things clearly describes the basic requirements for the development of acceptable learning programmes that meet the needs of South Africa and further encourages teacher educators to design curricula and implement policy. Finally the policy puts forward seven roles of a teacher that must be satisfied collectively by teachers within any particular school at any particular time.

The ‘New Integrated Strategic Planning Framework for Teacher Education and Development in South Africa, 2011-2025’ (DBE & DHET, 2011) is an integrated plan for teacher education and development in South Africa and responds to the list of challenges submitted at the 2009 Teacher Development Summit. Four working groups were put to task on the development of the plan and these groups covered four areas being: (1) Institutional arrangements; (2) Needs and programs;

(3) Support structures; and (4) Priorities and funding. As a strategy for teacher education and development in South Africa this document is an important clue to the education departments' major priority areas concerning teacher skills and values for professional development.

2.1.3. National schools related policy – CAPS and UMALUSI

In 1997 Outcomes Based Education (OBE) was introduced to South Africa to address the divisions affected by the apartheid government and those that lay within curricula. The implementation of OBE prompted a review of the education curriculum in 2000 and this review resulted in the 2002 Revised National Curriculum Statement Grades R-9 and the National Curriculum Statement Grades 10-12. The challenges experienced in trying to implement these two policies further prompted a 2009 review which resulted in the formulation of the Curriculum and Assessment Policy Statement (DBE, 2011a, 2011b). The Curriculum and Assessment Policy Statements (CAPS) are comprehensive documents that have been developed for each subject and address the weaknesses of knowledge and quality present in the previous curriculum policies. The CAPS elaborates on the valued knowledge, skills and values to be developed in the curriculum and how this may be attained through suitable assessment activities. The school curriculum policy documents are the focus of all courses within the teacher education programme and so teacher educators are strongly guided by these documents. The CAPS documents for the Natural Sciences and Technology integrated subject Grades 4-6 and Natural Sciences Grade 7-9 will serve as the sample policies to be analyzed under this section as this covers the Sciences from Grades 4-9. The Sciences was chosen as the subject for analysis as it may be considered one of the subject areas that lends itself most favorably to the inclusion of sustainable development issues and thus all the skills and values that may be developed through the engagement with these topics. It is thought here that an analysis of the Science related CAPS documents would provide the best indication about the degree to which the national curriculum addresses or guides teachers to implement an ESD.

The Council for Quality Assurance in General and Further Education and Training, UMALUSI exists as an independent quality council that was mandated by parliament in 2001. It is the General and Further Education and Training Qualifications Framework (2013) drafted by UMALUSI that is up for scrutiny here, along with the two selected complimentary CAPS policies.

3. An ESD analytical Framework

In order to analyze the different policies and/strategies relevant to South African Teacher Education in a conceptually sound manner, an adequate exploration must also be made of ESD related literature and policy. The analysis is summarized to display a justification for the analytical framework adopted and used in the policy analysis process. The *double lens analysis tool* that was used to assist the policy analysis process is presented and justified. However first it is necessary to explore the socio-political discussions that support the need for a sustainable development focus.

3.1. Turning from capitalism towards eco-socialism

In a democratic South Africa, social development is dependent upon job creation and therefore economic development. This often occurs at the cost of the environment, e.g. development and destruction of crucial habitats and wetlands. The important connection between social and economic development is not enough to make a sustainable difference if ecological development is ignored. Kovel (2013) also reflects on this phenomenon common to South Africa, whereby economic development booms in response to cries of poverty, simultaneously drowning out the need for environmental consideration.

Harvey (1998) concerns himself with metaphors presented by environmentalists, which often refer to the limits of the environment and consequently its collapse. Harvey (1998) finds these metaphors theoretically suspicious because they are socially determined and not scientifically measured, for there is no evidence only speculation of what the long term effects will be. Harvey (1998) refers to the 'web of life' metaphor (which acknowledges more observable, local and short term effects of human action) whereby every individual, as an inhabitant of the world affects the living processes around them and are in turn affected by these processes. "we need to recognize how our actions filter through the web of interconnections that make up the living world with all manner of unintended consequences." (Harvey, 1998, *Metaphors of Crisis, Collapse and "The End of Nature"*, para. 6)

The quantitative shifts in knowledge, technological advances, production, generation of waste, trade, population expansion and acquisition of resources, all indicate there is a need to respond

by considering a complimentary qualitative shift in our thinking about the environmental repercussions (Harvey, 1998). Environmentalists have played a vital role in alerting the public to the idea that environmental issues involve a lot more than just the probability that population expansion will lead to resource depletion, ultimately threatening the survival of all species (Harvey, 1998). To Harvey, the argument that there are many examples that display the unintended impacts of development on the environment, is far more persuasive than the argument that our actions will bring about the entire collapse of our world.

Such insight offered by Harvey (1998) resonates with the South African case whereby capitalist economic structures, although they make promises to diffuse poverty and uplift society through a boosting of the economy, they in fact offer no resolution to the socio-ecological (E.g. excavation of crucial habitats such as wetlands and sand dunes, poisoning of fresh water, deforestation and flooding) impacts that such development has incurred.

According to Marx (1977), we are in a metabolic relationship with our environment for as we change our environment so our environment changes. Harvey (1998) adds that every species has their niche in evolution, ours being the ability to create social structures, build on previous knowledge to guide future decisions, and the ability to reflect on and learn from history (beyond our small individual lives) to inform future investments. Harvey (1998) admits that this view of the world as species centred is very anthropocentric, but that it is honest in recognising ourselves for what we are: individuals who strive to assert their identity and aim to always further their abilities. Harvey (1998) challenges socialist thinking by adding that individuals exist in a world with other individuals of the same and differing species and so they should consider their own identity in relation to others. "If respect and love of others it vital to respect and love of self, then socialists should surely approach all others, including that of nature, in exactly such a spirit. Concern of our environment is concern for ourselves." (*ibid*, Towards a Basic Formulation, para. 3)

Harvey takes on a socialist and anthropocentric view of the value of environmental concern and the plight for sustainable development for the human race. This implies that the selfish plight of capitalist thinking is not a starting point for the resolution of environmental issues. The fight for social transformation and social justice can therefore be seen to be hypocritical if eco-justice is ignored.

Kovel (2013) refers to the term ‘ecosocialism’, which considers ecological crises from an existential perspective, placing oneself within the ecosystem as a connection, linking to other species in the system. Kovel (2013) comments that we have removed ourselves from nature and see ourselves as above it, owing it nothing, proceeding to extract from it.

The capitalist system has a tendency towards the promotion of unlimited growth (Marx, 1977). Kovel (2013) thus proposes the need to develop a different method of production to that of capitalism, a method that does not promote the idea of limitless production without environmental consideration. This notion is shared by the United Nations, who promoted the concept Sustainable Development. Ecosocialism offers an avenue, for much like ESD, it promotes the idea of individuals as agents of change, who originate from communities, schools and organizations, identifying and targeting environmental and social issues.

Kovel (2011; 2013) and Harvey (1998) argue that if nature has no rights then humans, as part of the ecosystem, also have no rights. Acknowledging the importance of nature and our ecosystems is not noble it is fundamental in defining our identity within the system. If a ‘conscience’ is what sets us apart as human beings, then Kovel (2013) argues we should exercise this asset for the intrinsic good of nature.

We are alerted by Kovel (2013) that the challenge of any leftist movement is that it is named such due to its inability to transcend capitalist thought and it is too easily satisfied with sensationalist ideas of social democracy and token greening. ESD challenges this sensationalism and tokenism by striking at the heart of transformational education and activism.

3.2. The conversation between ESD literature and policy

ESD aims to develop sustainably literate citizens, in the words of Parkin, Johnston, Brookes, Buckland & White (2004, p.20):

A sustainability literate person is able to: understand the need to change to a more sustainable way of doing things; have sufficient knowledge and skills to decide and act in a way that favours sustainable development; and recognise and reward other people’s decisions and actions that favour sustainable development.

The term sustainability and sustainable development for that matter bares a particular degree of ambiguity and subjective meaning as it is merely an ideal that cannot possibly be identical for all

(Pittman, 2002). Barsan, Nastasescu and Barsan (2011) attempt to describe the “Strong model of Sustainable Development.” (p.284). This strong model highlights the dependency of the economy on society and society on the environment. It reveals that not all societal activities are concerned with economy however all societal activities are dependent on at least one aspect of the environment.

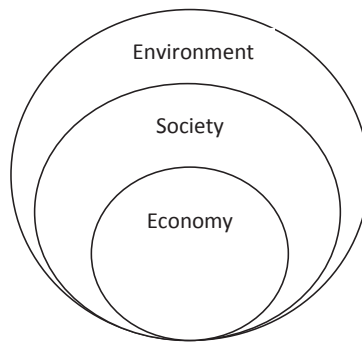


Figure 1. Strong Model of Sustainable Development

(Barsan et al., 2011, p.284)

This strong model of Sustainable Development features in two documents crucial to ESD, Agenda 21 (United Nations Conference on Environment and Development [UNCED], 1992) and the United Nations Decade of Education for Sustainable Development (UN, 2002). Agenda 21 was informed by the recommendations of the Tbilisi Declaration. In analyzing the Tbilisi Declaration (1978) main competencies for an Education oriented towards sustainability are stipulated. These competencies include the understanding that nature is a complex system that involves the interdependence of the physical, social economic and cultural spheres; a realization that local decision making has global impacts; and socio-economic growth directly influences the biophysical environment. Skill competencies include the demonstration of agency towards solving environmental problems, using critical thinking and problem solving skills. Value and attitudinal competencies involve those related to environmental agency. The Tbilisi Declaration

was more ecologically focused supporting the then named ‘Environmental Education’. Years later and a more ‘development’ focused ‘Education for Sustainable Development’ was described.

Chapter 36 of Agenda 21, like in the Tbilisi Declaration, mentions educator and learner competencies. The knowledge competencies include the understanding that all disciplines should address the biological, socio-economic and human development needs; as well as support the integration of environment and development into all disciplines, addressing local issues. Skill competencies include critical and creative thinking as teachers and learners become agents of change who solve environmental and development problems. Value and attitudinal competencies involve social agency and considering Alternate Knowledge Systems when addressing human development issues.

In 2002 at the World Summit for Sustainable Development (WSSD) it was recommended that a Decade of Education for Sustainable Development (DESD) be developed and implemented. The Decade was developed in 2005. The Decade (UNESCO, 2005) offers a long list of ESD principles, with the acknowledgement that educators in each context will interpret the principles slightly differently according to the values, needs and priorities of their unique context.

Education for sustainable development:

- is based on the principles and values that underlie sustainable development;
- deals with the wellbeing of all three realms of sustainability – environment, society and economy;
- promotes life-long 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 for its own, but all disciplines can contribute to ESD;
- uses a variety of pedagogical techniques that promote participatory learning and higher-order thinking skills [critical and creative thinking].

(*ibid*, p.30-31)

A brief background of policy and literature assists in making meaning of the ESD analytical framework used to analyze policies.

3.3. A double-lens ESD analytical framework

A double lens analytical framework was developed to assist the analysis of policies that varied in purpose and style. The first lens of analysis searches to highlight the main goals and values (also known as the ‘policy priorities’) of each policy document. Once these are lifted and thus the essence of each policy is lifted, the second lens of analysis is applied. The second lens, elaborated in Table 2, scrutinizes the findings from the first lens analysis and aims to identify the degree to which these policy priorities address any of the ESD principles. The following figure represents a simplistic model of the double lens process of analysis.

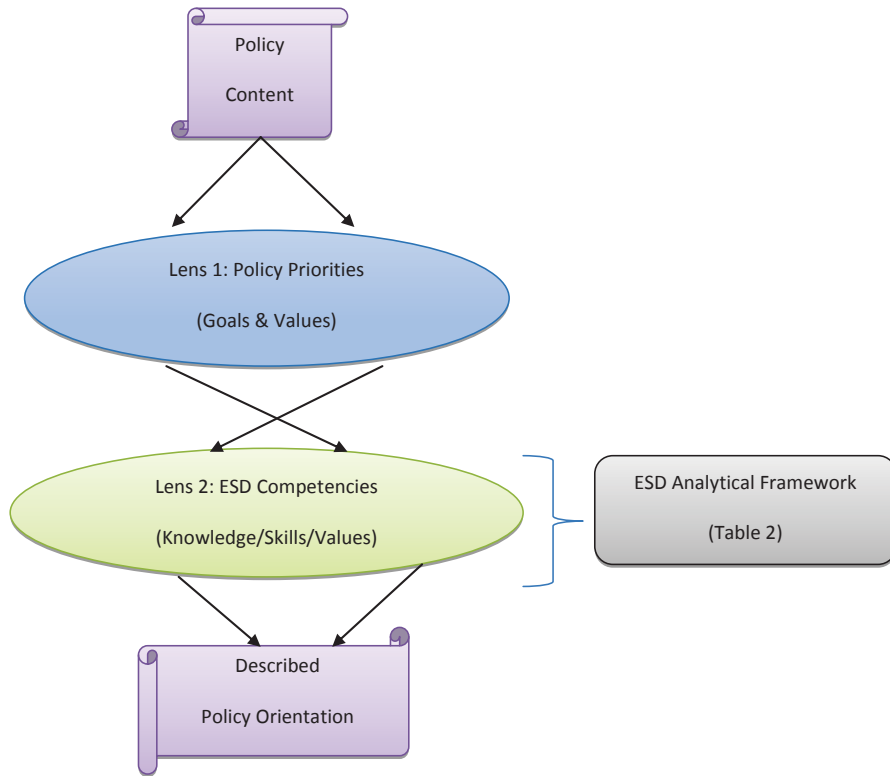


Figure 2. Double lens analytical process.

Table 2, which lists the ESD principles, has been developed through an analysis of literature and major policies on Education for Sustainable Development (Bentham, 2013). These principles support learning in, about and for the environment, as they list knowledge, skill and value competencies.

Table 2. An ESD analytical framework for Teacher Education related policy

Categories of ESD related themes	Sub-categories of ESD related themes
ESD Teaching and Learning Approaches (TL)	<p>Development of Action Competence (AC)</p> <ol style="list-style-type: none"> 6. Participation in decision making and community-based decision making (Eg. Debates and action plans) 7. Active learning approaches regarding Sustainability issues 8. Learner-centered approaches 9. Engagement in community and social development activities 10. Participatory and collaborative learning activities
	<p>Alternate Knowledge Systems approach to sustainability (AK)</p> <ol style="list-style-type: none"> 2. Considers different knowledge systems as an important starting point for exploring issues of sustainable development
ESD Skills (S)	<p>Critical and Creative thinking (CC)</p> <ol style="list-style-type: none"> 4. Explores ways of solving local contextually relevant problems 5. Considers society, economy and environment while problem solving 6. Carries out critical analyses of current knowledge and situations and their implications for future decisions
	<p>Systemic thinking (ST)</p> <ol style="list-style-type: none"> 4. Engage in looking for links to solve complex problems 5. Understand that systems are complex that usually involve more than the sum of their parts

	6. Engaging in partnership building to address needs and solve problems
	<p>Future thinking (FT)</p> <p>5. Recognizing the need for change</p> <p>6. Searching for a way to attain a sustainable future</p> <p>7. Understanding the short and long term effects of current decisions.</p> <p>8. The importance for renewing knowledge about evolving sustainability theory and models</p>
ESD Knowledge Competencies (KC)	<p>6. Promotes an understanding of various sustainability issues both local and global E.g. Food security, economic and social justice, democracy, distribution and use of resources etc.</p> <p>7. Promotes an understanding of how society, economy and the ecological environment play a part in these sustainability issues</p> <p>8. Promotes the sustainable use of and care for natural resources</p> <p>9. Promotes the understanding that all disciplines can explore ESD through their subject knowledge</p> <p>10. Connects relevance of subject knowledge to society, environment and economy</p>
ESD Values (V)	<p>4. Promotes an environmental stewardship</p> <p>5. Promotes social tolerance and equity</p> <p>6. Promotes collaboration in decision making and problem solving</p>

The double lens document analysis was carried out for all policies. General analytical notes were also made regarding noted patterns and/or statements within the policy that were relevant to the purpose of the study and provided added insight into the major thrusts of the policy itself.

4. Do Teacher Education related policies acknowledge ESD?

An analysis of teacher education and development policies and finally National school related policies is undertaken in much detail. Each policy is summarized with respect to its major focus and aim for education. Added to this insight is a more detailed analysis of the degree to which the major goals and values of each one of these policies motivates for an ESD address.

4.1. An analysis of Education White Paper 3

Education White Paper 3 (EWP3) demands the support of all stakeholders in Higher Education. The document looks mainly at the transformation of the higher education system in that it must be governed as a single national coordinated system to avoid the fragmentation that occurred in the past. It is important to understand that this historical document (Department of Education [DoE], 1997) set the scene for Higher Education transformation for the last 15 years and so although its' goals and values strongly reflect the change to a democratic state they have strongly determined where Higher Education is today. The discourse within the various chapters of the EWP3 is now explored.

The major challenge of the transformation process is summarized as being: "...to redress past inequalities and to transform the higher education system to serve a new social order, to meet pressing national needs, and to respond to new realities and opportunities" (DoE, 1997, p.3). Throughout the document 'national needs' are interpreted as being social and economic development needs. The major goals expressed throughout Chapter one of Education White Paper 3 serves to highlight the Challenges, Vision and Principles of the Higher Education transformation program. Chapter one of EWP3 includes: (1) the redress of past inequalities; (2) the achievement of societal transformation; (3) addressing the development needs of society; (4) the production of graduates that address the inefficiencies in the market place; (5) the development of a critical civil society that is able to compete in the global economy; (6) the ensuring of equitable access and retention of previously disadvantaged students; and (7) the attainment of quality, institutional autonomy, academic freedom, public accountability, and democratization.

Phrases such as: social, economic, cultural, intellectual life, strengthen country's enterprises, services, infrastructure, socially responsible, contributing to national development, national

growth, global competitiveness, continuous technological improvement, needs of industry and social reconstruction, all clearly show the goals and values of the HEI transformation program. Nowhere is it mentioned that the environment and the sustainable use of its resources is a focus in the social and economic development plight. The HEI transformation program is solely concerned with meeting the moral, political, social and economic demands of the new South Africa.

Chapter two of the EWP3 looks at 'Structure and Growth', chapter three 'Governance' and finally chapter four covers 'Funding' structures and procedures that support the documents main goals and vision. Throughout these remaining chapters of the EWP3, phrases such as: 'social equity', 'new social order', 'societal transformation', 'social redress', 'equity and justice', 'democratic society', occur no less than 60 times in the 50 page document and reflect the major goals and values of the document. Social equity and justice is a priority in the document along with economic development interests which is referred to no less than 37 times. It is not a surprise considering the fact that this document was compiled three years after the new democratic government was appointed and before 'sustainable development' became a buzz word in 2002.

Essences of ESD can be found in the language of the Education White Paper document. An example is when the document mentions supporting democracy through educational programs that promote critical and creative thinking and cultural tolerance, and contributing to the advance of knowledge in order to address diverse problems in South African contexts. Also when the document mentions ensuring a high-level research capacity, that promotes intellectual inquiry and technological and social development; develop student's social responsibility and awareness to social and economic development through community service programs; produce graduates with the qualities of lifelong learning, critical, analytical, problem-solving and communication skills as well as ability to deal with change and diversity, these are all part and parcel of ensuring sustainable development. The issue however is that sustainable development can never be achieved if the 'environmental development' component is missing. Thus, even though there is frequent focus and mention of social development and economic development initiatives, all of that is futile if we have failed to recognize that it must exist within an environment that has limited resources. Therefore when the White Paper mentions that Curricula must be reviewed for

its content, relevance, design and delivery, it is clear that the context for ‘relevance’ involves that of social and economic development and social equity and redress. Table 3 reveals a summarized version of the double-lens analytical process. Here the degree to which Education White Paper 3 motivates for ESD may be clearly observed.

Table 3. A double-lens analysis of EWP3

Education White Paper 3 – A double-lens analysis			
<u>Lens 1 Analysis</u>			
<i>Goals</i>		<i>Values</i>	
<ul style="list-style-type: none"> - Redress past inequalities - Meet national social and economic needs - Produce graduates to meet market needs -Develop critical civil society to compete globally -Ensure equitable access and retention of students -Meet the social, moral, political and economic demands of a new SA -Promote research capacity -Promote students responsibility to social and economic development through community development programs 		<ul style="list-style-type: none"> - Social development (equity and justice) - Economic development -Global competitiveness -Democracy -Social redress -Quality -Institutional autonomy -Public accountability -Academic freedom -Critical and creative thinking -Cultural tolerance -Addressing diverse South African problems 	
<u>Lens 2 Analysis</u>			
<i>Teaching and Learning Approaches (TL)</i>	<i>ESD Skills (S)</i>	<i>ESD Knowledge Competencies (KC)</i>	<i>ESD Values (V)</i>
-Indicates desire for students to participate in community based	-Indicates that students should be involved in locally	-Indicates the importance of understanding local	-Promotes social tolerance and equity (V2)

decision making and activities(AC1 & AC 3)	relevant problem solving (CC1) YET only indicates social and economic related problems -Indicates that lecturers involve industry collaboration (ST3)	and global issues YET only related to social and economic development (KC1)	-Promotes collaboration in decision making and problem solving (V3)
Policy Orientation (0/1/2/3)			2

Policy Orientation Key

Level	Description
0	No ESD orientation described in the policy
1	Some ESD elements are described but not in a manner that will ensure ESD address/ ESD is only expressed through content OR methodology
2	Many/Most of the ESD elements are described in the policy yet the strong model of sustainable development is neglected in that the three pillars of sustainability are not all present or not conceptually interlinked
3	ESD elements are all present in a manner that recognizes the strong model of sustainable development

The Table serves as an example of how the double-lens analytical process was applied to all policies.

- **An analysis of three teacher education related policies in South Africa**

The policies were read carefully using the double lens analysis tool, however any statement that also (1) indirectly suggested an element of ESD; (2) revealed an obligation to realize an ESD related principle; or (3) presented an opportunity for ESD orientation, was acknowledged. Any

silences and/or fragmented sustainable development perspectives have been highlighted and discussed. The table indicating the summarized analysis for the three teacher education related policies can be viewed in Appendix I.

4.2.1. The National Policy Framework for Teacher Education and Development in South Africa

An analysis revealed that some ESD elements are described but not in a manner that will ensure holistic ESD address. The National policy orients teacher professional development to focus on equipping teachers to address social inequities and to develop social tolerance. Although the policy often referred to a quality education, the policy never defined the term nor did it provide any useful elaboration. The policy reinforces self-directed and continuing professional development, even though it does not indicate which specific areas this development may focus upon. More detail of the analysis may be viewed in Appendix I.

