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, Huisingh & 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 1) and the conceptual model of the notional system (presented in figure 2). 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 teacher educators' roles and the historical and political context in which higher education exists. 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 1) and notional picture (see Figure 2), 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:

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/concerns 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"?

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:

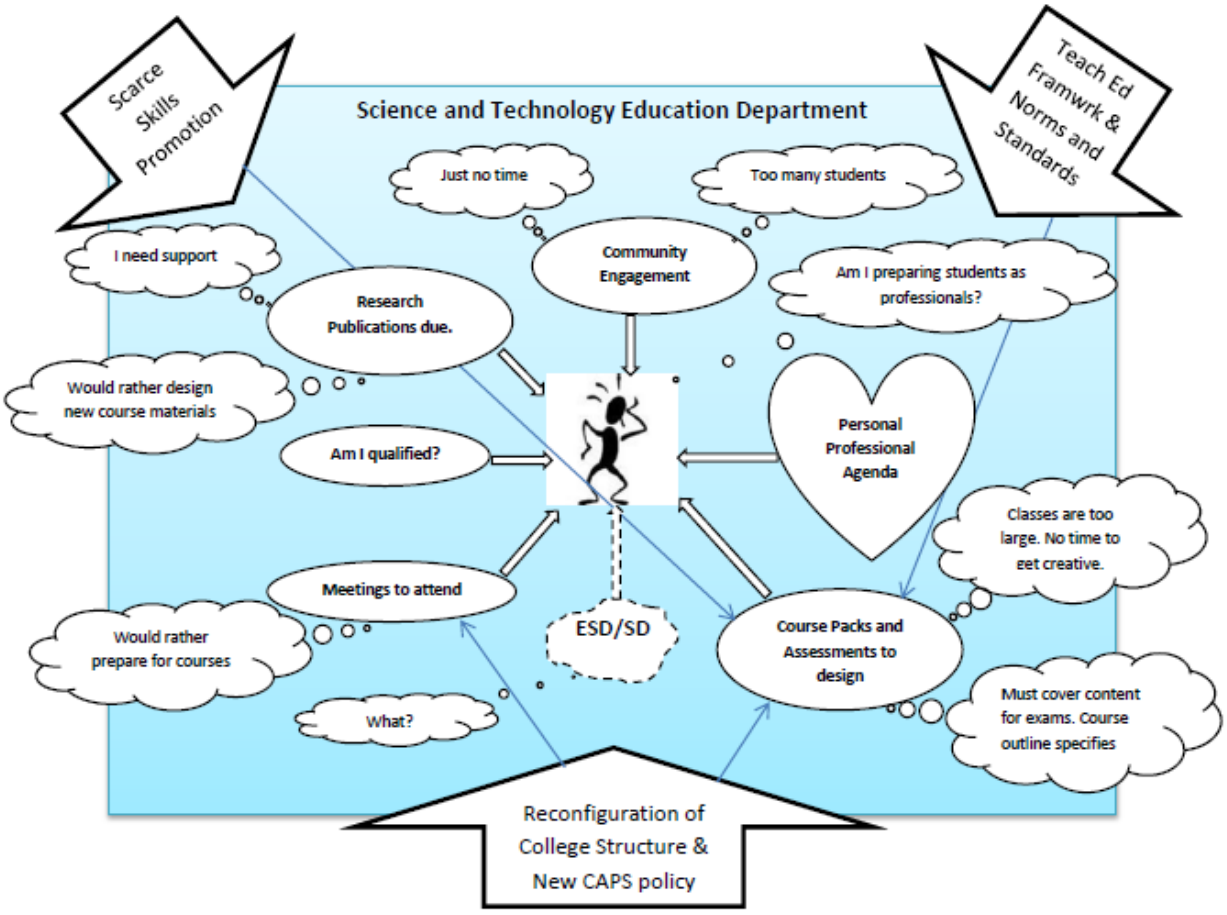

Figure 1. A Rich Picture of the Science and Technology Education Department

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 *good education* 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 