4.2.2. The Higher Education Qualifications Framework for Teacher Education

The analysis of this policy revealed that many ESD elements are described in the policy yet the strong model of sustainable development is neglected in that the three pillars of sustainability are not conceptually interlinked. The policy outlines the minimum requirements for teacher education qualifications in terms of the minimum set of competencies and the knowledge mix (disciplinary, pedagogical, practical, fundamental, situational) that should be developed. It is emphasized that educators need to be able to deal with social diversity and equity, whilst being researchers and curriculum developers. The framework encourages the development of critical and creative thinking and the solving of contextually relevant problems, which are described as social issues. Teachers are encouraged to incorporate alternate knowledge systems and to manage social diversity in their teaching. Teachers are also encouraged to engage in learner relevant teaching and learning approaches as well as develop a critical understanding of community and environmental development issues. Teachers are not encouraged to engage in the complexity of the interrelationship of social, economic and environmental issues and they are not encouraged to actively engage in addressing environmental issues which connect to the social and economic pillars.

4.2.3. The Integrated Strategic Planning Framework for Teacher Education and Development in South Africa (2011-2025)

An analysis revealed that some ESD elements are described but not in a manner that will ensure ESD address. The policy focuses on the sustainable quality improvement of teaching and learning through continuing professional development opportunities. The need to improve teacher knowledge, competence and professionalism is emphasized. The policy promotes the idea of developing professional learning communities (PLC's), placing the responsibility of professional development on the shoulders of teachers. However as indicated in the analyses of the CAPS document, ESD is not effectively indicated. Therefore the likelihood for PLC's to effectively develop ESD, is slim. Finally the policy places a strong emphasis on 'Social tolerance and equity': via the Education for All initiative (which aims to improve Early Childhood Development with regards to literacy and numeracy especially for learners in rural areas).

4.2.4. A broad analysis of three teacher education related policies

Reflecting more generally on the Teacher education and development policies it is found that referrals to a 'quality education' and 'higher order thinking skills' are often left undefined. The *National Policy Framework for Teacher Education and Development in South Africa* tasks teachers with the responsibility of self-directed professional development, in identifying the areas in which they themselves need to develop. One has to ask: if ESD is not a national focus and thus not a convincing curriculum focus, in what way can we hope for teachers to identify this area as a shortfall in their practice, thus qualifying a need for further development?

The *Higher Education Qualifications Framework for Teacher Education* represents the first time environmental development and sustainability is mentioned in the policy analysis process. The framework advises that the 'knowledge mix' (disciplinary, pedagogical, practical, fundamental, situational) be used to design learning programmes. It is suggested here that ESD offers a functional way of applying the knowledge mix concept to any module and teacher education programme. What was noted to be missing from this policy in order to realize a conscious ESD focus was the integration of ESD knowledge, skills and values into this 'knowledge mix'.

The *Integrated Strategic Planning Framework for Teacher Education and Development in South Africa (2011-2025)* much like the National Policy Framework places the responsibility of

professional development largely on the practitioners' shoulders, by suggesting the forming of Professional Learning Communities (PLCs). It can be expected then that teacher professional development will be concerned with the understanding and implementation of the curriculum. It seems then that PLCs focusing on ESD implementation will only begin to establish themselves once the prioritizing of an ESD orientation in the curriculum itself takes place. Time and again, throughout the policy analysis process, reference to social tolerance and equity is foregrounded, however the complex interrelationship between society and the environment is never addressed. Education seems to be more about human development and less about sustainable development which is concerning.

4.3. An analysis of UMALUSI and CAPS

The following section looks at the National Qualification Framework (NQF) levels 1-4 that covers Grades R till 12. The UMALUSI qualifications framework which provides insight into the purpose of these NQF levels, are explored for evidences of direct and/or indirect support or guidance for an ESD. The CAPS documents which are based at the practical school level are also explored for more direct principles of ESD such as those indicated by the developed ESD framework.

4.3.1. UMALUSI

An analysis of UMALUSI policy revealed that not all aspects of ESD are engaged in a meaningful and interlinked manner. Social and economic development is the focus of this policy even though goals do indicate a focus on being critical and active citizens who are environmentally respectful. However the strong focus is on equipping learners with discipline-related knowledge and skills and preparing learners for general citizenship and the workforce. Education for All is another major focus of the policy. Education for All is a program that aims to improve literacy and numeracy especially amongst individuals who have been denied access to a 'quality education'. Although environment is referred to, it is not reiterated and emphasized throughout the policy discourse.

4.3.2. Curriculum Assessment Policy Statement

An analysis of the CAPS document showed an orientation towards providing educators with a set of guidelines about the subject, its main teaching and learning objectives, an explanation of how the curriculum is organized into its content and a list of the skills that should be developed. A deeper analysis of this guiding document revealed that: (1) learner centered approaches were advocated in the goals, however these approaches were seldom supported throughout the document; (2) active learning approaches and community involvement was not supported; (3) the covering of indigenous knowledge systems barely featured in the description of the content to be covered; (4) even though the document did acknowledge the idea that systems are complex and involve more than the sum of their parts, very little attention was paid to how society, economy and environment should be considered during problem solving; (5) futures thinking by reflecting on the long and short term effect of decisions was recognized. However the major emphasis was the development of knowledge competencies. The content coverage did promote the sustainable use of resources in various instances as well as the consideration of one or two of the pillars of SD when attempting to understand local and global sustainability issues. However an understanding of how all pillars tightly interlink when exploring SD issues was not promoted.

Very well presented in the doc was: the connecting of subject knowledge to society, economy and environment, to show its relevance (KC5) -All three values were presented: the promotion of environmental stewardship, promotion of social tolerance and equity and the promotion of collaboration in decision making and problem solving (V1-3), HOWEVER environmental stewardship was the most highlighted yet the least supported by activities. A lack of action competence development and activities showed the lip service nature of the mentioned value.

4.3.3. A broad analysis of UMALUSI and CAPS

The National School related policies namely *UMALUSI* and *CAPS* provided elaboration for all higher education and teacher education and development policies, providing the meat for what was referred to as ‘quality education’ and ‘higher order thinking skills’. The limitations of the content analysis of the national school curriculum policies is that only two national curriculum statements (Science and Technology for Grades 4-6 and Natural Science Grades 7-9) have been analyzed. When the UMALUSI quality framework refers to creating a holistic citizen, one that is

socially responsible, compassionate and environmentally respectful, it may be argued that this intended purpose and outcome for level 1 of the NQF can only be achieved through the holistic education system, and not within one specific discipline or subject within a particular grade. A counter argument proposed here, is that if the natural sciences and technology learning areas do not promote this focus in a convincing manner, to what degree can we expect other learning areas and subjects (less traditionally linked to issues of sustainable development) to develop attributes of an ESD?

UMALUSI referred to supplementary goals which showed relevance to some of the ESD principles. Although these goals did not allude to the important interaction with SD issues and the three pillars of Sustainability, the goals did indicate emphasis on being critical and active citizens who are environmentally respectful. The responsibility of addressing these goals is given to each teacher regardless of the discipline.

The CAPS analysis revealed that in most instances when ESD principles were indicated in the policy, these were done in a general sense and not with specific reference to sustainable development issues. A curriculum that achieves this will always narrowly yet crucially fall short of an adequate ESD. A particular finding revealed that authentic problem-solving was never mentioned in the content and assessment tables in Section 3. Rather contrived scientific and technological problems were more popular, thus removing the elements of active agency and critical thinking. Another observation made within the Science and Technology CAPS was the almost complete neglect of ESD address in both Grades 4 and 5, the fundamental years for the development of ESD Skills and Values.

5. Conclusion

Teaching and learning needs to become more learner-centered and involve participatory and activity-based approaches to learning about sustainable development issues (SADC, 2005) Policy guiding teaching and learning in South Africa has attempted to make education more meaningful and relevant yet in more valuable ways it falls short of accomplishing this. Findings reveal that concerns regarding the over-simplification of sustainable development issues and inability to grasp and engage the interrelationship of the three pillars of sustainability (Jickling, 2004) are persistent in all policy documents, especially the CAPS where content fails to “focus

on core concepts necessary to understand the issues, and social innovations that provide ways forward and ‘out of’ or ‘in response to’ the issues presented...” (ADEA, 2012, p.27-28)

Reflecting on the Teacher education and development policies, referrals to a ‘quality education’ and ‘higher order thinking skills’ are often left undefined, leaving much open to interpretation. Both the National Policy Framework for Teacher Education and Development in South Africa and the Integrated Strategic Planning Framework for Teacher Education and Development place professional development on the shoulders of practitioners. To restate the concern from earlier regarding self-directed professional development, one has to ask: if ESD is not a national focus and thus not a convincing curriculum focus, in what way can we even hope for teachers to identify this area as a shortfall in their practice, thus qualifying further teacher development?

Throughout the policy analysis process, reference to social tolerance and equity is fore-grounded. The complex interrelationship between society, environment and the economy and this relationships’ role in considering an Education for Sustainable Development is, however, not being highlighted or discussed. Education seems to be more about human development (focusing on the social and economic pillars) and less about holistic sustainable development. This is contradictory to what UNESCO (2010) describes as the crucial dimensions to understanding the reality and complexity of sustainable development;

...the international community needs to understand green economies as sustainable societies, creating a balance between environmental, societal, cultural and economic considerations in the pursuit of an enhanced quality of life. A key advantage of the concept of sustainable development is that, through its social, economic and environmental pillars as well as its cultural and ethical dimensions, global challenges are understood in all their complexity. (p.5)

Analyzing the major foci of each policy revealed that the policies in some instances weekly address the environmental pillar, yet strongly address the social and economic pillars. A casual look at the policy may create the illusion that all three pillars are being addressed. However, the drastic imbalance results in a more human development focus, and less of human-environmental development equilibrium. It is not enough to design and implement an ESD oriented program when the very policies that guide teaching and learning in South Africa are contrary to a holistic realization of South Africa’s current sustainable development issues. An ESD program becomes sustainable within an education system when it has complimentary supporting educational

structures. South Africa has learnt from Outcomes Based Education days that if aspects such as the training and retraining of teachers, design of new learning resources, opportunities for teacher dialogue, new forms of assessment, parent involvement, school buy-in etc., do not support the innovation, then it's implementation cannot be successful (Jansen & Christie, 1999) For a reorientation of a curriculum focus, comes the need for a reorientation of the education system, meaning its fundamental supporting policies.

Education White Paper 3 revealed a strong emphasis on social and economic development and equity, neglecting to realize that both social and economic development exists in an environment that has limited resources. The National Policy Framework for Teacher Education and Development in South Africa focused on teacher professional development that equips teachers to address social inequities, manage diversity and provide a quality education. Quality education remained undefined within the policy. The Higher Education Qualifications Framework for Teacher Education focused on developing critical and creative thinking to solve social problems; promotion of social equity and tolerance to deal with diversity and respect others; implementation of learner relevant teaching and learning approaches that considers learners knowledge systems. The policy also mentioned briefly about the development of a critical understanding of community and environmental issues. However when it came to defining the Knowledge mix that the teacher education program was expected to have there was no mention of the integration of any ESD related knowledge, skills and values. The Integrated Strategic Planning Framework for Teacher Education and Development in South Africa (2011-2025) solely emphasized social tolerance and equity and never the interrelationship between society, economy and the environment and the associated issues. The constant emphasis on social equity and economic development is not surprising considering South Africa's harsh Apartheid History and high rate of HIV/AIDS and poverty. Even more reason for an Education that spends time understanding and addressing the complexity of such issues. The lack of ecological discourse in policies is an indicator of its lack of priority and status in the implemented environment. The ecological pillar needs to support and be supported by the social and economic pillars within policy discourse.

When the UMALUSI quality framework refers to creating a holistic citizen, one that is socially responsible, compassionate and environmentally respectful, it may be argued that this intended

purpose and outcome for level 1 of the NQF can only be achieved through the holistic education system, and not within one specific discipline or subject within a particular grade. A counter argument proposed here, is that if the natural sciences and technology learning areas do not promote this focus in a convincing manner, to what degree can we expect other learning areas and subjects (less traditionally linked to issues of sustainable development) to develop attributes of an ESD? According to UNESCO (2010) ESD is an education that requires cross-disciplinary attention and implementation and if teachers insist ESD to be the focus of disciplines other than their own, then the ESD focus is lost before it had a chance.

The CAPS analysis revealed that in most instances when ESD principles were indicated in the policy text, these were done in a general sense and not with specific reference to sustainable development issues. A curriculum that makes no direct connection between discipline knowledge, skills and values and the address of sustainable development issues, more often than not will narrowly yet crucially fall short of an adequate ESD. A particular finding revealed that authentic problem-solving was never mentioned in a single case in the exploration of the content and assessment tables in Section 3 but rather contrived scientific and technological problems were more popular. Another alarming observation occurred within the Science and Technology CAPS which was the almost complete neglect of ESD address in both Grades 4 and 5, the fundamental early years for the development of ESD Skills and Values. It would seem that although significant attention is given within the content outline (Section 3), to SD issues address, a lack of policy support with regards to defining and emphasizing complimentary Teaching and Learning Approaches and ESD skills is provided. The NS CAPS document is more likely to support an education 'about' SD and not so much an education 'for' SD.

The neglect of active competence in the selection of teaching and learning approaches does not provide good opportunities for citizens to apply their learning to a variety of contexts; solve relevant problems and engage in collaborative decision making. A common phenomenon persists as Tilbury (2002) states that educators do not see ESD as a process of learning as they mostly reduce it to content that must be incorporated into relevant subject specializations. Therefore it can be said that curriculum policy that also fails to support ESD as a process of learning, makes the realization of an adequate ESD more challenging. In conjunction with this, the neglect of how each discipline needs to acknowledge the three pillars of sustainability is to deny the

development of citizens who are able to understand the complex implications of decisions and the need for change in a way that is both socially and environmentally responsible.

Much essence within policy documents may be lost in translation between the intended and enacted curriculum. It is realized that there does exist a gap between the rhetorical and implemented policy (Smit, 2005) and that just because certain principles of ESD are not present or convincingly evident in educational policy, does not mean that these principles are not in fact implemented. However for ESD principles not to be considered consciously and/or even considered indirectly in educational policy is to crush the seed before it has been planted. This would mean denying ESD any opportunity to manifest itself in a way that is sustainably supported by policy structures.

Where some may argue that indirect application of some of these ESD principles is sufficient in order to claim that ESD is being addressed, this paper has argued otherwise. Rather ESD is an all or nothing type of education, relying on the realization of each of its principles in order to realize a holistic education. That is to say that relying more heavily on some of its principles than others, such as displayed in the policies analyzed here, is just as crippling.

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Appendix 1

Table 4. An analysis of Three Teacher Education related policies in South Africa

4.2.1. The National Policy Framework for Teacher Education and Development in South Africa	
Policy Foci	Particular Alignment/misalignment to ESD
<ul style="list-style-type: none"> • Enhancing teacher professional competence and performance • Social equity issues • Teacher demand and supply issues • Procedure and requirements for teacher education program recognition • Conceptual and Pedagogical needs • Management and Quality assurance of the new continuing professional teacher development system • Supporting policy by providing teacher support structures • Teachers responsible for self-directed professional development 	<ul style="list-style-type: none"> • Teacher professional development should equip teachers to address social inequities and tolerance. • “Diversity management” • No elaboration or definition of what was ever meant by a ‘quality education’
Score: Some ESD elements are described but not in a manner that will ensure ESD address/ ESD is only expressed through content OR methodology	1
4.2.2. The Higher Education Qualifications Framework for Teacher Education	
Policy Foci	Particular Alignment/misalignment to ESD
<ul style="list-style-type: none"> • Outlines the minimum requirements for teacher education qualifications • Describes the knowledge mix (disciplinary, pedagogical, practical, fundamental, situational) needed in teacher qualifications • Defines of a minimum set of agreed-upon competencies for Initial teacher education programs 	<ul style="list-style-type: none"> • Develop critical and creative thinking that explores ways of solving locally contextually relevant problems (said in context of social problems) • Alternate knowledge systems incorporated into learning: “incorporating situational and contextual elements” • Promotes social tolerance and equity by

<ul style="list-style-type: none"> • Educators as curriculum designers, implementers and researchers. • Address poor content and conceptual knowledge found amongst teachers • Develop competencies that enable teachers to deal with diversity and transformation • Satisfy the 7 roles of an educator 	<p>enabling teachers “to deal with diversity and transformation”</p> <ul style="list-style-type: none"> • Learner relevant teaching and learning approaches • Developing a sense of respect and responsibility towards others. • Develop critical understanding of community and environmental development issues • Acknowledging that knowledge systems are complex and interlining 	
<p>Score: Many/Most of the ESD elements are described in the policy yet the strong model of sustainable development is neglected in that the three pillars of sustainability are not all present or not conceptually interlinked</p>		<p>2</p>
<p>4.2.3. The Integrated Strategic Planning Framework for Teacher Education and Development in South Africa (2011-2025)</p>		
<p>Policy Foci</p>	<p>Particular Alignment/misalignment to ESD</p>	
<ul style="list-style-type: none"> • Sustainable quality improvement of teaching and learning • Provision of Teacher education to people of all races • Improvement of teacher knowledge, competence and professionalism • Teacher demand, supply and utilization in South Africa • Policy alignment • Need for Early Childhood Development practitioner development • Need for Education Resource Centres 	<ul style="list-style-type: none"> • Professional Learning communities are proposed putting responsibility on the practitioner – yet the CAPS curriculum does not indicate ESD effectively (see Table 4) • Strong focus on ‘Social tolerance and equity’: via the Education for All initiative (which aims to improve Early Childhood Development with regards to literacy and numeracy especially for learners in rural areas). 	
<p>Score: Some ESD elements are described but not in a manner that will ensure ESD address/ ESD is only expressed through content OR methodology</p>		<p>1</p>

Table 5. An analysis of UMALUSI and CAPS school based policy

4.3.1. UMALUSI	
Policy Foci	Particular Alignment/misalignment to ESD
<ul style="list-style-type: none"> • Quality assurance for Grades R -12 • “..the development of a single yet diverse general and further education and training sector that serves the needs of the individual, South African society and the economy” (2012, p.9) • Equip learners with discipline-related knowledge and skills and prepare learners for general citizenship and the workforce • Teacher to develop supplementary goals such as confidence, passion, multi-skilled, environmentally responsible, independent etc. 	<ul style="list-style-type: none"> • Social and Economic development focus • Supplementary goals are relevant to some of the ESD principles discussed yet do not allude to the important interaction with SD issues and the three pillars of Sustainability • However, goals do indicate emphasis on being critical and active citizens who are environmentally respectful. • Education for All – improve literacy and numeracy. ‘Social tolerance and equity’
Score: Some ESD elements are described but not in a manner that will ensure ESD address/ ESD is only expressed through content and not methodology/ESD is only mentioned through methodology and not conceptually	1
4.3.2. Curriculum Assessment Policy Statements	
Policy Foci	Particular Alignment/misalignment to ESD
<ul style="list-style-type: none"> • Provides the general and specific aims of South African Curriculum, as a guideline for Educators. • Provides educators with: a definition of the subject; the main teaching and learning objectives for the subject; an explanation of how the subjects curriculum is organized into content and concepts; the time allocated for each area of the curriculum; the subjects specific aims; and a list of all the process skills that need to be developed 	<ul style="list-style-type: none"> • Learner centered approaches were mostly advocated (AC3). Other categories were very poorly supported in the body of the document even though mentioned in the goals of the first two chapters. • Active learning approaches and community involvement (problem solving and decision making) were not supported. • Indigenous knowledge systems barely featured in the covering of content. • Did not pay significant attention to how society, economy and environment should be considered

	<p>during problem solving</p> <ul style="list-style-type: none"> • Did consider analyzing current knowledge and situations and their implication for the future (CC3) • Addressed the idea that systems are complex and involve more than the sum of parts (ST2) • Placed much emphasis on observing the short and long term affects of current decisions (FT3) • Knowledge competencies were the most thoroughly covered. • Promoted an understanding of local and global sustainability issues, but not always using all three pillars and never looking at the interrelationship (KC1) • Promoted an understanding of how society, economy and environment play a part in SD issues. Did not reveal all three pillars and the interlinking though (KC2) • Promoted the sustainable use of resources (KC3) • Very well presented in the doc was: the connecting of subject knowledge to society, economy and environment, to show its relevance (KC5) -All three values were presented: the promotion of environmental stewardship, promotion of social tolerance and equity and the promotion of collaboration in decision making and problem solving (V1-3), HOWEVER environmental stewardship was the most highlighted yet the least supported by activities. A lack of action competence development and activities showed the lip service nature of the mentioned value.
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Score: Many/Most of the ESD elements are described in the policy yet the strong model of sustainable development is neglected in that the three pillars of sustainability are not all present or not conceptually interlinked	2
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9. Article 3

Teacher educators' competency development priorities: barriers and avenues to Higher Education for Sustainable Development

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This article aims to explore the knowledge, skill and value based competencies that teacher educators in a Science and Technology education department at a South African Teacher training institution prioritize and what factors inform this orientation in their courses. Grounded theory strongly guided the collection of data as well as the coding process that took place during the analysis of interviews with participants. Findings indicate that a curriculum innovation in teacher education institutions, such as ESD, will not be realized if it is not supported by national curriculum; institutional research agenda and professional interests and background. Findings also show that contextual factors, such as increasing professional responsibilities, misaligned student expectations and university culture can offer major barriers to teacher educators wishing to reorient curricula towards ESD. We feel that these factors also offer information about and implications for the future of ESD implementation in teacher education. This article further offers a list of the core and peripheral barriers that should be considered when attempting to reorient higher education towards sustainable development. The article concludes by further commenting on the realistic future for ESD in South African teacher education.

Keywords: Competences; teacher education; Education for Sustainable Development

Introduction

Education has been publicly assigned a significant role in ensuring the challenges of sustainable development are met (UN, 1992; UNESCO, 2005; SADC-REEP, 2013). When attempting to achieve sustainability in Higher education, two broad obstacles must be named (Sylvestre, Wright & Sherren, 2013). First is the contested and ambiguous nature of the term sustainable development/sustainability. Second is the complex nature of higher education institutions as organizations. These two obstacles face any institution hoping to orient towards sustainability education. However, what we have learned is that a lack of a holistic understanding of ESD is less of a barrier to its implementation than the agenda driving the institution and its' faculty members.

Current debate also focuses on the part that Universities should be playing in the process of conceptualizing sustainability (Sylvestre et al. 2013). However according to Sylvestre et al. one thing that has been left largely unexplored is how tensions regarding the role of universities with respect to sustainability are experienced at a faculty level. Although UNESCO's (2005) document on 'guidelines and recommendations for reorienting teacher education for sustainability' raises some of these tensions, it does not reveal how these tensions interconnect to affect one's practice at a single institution. One can begin to understand the tensions regarding higher education for sustainable development when exploring why teacher educators develop the knowledge, skills, values and behaviours they do in their courses. These influencing factors say something about the role that Universities currently play with regards to promoting sustainability and the role they are likely to play in the future. If we are able to identify the barriers that stand in the way of a successful orientation and are further able to identify the pervasiveness of these barriers, we may then be in a position to comment on the likely success of a Higher Education for SD. Although a long list of the factors deterring sustainability in higher education has been compiled (Velazquez, Munguia & Sanchez, 2005; UNESCO, 2005) these factors have not been classified according to their pervasiveness within the higher education institution. Furthermore, the interconnectedness of these factors has not been investigated in order to suggest how barriers to HESD may be addressed systematically. This paper attempts to take that one step further.

A structural overview

In foregrounding the study, the purpose of the study is briefly highlighted as well as the data collection process and finally the participant selection process is described. Second, we provide a brief summary of education in South Africa, highlighting the major transformations and challenges from 1994 to date. Following this, we describe the methodological considerations. We engaged interviews as our method of data collection. Grounded theory (Glaser, 1978; 2004) assisted the coding process that took place during the analysis of these interviews. Finally, the findings are presented within three thrusts, each relating to the study's three focus questions.

Competency Development

The term 'competency' or 'competencies' is referred to throughout the article and pertains to a set of observable knowledge/skills/values/behaviors (Bowden, 2000) that need to be developed to varying degrees, in order for the student to be declared prepared for teaching. The term competency is referred to often in education when talking about the development of varying knowledge/skill/value/behavioral based outcomes (Jansen, 2006). According to the Washington State Human Resource website (<http://www.hr.wa.gov>, 2012) competencies "are measurable or observable knowledge, skills, abilities, and behaviors (KSABs) critical to success in a job." According to this same source, knowledge competencies refer to the practical and theoretical understanding of the subject; skills and abilities refer to the learned or natural ability to perform acts; and finally behaviour refers to a pattern of desired conduct and/or actions.

Education's long standing familiarity with Bloom's (1956) learning objectives and their related observable indicators or outcomes has resulted in the related term 'competency' being used often and well understood in Teacher Education arena's. Due to this familiarity with the term and its meaning this term was also preferred when probing participants to share their existing professional practice and concerns.

The study would be based on a very unstable foundation if it was assumed that teacher educators knew about and/or shared the researchers understanding of the term 'Education for Sustainable Development' Therefore we decided that it would be more valuable to look at the 'competencies' that teacher educators advocated and developed in their existing practice and later measure this against the principles that ESD advocates in order to identify the degree of ESD focus at the institution. The value of a holistic understanding of ESD is unquestionable, however in order to achieve a bottom-up approach it was deemed a priority not to alienate these willing participants.

Although teacher educators were asked about their understanding of ESD and ways in which they thought they addressed ESD, it was soon clear that the term ESD should not be forced too hard as it appeared to alienate participants initially. We noticed that a more open conversation was encouraged when exploring teacher educators practice and what motivated their practice instead of interrogating how their practice did or did not consider ESD. It was important to reflect that the purpose of the research was not to get teacher educators to understand the term ESD (albeit important) but rather to understand whether any of its elements featured in their practice and their interests and what motivated this. In order to remove the researchers' top-down presence one would need to work from the participant perspective. This made it possible to explore teacher educators' professional interests and what competency priorities they promoted in their practice as well as the factors that motivated these choices. This insight provides useful information for ESD agents looking for ways to gain volunteerism and acceptance (UNESCO, 2005, p.41).

ESD as a quality education

Reports from the South African Development Community and the United Nations display the need for all existing education systems to be reoriented towards an education for sustainable development (UN, 2012; SADC-REEP, 2013) In 2005 the Secretariat of the Southern African Development Community ¹(SADC) requested support from the SADC Regional Environmental Education Programme in the writing up of guidelines for the participation in the United Nations Decade of Education for Sustainable Development. Consultation meetings took place in thirteen different SADC countries producing consultation reports that were informed by the participation of many stakeholders (SADC-REEP, 2013).

The reports emphasized that, existing education initiatives that address environmental issues and sustainable development challenges, should be strengthened and promoted (SADC-REEP, 2013). Related to curriculum and pedagogy, the reports identified that knowledge of sustainable development and sustainable development issues needs to be promoted amongst educators. It is suggested that Curriculum reform will need to take place across disciplines, to include sustainable development issues and challenges, considering the political, economic, societal and environmental aspects. Also, "Orientations to teaching and learning will need to shift significantly to allow for more participatory, learner-centered, practice-based approaches." (SADC-REEP, 2013, online source)

¹ SADC: Consists of 15 Southern African countries and is dedicated towards achieving development, peace, security, economic growth, poverty alleviation, and to providing the disadvantaged with a quality of life. The SADC is founded on principles of sustainable development and democracy.

The reports also emphasized that educational leadership needed to be strengthened in order to address socio-ecological challenges and issues through education. "This indicates that attention needs to be paid to including ESD approaches in universities and colleges and particularly in Educational Leadership training programs." (SADC-REEP, 2013, online source)

In June 2012, the Rio+20 United Nations Conference on Sustainable Development took place in Brazil. In the report, education's responsibility towards sustainable development was highlighted as Ministers agreed to promote Education for Sustainable Development (ESD) through the active participation of educators, students and local partners (UN, 2012).

There is no question that Education is as pertinent to the attainment of sustainable development as it was when it was first given the responsibility in Agenda 21 (UN, 1992). Having approached the 2014 deadline for the implementation of Education for Sustainable Development according to the United Nations Decade of Education for Sustainable Development (UN, 2002), it is most relevant to explore how education institutions are contributing towards this focus. This article attempts to carry out such an exploration by identifying the main competencies that Science and Technology teacher educators at one teacher education institution emphasize and develop in their courses and why. Teacher educators' discourse on competency development in their courses is analyzed to inform conclusions made about the possible future of ESD in teacher education in South Africa.

Foregrounding the Study

The institution selected for the remainder of this study, was selected due to its' relatively good response rate to a pilot survey as well as its accessible location. The good response rate indicated likelihood for sustained participation for the rest of the study. We undertook 13 interviews with eight teacher educators and one Acting Dean from one teacher education institution in South Africa. Due to the in-depth nature of the interviews only one department was selected, that being 'Science and Technology Education'. The selection of this department was affirmed after considering UNESCO's (2002) emphasis on the contribution that Science and Technology need to make towards a realization of Sustainable Development. The one-on-one interviews searched to identify what competencies teacher educators wish to develop in their courses and what influenced their focus on these competencies. We considered this important because when comparing the competences emphasized against the ESD Framework (see Table 2) we claim that it offers insight into the current state of ESD. Furthermore, the competencies emphasized today and what motivates this may hold implications for future implementation of ESD in teacher education institution.

Education in South Africa

The history of education related policy in South Africa highlights many waves of change and transformation that teacher educators have had to endure and adjust to. Understanding the historical context for Education in South Africa is helpful in understanding the competency choices made by teacher educators and the projected priorities of a particular teacher education institution in South Africa. South Africa has only been a democratic state for just under 20 years and during that

time teachers and teacher educators have had to adjust to the implementation of multiple education and higher education policies. In 1994 when South Africa held its first democratic elections it marked the turning point for South African education, from a highly prejudiced and divided education system towards an inclusive education system that embraced multiple cultures and multiple perspectives on education. Due to the political changes in 1994, the Department of Education have since then “..issued several curriculum-related reforms intended to democratize education and eliminate inequalities in the post-apartheid education system.” (Jansen, 2006, p.321)

At first post-apartheid curricula underwent a cleansing of all prejudice embedded in its’ content and approaches. A few years later, curricula still focused heavily on content and needed to be reoriented to share its focus on skill and value development, promoting the holistic development of the learner. A third phase of change was motivated by the realization that teachers who had gone through a previously inhibiting and discriminatory tertiary education were not equipped to deliver such a learner-centred curriculum and so the curriculum was altered to assist in bridging this gap. Ten years later yet another phase of curriculum change has taken place recently with the new Curriculum and Assessment Policy Statement which aims to reverse the watered down curriculum that resulted in direct retaliation to the content-focused pre-apartheid curriculum. Table 1 is adapted from Bentham, Sinnes and Gjøtterud (2014) and accentuates the rate of education and higher education policy development:

Table 1. Education and Higher Education policy transformation

Basic Education Policy		Higher Education Policy	
1994-1997	South African Constitution (1996), National Education Policy Act (1996), South African Schools Act	1997	Education White Paper 6 – A program for Higher Education Transformation
1998-2001	Curriculum 2005 and associated Learning area and subject statements	2007	National Policy Framework for Teacher Education and Development in South Africa
2002	Revised National Curriculum Statements	2011	Higher Education Qualifications Framework for Teacher Education
2011-2012	Curriculum Assessment Policy Statements and associated program guidelines	2011	Integrated Strategic Planning Framework for Teacher Education and Development in South Africa, 2011-2025

Kruss (2008) and Reddy (2009) both draw attention to the fact that when Educational transformation was taking place from 1994, it was not only school curricula that was changing but also teacher education was overhauled when changes took place in the Higher Education sector.

The focus shifted from highly fragmented teacher education colleges as producers of teachers to nationalized university associated education faculties that offered professional teacher education. Faculties of Education became less about teacher supply and more about professional development and research-based practice. “..teacher educators, in addition to keeping up to date with developments in their discipline, also have to keep abreast of a range of new curricular and policy imperatives in the country.” (Robinson & McMillan, 2006, p.327) According to Reddy (2009)

educational policy changes have been directly influenced by National socio-economic conditions and goals.

Understanding the context in which teacher education functions and thus the challenges and changes facing teacher educators, may offer insight into why professionals prioritize the development of certain competencies in teacher education, however this is not assumed a given.

Teacher Educator Identity

Hargreaves (2000) reflects on how difficult it becomes to define professionalism and the autonomy that goes with it, when the policy context is constantly changing and with it roles and responsibilities. At first glance it would appear that educator roles are constantly changing and therefore this learned 'flexibility' should be complementary towards embedding a transformative ESD in a teacher education programme. The reality that has been personally observed is that a volatile policy environment in South Africa at least, has left teacher educators overloaded with additional responsibilities which they are still working to master. The constant top down reformulation of roles has translated into the questioning of individual professionalism and autonomy. This has filtered down to teacher educators beliefs that they are unable to fight for curriculum space and to influence curriculum much at all. It is difficult to be creative and exploratory in one's field when one is still trying to gain balance from the frequently shaken grounds.

According to Moletsane (2003) research supports the conclusion that prevailing education policies and teacher professional development programmes are unable to meaningfully change teaching and learning in South Africa. Moletsane (2003) suggests that this may be due to the decontextualized nature of such policies and programmes, which has resulted as a consequence of "the lack of focus on the various factors that shape teacher identity, as well as the lack of grounding of emerging policies and practice in the contemporary and historical contexts in which teachers have had to function." (p.323)

Having said this, 'context' is not simply the organizational structures, policies and/or procedures, it also includes the actors. This research approach acknowledges that when talking about change and innovation the teacher educators' interpretation of their organizational environment and their identity play a large role, as it does in their everyday professional practice and competence development.

Methodology

This article addresses three focus questions:

1. What competencies do teacher educators prioritize in their courses?
2. Why do teacher educators prioritize these competences in their courses?
3. What barriers exist for a successful embedding of ESD in Higher Education?

These questions also guide the presentation of the findings section.

Participants and Context

The study involved one Acting Dean of Education and eight teacher educators at a Science and Technology Education Department in one Teacher Education Institution in South Africa. All teacher educators were given the option of joining the study and in total two Science teacher educators and six Technology teacher educators volunteered to take part. The names given to these teacher educators are: Amy, Barbara, Berta, David, Dora, Michael (Technology); Lindy and Rebecca (Science).

The teacher educators range in age, race, gender, experience and professional qualification. The Teacher Education Institution exists as part of a University, 'Education' being just one 'school' within this University. Students attending the University range diversely in terms of age, race, nationality, language, Grade 12 scores and quality of previous education.

As stated before education in South Africa has undergone a number of policy revisions since 1994 and as a result teachers and student teachers face the challenge of understanding and applying the principles of constantly revised learning outcomes and competencies (Reddy, 2009). Teacher Educators as a result engage in much revision of their course outlines to suit the changing requirements of the National Curriculum.

In-depth Interviews

The in depth qualitative interviewing method was used to access detailed perspectives, ideas and opinions of teacher educators who reflected on their 'competency development' (Kvale, 1996; Kvale & Brinkman, 2009; Rubin & Rubin, 2012). The interviewer (the first author) aimed to paint a full picture of the complex situation by piecing together stories from the different interviewees and interviews.

Although a list of structured questions was formulated, their order was not predetermined and the emergence of new follow-up questions occurred across interviews and interviewees. This un/semi-structured interview method served quite useful for the clarification of ideas and examples shared by teacher educators (Lincoln & Guba, 1985). The general sequencing and framing of the interview questions was carefully considered in the interviews (Cohen, Manion & Morrison, 2007). For example conceptual questions that asked about interviewees definitions of certain terms, such as ESD, were not only asked at the end of the interview but were also framed in a way that assured there was no correct definition, that there was only one's perception of what the term meant to them. Many visits to the department and informal e-mail chats and cellular text messages assisted in establishing a rapport with teacher educators making them more likely to share their thoughts and opinions (Kitwood, 1977).

The first set of data was generated via an interview with the Acting Dean, who had been at the institution for years and therefore knew the departments best, was interviewed. The following key questions guided the interview process:

9. What areas in Education do you think need attention/priority?
10. What policy guides teacher educators in the design and delivery of their courses?
11. What type of teacher does the School of Education aim to develop?
12. What factors do you think play a significant role in how teacher educators design and implement their courses?

The next phase of data generation, involved an initial one-on-one interview with all teacher educators, except two (Amy and Dora) who requested they take the interview together. This first interview was to establish more about their personal professional identities i.e. roles, interests, concerns, priorities and challenges and finally at the end of the interview their initial understanding of ESD. The teacher educators were asked the following key questions:

8. What competencies do you emphasize in your module or teaching?
9. Why do you emphasize these competencies in your teaching?
10. What are your main priorities or goals as a teacher educator and Academic?
11. What factors guide your practice?
12. In what way do you understand the term Education for Sustainable Development?

The third phase of data generation involved a second interview with each participant, which was more focused due to the initial coding process of the first interviews, was however open-ended. The purpose of the second interview was to identify the competencies that teacher educators aimed to develop and what factors influenced this focus, as well as how teacher educators' understood the term ESD:

6. Could you tell me a bit about each of your modules and the competencies that you promote through each of these modules/courses?
7. How do you address these competencies in your modules? (Could you please refer specifically to your course outline and assessment activities in answering)
8. Why do you address the competencies mentioned?
9. What is your understanding of Education for Sustainable Development?

The coding process is briefly explained to show how hypotheses regarding the possible future for ESD implementation in Teacher Education were generated.

The coding process

Grounded theory is a term that refers to the identifying of substantive and theoretical codes that emerge from a particular set of data and the generation of theory from these codes through a study of their interrelationships (Borgatti, 2012). In generating substantive and theoretical codes, the 'constant comparative method' described by Glaser (2004) was used. This comparative method involved three types of comparison: (1) Incidents² in the data were compared to other incidents, developing concepts i.e.: substantive codes; (2) these concepts were then compared to more incidents in order to determine whether more concepts needed to be identified or whether more elaboration needed to be added to the already identified concept; (3) and finally concepts needed to be compared to other concepts to generate hypotheses about their relations to one another i.e.: theoretical codes. The coding involved a degree of 'theoretical sensitivity' as it was informed by conceptual and theoretical knowledge.

² *Incident*: refers to any event or happening in the data and is identified as a single unit that can be compared against other units.

Applying Theoretical Sensitivity

In reaction to claims that Grounded Theory allows for an untainted analysis of data, whereby codes emerge from the data, Kelle (2005, p.3) pointed out that “it is impossible to free empirical observation from all theoretical influence since already (...) seeing is a ‘theory-laden’ undertaking.” Glaser and Strauss (1967) were party to this realization and acknowledged the need for theoretical sensitivity or a lens that would assist analysts in identifying what in the data could be considered relevant.

The ESD conceptual framework in Table 2 is employed here as the conceptual and theoretical knowledge that served to support the coding process. It was developed after an extensive exploration of what literature identified to be crucial competencies for ESD (Bentham, 2013). The framework highlights the principles that informed the researcher as to when participants were orienting their conversation and practice towards an Education for Sustainable Development, and was applied when engaging in the theoretical coding process. The framework was therefore used to identify which of the teacher educators’ competency foci aligned with the recognized ESD competencies.

Table 2. Education for Sustainable Development framework (From Bentham 2013).

Categories	Concepts & Codes
ESD Teaching and Learning Approaches (TL)	Development of Action Competence (AC) <ul style="list-style-type: none"> 11. Participation in decision making and community-based decision making (E.g. Debates and action plans) 12. Active learning approaches regarding Sustainability issues 13. Learner-centered approaches 14. Engagement in community and social development activities 15. Participatory and collaborative learning activities
	Alternate Knowledge Systems approach to sustainability (AK) <ul style="list-style-type: none"> 3. Considers different knowledge systems as an important starting point for exploring issues of sustainable development
ESD Skills (S)	Critical and Creative thinking (CC) <ul style="list-style-type: none"> 7. Explores ways of solving local contextually relevant problems 8. Considers society, economy and environment while problem solving 9. Carries out critical analyses of current knowledge and

	situations and their implications for future decisions.
	<p>Systemic thinking (ST)</p> <ol style="list-style-type: none"> 7. Engage in looking for links to solve complex problems 8. Understand that systems are complex that usually involve more than the sum of their parts 9. Engaging in partnership building to address needs and solve problems
	<p>Future thinking (FT)</p> <ol style="list-style-type: none"> 9. Recognizing the need for change 10. Searching for a way to attain a sustainable future 11. Understanding the short and long term effects of current decisions. 12. The importance for renewing knowledge about evolving sustainability theory and models
ESD Knowledge Competencies (KC)	<ol style="list-style-type: none"> 11. Promotes an understanding of various sustainability issues both local and global: Food security, economic and social justice, democracy, distribution, use of resources etc. 12. Promotes an understanding of how society, economy and the ecological environment play a part in these sustainability issues. 13. Promotes the sustainable use of and care for natural resources 14. Promotes the understanding that all disciplines can explore ESD through their subject knowledge 15. Connects relevance of subject knowledge to society, environment and economy.
ESD Values (V)	<ol style="list-style-type: none"> 7. Promotes an environmental stewardship 8. Promotes social tolerance and equity 9. Promotes collaboration in decision making and problem solving

Participants were specifically not asked how they practiced ESD due to (1) the lack of familiarity with the concept and (2) not wanting participants to feel the need to perform. Rather, we used the ESD

framework to identify whether their responses indicated any ESD principles. In this way, the framework assisted in alerting us as to certain data to be deemed relevant for analysis. However, there were many more instances when teacher educators made mention of competences that were not aligned with ESD but rather (as we later realized) with the five major competency areas of teacher education at this particular Institution. This concept of ‘five competency areas of teacher education’ was gleaned from the initial interview with the Acting Dean and helped us to make sense of teacher educators’ said competency priorities. Therefore in the first section of the findings where teacher educators’ competency priorities are categorized, they are done so according to the five driving objectives of teacher education and the additional sixth ESD category.

Findings

The data generated from in-depth interviews with the Acting Dean and the teacher educators has been combined under thematic sub-headings to identify and expand upon the main findings which inform the main hypotheses teased out here. These hypotheses explore the relationships between the coding incidents. The thematic subheadings follow (in italics) under the relative research questions that this article aims to address.

The competencies that teacher educators prioritize in their courses

- (i) Competency development prioritizes the development of discipline related conceptual and pedagogical knowledge and skills

According to the Acting Dean the Teacher Education Programme (TEP) develops five competency areas: (1) students’ knowledge about education; (2) students’ knowledge about the content of their teaching subject; (3) students’ knowledge about how to teach the subject in schools; (4) about the general practice of a teacher; and (5) about oneself as a professional. These five competency areas can be found to relate to the competences highlighted by the teacher educators, with an addition of a sixth competency area, ESD. The teacher educators competences listed below are arranged according to their relevance to the six competency areas:

Teacher educators collectively made reference to the following competency development foci:

(1) Students knowledge about education

- Show a link between policy, teaching and learning
- Interpret and implement the Curriculum and Assessment Policy Statements

(2) Students knowledge about the subject content

- Knowledge of Scientific and Technological concepts (E.g. Structures, systems and controls, processing, communication, nutrition, chemical equilibrium etc.)
- Application of Scientific and Technological knowledge and skills to address societal needs

(3) Students knowledge of how to teach their subject

- Scientific process skills (Observe, hypothesize, design and conduct investigations etc.)
- Technological Design Process skills (Design, Make and Evaluate)

- Master the use of tools and equipment needed for Technological and Scientific activities
- (4) General practice of a teacher

- Develop students ability to communicate ideas and explain concepts
- Engage in critical debate

(5) Teacher as a professional

- Be resourceful in one's teaching: use what you have available to teach the curriculum
- Be a reflective practitioner
- Be up to date with current developments in Science/Technology Education
- Motivate for good work ethic

(6) ESD (albeit linked to the national curriculum statement objectives and (3) above)

- Understand and explore the link between Technology/Science, society and the ecological environment
- Critical thinking and problem solving
- Encourage learner centered teaching and learning
- Innovative and creative thinking
- Understand that alternate knowledge systems are valuable and complementary

All competences listed, related to the subject being taught (E.g. Science and Technology) and all skills being developed were also specific to the subject. This means that if teacher educators don't see a competency as directly related to the subject more than likely it won't be developed even if in itself it is a worthy competency. The competencies we have listed under the sixth category 'ESD' are competencies that teacher educators find to be characteristically developed through engagement with the discipline. So, although we have created a sixth category, it is likely that teacher educators would have grouped these competencies under the third competence category titled 'Students knowledge of how to teach the subject'. However we recognize them to promote an orientation towards ESD.

Factors shaping teacher educators' competency foci

At this point it would seem logical to draw a direct causal link between the Teacher Education Programme competency foci and teacher educator competency priorities. However it is necessary to state at this point that teacher educators were not aware of these five competency foci. Also, when asked why they prioritized the competencies they did, other motivations came forth.

- (ii) Leadership and Institutional support can motivate a change in competency foci in the face of professional pressures

The Acting Dean expressed that staff is being exploited by the system as their roles and expectations have changed. Staff who have been lecturing for years without a PhD, now experience, the push to "...get their PhDs, to continue publishing.." and teacher educators also face challenges as they try to

“finalize the re-conceptualization of the new B.Ed [Bachelor of Education] program”, which requires redesigning of many areas within existing tertiary curricula. Teacher educators confirmed the added pressure that the change in institutional structure placed on achieving expected roles and responsibilities. Such a time consuming process of relearning roles and assuming added responsibilities proved to be cognitively and emotionally draining. Such pressures seemed to impact Teacher Educator’s attitude towards ‘new’ ideas such as ESD, yielding a weak level of ownership/responsibility towards new innovations that were seemingly unrelated to institutional objectives.

However, Berta (The head of the Technology department) revealed that she was interested in curriculum development with regards to two thrusts: (1) Indigenous knowledge as a valuable knowledge system, promoting it through the course materials; and (2) Engaging students in learning their subject through interaction in industry. It would seem that these two foci were motivated and supported by available funding, alignment with discipline identity and supported by professional interests.

The directional change was motivated by academics personal interests and therefore their eventual ‘buy-in’, as well as supported by university culture, and with it funding. Academic ‘buy-in’, although largely influenced by the number of responsibilities teacher educators have at the time of innovation, was also motivated by the leadership offered by Berta (seen as a leader). The new curriculum areas show a potential towards the orientation of some ESD competences highlighted, however this depends on the conscious intention of the designers. Simply, Teacher educators felt supported by institutional culture and management, raising their autonomy and thus emotional response to the innovation.

(iii) Institutional drivers and teacher education policy influence competency development

The Acting Dean refers to institutional drivers of module design being: ‘Research’; ‘Responsiveness to the Country’s Needs’; and ‘Qualification Standards’ in terms of the Teacher Education Program. He refers to the mission statement as an important reference for a teacher educator. The mission statement refers to being a research-led institution that provides academic support to individuals from disadvantaged backgrounds, the foundational knowledge that must be developed and the attitude for justice. The Acting Dean adds that it is “...research agendas that have been unfolding and informing what we do.” He shares an example of a current research agenda that has arisen: ‘scarce skills’. This research agenda suggests that skill development needs to be a focus in curricula, and has arisen as a response to the needs of the country. Research agenda as a driving factor for course design is confirmed by the teacher educators.

Rebecca identified a rising research agenda that informed the design of one of her modules as well as her competence development. “You will see the whole African Knowledge Systems coming into focus now, especially in this institution.” When asked what competencies she highlighted in her teaching she said that her one course explored “understanding of alternate knowledge systems (AKS). To show that indigenous wisdom does exist, to acknowledge and promote it as valuable in sustainable development.” Students were required to design lessons that incorporated Indigenous Knowledge in the Science classroom.

The Acting Dean identified two main policies that serve to inform professional roles and practice. Firstly, Teacher Educator roles are outlined within the National Policy Framework for Teacher Education and Development in South Africa (2007). These are the same roles that teacher educators need to prepare teachers for. Second, teacher educators need to refer to the National Qualification Framework for performance indicators regarding the level and expected outcomes for the Bachelor of Education Program. Teacher educators often made reference to how the National Qualification standards limited their autonomy to design new courses. This may indicate that although policy is considered in course design and planning, it may also serve as a deterrent for curriculum innovation. If that is the case, then it would seem logical that ESD feature as a priority in teacher education policy, to be used as a tool for responding to the country's needs, i.e. an institutional driver. The Acting Dean on the other hand described teacher educators as autonomous, having power to "argue for position in the curriculum". However, this would need to be powerfully substantiated and supported and would need to contribute towards the exit level outcomes of the qualification. He added: "... what goes into the design of the curriculum itself is now left up to the lecturer." According to the Acting Dean this is influenced by "their attitude about bringing new things in."

To conclude, the University mission states that the country's needs lie in the areas of scarce skills and social equity promotion. This is in line with ESD competences. However, the crucial environmental aspect also needs to be addressed whilst claiming to address the country's needs through institutional objectives and research agenda. Once again, a more conscious orientation to ESD and its principles through institutional research agenda is necessary.

(iv) Personal professional research interests influence competency development

Research agenda thus far have been said to be defined by the institution, influencing what teacher educators focus on in their courses and curriculum design. However, research at the institution is also defined by professionals and their interests (professional identity), which was also found to influence their course designs.

Often when teacher educators described the competencies they deemed important in their courses, these competencies related to their personal 'research topics' and areas of research interest. This indicated a fair degree of professional autonomy when it came down to course curriculum design. This challenges the prior claim that teacher educators are demotivated to redesign curriculum due to national qualification standards. However, a distinction between what is formally included in the course outline and what teacher educators cover in class time is not made here. The following analysis explores the different teacher educators' research interests and how these influenced what they deemed important for curriculum attention.

Michael, Dora, Amy and Berta exhibit similar research interests. It became very obvious that these very interests were mirrored in the competencies they prioritized in their courses. For example Michael shares that his research interests include 'Social development through Technology Education' as well as 'Motivating children to be creative in the classroom'. This coincides with his view of the most pertinent competencies that need to be developed: "to be innovative, to be creative and try out new things, [...] so anything I do in the classroom they must be able to link it to society." This implies that although Institutional research agendas influence competency development in curricula, so too does personal research interests. However, an important point was

raised by Lindy, that if personal professional research interests were not aligned to institutional research agenda, it was often difficult to secure support.

(v) Personal professional interests/concerns and collaboration guide competency development

Across the teacher educators, personal professional interests included social development; creative and critical thinking; relevant education; education as a response to the country's economic and social needs; and skills development, in terms of design and communication skills. Teacher educators seemed to value and prioritize competencies related to these concerns and interests in their teaching. Professional Collaboration also proved an influential factor in curriculum design among academics. For example, David covered a section on the recycling of plastics after Dora and Amy provided him with material that covered the topic. Consequently they relayed their interests to David.

Thus, personal professional interests and shared interests carry a powerful ability to influence what competencies teacher educators prioritize in their courses. Rebecca is concerned about the social ills and challenges that face South Africans, issues such as poverty, hunger and disease. She has designed an assessment task whereby students have to make a food garden. Students do research on the crop to find out about their ability to address the nutritional need. "I enable my students to actually think deeply about the reasons behind these social ills and ways in which they can actually address them and we do so in a very tangible way, for example I engage them in a gardening task". Rebecca engages in food gardening related to mal-nutrition mostly because "my interest is in human physiology so perhaps that creates a bias towards diseases which are experienced in humans in particular..." This indicates that teacher educators do yield a significant amount of autonomy that is in part affected by teacher educators' personal interest and thus motivation. This professional autonomy however needs to be supported either by 'discipline identity' or institutional objectives to permeate the teacher education programme.

"The academic freedom of IHEs [Institutes of Higher Education] allows critical discourse of current knowledge and practices." (UNESCO, 2005, p.29) The reality on the ground, is that 'freedom' or autonomy is not only limited by program/course certification but also by teacher educators' perceived limited autonomy. Simply, although teacher educators feel they have the freedom to design their lectures and assessments as they please, in some instances they are limited by course objectives that they have inherited from past academics. They also feel pressed for time as often contact sessions are interrupted by student strikes in the first portion of every semester. Besides such barriers, teacher educators practice is driven by their professional interests, which have been found to be motivated by institutional research agenda and support. So although it is the responsibility of teacher educators to engage in this critical debate of ESD, it appears they have been given very little space and cause to do so.

(vi) Competence Development is influenced by National curriculum

It is significant to mention that part of the Technology education curriculum refers to 'ESD Knowledge competencies', such as the impacts of Technology on society and the environment. It is on these occasions where David considers the complex interrelationship of the pillars of sustainable development. For according to David, technology education "...talks about the impacts of technology on man, the impacts of technology on the environment, as good as it may be, it also has adverse

effects..." It is the curriculum that drives his attention to the consideration of the pillars. When ESD exists within the curriculum, teacher educators develop a strong connection to some ESD principles.

Dora comments on her method module, the main focus being, understanding the Technological Design Process and how to teach it. "...so their first assignment was to actually develop a lesson to teach that definition, [...] Technology solves problems. Technology is about caring for the environment. Technology is about caring for society so they had to cover all of those aspects in their assignment." Michael adds to the understanding of how curriculum influences competency development: "The design process is key to the whole of this, to all of the modules. [...] whatever we put into our courses must affect what they will go and teach." All Technology teacher educators emphasized how the definition of Technology and its' associated Technological Design Process, guides all Technology Education modules. For these teacher educators, skills such as critical thinking, problem solving and creativity are not just competencies that are characteristic of an effective teacher, but also characteristic of Technology Education. As Barbara states: "Critical thinking to me is very important, especially in Technology, and creativity and problem solving, [...] they must try to be problem solvers coming up with the solutions they experience in their environment and in their society."

Finally Lindy, a Science teacher educator explains how pressure to cover the content can be a determining factor for the way the course transpires, "when I saw them last year in Physical Science I could not finish what I was supposed to do." As a result her assessments mostly consisted of tutorials, based on text book content and did not engage the relevant application of the content to society. There exists a push to cover the content in time in order to prepare students for the curriculum they need to teach. Teacher educators pose that this presents a very big challenge, limiting their time availability and consequently their ability to reorient and redesign course material towards worthy curriculum innovations such as ESD. However, ESD competencies that feature in the National Curriculum are addressed in course curricula.

(vii) Competency Development is influenced by Time, Numbers and Student expectations

Teacher educators often referred to the number of students in their courses and how this left them with less time to do important things like research and revamping course materials. Rebecca describes some of the challenges she faces: "high work load, large classes, I am really struggling to meet the demands of the work on the due dates," she adds that class size also influences the activities she can explore with her students: "...so if I am teaching a class of 70 for example, it makes it very difficult to actually plan a field trip without taking too much of my module time and the time of other lecturers' modules."

The University motivates for social uplifting and engagement with community. This is an institutional driver that supports ESD. A glance at the 'Action Competence' category in the ESD framework presented in Table 2 shows important activities such as 'participation in community-based decision-making' and 'engagement in community and social development activities'. It is therefore interesting to note that none of the teacher educators engaged their students in these types of activities even though it is supported by their personal professional interests and institutional research agenda and culture. This interesting observation has been explained by reference to time limits and student numbers.

Another surprisingly strong factor influencing teacher educators' course design and delivery was student expectations and caliber. Generally teacher educators observed that students are lazy to read materials and do further reading on relevant topics. Amy and Dora instead of doing the practical activities they had lined up for the course were forced to use the remaining two weeks of their module time on teaching the content. Dora commented: "They wanted us to sit with the course pack and teach it to them page by page [...] So we spent the last two weeks teaching them the content." It appears that student expectations impact what teacher educators are able to cover in the course as well as serve as a demotivation for curriculum innovations that employ more interactive assessment methods.

Teacher educators reflected that some students find the courses very difficult to grasp (attributed to the lowered entrance levels to satisfy the need for teachers nationally). This limits teacher educators' freedom and motivation to design assessments that challenge and engage students at a more critical level. It appears that extrinsic factors shape intrinsic motivation at this institution (Jansen, 2003).

Barriers to embedding ESD in Higher Education

An analysis of the interview transcripts revealed a number of reoccurring factors that contributed towards teacher educators reasons for focusing on certain competences and for not promoting ESD related competences. These factors could be classified as barriers impeding the embedding of ESD in the HEI. Two categories of barriers, namely core and peripheral barriers seem to be present:

Core Barriers – These barriers are less obvious/visible, yet they have a more pervasive impact on organizations ability to embed change. These barriers are not easily removed as they have been reinforced by peripheral barriers.

Peripheral Barriers - These barriers are more obvious/visible and have less of a pervasive impact on organizations ability to embed change. These barriers are often mistaken as the primary barriers to change. These barriers are easier to overcome.

An example of these two concepts can be displayed using the findings of this study. Although 'lack of time' and 'student numbers' was often identified as a core barrier to embedding SD in TE curricula, it soon became apparent that although these were a demotivation for curriculum development they were also not the core barriers to ESD. In fact what became apparent as the analysis of interviews unfolded, was that teacher educators either did not see a need for the embedding of SD in their curricula and in some cases did not see how their discipline related to SD or did not feel supported by the University culture and values in such an endeavor.

This core barrier became apparent as academics were asked about what they thought about ESD. The Acting Dean for one commented "as a research led institution we should be supportive of all of these endeavors." Yet followed this comment later by stating that "I don't think we as an institution or as a faculty or school really engage with this concept [referring to ESD]..." he added that perhaps if it was done it was mostly "uncoordinated" occurring only if it was a personal professional interest or if the discipline happened to promote a similar principle through its content.

Teacher educators' responses to what they thought about ESD, served to confirm that the lack of knowledge and interest in ESD would offer as a core barrier to its implementation. Teacher

educators admitted to not considering SD when designing their courses and one even commented that although they thought it was valuable, there were other more pressing concerns, like providing learners with desks, chairs and an adequate teacher to learner ratio. Teacher educators have defined their core priority as delivering and preparing students for the delivery of the national curriculum. This core purpose is reiterated through the competency development foci in their courses. Although teacher educators displayed an interest towards getting to understand and implement ESD other pervasive barriers offered as strong opposition.

Identifying ESD competences (which are subject to change as we come to understand and contextualize SD better) is the least of HESD’s challenges, albeit important for a good foundation (Rieckmann, 2012) for curriculum development. HESD needs to identify and overcome its’ core barriers. Another core barrier to integrating SD in HE curricula is the solid discipline boundaries that force the compartmentalization of content and therefore the content-focus of curricula (Lambrechts, Mula, Ceulemans, Molderez and Gaeremynck (2013). We feel that problem solving for SD could provide a uniting core interest that may help to transcend the traditional paradigm of Universities, thrusting Higher Education into a paradigm of transformative learning.

Many competences focused on in HEIs only refer to elements of SD unconsciously (Lambrechts et al.), such as engaging in creative thinking. This might cause us to always fall short of a meaningful reorientation of education towards SD. If we constantly reflect on the unconscious ways in which our practice does address tenets of ESD instead of the more robust ways in which it does not, this will lead us to justify that our practice in some ways has always been complimentary to ESD. For these reasons, it is important to understand the barriers and opportunities for holistic ESD integration into a HEI. Table 3 reveals the categorization of the barriers identified in this study.

Table 3. A categorization of barriers to embedding ESD in Science and Technology Education

Nature of Barriers	Core Barriers	Peripheral Barriers
Research	<ul style="list-style-type: none"> • ESD is not supported by current University research agenda 	<ul style="list-style-type: none"> • ESD does not align with personal research focus
Professional identity	<ul style="list-style-type: none"> • Little to no professional collaboration for change • A culture of professional isolation is supported • ESD misaligns with personal professional interests 	<ul style="list-style-type: none"> • Lack of Understanding and exposure to ESD as a concept • Lack of real/perceived professional autonomy • ESD is perceived as being misaligned to one’s professional roles
Curriculum Development	<ul style="list-style-type: none"> • A strong content knowledge focus which is supported by a similar focus within current curriculum policy • ESD misaligns with professional interests and priority 	<ul style="list-style-type: none"> • ESD is not perceived to align with certain curricula • A decontextualized curriculum application • Lack of professional collaboration for curriculum development • Perceived lack of autonomy to change curricula
Discipline Identity	<ul style="list-style-type: none"> • Strong curriculum policy 	<ul style="list-style-type: none"> • Lack of community

	<p>focus</p> <ul style="list-style-type: none"> • Strong content knowledge and content specific skills focus 	<p>engagement</p> <ul style="list-style-type: none"> • Lack of active engagement and decision making activities
University Culture	<ul style="list-style-type: none"> • Teacher Education Program is highly responsive to University perceived needs of the country which misaligns with SD • Teacher Education Program is strongly aligned to delivering the curriculum 	<p>*Linked to all other peripheral barriers</p>
Professional Concerns	<ul style="list-style-type: none"> • ESD is not a University concern or trend • ESD is not promoted through HE policy 	<ul style="list-style-type: none"> • High work load • Time availability • Students' poor content knowledge/caliber • High number of students • Student complacency

We propose that the very barriers identified above if reworked and remedied, can also offer as crucial gateways to embedding ESD in HE. It is important to acknowledge that barriers may vary in degree of influence depending on the institution. This implies that universities need to engage three steps:

1. Identification of barriers to embedding ESD
2. Categorizing of the core and peripheral barriers
3. Determining how each barrier will be addressed and the order in which they will be addressed (realizing that peripheral barriers are often connected to core barriers).

However, this study offers more than just insight into the identification and categorization of barriers to HESD. In many ways these findings serve to reiterate the UNESCO (2005) findings regarding major barriers to ESD implementation in teacher education. These findings also elaborate on which barriers are more pervasive and influential for teacher educators. By illuminating which barriers are more persistent and which can be overcome more easily, the research starts to reveal a clearer path for change. This is opposed to implementing all guidelines and recommendations made (UNESCO, 2005) without a focus on what specifically needs to change and who is responsible for that change at which level of the institution/system. To demonstrate the complexity I am referring to: It is important to acknowledge teacher educators limited autonomy (due to national policy and inherited courses) at the same time their ability to directly influence the curriculum at a classroom level. It is also important to understand that although time and funding may serve as a barrier to ESD implementation (UNESCO, 2005) it is not as pervasive a barrier as a lack of personal professional interest regarding ESD. However these two barriers are inextricably linked. These findings provide tone to a seemingly full picture provided by UNESCO (2005).

The future for ESD implementation at Teacher Education Institutions in South Africa

ESD related principles are engaged at this institution however this is neither done intentionally nor powerfully. In reference to the ESD framework represented in Table 2, it was found that insufficient

attention and priority is being paid to the development of action competence. Although teacher educators reflect on the importance of learner-centered approaches to teaching, these do not involve learners in the much needed participation in community-based decision making. Students are not engaged in community and social development activities, nor are they engaged in active learning approaches regarding sustainability issues. ESD teaching and learning approaches are centered on the ideal for 'action competence' in citizens, developing individuals who are able to make informed decisions towards addressing current issues and needs in an inter-generationally considerate manner. The lack of action competence address speaks to other ESD competencies that are insufficiently focused on.

ESD Skills that are not engaged sufficiently, include critical and creative thinking. Although teacher educators do emphasize the importance of developing critical and creative thinking, their lack of engagement with action competence based teaching and learning approaches, limits this realization. Problem solving opportunities provided to students are often limited (in authenticity and open-endedness) due to time, numbers and student caliber. Remarkably, teacher educators give a lot of attention to systemic and future thinking as they encourage students to consider the impacts of Science and Technology on society and the environment. We believe, however that this also needs to be done in the context of authentic and not contrived problem solving opportunities. This speaks to an ESD value that has gone untouched, 'the promotion of collaboration in problem solving and decision making'. It appears at a glance that a focus on 'ESD teaching and learning approaches' i.e. promotion of action competence, can offer a crucial instrument for the address of ESD related skills, knowledge and values and this is reflected in the HESD Framework.

The reconfiguration of the College and reconceptualization of the Bachelor of Education programme has placed pressures on teacher educators who have had to revise their roles and responsibilities. These roles and responsibilities have loaded teacher educators with administration and research duties on top of their teaching responsibilities proving to be both emotionally and mentally draining. These factors play a role in their motivation for innovation.

Institutionally endorsed research agenda drives the research that is embarked upon at the Institution, becoming a motivation for teacher educators to also address related research ideas in their practice. For example: scarce skills, relevant education, social and economic development, indigenous ways of knowing, HIV/AIDS and health and gender education. Formal University research agenda are identified according to what is declared to be the current needs of the country. If research agenda drives competence development in this way then an implication for ESD realization is to deem it significant enough to feature as a formal research agenda at Teacher Education Institutions. Personal professional research interests also prove as a motivator for competency development in courses, however this needs to be supported by institutional research agendas.

Teacher Educators are given the professional autonomy to change the course design, yet this is within limits. Changes need to be approved by examinations board. Should teacher educators decide to make changes and implement them, this may still depend upon student numbers, student expectations and caliber, pressing deadlines, administration and pressures to produce research publications. However findings suggest that supportive leadership may provide enough motivation to overcome these barriers, through meaningful collaboration. This suggests that the development of 'subject focus groups' oriented towards developing teaching and learning resources that promote

ESD, could be successful if faculty management recognized and supported this as meaningful continuing professional development.

Competence development is strongly influenced by the national curriculum taught in schools. Teacher educators' ideas on teacher competence was tightly linked to the curriculum as teacher educators developed competencies they believed student teachers would need when they entered the school system. This means teacher educators promote what they perceive to be in the national curriculum. If ESD is not a significant focus in the curriculum, which is identified by Bentham, Sinnes and Gjøtterud (2014), consequently it won't be a focus for competence development in Teacher Education Programmes. Consequently the curriculum can be seen as a crucial tool for moving closer to an ESD realization. Higher Education must share responsibility when it comes to an effective realization of ESD. If research informs policy and National curriculum development, then Institutional research agendas should promote an ESD orientation. University research agendas inform and support professional interests which ultimately impacts competence development.

Conclusion

According to Robson (2002) case studies are less likely to provide grounds for statistical generalization and more likely to provide support for analytical generalization whereby the study displays ways in which similar cases can be understood or analysed. This particular case shows how an innovation such as ESD faces multiple challenges that must be understood before a process of reorientation can be supported meaningfully by teacher educators and academics. The analysis suggests that any institution that bears similar factors or structures, will respond similarly to ESD. The study also suggests that any innovation will experience the same reception that ESD experiences if it is similarly foreign to National curriculum and Higher Education Institution (HEI) policy priority/culture which are believed to be the two major drivers of professional practice and course design.

According to the International Association of Universities (IAU, 2011) only 15 universities out of 14 000 universities worldwide have published sustainability reports. This suggests that what Universities perceive to be the needs of society is not in alignment with SD principles. Ultimately this means there is a high risk that economic and social needs will continue to precede the needs of the environment crippling our ability to address future needs.

Universities need to be leaders in change and more specifically leaders in change for sustainability. This requires a better understanding of the needs of the present and future generations (Lozano Lukman, Lozano, Huisingh, and Lambrechts (2013) However there is an even more pressing prerequisite to such change: University faculty must be given the autonomy and support to create new paradigms and with them new curricula that is responsive to the current and local needs with consideration of long term needs (Lozano et al.)

A special issue of the Journal of Cleaner Production in 2013 asks a pertinent question: "Are universities leading in the development of sustainable development mental models and paradigms and in transferring the related SD memes to their students or are they reacting to stimuli from

society and thus the sustainable development memes are being transferred to the universities from society?" (Lozano, 2013, p.4)

From our analysis of the science and technology departments' organizational structures and processes as well as from a discussion with the acting dean at the particular HEI, it would appear that the university responds to the perceived needs of the country. This response is inspired by the financial support that is gleamed when engaging in 'cutting edge research' and producing high level publications. The trepid truth however is that what is interpreted current and cutting edge research in South Africa, differs greatly to long standing developed nations such as those in Scandinavia and Europe where SD is a buzz word and has for the last ten years or so been given considerable attention. South Africa is a nation that still faces many social challenges that many still believe can be righted purely via economic channels. Consequently cutting edge research has focused on the advancement of the pure and human sciences to address issues of equality, HIV prevalence, poverty, and access to a quality education for all. Unconscious elements of SD may feature but it certainly has not been a focus. For South Africa Lozano's (2013) question has little relevance but could be reworded to ask: Are Universities taking an active role in assisting society in understanding how addressing the actual needs of society instead of the perceived needs can lead to a more sustainable future?

The integration of sustainable development oriented competences in Higher Education curricula should be seen as a pertinent movement towards attaining sustainability in HE (Lambrechts et al.). It should also be recognized that a crucial supporting achievement would be the reorientation of HE culture and values towards the recognizing and satisfying of long term societal needs. With enough futures and systems thinking one cannot get away from the fact that societal needs include the balancing of the three pillars of sustainability and not only what society thinks it needs (Economic equity).

Competences for SD are founded on a particular set of values and ethics (Lambrechts et al.). It is for this reason that it is most necessary to ensure that the Higher education in which these SD competences are intended to be embedded, somehow align with the institutions values and culture closely enough.

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10. Article 4

A teacher education for sustainable development system: An institutional responsibility

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Abstract

Soft systems methodology is commonly used in organizational research and can be very useful when attempting to understand both organizational structures and dynamics. A teacher education institution is identified here as an organization. Soft systems methodology is employed to gain a picture of the current organizational structure of a Science and Technology Education Department and to further develop a hypothetical picture of what the same organizational structures would look like if they incorporated ESD. These two pictures were presented to a group of teacher educators within the particular department during a focus group interview, where they were encouraged to reflect on three foci. This paper explores the teacher educators' responses to the hypothetical system picture which elaborates on a system for teacher education for sustainable development. The paper concludes by reflecting on teacher educators' responses and what they imply for the future of ESD at this teacher education institution. The article reveals that the following findings permeated teacher educators responses to the notional system picture for teacher education for sustainable development: (1) management's perceptions of professional autonomy differs from that of teacher educators; (2) there exist seven relevant sub-systems that influence teacher educators' priority and practice; (3) teacher educators felt that research and leadership were the most powerful tools supporting the suggested ESD curriculum innovation; (4) although ESD is deemed important, it is not a priority for teacher educators owing to various reasons.

Keywords: Soft systems methodology; Education for Sustainable Development

1. Introduction

The United Nations Decade of Education for Sustainable Development (2005 – 2014) requests that sustainable development issues be incorporated into education in a holistic and trans-disciplinary manner. This involves the embedding of sustainable development (SD) competencies into existing education programmes.

The promotion of education for sustainable development (ESD) in higher education is, "considered crucial to building a sustainable future and to placing young people at the center of development." (Wals, 2013, p.5) This responsibility and importance of ESD is shared by UNESCO (2005) and the United Nations Economic Commission for Europe (UNECE). Furthermore, the Lüneburg Declaration of 2001 reinforced the emphasis made within Chapter 36 of Agenda 21 (1992), that Higher Education should play a crucial role in supporting education's ability to address sustainable development challenges. The Declaration invites universities to sign the Declaration and commit to reorienting education towards sustainable development.

The notion of ESD being a critical tool for realizing SD has been restated within leading international agreements regarding climate change (UNESCO, 2014). ESD is not just an educational philosophy, it is also strongly supported by an enormous variety of scientific, historical, economic, political, and integrated studies (Huckle, 2014). It is intended, in these times of prevailing social, economic and ecological injustice, that education serves the purpose of empowerment (UNESCO, 2014). Learners need to be encouraged to develop competencies that will equip them to address local injustices, enabling all citizens to flourish now and in the future.

The responsibility afforded to Higher Education for the promotion of SD first featured in the Stockholm Conference on the Human Environment in 1972, then again in 1975 in the Belgrade Charter, followed by the 1977 Tbilisi Declaration, as well as in Agenda 21 (1992) and more recently the Africa Consensus Statement to Rio+20 (United Nations Environment Programme [UNEP], 2011; 2012). There is no doubt that Higher Education is seen as instrumental for the realization of sustainable development. This responsibility is legitimately placed on Higher Education Institutions (HEIs) as they are the pioneers for the generation of new knowledge, which is appropriate here considering the relatively new field of ESD. Also, universities are able to transfer knowledge to society via community outreach and by educating students who eventually enter into the public sectors, becoming our future decision-makers.

Wals (2013) and a group of experts set out on a large-scale study to determine what progress had been made with regard to the implementation of ESD. All learning that took place at European schools, universities, communities and in industry was reviewed, as well as policies and structures examined according to their provisions for ESD. An interesting observation revealed a pattern, universities that were found to be highly research-driven paid significantly less attention to sustainability generally and ESD specifically (Wals, 2013). This appeared to be supported in our study however this deduction would not have been possible from a single case study. This supporting evidence adds meaning to further observations made.

A lack of ESD orientation is not the case for all universities and is evidenced by the more than 1000 university leaders who have signed their allegiance to the reorientation of education towards sustainable development. Allegiance has been signed through treaties such as the Talloires Declaration, Kyoto Declaration, Earth Charter, Luneburg Declaration, Ubuntu Declaration and many more (Lozano, Lukman, Lozano, Huisingsh & Lambrachts, 2013).

The Ubuntu Declaration, which was discussed and signed by international education and scientific organizations in Johannesburg, South Africa, emphasizes the importance of Science and Technology Education in realizing a sustainable future (United Nations [UN], 2002). The term 'Science' in the declaration refers to both the Natural Sciences and the Social Sciences. The Declaration further acknowledges that education's main purpose is to share knowledge, skills and values in a manner that empowers individuals to enact transformation. Such a powerful medium should therefore be utilized in the plight for sustainable development. The Ubuntu Declaration thus requests tertiary educators to review their programs in terms of the curricula, in order to promote problem-solving and decision-making geared towards sustainable development agenda.

Declarations, charters, partnerships and conferences from 1990 until now "emphasise that universities have a moral obligation to work towards sustainable societies, focusing on environmental degradation, threats to society, and sustainable production and consumption for this and future generations." (Lozano et al., 2013, p.17) Whether a university has physically signed allegiance to such treaties does not ensure that SD practices permeate the entire system. Many universities have adopted tunnel vision, focusing on the 'greening' of the campus at a structural level (Tilbury, 2011). The nature in which sustainable development is eventually incorporated into the curriculum (bolt-on or build-in) depends upon the institutional culture (Wals & Jickling, 2002). Some of the reasons Lozano et al. (2013) provide for why universities have not engaged with sustainable development include: (1) a lack of awareness; (2) educators feel inadequate as their knowledge is limited about SD; (3) educators feel the curriculum is already overcrowded; (4) educators lack the support to develop and implement SD; (5) educators doubt the relevance that SD has to the discipline they teach; (6) the discipline structures and historical pedagogic practices don't line up with ESD.

Higher education has been tasked with the duty of reorienting education to address national and local sustainable development challenges. This paper aims to explore teacher educators' responses to a suggested hypothetical system of Teacher Education for SD and to reflect on what teacher educators' responses imply for the future of ESD.

2. Foregrounding the Study

This article reports on a section of data attained from a larger study. The larger study conducted an initial South African survey which assisted in identifying a Teacher Education Institution that would be willing to participate in the study. The survey revealed the prevalence of a misconceptualisation of both what an Education for Sustainable Development entails and who it involves. Respondents revealed that terms such as 'sustainable development' 'biophysical systems' and 'sustainability' were terms related to other disciplines such as natural science and geography. Owing to the prevalence of misconceptions related to the sustainability-related terms used, it was decided that the survey would merely serve as a selection tool. This was possible as the survey indicated one Teacher Education Institution (TEI) that reflected a higher response rate than the other institutions, indicating a willingness to participate in the next phase of the study.

Once the institution had been identified, an interview with the acting dean provided confirmation that the department of Science and Technology Education should be involved in the remainder of the study. This was supported by the Ubuntu Declarations' (UN, 2002) emphasis on the need to reorient Science and Technology specifically. The third phase of the study involved one-on-one interviews with willing teacher educators. Teacher educators were interviewed twice each and asked about the competencies that they prioritized in their practice and why. Teacher educators described the courses they taught and the kind of teaching and learning activities in which they engaged. Teacher educators also reflected on their challenges, interests and desires for future practice. Finally teacher educators reflected both on their understandings of Education for Sustainable Development and how/if they envisaged this in their practice.

The final phase of the study involved a focus group interview with the teacher educators. It is this part of the study that forms the focus for this article. The focus group interview employed soft systems methodology, which called upon the major findings from the one-on-one interviews, to construct the rich and notional pictures that would serve as the focus for discussion. The researcher was responsible for analysing the interviews and constructing the rich picture and the hypothetical/notional system picture for the focus group discussion. The construction of the notional system-picture was informed by the relevant sub-systems that had been identified during the interview analyses as well as by Checkland's (1981) eight suggested verbs. Teacher educators reflected on the hypothetical notional system picture presented, with regard to how it aligned or misaligned with their functions and concerns. This discussion provided insight into the implications for future ESD implementation in Teacher Education Institutions.

2.1. An Overview

The article contextualises teacher education in South Africa according to the major political changes that took place from 1994 onwards. This contextualisation of teacher education sets the scene for this particular case study, in which one Teacher Education Institution (TEI) in South Africa is explored. The Teacher Education Institution is identified here as an organization and the typical qualities of such an organization are revealed through an exploration of relevant literature. The defining of a TEI as an organization, qualifies the methodology, which employs systems thinking and its related Soft Systems Methodology (SSM) (Waring, 1996). SSM can be used to understand an organization and the implications for innovation and change.

The article continues by outlining the context of the study and describes the applied methods. Besides Soft Systems Methodology, more specific methods included one-on-one interviews and a focus group interview. The article reports on the main findings from the one-on-one interviews and uses these to construct both the rich picture (see Figure I) and the conceptual model of the notional system (presented in figure II). The main findings from the focus group interview reveal how teacher educators responded to a conceptual model of a notional system for Teacher education for sustainable development. These findings are summarised and their implications for the future of ESD in TEIs is discussed.

2.2. Contextualizing Teacher Education in South Africa

To understand the greater context or system in which participating teacher educators' talk about their immediate working environment, it is necessary to provide a brief background to tertiary education in South Africa.

Teacher Education in South Africa has undergone multiple changes which have reflected the multiple changes that have taken place in the greater education system, owing to political transformation (Reddy, 2009). During the apartheid era education institutions at all levels were controlled provincially. Since the fall of apartheid and the rise of democracy, higher education institutions have become nationally governed, ensuring national competence. With this shift came the regrouping of Higher Education Institutions, forcing teacher training colleges to become part of the university system. "Teacher educators are repositioned – they are now both curriculum designers and deliverers and knowledge producers, under pressure from their institutions to 'publish or perish'." (Parker & Adler, 2005, p.62)

The very first South African Teacher Education Audit took place in 1994 and it found teacher education to be very fragmented. At the time there were over 280 different types of institutions offering distant and contact teacher education (e.g. state colleges, private colleges, universities, technikons and NGOs). In response to the audit, major institutional restructuring took place which was intended to remedy the costliness of the college sector and the fragmentation of governance in teacher education. Consequently, many teacher educators found themselves shifting from a college culture to a university culture. "..., teacher education has shifted from being based in independent colleges in a post-secondary sector to being incorporated within the tertiary sector, with varying degrees of de/re-professionalisation..." (Kruss, 2008, p.4)

Accompanying the institutional restructuring was the change in education policy which boasted an Outcomes Based Education (OBE) (and its newly integrated qualifications) framework. These changes impacted significantly on the curriculum, pedagogy, program structures and the perceived roles of educators. This meant that teacher educators were required to teach a curriculum and in some cases a pedagogy that they themselves

had not been prepared for (Kruss, 2008). This also meant that already qualified teachers in the system had to be retrained according to OBE. This not only challenged teacher educators' knowledge, it also challenged their workload, as in the case of any re-curriculation process. The challenges offered by this double-barreled wave of change, including transformation in school curriculum and teacher education restructuring, was not over. In 2002 the National school curriculum was revised due to: "...inequalities and the realities of under-resourced schools which had large classes and teachers largely untrained in learner-centred education and making their own curricula." (Chisholm, 2003, p.6) It was hoped that the revised curriculum would equip learners to respond to the social and economic needs of the country.

Ten years later in 2012, the new Curriculum Assessment Policy Statements were published, both specifying and placing emphasis on content in the school curriculum. This curriculum change occurred as it was felt that curriculum content had been watered down considerably in reaction to the previous apartheid content-driven curriculum. Consequently teacher educators are now left to make sense of the curricular changes and prepare students to enter a seemingly volatile education system.

If one is to be realistic about the factors that affect ESD implementation in teacher education, it is necessary to reflect upon the historical and political context in which higher education exists and teacher educators' roles. This may offer insight into teacher educators' curricular choices and the manner in which they make meaning of their roles and functions. According to Stir (2006), and also applicable to South Africa's higher education system, the transforming of teacher education was and still is taking place at the same time at which ESD is being debated and explored. So although there is consensus that ESD is most valuable, the intended stakeholders are still debating and grappling with its definition and its implications for policy and practice. At the same time, teacher educators are trying to understand an academic environment that keeps changing.

2.3. A Teacher Education Institution as an Organization

This article aims to reveal teacher educators responses to a hypothetical system picture for ESD, thus indicating the prognoses for ESD. In order for the hypothetical system picture to be drawn up, a thorough investigation into the existing system as an organization, needed to be conducted. This was achieved using organization theory and more specifically soft systems methodology (SSM). The following exploration of the Teacher Education Institution as an organization reveals how the rich picture (see Figure I) and notional picture (see Figure II), which sparked discussion during the focus group interview, were informed. One-on-one interviews contributed greatly to the construction of these pictures and literature on organization theory served as a guide for synthesis during the analysis of the interviews.

Lozano (2013) identifies universities as very complicated institutions. His analysis shows that universities, as with any social system, have smaller parts that interact and interconnect, such as its values, rules, individual members, actions and behaviors. All these aspects both affect, and are affected by, each other, producing a multiplicity of interactions and results. Lozano (2013) states that all university systems have four main concerns, these include: Education (In the form of courses and their curricula); research; campus operations; and community outreach. According to Lozano, all four of these concerns are both interdependent and linked. This study provides further detail on the nature of these four concerns.

The term "organization" is understood here to signify a social system or institution that constantly changes according to both internal dynamics and external environment (Morgan, 1980; Van Tonder, 2004).

"...we are able to define Organisation Theory (i.e. theory of organization) as that set of related concepts and principles which aims to provide a plausible description of, and an explanation for, the nature and functioning of the organization, and how the organization impacts on or is impacted on by the broader context (e.g. society) and the people with whom it interacts..." (Van Tonder, 2004, p.14)

Organization theory can therefore be used to assist in understanding the complexity that exists within organizations as well as assist in coming up with innovative ways of coping with such complexity (Hatch, 2012). For some, the many organization theories that do exist present an obstacle when they do not concur. However, this theoretical pluralism can alternatively be viewed as a strength. Organizations are mostly complex and so multiple perspectives/theories and their tools can be used to better understand these organizations (Hatch, 2012).

According to Hatch (2012) two important techniques for a researcher of organizations to develop, are that of 'abstraction' and 'chunking'. Abstraction is the process whereby major or broad concepts are developed as a result of summarizing experiences and/or observations. The broad concepts serve to capture the essence of the personal experiences/observations. Chunking is engaged, whereby relations and connections are drawn between the broad concepts. The idea is to "...use your personal experiences to develop concepts with which you can understand or build theories, and then use your concepts and theories to better understand your experiences." (Hatch, 2012, p.9) It is 'chunking' that assists in the activity of theorizing. However 'abstraction' results in the loss of detail and for this reason the dialectic between theoretical understanding and personal experience is continuously engaged in order to add meaning to this particular case.

The university as an organization can be said to take on the metaphor of the organism (Spencer, 1873). This metaphor refers to a system of interconnected and interdependent parts that all work together to support the life and functioning of the organism within its changing environment. The strong interaction between the organization and its environment reveals the open-systems approach to survival and functioning (Morgan, 1980). The relationship between the organization and its environment is based on the principle that the organization both has needs and yet also serves important roles in the surrounding environment and society. The organization must also respond to the needs of its environment. However, anyone who has studied an organization, such as a university or any tertiary institution, will tell you that functions and sub-systems are hardly neat and co-ordinated. Weick (1974) introduced the idea of an organization as a loosely-coupled system (In Morgan, 1980), challenging the idea that organizations are well-organized, so to speak. Hannan and Freeman (1977) introduced the idea of an organization as an ecosystem in which competition and natural selection occurs, viewing organizations as adaptive systems. There are many metaphors that can be attributed to the university as a type of organization. This paper uses such insight to make meaning of one particular teacher education institution, in order to identify what implications organizational factors have on the future of ESD implementation.

Systems theory has been one of the most dominant schools of thought across organization theories since the 1980s and still is today (Checkland, 1981; Astley & Van de Ven, 1983; Checkland & Scholes, 1990; Waring, 1996; Skyttner, 2001; Luhman & Cunliffe, 2013). Systems theory, although it offers no prescribed methodology for organizational analysis, Checkland and Scholes (1990) and later Waring (1996) revealed an interactive methodology for analyzing soft systems in a flexible manner. Some aspects of this methodology have been engaged and adapted for the purposes of this study.

3. Methodology

3.1. Systems Thinking: An approach to understanding the Organization

Systems theory and systems thinking not only allows one to develop an understanding of the organizational context, it also assists in understanding in detail what the internal relations are within the organization itself (Van Tonder, 2004).

Systems have been classified into either 'hard' or 'soft' systems. Hard systems are understood to be those instances of functioning that rely minimally on human activity or input. This makes the system outcomes often more predictable and quantifiable than soft systems. Soft systems involve people and their decisions and activity that are shaped by their values, beliefs and attitudes. As a result soft systems are highly unpredictable. Soft systems also are known for their limited ability to measure their properties as these are often in the form of interests, opinions and points of view (Waring, 1996). A teacher education institution is both a human activity system and a soft system.

For this purpose a soft systems methodology (SSM) is engaged in this study to gain better insight into the teacher education terrain. According to Checkland and Scholes (1990), soft systems methodology (SSM) is a continuous learning cycle, much like action research, except that its methods are rooted in understanding organizational structures and functions. This study did not employ soft systems methodology (SSM) in an attempt to change existing organizational structures and functions although this could eventually be aspired to. "Understanding the territory is crucial to changing it." (Van Tonder, 2004, p.52). Here SSM is engaged as a practical systems thinking approach to understanding the teacher education institution as an organization and what this means for the future of ESD implementation. Waring (1996) provides a summary of SSM adapting it from Checkland (1981).

3.2. A soft systems methodological approach

SSM begins with stage 1 which involves accessing information about the situation. This information assists in creating a rich picture of the situation for stage 2. It is crucial to interview key figures at this stage of the process. Often these key figures are able to highlight the culture and governing structures of the organization. Interviews provide the researcher with a broad view of the main concepts that are relevant in the organizational environment. It is these concepts that will be used to draw up a rich picture of the situation. A rich picture is simply a picture that summarizes the human activity that the researcher is analysing at the *beginning* of their study.

Stage 2 involves an unpacking of the rich picture, to reveal the major issues and primary task areas. The importance of stage 2 is more specifically to identify the parts that contribute to or seem relevant to the situation/problem situation. This may be done by identifying the main issues and primary tasks of the system. For example one of the primary tasks of the Science and Technology Education Department is to produce: (1) Students proficient in Science and Technology education content and skills. The rich picture should display the main issues and primary task areas which are important to the situation.

Stage 3 specifically involves the naming of ‘relevant systems’ and devising root definitions for them. In this study, however, we referred rather to ‘relevant sub-systems’ within the greater university system. In order to identify the relevant sub-systems and their root definitions, the CATWOE test (Checkland, 1981) must be applied. To ensure that the identified sub-system can be legitimately defined as a sub-system, it needs to contain the following attributes:

Customers:	E.g. Bachelor students receiving a service delivery of education
Actors:	E.g. Teacher Trainers/Lecturers explicit, and Education and University policy implicit.
Transformation:	E.g. Sustainable development oriented teaching and learning
Worldview:	E.g. Education for Sustainable Development is a ‘good education’
Owner:	E.g. Science and Technology Teacher Educators
Environment:	E.g. Time limited by both workload and demand to publish and conduct research, University Policy and priority, Department of Education Curriculum as leader, number of teacher trainers motivated to reorient towards ESD.

As an example, an efficient or appropriate root definition for the sub-system: ‘Science and Technology Teaching and Learning’, would be:

‘A sub-system owned by the University and run by the Science and Technology teacher educators, which aims to deliver a *good education* to Bachelor students, that is in line with University and greater education policy.’

Stage 3 and 4 are linked and require abstract thinking by the analyst or researcher. Stage 3 and 4 involves the mapping of a *notional system* of “What might be” (Waring, 1996, p.91) and not what “is there” or “ought to be there”. So this is where the analyst/researcher uses his or her logic to determine what would need to be in place within the system in order for the system to be functional towards its primary tasks/objectives such as curriculum design, research productivity and development in teaching and learning etc., as well as an Education for Sustainable Development in this case.

Stage 4 involves taking the relevant sub-systems, which constitute the greater Teacher education institution system being analysed, and constructing a conceptual model of what the system would have to consist of in order for it to logically work. At this stage the analyst is still working with a *notional system* and NOT a solution. Checkland’s (1981) eight suggested verbs (Determine, formulate, allocate, set-up, operate, establish, decide, monitor) are used to assist with the construction of the Science and Technology Education for Sustainable Development notional system conceptual model.

Stage 5 requires that we ‘come back to the practical situation on the ground’. This is where the rich picture that is created in stage 2 is compared with the notional system ‘conceptual model’ created in stage 4. This comparison should highlight the main incongruence’s between what is and what might be, in the possibility of moving towards what ‘could be’. According to Waring (1996) the goal is to draw up a list of activities that are either not done or not done satisfactorily. The list should merely say what is missing or inadequate. How these should be corrected is not the concern of this stage. The purpose of the list is to provide an agenda for discussion with the actors.

Stage 6 involves a debate with the actors concerned. The analyst’s role at this point is to get the actors to reach an agreement about which activities are missing or inefficient in their own system/situation. Some or all of the analysts’ suggestions regarding the list of inefficient or lacking activities (formulated in stage 5) may be turned down by the actors, but at least this is where explanations and substantiations will be provided by the actors.

Stage 7 involves action for change. This is where actors discuss how they plan to implement the agreed list of changes discussed in stage 6.

What is significant about SSM is that it does not have the intent of finding a solution to an already defined problem, rather this methodology has the intent of finding out more about the situation and thus problem finding and solving only comes at the end of the process. SSM is about a more comprehensive identification of the nature of the problem/situation. Consequently it is a methodology that favors change.

3.3. The Context of the study

The Science and Technology Education department (a sub-system) within the University as an organization and therefore a larger ‘system’ formed the focus for the study. Participants included eight Science and Technology educators, widely representing gender, race, expertise, age and experience, and one acting dean. Science and

Technology teacher educators were focused on as Science and Technology have been recognized as leading subjects in attaining social and economic development (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2002) in the greater plight for sustainable development. One of the participants involved is also the head of the technology department at this particular teacher education institution in South Africa, providing insight into institutional structures and plans. The study involved two one-on-one interviews, followed by a focus group interview with all participants. This article focuses on answering two main questions: (1) What are teacher educators' responses to a notional system for teacher education for sustainable development; (2) What do teacher educators responses imply for the future of ESD?

Stage 1 and 2 of the SSM process called upon data from the one-on-one interviews. These data are not explored extensively here for purposes of length. The remaining stages 3 to 6 call upon data from the final focus group interview.

3.4. Method

The acting dean and the head of department for Technology, as well as the Science and Technology teacher educators were all interviewed to provide information that would inform the construction of the rich picture of the situation on the ground (stage 1). The acting dean was interviewed in order to access greater insight into the culture and major objectives of the institution.

Excerpts from these interviews have been included in the discussion of the data in order to provide support for the details provided in the rich picture. The interviews provide the researcher with a broad view of the main concepts that are relevant within the organizational environment. These concepts were used to draw up the rich picture of the situation.

According to Waring (1996) at this point the rich picture and the conceptual model of the notional system would be compared and a list of activities that are either not done at all or not done satisfactorily would be drawn up by the researcher. The purpose of the list is to provide an agenda for discussion with the actors. This is where our method differed, for teacher educators were not presented with a list of all the incongruences across the rich picture and the conceptual model of the notional system. This was owing to the realisation that this group of teacher educators were not gathered with the intention of getting them to see how they could make a shift to an ESD embedded teacher education. Rather SSM was employed to get teacher educators to reveal which factors influenced their ability and willingness to do so. Instead, participating academics were presented with the rich picture and the conceptual model of the notional system and asked the following questions:

Considering the rich picture (situational analysis) and the conceptual model of the notional system, do you:

1. Have any comments regarding these two representations?
2. See any need/opportunities for a bridging across to the conceptual model?
3. See any problems/challenges with bridging across to the conceptual model?

Teacher educators engaged in a focus group discussion. Excerpts from this discussion are lifted to support the major ideas reported on in this study.

Stage 7 is the final step and involves colleagues getting together to discuss actions that would need to be taken to affect change towards a desired outcome. This step was not embarked upon in this study as this stage could not be imposed by the researcher. It is hoped that the findings revealed here may eventually assist in further discussions regarding future actions for ESD orientation in teacher education.

Although some steps of the Soft Systems Methodological approach offered by Waring (1996) were adapted, the main purpose of using SSM was to provide a basis for discussion with teacher educators. By presenting teacher educators with a rich picture of their current situation, they were able to comment on the details and accuracy of this picture. By presenting teacher educators with the conceptual model of the notional system of teacher education for SD, teacher educators were now faced with a hypothetical system that embedded ESD. By offering up these images, teacher educators were able to reflect on the components within the notional system model and draw difference and similarities to their situation. The two pictures provided allowed teacher educators an opportunity to comment on the possibilities for and/or challenges of achieving a similar model in practice.

3.5. Interview methodology

3.5.1. One-on-one Interviews

According to SSM, Interviews should not be leading but should rather ask open ended questions that require the actor or key figure to explain at length about the situation. For example academics were asked questions such as:

13. Could you briefly tell me about the courses you teach?
14. What competencies do you emphasize in your module or teaching?

15. Why do you emphasize these competencies in your teaching?
16. Are you and your students involved in any type of community engagement? Why?
17. What are your main priorities or goals/concerns as a teacher educator and academic?
18. What factors guide your practice?
19. In what way do you understand the term “Education for Sustainable Development”?

A major challenge of the interview process was withholding interviewer advice or opinions (Cohen, Manion & Morrison, 2007), for often these were requested by the interviewees. Teacher educators were clearly not confident about the meaning of ESD and thus tended to seek for clarity from the researcher (the first author). The way in which this was handled was by explaining the open-ended nature of the interview. This encouraged the idea that no response was right or wrong but rather that everyone’s response was valuable and supported by various contexts and/or experiences. The interviewer expressed their interest in only the interviewees’ context, something which they communicated that they knew little about. This assisted interviewees in becoming very descriptive and more confident in offering up their ideas and opinions.

The strength of the interview method was the ability to clarify meaning when it became apparent that the interviewee had misinterpreted the questions (Cohen, Manion & Morrison, 2007).

3.5.2. A Focus Group Interview

The advantages of group interviews is that they can yield a wider range of responses, by means of encouraging emergent discussion or ideas once group members hear what other members think. They can also provide an opportunity for group members to hear what other members think about a topic that has never been discussed before (Cohen, Manion & Morrison, 2007). The disadvantage, of course, is that individuals who bear different opinions to that of the group may be muted if they lack the confidence to pose an antagonistic idea or opinion. It was up to the interviewer to create an atmosphere where individuals felt comfortable enough to be different in a group. In this study the group of participants shared a rapport with each other that allowed for and encouraged the differences in opinion and therefore promoted further discussion around these areas. The main challenges of the group interview was insuring everyone had a voice in the interview and trying to diffuse hot debate in a way that did not harm any of those respondents involved.

Focus group interviews mainly engage interviewees in either a discussion or an exchange between each other and not with the interviewer, who is there to ensure group members continue on topic. The topic or focus is supplied by the interviewer, however the majority of the discussion is engaged in by members who themselves can pose questions (on topic) to each other. Participants mostly conversed together, eventually forgetting the researcher’s presence as they continued to discuss in a natural manner.

To some extent the focus group interview also posed as a ‘therapeutic interview’ (Kitwood, 1977), for it encouraged self-reflection and self-awareness as active agents within the Higher Education Institution. Interviewees questioned one another and their respective perceptions of their own autonomy. Interviewees also encouraged each other both to be agents of change and to take charge of their own development.

4. Findings

4.1. Developing a rich picture of the situation

After the one-on-one interviews were conducted and the data analysed, the following issues were revealed:

Issues	Primary task-related areas
Curriculum change from C2005 to CAPS	New orientation to module delivery
Research Productivity demands	Research and publications
Qualifications	Attain a PhD
Workload	Development of Teaching and Learning, informed by research
Academics as curriculum designers	Curriculum design and development
Community Engagement	Student-engaged community Outreach

Promote Scarce Skills	Curriculum to address ‘needs’ of the country
Encourage professionalism	Encourage students to read
ESD is not a curriculum focus	ESD principles are taught according to their relevance to the module

Open-ended questions assisted in allowing participants to talk at length about their practice and their work environment. The acting Dean provided detail about the major policies that are said to guide teacher educators and their practice. The Dean added that there are other factors such as the institutional culture that strongly guides academics:

*“we are a **research led institution**, what does it mean? In terms of curriculum instruction...how are we promoting the idea of research?”*

*“There are also research agendas that have been unfolding and informing what we do. So you have to be guided by what the research is saying, current research and how that impacts...for example the supply and demand of teachers. Research in that area has significantly shifted what we do. For example we are **promoting scarce skills**, and they have become a priority...”*

The acting Dean acknowledges that all activities are ultimately guided by what the institution and the profession requires, which is ultimately decided by the country’s perceived needs. He also reflects on the current priorities of the University, which include the push to ensure **all academics get their PhD’s** and the re-conceptualisation of the Bachelor programme.

Finally the acting Dean reveals that **Sustainable Development (SD) is not a focus** in any particular curriculum or module at the institution, however he is sure elements of it will appear in an uncoordinated way. This is confirmed when for example Dora reflects on her curriculum design in one interview:

“To be honest it didn’t come into the initial thinking when we were doing the course outline but maybe...the only real aspect that came out was [...] We are really trying to encourage them to make sure they only use recyclable materials and resources”

Specific attention was paid to expressions of concern and frustration about organizational structures and processes for example, as these offered clues about the problem situations as well as the greater situation in general. Even a lack of concern about a problem or situation can be a clue about factors contributing to the greater situation. The following are some excerpts from various interviews with participants, displaying some of the concerns they voiced.

David and Michael voice their concerns for South Africa’s future economic development and echo the acting Dean’s comments about **scarce skills** becoming a focus in curricula in response to the country’s needs:

“South Africa needs to develop to the stage where we have our own machinery [...] So I am looking at developing, or development in terms of, do we produce skilled students who will actually partake, or play a role in economic development?”

“The curriculum itself is saying...for technology education there must be new development.[...] So the bottom line is they need to know what’s happening to inform how they are teaching for forward development.”

Whereas Rebecca voices her concerns about the **quality of education** as well as the need to promote a sense of **professionalism** in students:

“the quality of teachers is one of the issues, the thing that is probably another issue in education...in Science education in particular is that of making Science education relevant in the lives of South Africans”

Michael reflects on the reason why **community outreach** is not engaged in many modules. The other participants agree with these reasons which are also connected to **workload**:

“Maybe it is because we are not encouraging it as lecturers?”

“Because of the time constraints that we have and because of the large numbers that we have it’s not conducive. [...]I am sitting with 65 in a class. And it is supposed to have been a maximum of 30”

The rich picture was developed to display the main concerns/themes (indicated in bold) and more so were raised by the teacher educators.

All of these issues and their related activities assisted in constructing the following picture:

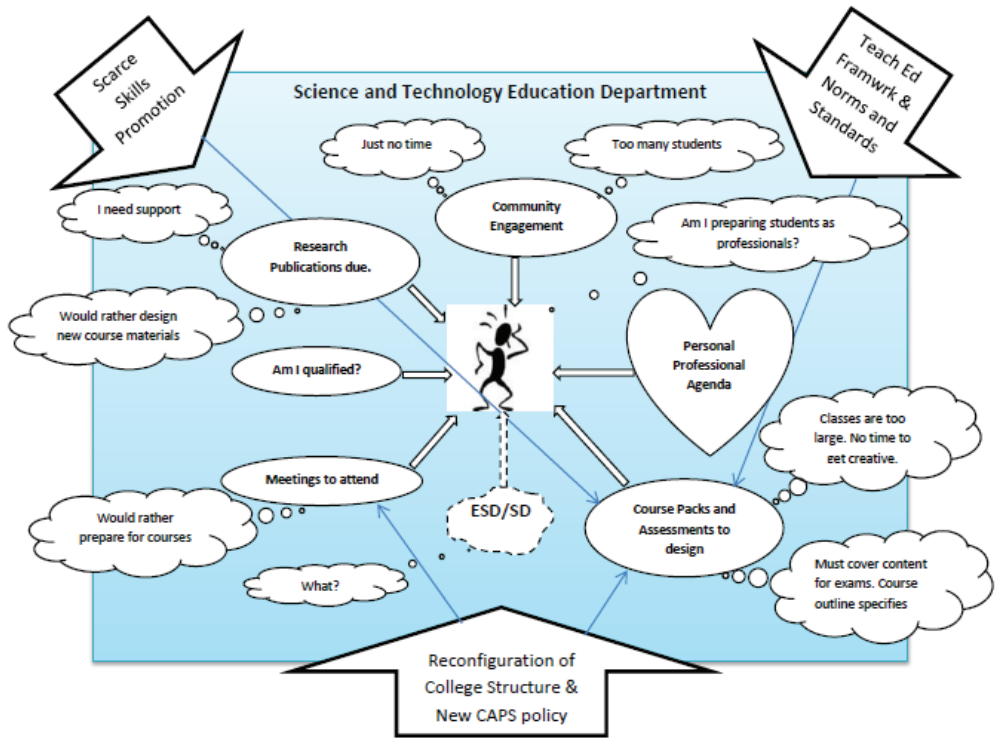


Figure I. A Rich Picture of the Science and Technology Education Department

The rich picture points to a situation whereby academics feel overloaded. They feel torn between improving teaching and learning through curriculum development, and improving their own professional status by attaining adequate qualifications and also producing research publications timeously. Teacher educators have their own personal professional interests and often reflect these both in their practice and in their course-design. However, the University also promotes certain research agenda and scarce skills. Courses are mostly influenced by current National School Policy and by University priorities (E.g. scarce skills and current research agenda). Teacher educators display a frustration to satisfy their workload, as well as realise their personal professional interests in the face of what the University values. Teacher educators describe themselves as autonomous yet when asked about curriculum design and the possibility for ESD incorporation, they refer mostly to their limitations. These limitations include the need to cover content for the examinations and the in-depth process of trying to change course outlines through the correct channels.

4.2. Developing a conceptual model of a notional system

After having created the rich picture of the situation in the Science and Technology department, we wanted to name the 'relevant sub-systems' within the bigger system/organization and devise the root definitions for each sub-system. This process assisted in understanding which sub-systems needed to feature in the notional system in order for it to represent a plausible system that still served its needs. The notional system would need to consider the institutional culture in every structure and function, for example:

Table 1. Relevant sub-systems and their Root definitions

Relevant sub-system	Root Definition
Professional Development quota system ^{*1}	'A system to monitor and measure teacher educators professional achievements with regards to research productivity output, community engagement and teaching load.'
Science and Technology teaching and learning system ^{*2}	'A system owned by the University and run by the Science and Technology teacher educators, which aims to deliver a <i>good education</i> to Bachelor students, that is in line with University and greater education policy.'
Research system ^{*3}	'A system involving academics investigating their own and others practice in order to improve teaching and learning and publish significant findings that contribute to the field.'
National Curriculum system ^{*4}	'A system stipulating what knowledge, skills and values learners in schools need to acquire, thereby influencing what teacher education curricula should prepare student teachers for.'
Academic Qualifications system ^{*5}	'A system guiding institutions about what minimum qualifications employees require to hold a particular position and perform a particular duty.'
Tertiary Module Curriculum Design system ^{*6}	'A system monitored by exams board, serving to approve or decline proposed curriculum additions or changes made by applying academics or disciplines.'
Institutional Culture system ^{*7}	'A highly established system that underpins institutional objectives which guide and support certain activities and research at the institution.'

The relevant sub-systems are all sub-systems of the particular Science and Technology Department within the greater University Organization. These relevant sub-systems are considered in the construction of a conceptual model of a notional system for Science and Technology teacher education for sustainable development (Figure II). This consideration can be viewed by the superscripted numbers ^{*1-7}.

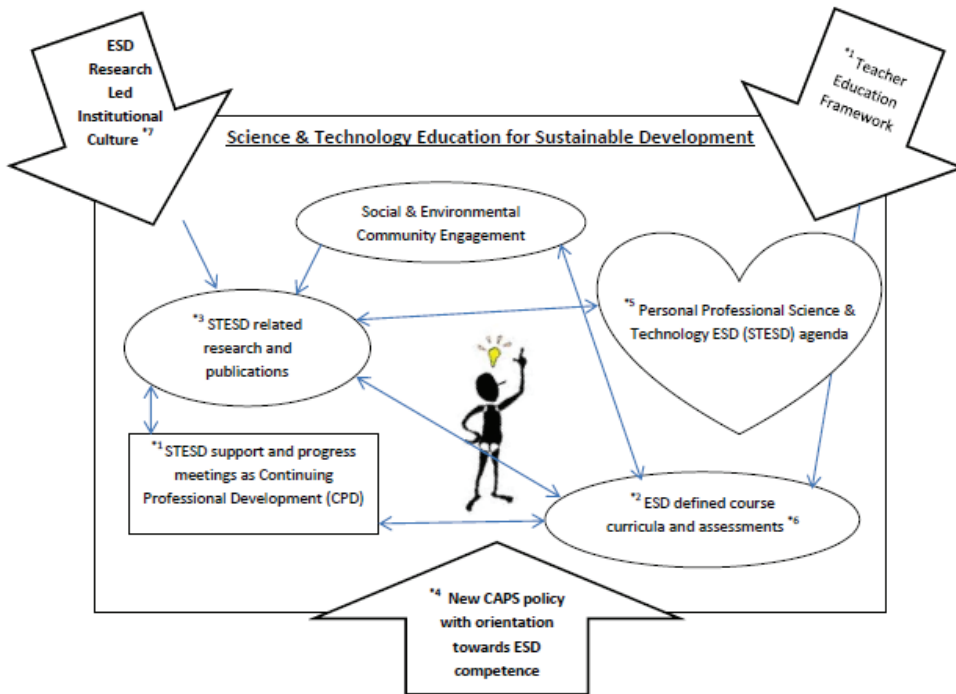


Figure II. A notional system of Science and Technology Teacher Education for Sustainable Development

Figure I and II were revealed to teacher educators through a power-point presentation during the focus group. Knowledge of the situation (as depicted in Figure I and Table 1) and knowledge of ESD support structures (E.g. ESD oriented curricula and research) assisted the researcher in creating Figure II.

The conceptual model suggests that ESD would need to be a research focus which could inform the development of an ESD defined curriculum. This way ESD would not simply be added to the workload, rather it could be used as a focus that would help to merge research and curriculum design in a complimentary fashion. Professional development could therefore be linked to this objective as well.

Figures I and II would further be used to spark debate amongst the participating academics. Academics reflected on what they thought about the notional system and whether or not they saw the need and ability to bridge across to the notional system idea.

4.3. Sparking debate around a Notional system for ESD in Teacher Education

The purpose of the focus group interview was to identify teacher educators' responses to the suggested conceptual model of Science and Technology teacher education for sustainable development. Teacher educators reflected on the obstacles, challenges and possibilities of engaging the notional system. From the discussion the study attempts to make supported conclusions about the potential future for ESD in this particular case.

4.3.1. Using research to promote ESD oriented curricula

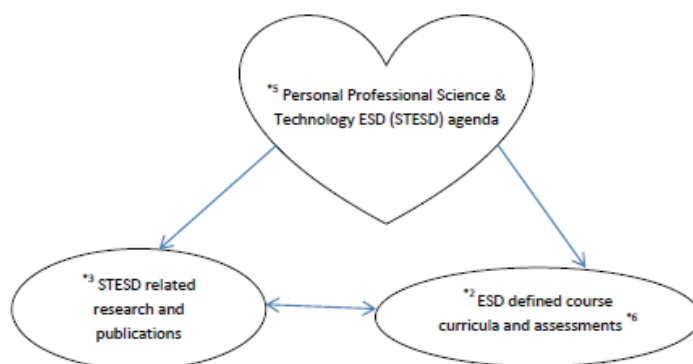


Figure III. Linking research to curriculum development

Figure III represents a portion of the notional system picture that teacher academics focused on. Teacher educators reflected on the link between research and curriculum development. They talked about the possibility of using their research interests to develop their existing curricula. Collaborative research also seemed to be a topic that had been explored in strategy meetings before. Teacher educators consequently showed interest in exploring the broader theme of ESD through all personal research interests. Berta (seen as the leader of the Technology department) offered encouragement to teacher educators wishing to engage in ESD-oriented research for ESD oriented curriculum development. Teacher educators displayed a desire for leadership in such an activity however, Berta displayed a desire for teacher educators to run with the project on their own and be agents of their own professional development.

Dora, a Technology educator, responded that using research as a tool for curriculum design would pose as a challenge owing to the different personal professional interests that different academics have. However Lauren, a Science educator said:

We are at a stage of thinking of doing collaborative research [...] we are all in our specific subjects and look at it in that way so that we come up with one research covering a number of areas. However, I think that is a very good idea that the research that is done is done together and then we are looking at the different subjects.

In summary, Lauren was of the opinion that collaborative research would be possible if the research foci fell into a larger common focus.

Examining the different research interests of the academic participants revealed: Technological design, policy development, indigenous knowledge systems, relevant technology education and conceptual knowledge development. One can imagine how a focus on Sustainability could permeate these topics. Education for sustainable development does not only include content that looks at the integration of economy, society and the environment, it also focuses on pedagogical methods that promote problem solving using various forms of knowledge, futures thinking, active agency and decision making.

Amy's research interest looks at Indigenous Knowledge Systems (IKS). Amy shared her desire to develop Indigenous Knowledge Systems in her teaching, which after she was shown a slide on UNESCO's ESD principles (also shown in the power point presentation) identified it as relevant to ESD. Alternate forms of knowledge are considered valuable to exploring sustainable choices (UNESCO, 2002). "Then it makes whatever I am researching more...worth the while. [...] allowing students to learn from what I have already experienced in IKS, so I'm definitely going to try next year, to try and do that."

When the researcher asked what would assist her in achieving this goal, Amy replied it would take her own research and professional interest to make it happen. Berta provided support commenting that it would take a lot of specific reading and should be carefully thought out in order to provide quality material to the course. Berta was providing confirmation to Amy that if she wanted to make changes to a course she had the freedom but needed to put in the effort to make sure it met institutional standards. It was at this point that Berta reflected on the lack of community engagement. Berta felt that research was the perfect gateway to addressing community action and that this was up to individuals to once again express their agency. How can teacher educators promote action competence if they themselves lack this?

David draws attention to the fact that research and leadership are major contributors to change in the department and its curriculum.

I think that the issue of collaborative research has a big role to play in the sense that, if we can all be engaged in collaborative research, we can be in a position of contributing positively towards revamping our course modules. For instance with our Technology B.Ed. module a lot of revamping has been done, but so far there is one key player (indicates with his hands that he is referring to Berta) [...] she actually does that delegation, which is one way of...which is actually empowering us and I should think also it's like a push behind to say, you know, go for it. [...] With that kind of support I see that there is a possibility that we can take this discipline to a higher level (gestures his hand towards the two models on the white screen).

It is clear that Berta's delegation has been most instrumental in empowering David and the others thus far and he feels that she can further inspire and empower them to make changes towards an ESD focus. This is significant in that it highlights a dependence on the Head of the Department. Berta herself however tries to push this back in the direction of her colleagues stating that it is something that they will need to want to do and consequently need to do the groundwork. Currently Berta is focused on a different curriculum initiative: relevant technology education. It looks at how students can learn in the work place, about Technology and real design. This has consumed her focus. Although it may be linked to ESD it does not embrace all principles of ESD substantially, focusing mostly on Technology for social and economic development. At what point do both the leader and the colleagues join together? (Who waits for whom? Is it a case of waiting or is it a case of excuse making owing to workload and the overwhelming feeling of not having enough time to get it all done?)

Considering this, the aspect of the notional system picture depicted in Figure II that needs to be given attention is professional development support. In order for a STESD support system to work it would have to be based on teacher educator's practice, reflection on their practice (research) and further supported by leaders and management.

4.3.2. Academics question their autonomy

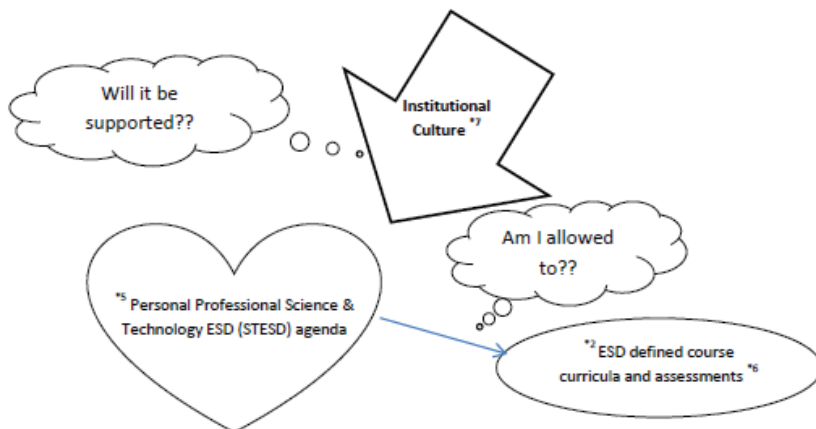


Figure IV. Teacher educators question their autonomy to change the status quo

This part in the discussion revealed that teacher educators did not feel confident in the amount of agency they could exercise. This uncertainty was dictated by a perceived lack of status due to: (1) not having a PhD; (2) insufficient support from and meetings with 'experienced' academics; as well as (3) pressure to align personal interests and activities to university culture.

Teacher educators turned to talking about the re-curriculation process that was going on. They commented that this forced them to enter many meetings which consequently took up a lot of their time but recognised that it was for a good cause. However some of the less experienced academics felt as though their input was not valued. Dora comments:

I think position is very important, maybe in terms of those priorities where the second was to produce more doctoral students, certainly people without those qualifications are not recognized. We were part of the restructuring and suddenly we are not anymore

Lauren wanted to invite some support to the re-circulation meetings, to assist her in the design of her Science curriculum as she was the only academic doing her subject. However, she felt that it was not in her jurisdiction to do so, only to be informed by Berta that it was an open forum. This came as a surprise to Berta who did not realise that this was how some of the academics were feeling. This reveals how such focus group discussions have the ability to emphasize the hidden dynamics that academics experience, which only emerge once academics are given a specific focus and an open forum for discussion. This forum allowed academics the opportunity to finally voice hidden assumptions which could now be clarified and challenged.

Lauren felt that there was little in the way of sit down support meetings from more experienced academics and that this was attributed to those academics limited time. Berta however, challenged the presented situation by asking her colleagues who they thought should be responsible for setting up these opportunities for development. Berta commented that they all had the power but were not using it.

It appears at this point in the discussion that some academics express that their autonomy is limited according to their qualification and experience, limiting their input to the design of the B.Ed curriculum. The less experienced academics share the comments and challenges that they have endured regarding their autonomy. They try to tread the delicate line between innovative practice and offending colleagues who have been there for years and who have taught the courses before them. Berta however, strongly feels that their autonomy is linked to their agency and willingness to try out new things.

Academics also felt that their autonomy was limited according to the University culture, in terms of the research agendas that were promoted and received funding. Teacher educators whose research areas did not fall in the University Niche areas received little support in the way of recognition and funding. This indicates that research agenda relating to ESD would also suffer the same challenge.

4.3.3. Opportunity for innovation is limited by ability and expectations

Teacher educators referred to many barriers that could possibly limit them to embedding ESD in the curriculum.

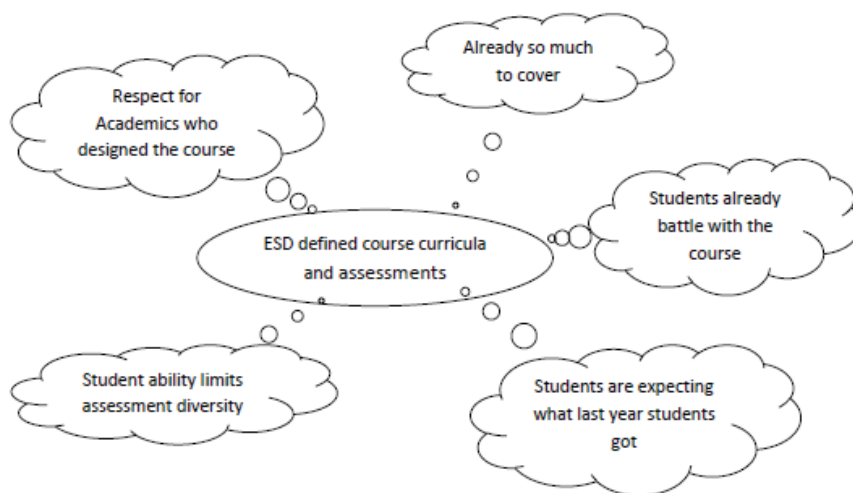


Figure V. Teacher educators’ thoughts on the barriers to embedding ESD

Dora expressed that she felt restricted by the course requirements and the experienced academics who had taught the course before her:

What about the fact that the courses are already designed, we have a framework, we only allowed to change a course a certain percentage. [...] What if you feel there isn't enough of these things in it (referring to ESD principles)? It's kind of the course you have been asked to do, so.

She also added an interesting comment that displayed quite clearly, how she and others misconceive ESD as simply adding to an already overloaded curriculum.

I enjoy developing material so, if I could, I would design all my courses, but obviously you can't just have somebody designing their own courses on their own because who knows what they will put in their courses, maybe they are not covering what needs to be covered, [...] there's so much that you have to

cover, that you are bound to in the framework but also you need to bring in more of your own stuff, and how much can you do that?

ESD is not seen as a methodology here but rather as content on SD issues. This is a limiting conceptualization of ESD and may result in the decision not to incorporate this much needed curriculum in this and/or other contexts.

Dora and Amy added that students' expectations posed another challenge to making changes in the curriculum. Students contested the course saying their friends didn't have to do certain tasks and content the previous year so why should they be expected to do it this year. It seems as though students who have done the course previously inform current students as to what to expect from the course and when these expectations do not meet the course activities and content, students become difficult to manage. Students seem to be very aware that they are clients to the greater business of the University.

Apart from student expectations, student calibre can also offer a barrier to the types of activities and assessments that teacher educators engage their students in. Berta refers to one particular ESD principle that they are finding difficult to ensure due to student calibre.

..we are finding the last one a bit of a challenge ("Uses a variety of pedagogical techniques that promote participatory learning and higher-order thinking skills [critical and creative thinking]") Promoting higher order thinking skills. [...] people were writing in and complaining about the level of our students that they don't know how to do this and they cannot do that. I think we all want to develop higher order thinking skills, and promote it in our teaching but I suppose we crossed it off. A lot of people say that because of the nature of the level of students we have, we are not able to achieve that.

All participating academics commented on the calibre of the students and how this often limited their ability to design assessments that challenged them. Academics feel as though they are teaching to merely pass their students as opposed to challenging them to engage in higher order thinking skills thus becoming effective decision makers in society.

Teacher educators revealed their ideas on the barriers they would encounter when attempting to engage figure II. The barriers they identified also revealed that teacher educators own limited conceptions of ESD: (1) as an adding to the existing curriculum, as opposed to using SD issues as a tool to explore course content in a meaningful manner; and (2) as a process of redesigning the entire course curriculum, as opposed to using existing course curricula to explore SD issues in an informed and participatory manner; (3) as a process of devising assessments that students find difficult engaging with, as opposed to the designing of assessments that are learner centred and contextually relevant.

4.3.4. ESD is an important curriculum innovation

Dora reflected on the importance of ESD and the possibility of incorporating it into curricula and practice:

I think we all kind of think it is important, an important aspect. [...] So maybe that's what we need, almost like an action plan in looking at that, and maybe when we reach in the bottle of 'too busy', 'too much this', 'too much that', it is what's stopping us. But if we do want it then I think it's attainable but we just have to put the steps in place.

This comment was most remarkable. For one week later when we attempted to start an email conversation about plans of action, we received only two replies and they stated that they were too busy preparing for exams and designing the next semester's modules. Perhaps the point is that ESD at this point, and for various reasons already revealed (re-curriculation, incorporation of the new CAPS curriculum, research publications, studying to attain their qualifications, lack of University research agenda and consequently funding) is not a priority. This is not an attempt to condescend to these academics, rather this is an attempt to highlight the importance of making ESD a major policy concern for Higher Education as well as making ESD a pertinent focus for Institutional Mission Statements (linked to university culture), not to mention be incorporated into their research agenda as an attempt to meet the national responsibility towards Sustainable Development. Academics alone cannot be loaded with unsupported responsibility, when they are subject to so many other priority concerns.

Lauren added to Dora's reflection stating that: "The language is too high for me. We don't speak that. That's far beyond us." And shortly afterwards stated: "...it depends on what an individual...how they want to structure their time around that." Lauren continued to reflect directly on the two figures presented in the power-point presentation:

I am saying that's the model of thinking all over (referring to the rich picture) but the next model (notional system) that you showed can be a way of making the first model smarter and then it would be easier for one to achieve all of those things. If we each looked at the links, so how I can use my teaching to do my publications. So it means my students will be my participants. So whatever I see there and the report that I write about it will be the paper that I write so I can still work smart in using those links so that I don't

find myself being spread out all over. So it depends on me as an individual to structure those things in a way that will work for me.

Lauren's comments reveal that academics to some extent feel that they do have the autonomy to affect change however that autonomy is contaminated when all other factors have to be considered. These factors include workload, university culture and whether or not they feel ESD is significant enough for a reorientation of professional practice.

All academics expressed the importance of addressing ESD. In some ways they felt that they were already doing so through their subjects and that the nature of their subjects in some cases lent itself to address some of these principles. The issue remains, without a conscious and overt intention towards the principles of ESD, student teachers and their learners will not be sufficiently aware of the sustainability issues that are rife, the complexity of these issues and the actions that one can take in order to make meaningful decisions about these issues.

5. Implications for Future ESD orientation in Teacher Education

During the construction of the rich picture, teacher educators revealed through one-on-one interviews that there were a number of basic issues that they afforded priority in their practice. These issues covered areas pertaining to: the change from the old curriculum 2005 to the new CAPS curriculum and this impacted their course design; the demands to get a PhD and to publish articles; the promotion of University valued scarce skills and professionalism; the increasing workload due to student numbers and changing academic roles; and the need to engage in community engagement which they felt they never have time for. These were issues that the teacher educators identified.

During the development of the notional system for teacher education for sustainable development, it was identified that the University consisted of seven relevant sub-systems. These sub-systems indicated that seven attributes needed to be considered and incorporated into the notional system for it to be representative of the context and thus workable. These seven sub-systems covered the following areas: professional development, Science and Technology teaching and learning, research, national curriculum, academic qualification, curriculum design quality board, and the institutional culture.

Although a working system was proposed by means of figure II, a focus group discussion revealed emergent challenges and barriers. These included: (1) if collaborative research was engaged by the Science and Technology education department, owing to ESD not being recognized by the University policy and culture, it is unlikely that academics would receive much support from the Institution; (2) academics felt they needed leadership from the head of department to guide them through the unfamiliar territory, however the head of department felt that academics should be their own agents of change (who would make the first move?); (3) Academics expressed they have the ability to design curricula and affect change, however they are careful not to offend previous lecturers of the course, or they find the process to apply for the rights to make changes to existing courses, too monitored and complicated; (4) also factors such as student expectations and calibre, time availability, student numbers, lecturer experience and status, as well as national curriculum focus, all impact and restrict their autonomy; (5) Finally ESD curriculum innovation was deemed important yet due to the basic issues and task related areas mentioned earlier, it was not a priority focus. However, teacher educators did express that if ESD was recognized in existing institutional culture and policy as well as in the national curriculum, it would serve as a greater motivation for collaborative research and course curriculum design.

These findings suggest the need for a Continuing Professional Development (CPD) support sub-system. This relevant sub-system would enable teacher educators to gain a better conception of what it would mean to embed ESD in the Science and Technology teacher education department. A CPD support sub-system would help to build autonomy and agency as teacher educators of various degrees of experience pool their resources in order to improve teaching and learning.

According to Jansen (2004), autonomy has always been contentious in South African Higher Education. Government requires all qualifications offered at universities to comply with the new National Qualifications Framework and so academic qualifications undergo rigorous quality-assurance procedures. Linked to autonomy is the issue of 'management and governance'. Universities are expected to produce strategic plans for every aspect of the university, producing 3–5 year plans, which has been motivated by the government to ensure performance against government expected outputs. Functions such as finance, budgeting, student administration and quality assurance have been taken out of the hands of the academic departments, forming separate departments within the university.

Participating academics reflected on the detailed procedure that they would need to engage should they wish to change their module design significantly. Academics described this as 'limited autonomy' and a barrier to trying new innovations in the field of teaching and learning. On the topic of autonomy, academics expressed how the University funded research that was embedded in particular agenda and how publications in these areas also

secure status. If these are the institutional priorities then soon enough they become academic's priorities, who soon realize it is a case of sink or swim.

According to Jones, Trier and Richards (2008) 'time' can be considered an internal obstacle or factor influencing the implementation of ESD. This is because the 'time' required to embed ESD into any particular curriculum, requires varying amounts of motivation and energy input, which is individually determined. Academics often reflected on time which indicates the low level of motivation for the innovation in the first place.

At this point, after considering the barriers opposing educational change in TEI's, it is not surprising for one to pause for a moment and ask: What is the motivation for teacher educators to adopt an ESD approach to education? For us the answer is simple: An education that claims to be democratic must offer citizens an opportunity to engage in a meta-analysis of their own identity and participation as a citizen. Any education that does not allow learners to critically reflect on the impact that individual actions have on others and future generations, is a democracy-deficient education (Huckle & Wals, 2015). The shift that South Africa and the world have made towards a neoliberal economic participation has served to push democracy out of our reach. A sustainable and democratic citizen values the even distribution of environmental resources, ensuring that this citizenship extends beyond geographical and generational borders (Huckle, 2014; Huckle&Wals, 2015). A more relevant question is: What are leaders in teacher education doing to reveal this ESD imperative to teacher educators whom are supposedly driving *transformational* teaching and learning?

Within this particular teacher education department, recall two specific ESD aligned foci were mentioned as professional interests: Indigenous knowledge systems and critical thinking. According to UNESCO (2014) the contribution of cultural diversity (respecting and valuing difference) and indigenous local knowledge to initiatives of sustainable development are vital for their success. Therefore a motivation for teacher educators to engage ESD could be that it provides a meaningful platform for the exploration of indigenous knowledge systems. Turning now to critical thinking, Huckle (2014) reflects on the avenues ESD provides for the engagement of critical discourse analysis. Huckle (2014, p.231) supports his claim by referring to Friere and Dewey's concept of a democratic education, one in which co-operative reflective dialogue leads learners in discovering a more truthful meaning of their world. What is being spoken about here is a transformational teaching and learning, one that serves to empower learners as opposed to confining them.

Although TEIs are in the business of developing teaching and learning, they are also largely concerned with research productivity (sometimes to the demise of their primary function of teaching and learning). There is no reason why it should be a case of one or the other. Through an integrated ESD approach, such as is the case with 'eco-schools', teaching and learning itself may be transformed simultaneously addressing contemporary research interests (Huckle, 2014). ESD provides a critical discourse analysis of education itself, constantly questioning the principles on which education has been designed and the motivations for these. ESD is a leading educational initiative and therefore provides a leading research agenda.

ESD is so much more than an afterthought or an overlay to see how much we can identify in what we are already doing. According to Tilbury (2011) sustainable development "engages universities and colleges in a quest for inter-disciplinarity, participatory pedagogies, 'real world' research as well as the opening of institutional boundaries so that the notion of sustainable communities is extended beyond university and college walls." (ibid, p.2) She adds that all of these aspects need to connect in a meaningful way. Of concern, is that over the years leading researchers in the field of SD and ESD have identified that higher education institutions are still very far from a meaningful ESD orientation and those institutions that are integrating ESD are mostly doing it in a piece-meal way (Sterling, 2004; Sterling & Scott, 2008; Lambrechts, Mula, Ceulemans, Molderez & Gaeremynck, 2013). The Earth Charter urges that we: "Provide all, especially children and youth, with educational opportunities that empower them to contribute actively to sustainable development." (UNESCO, 2000)

In order for a successful embedding of sustainable development competences into the curriculum, it is pertinent that management be involved in the initiative (Jain, Aggarwal, Sharma and Prateek, 2013). As displayed by David, rising academics are looking for leadership and guidance towards what is to be deemed 'important'. At the moment academics look to management who identify certain research agenda as important, and not one of those refer to SD. Academics are encouraged to publish in order to secure promotion, to deliver what the University values and ultimately 'what the country needs'. However, who critiques these perceived 'needs' of the country? National demands for social and economic development at the loss of our natural resources, popularly represents the perceived needs of the country. At what point does a University enact its autonomy in correcting society about what the country actually needs? This will never take place if University policy does not promote transformative learning and is not itself informed by current research in SD.

According to Rieckmann (2012) higher education in a changing world, is not only about developing people's abilities to acquire and generate knowledge, but it is also about enabling people to reflect on the effects of their own behavior and decisions. "...absolutely essential is a new learning culture which does not confirm academic tradition but examines its potential for a sustainable future, in an open-minded, reflexive and participative process." (Rieckmann, 2012, p.128)

We pose that in order for education to be equipped to address sustainable development challenges in South Africa, ESD needs to become the culture of more and more Higher Education Institutions and more specifically, teacher education institutions. According to Lozano et al. (2013) the university system, its curricula, research, assessments, community activities and policies can be oriented towards sustainable development by: collaborating with other universities; introducing programmes that inform educators and by making Sustainable Development part of university culture. This study reveals the system factors that influence innovation and that offer barriers to ESD implementation. The lack of agency which seems to be influenced by the perceived lack of autonomy plays a large role in the design of module curricula. Whether this 'lack of autonomy' is employed as a scapegoat to action is impossible to speculate. It is also rather irrelevant, when it is strongly apparent that university culture and priority as well as national school curricula are key informers of professional practice. Added to the challenges however, is the lack of knowledge about what ESD advocates and entails.

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11. Appendix 1 - Web-based survey

Dear

I must thank-you for taking the time to read this request. I am a doctoral student of the University of Life Sciences in Norway. I am South African however I was awarded a scholarship to further my studies abroad. My research interest lies within the teacher training institutions in South Africa. My research title is currently:

An investigation of Education for Sustainable Development policy interpretation and implementation at teacher training institutions in South Africa

The very first phase of data collection involves a wide scale web-based survey to as many (if not all) teacher training institutions in South Africa.

This survey has been set up on a web interface, allowing academics to fill it in with the least amount of effort and demand for time (estimated at 15 – 20 minutes). Each completed response will only be traced back to the institution, but never to the individual academic, hence the preferred use of the web-based survey technique. The name of the institution will never be revealed in relation to Data and findings, and the name of the institution is only requested to assist categorization of data sets. The completion of this study is estimated to be the 31 August 2013, at which time the data from this study will be published, taking care to ensure anonymity and confidentiality.

I would be so grateful should you find time to fill out the survey. Please note that your participation in this survey is completely voluntary. Please click on this link to fill in the web-linked survey:

https://docs.google.com/spreadsheet/viewform?hl=en_US&formkey=dDM2N1BnVIFeWQ4ZjFDVlBxTWlVVI6MQ#gid=0

Thanking you kindly

Hayley Bentham

Cell: 079 2262702

Email: genisat@gmail.com

Section for Teaching and Learning

Norwegian University of Life Sciences

Briefly indicate which department/discipline you work in at the faculty of Education

4. The table below lists knowledge, skills and attitudes.

The level of attention that the development of these knowledge, skills and attitudes are given Personally (As a personal employee endeavor) and Institutionally (In compliance with Institutional policy) can be ranked:

Ranking:

0 – Not sure what attention is given to this/Does not apply to my employee obligations

- 1- No attention is given to this**
- 2- Occasional attention is given to this**
- 3- Attention is Often given to this**
- 4- Attention to this is Main priority**

Regarding student content knowledge

		0	1	2	3	4
a. Develop student knowledge of biophysical systems, their potentials and limits	Personally					
	Institutionally					
b. Develop student knowledge of the technologies societies use to 'exploit' these bio-physical systems and the environments they create in the process	Personally					
	Institutionally					
c. Develop student knowledge of the economic systems that shape investment in environmentally appropriate or inappropriate technologies. Eg. Investing in automobile companies as opposed to the public transport sector	Personally					
	Institutionally					
d. Develop student knowledge of the political systems (local, national, regional and international) which regulate the social use of bio-physical systems and the environment Eg. National coastal regulations on fishing and use of four wheeler vehicles on sand dunes	Personally					
	Institutionally					
e. Develop student knowledge of social systems (the economic, political, civil and private spheres of people's lives) which embrace the interests, power and strategies of different racial/gender/religious/economic/groups	Personally					
	Institutionally					
f. Develop student knowledge of the different cultural systems (technologies, beliefs and values), and how these may help or hinder people in understanding and/or improving their environmental predicament Eg. Traditional sustainable ways of cultivating indigenous medicinal plants.	Personally					
	Institutionally					

Regarding student Skills and Values

g. Students are encouraged to engage in verbal debate about sustainability issues. Eg. Debates about development versus conservation	Personally					
	Institutionally					
h. Students are encouraged to draw connections between their discipline and society, the economy and the physical natural environment. Eg. Recognising the social, economic and environmental factors connecting to the study of Physics/Mathematics/Development studies etc.	Personally					
	Institutionally					
i. Students are encouraged to engage in contextually (locally) relevant problem solving. Eg. Students engage in community development projects towards bringing water to the community for food production.	Personally					
	Institutionally					
j. Students are encouraged to engage in sustainable development actions. Eg. Students take on an activist roles in addressing issues concerning the interconnections of society-economy-environment and policy	Personally					
	Institutionally					
k. Students are encouraged to become part of knowledge production. Eg. Students are encouraged to add to the knowledge field by adding absolutely new data/knowledge through the engagement in novel investigations.	Personally					
	Institutionally					
l. Students are encouraged to think critically. Eg. Students do not blindly accept knowledge but challenge/question its authenticity	Personally					
	Institutionally					
m. Students are encouraged to think creatively. Eg. Students are given the freedom to explore topics and ideas in a way that realizes individuality and ingenuity.	Personally					
	Institutionally					
n. Academic takes time to examine the current curriculum for topics relevant to local and/or global sustainability	Personally					
	Institutionally					

- 5. The following questions in this section are linked to your previous responses regarding the level of attention given to certain knowledge, skills and attitudes listed.**

Instruction: Please tick the factors that you think most influence the address of the knowledge, skill or value indicated above the table.

- a. The development of student knowledge of biophysical systems, their potentials and limits**

Faculty Policy	
Academics' Personal Interests/Knowledge	
Available Finances	
Faculty Interest/motivation/emphasis	

National Policy/guidelines	
Institutional tradition	
Colleague support	
Students interests/demands	
Available time and number of students	
Relevance to the Course/module	

If 'Other' factors are more influential please state them briefly

- b. The development of student knowledge of the technologies societies use to 'exploit' these bio-physical systems and the environments they create in the process**

Faculty Policy	
Academics' Personal Interests/Knowledge	
Available Finances	
Faculty Interest/motivation/emphasis	
National Policy/guidelines	
Institutional tradition	
Colleague support	
Students interests/demands	
Available time and number of students	
Relevance to the Course/module	

If 'Other' factors are more influential please state them briefly

- c. Develop student knowledge of the economic systems that shape investment in environmentally appropriate or inappropriate technologies. Eg. Investing in automobile companies as opposed to the public transport sector**

Faculty Policy	
Academics' Personal Interests/Knowledge	
Available Finances	
Faculty Interest/motivation/emphasis	
National Policy/guidelines	
Institutional tradition	
Colleague support	
Students interests/demands	
Available time and number of students	
Relevance to the Course/module	

If 'Other' factors are more influential please state them briefly

- d. Develop student knowledge of the political systems (local, national, regional and international) which regulate the social use of bio-physical systems and the environment**
Eg. National coastal regulations on fishing and use of four wheeler vehicles on sand dunes

Faculty Policy	
Academics' Personal Interests/Knowledge	
Available Finances	
Faculty Interest/motivation/emphasis	
National Policy/guidelines	
Institutional tradition	
Colleague support	
Students interests/demands	
Available time and number of students	
Relevance to the Course/module	

If 'Other' factors are more influential please state them briefly

- e. Develop student knowledge of social systems (the economic, political, civil and private spheres of people's lives) which embrace the interests, power and strategies of different racial/gender/religious/economic/groups**

Faculty Policy	
Academics' Personal Interests/Knowledge	
Available Finances	
Faculty Interest/motivation/emphasis	
National Policy/guidelines	
Institutional tradition	
Colleague support	
Students interests/demands	
Available time and number of students	
Relevance to the Course/module	

If 'Other' factors are more influential please state them briefly

- f. Develop student knowledge of the different cultural systems (technologies, beliefs and values), and how these may help or hinder people in understanding and/or improving their environmental predicament** Eg. Traditional sustainable ways of cultivating indigenous medicinal plants.

Faculty Policy	
Academics' Personal Interests/Knowledge	
Available Finances	
Faculty Interest/motivation/emphasis	
National Policy/guidelines	
Institutional tradition	
Colleague support	
Students interests/demands	
Available time and number of students	
Relevance to the Course/module	

If 'Other' factors are more influential please state them briefly

- g. Students are encouraged to engage in verbal debate about sustainability issues. Eg. Debates about development versus conservation**

Faculty Policy	
Academics' Personal Interests/Knowledge	
Available Finances	
Faculty Interest/motivation/emphasis	
National Policy/guidelines	
Institutional tradition	
Colleague support	
Students interests/demands	
Available time and number of students	
Relevance to the Course/module	

If 'Other' factors are more influential please state them briefly

- h. Students are encouraged to draw connections between their discipline and society, the economy and the physical natural environment. Eg. Recognising the social, economic and environmental factors connecting to the study of Physics/Mathematics/Development studies etc.**

Faculty Policy	
Academics' Personal Interests/Knowledge	
Available Finances	
Faculty Interest/motivation/emphasis	
National Policy/guidelines	
Institutional tradition	

Colleague support	
Students interests/demands	
Available time and number of students	
Relevance to the Course/module	

If 'Other' factors are more influential please state them briefly

- i. Students are encouraged to engage in contextually (locally) relevant problem solving. Eg. Students engage in community development projects towards bringing water to the community for food production.**

Faculty Policy	
Academics' Personal Interests/Knowledge	
Available Finances	
Faculty Interest/motivation/emphasis	
National Policy/guidelines	
Institutional tradition	
Colleague support	
Students interests/demands	
Available time and number of students	
Relevance to the Course/module	

If 'Other' factors are more influential please state them briefly

- j. Students are encouraged to engage in sustainable development actions. Eg. Students take on activist roles in addressing issues concerning the interconnections of society-economy-environment and policy**

Faculty Policy	
Academics' Personal Interests/Knowledge	
Available Finances	
Faculty Interest/motivation/emphasis	
National Policy/guidelines	
Institutional tradition	
Colleague support	
Students interests/demands	
Available time and number of students	
Relevance to the Course/module	

If 'Other' factors are more influential please state them briefly

- l. Students are encouraged to become part of knowledge production. Eg. Students are encouraged to add to the knowledge field by adding absolutely new data/knowledge through the engagement in novel investigations.**

Faculty Policy	
Academics' Personal Interests/Knowledge	
Available Finances	
Faculty Interest/motivation/emphasis	
National Policy/guidelines	
Institutional tradition	
Colleague support	
Students interests/demands	
Available time and number of students	
Relevance to the Course/module	

If 'Other' factors are more influential please state them briefly

- m. Students are encouraged to think critically. Eg. Students do not blindly accept knowledge but challenge/question its authenticity**

Faculty Policy	
Academics' Personal Interests/Knowledge	
Available Finances	
Faculty Interest/motivation/emphasis	
National Policy/guidelines	
Institutional tradition	
Colleague support	
Students interests/demands	
Available time and number of students	
Relevance to the Course/module	

If 'Other' factors are more influential please state them briefly

- n. Students are encouraged to think creatively. Eg. Students are given the freedom to explore topics and ideas in a way that realizes individuality and ingenuity.**

Faculty Policy	
Academics' Personal Interests/Knowledge	
Available Finances	
Faculty Interest/motivation/emphasis	
National Policy/guidelines	

Institutional tradition	
Colleague support	
Students interests/demands	
Available time and number of students	
Relevance to the Course/module	

If 'Other' factors are more influential please state them briefly

- o. Academic takes time to examine the current curriculum for topics relevant to local and/or global sustainability**

Faculty Policy	
Academics' Personal Interests/Knowledge	
Available Finances	
Faculty Interest/motivation/emphasis	
National Policy/guidelines	
Institutional tradition	
Colleague support	
Students interests/demands	
Available time and number of students	
Relevance to the Course/module	

If 'Other' factors are more influential please state them briefly

- 6. To the best of your knowledge, does your Institution run environmental education based courses?**

Yes No Unsure

- 7. To the best of your knowledge, does your Institution at any level employ sustainable development foci?**

Yes No Unsure

- 8. Only Answer this questions if you are a Lecturing Academic**

- a. Do you as a Lecturing Academic implement aspects of Sustainable Development in your practice?**

Yes No Unsure

b. Mark the options that are appropriate to how *You* implement aspects of Sustainable Development into your practice.

- Community development projects
- Research endeavors
- Course/Module content
- Course/Module Assessment
- Through examples used in lecture delivery
- Extra-curricula clubs/societies
- Other

c. Please select the level of encouragement that is provided to motivate students to engage in specified actions below.

0 – No support is provided for this

1 - It is hoped that this takes place

2 – Students are verbally encouraged

3 – Students are encouraged via assessment strategies and other support structures

What level of encouragement do you provide student teachers to motivate them to:

	0	1	2	3
Develop critical thinking in their teaching at schools				
Develop creative thinking in their teaching at schools				
Engage their learners (during practice teaching) in debates around sustainable development issues				
Engage their learners in systems thinking , whereby they promote the interconnections between discipline(s) knowledge, society, economy and the environment				
Engage their learners in active participation in the address of local sustainability issues				

Engage their learners in problem solving and relevant decision making that considers social and environmental sustainability.				
Use local natural environments as a teaching tool in the attempt to instill a sense of responsibility towards the sustainability of the social and natural environment				
Use science and technology effectively and critically in their teaching, showing responsibility towards the environment and the health of others.				
Understand their learners world views and cultural assumptions and use these as a starting point for addressing sustainable development issues				
Explore the successes and failures of past developments in order to show learners how we can learn from the past to ensure a more sustainable future				
Be critical reflective practitioners who are open to and see the need for ‘educational change’				

9. How do you understand the concept of educating students towards sustainable development?

10. Do you freely consent to the researcher adding this anonymous information provided above to a larger data set that will be used as part of a PhD research project?

Yes

No

Gratefully Thanking you for your Participation

And Time!

12. Appendix 2 – Emergent codes and categories

Code	Meaning	Category
RT1	Research Topic: IKS	Research (R)
RT2	Research Topic: Learning in Sci & Tech	
RT3	Research Topic: Design	
RT4	Research Topic: Integration of Science and Technology	
RT5	Research Topic: Responsible Community Engagement	
RT6	Research Topic: Teacher professional development	
RT7	Research Topic: Relevant Education	
RT8	Research Topic: Pedagogical Content Knowledge of 'Chemical Equilibrium'	
RT9	Research Topic: Social Development in Technology Education	
RT10	Research Topic: How to encourage creative thinking in Technology learners	
RT11	Research Topic: Sexuality Education	
PCfR	Professional Collaboration for Research	
RfAS	Research for African Scholarship	
RP	Research Productivity	
EoC	Evidence of Change	Change (C)
FfC	Factors motivating for Change	
AfC	Attitudes for Change	
PCfC	Professional Collaboration for Change	
PD	Professional Development	
RC	Resistance to Change	
ESD(KC)	ESD Knowledge Competency	ESD
ESD(S)	ESD Skills	
ESD(V)	ESD Values	
AESD	Against an ESD principle	
LESD	Lack of ESD principles	

Code	Meaning	Category
UoESD	Understanding of ESD	
PPI	Personal Professional Interests	Professional Identity (PI)
PQ	Professional Qualifications	
PA	Professional Autonomy	
PR	Professional Roles	
PE	Professional Experience	
SPD	Self-directed Professional Development	
PC	Professional Collaboration	
PKG	Professional Knowledge Gap	
FgPP	Factors guiding Professional Practice	
IoTC	Ideas on Teacher Competence	
CT1	Curriculum Orientation Theme 1: Design	Curriculum Development (CD)
CT2	Curriculum Orientation Theme 2: Industry as a context for learning	
CT3	Curriculum Orientation Theme 3: Indigenous Knowledge Systems	
CT4	Curriculum Orientation Theme 4: Responsible Community Engagement	
LRCD	Locally Relevant Curriculum Development	
PCfCD	Professional Collaboration for Curriculum Development	
FfCD	Factors driving Curriculum Development	
SDKF	Strong Discipline Knowledge Focus	
RD	Reconceptualising the Discipline/Programme	Discipline Identity (DI)
DS	Department Structure	
QS	Qualification Standards	
CS	Collegial Support	
CoT	Characteristics of Technology	
CoS	Characteristics of Science	

Code	Meaning	Category
CPA	Curriculum Policy Alignment	
LCE	Lack of Community Engagement	
AoK	Application of Knowledge	
AS	Application of Skills	
PTM	Practical Teaching Methods	Teacher Education Programme (TEP)
PKD	Professional Knowledge Development	
RCN	Responsive to Country needs	
RE	Relevant Education	
QE	Quality Education	
RT	Resourceful Teaching	
QE	Quality Education	Professional Concerns (PC)
RE	Relevant Education	
EE	Empowering Education	
LCE	Lack of Community Engagement	
WL	Work Load	
CPA	Curriculum Policy Alignment	
TA	Time Available	
TC	Teacher/Student Complacency	
PCK	Poor Content Knowledge	
GPC	General Professional Concerns	
AoC	Individuals as Agents of change	Other Pedagogical Philosophies (OPP)
SCK	Strong Content Knowledge	
IE	Indigenous Epistemology as knowing	
LAC	Learning as Active Construction	

13. Appendix 3 – Examples of Coded Data

Data excerpt	Memos	Code	Category
<p>Researcher: "which competencies do you promote in your modules and why, and these don't need to be specific to your concept of ESD but just specific to the competencies that you think are important to promote."</p>	<p>Rebecca is asked about which competencies she promotes and the factors guiding these decisions.</p>	<p>FgPP</p>	<p>PI</p>
<p>Rebecca: "I think the competency where teacher trainees can look at the quality of life of South Africans and currently many South Africans are being impacted by poverty, by disease, by malnutrition, by poor nutrition and the results...the reasons for these are multi-faceted. So what I do is, in my module I am able to...I enable my students to actually think deeply about the reasons behind these social ills and ways in which they can actually address them and we do so in a very tangible way, for example I engage them in a gardening project."</p>	<p>Rebecca would like students to be able to observe and critically reflect on the quality of life of many South Africans and reflect on the multi-faceted reasons for poverty, disease, and malnutrition. Rebecca feels she is able to explore and address these in a tangible way through the gardening project.</p>	<p>ESD(K), ESD(S), ESD(V), PPI, RE, IoT, LAC, AoC, PKD, LRCD, FgPP</p>	<p>ESD, PI, PC, OPP, TEP, CD</p>
<p>Rebecca: "I get help from the botanical society and they assist students in creating compost, organic compost. They assist them in techniques of perma-culture and so my students actually visit with them, the botanical gardens designs a program for my students to enable them to do door frame gardening, an example. And their skills are actually learnt in a hands-on way at the botanical gardens and then they come here and they apply it"</p>	<p>Rebecca gets assistance from experts in the field of permaculture. Students are assisted by the experts from the Botanical Gardens whilst working in their gardens</p>	<p>PCfCD, ESD(TL), AoK, PTM, PC, PKG</p>	<p>CD, ESD, DI, TEP, PI</p>

Data excerpt	Memos	Code	Category
<p>Rebecca: "Then the crops that they plant are researched, it's something that they research and often it has to do with maintenance of good health or management of disease, so in this way they are taught the different practical skills which are involved in food production, they are taught about the underlying reasons for food shortage. Some of these are socio-economic, related to over-consumption, related to excessive use of resources, some of them are socio-political and related to unemployment and poverty and that kind of thing. So they are taught the underlying reason for the social ill, practical skills which enable them to address the problem of food shortage for example and then they are taught...well they are not taught but they are expected to engage in research about the diseases which are related to nutrition and diseases which can be managed through nutrition and then they actually engage in planting the crops and reaping them, so those are some of the competencies that are developed and play out in the Biology Module."</p>	<p>Students have to research the plants they want to plant to identify in what way this plant will benefit the malnourished or diseased individual. They then have to apply the knowledge and skills of food production to create and manage their garden. Students explore socio-economic reasons for food shortage such as unemployment, poverty etc. Students explore the use of certain foods in the treatment of diseases related to nutrition.</p>	<p>RfL, ESD(K), ESD(TL), RE, Aok, AS</p>	<p>TEP, ESD, PC, DI</p>

Data excerpt	Memos	Code	Category
<p>Researcher: ".why do you look at those particular competencies in that module? Rebecca: "Because, the module is designed in a way that allows me to do that. I teach nutrition and I also teach circulation so there are some topics in physiology and my speciality is in human physiology so perhaps that creates a bias towards diseases which are experienced by humans in particular so I teach respiration, I teach circulation of all the organisms of course, but I concentrate on human physiology when I teach these as well as nutrition and reproduction and in each case I can enable students to link each of the systems and link them eventually to nutrition and then look for solutions in nutrition. So that is one of the reasons why I do it the way I do it. The other thing is that although the topics are specified by course template I have the freedom to choose which topic I will concentrate on and how I will actually go about teaching it. So that is an enabling factor, the way the modules are actually designed ."</p>	<p>When asked why she focuses on those competencies, Rebecca replies it is due to (1)the flexible design of the module which allows her to be creative in that way; (2) as well as the fact that her strength lies in human physiology so because the module covers nutrition and circulation of all types of animals, she favors/is biased towards human physiology; (3) and she also see the opportunity to get students to link the organ systems together through a project that uses nutrition to treat other system disorders for example; (4) finally the topics are specified in the course templates however she is given the freedom to choose which topic to concentrate on when and how she goes about teaching it.</p>	<p>FgPP, PA, PPI, PKD, QE, DCK</p>	<p>PI, TEP, PC, DI</p>

Data excerpt	Memos	Code	Category
<p>Researcher: "The next question looks at how you address the competencies in your modules,..." Rebecca: "I look at food gardening as they relate to poverty, food gardens and it's relation to gender, to disease, to policy issues about food provision, to food security, to malnutrition and political perspectives. So students are allowed to choose any theme, any one of the seven themes in order to address food security in this country, so they are required to access information on the themes, they are required to actually work in groups and to critically analyse the information that they have accessed and present this to the class."</p> <p>Rebecca: "So essentially the outline simply signals nutrition but does not go into the detail that I have given you here."</p> <p>Researcher: "So you look at: Nutrition, reproduction, respiration, transport and immunity. Those are the sections that you cover?" Rebecca: "Yes."</p>	<p>Rebecca feels that she addresses the competencies in her module through the food gardening project where she develops the concept of food security from a political and socio-economic perspective. Students are given the freedom to choose one of seven themes to address food security in South Africa, where they are required to access information and critically analyse this info.</p>	<p>RfL, ESD(K), ESD(TL), RE, EE, AoC, LAC, PTM, RCN</p>	<p>TEP, ESD, PC, OPP, TEP</p>
<p>Researcher: "And within these sections do you cover other competencies that you think are important like skills or knowledge base competencies?" Rebecca: "Yes I do, the scientific skills are developed within the modules, the different kinds of scientific skills like observing, hypothesis generation and design of investigations and conducting of investigations and that kind of thing. So science process skills are developed through the module."</p>	<p>Rebecca explains that the course outline doesn't give too much detail but essentially she has to cover nutrition, reproduction, respiration, transport and immunity.</p> <p>Other competencies that Rebecca focuses on includes scientific skills such as observing, hypothesising, designing investigations and conducting investigations. Science process skills are therefore developed.</p>	<p>DCK, PA</p>	<p>DI, PI</p>
<p>Researcher: "And within these sections do you cover other competencies that you think are important like skills or knowledge base competencies?" Rebecca: "Yes I do, the scientific skills are developed within the modules, the different kinds of scientific skills like observing, hypothesis generation and design of investigations and conducting of investigations and that kind of thing. So science process skills are developed through the module."</p>	<p>Other competencies that Rebecca focuses on includes scientific skills such as observing, hypothesising, designing investigations and conducting investigations. Science process skills are therefore developed.</p>	<p>CoS, DDRS</p>	<p>DI</p>

Data excerpt	Memos	Code	Category
<p>Researcher: "What kind of problem solving do you?...or are those more laboratory based problem solving skills?" Rebecca: "No, they more real life based, more context based and less laboratory based.[...] The example is in the food gardening for example, yes. The problem based approach is that they are required to identify firstly a disease that is prevalent in the community in which they reside and then they need to find ways in which...they need to look at the incidence of the disease, the current ways in which the disease is managed and then to find practical ways in which the disease can be managed through nutrition and that is where the gardening comes in."</p>	<p>Rebecca's problem solving is not contrived but rather contextually based and not so much laboratory based. She gives the example of the food gardening to make her case. Students have to identify a disease that is prevalent in their community and research ways in which the disease is managed through nutrition, to inform her choice of crop.</p>	<p>ESD(TL), ESD(S), RfL, LAC, RE, EE, RCN</p>	<p>ESD, TEP, OPP, PC</p>
<p>Researcher: "And then you teach another module don't you?" Rebecca: "Yes I do teach Natural Science pedagogics, but I have not prepared in terms of this interview for Natural Science." Researcher: "Okay well then maybe I could just send you a few questions via email would that be okay?" Rebecca: "Yes that's alright."</p>	<p>Rebecca was unable to respond to the questions I intended posing to her about her other module. We decided to do it over email instead.</p>	<p>PR</p>	<p>PI</p>

Data excerpt	Memos	Code	Category
<p>Researcher: "Okay, what enables or motivates you to address these particular competencies in your module?"</p> <p>Rebecca: "I look at problem solving because I want, I would like to establish, or to engage my students with problem solving at the outset. I teach nutrition first, it's the first topic, so I would like them to engage in problem solving approaches to alert them to the link between Science and society and to alert them to their power to make a difference, to make a positive difference in their society. So I think it is because of the positioning of the topic at the beginning of the module that I employ a problem solving approach at that point. And of course the problem solving runs through the module but not as much as it does in the first section which is nutrition. So um, and food shortage and disease management are issues which are prevalent in this country. [...] They not problems that students are unfamiliar with, it is prevalent in each of their societies, in each of their communities. So it is something that they can practically address. So that is the reason for adopting that approach at the outset."</p>	<p>Rebecca substantiated why she looks at problem solving as important. She feels it is necessary to establish problem solving skills upfront. She wants to alert students to the link between science and society and their power to make a difference in society, using this knowledge. Because nutrition is the first topic she employs problem solving using the gardening project. She admits she does get students involved in problem solving throughout the module but it is not to the extent that the first topic covers. She feels that food security and disease management are South African issues that are prevalent and so students can relate to it personally.</p>	<p>RE, EE, ESD(TL), CPA, RCN, AoC</p>	<p>PC, ESD, DI, TEP, OPP</p>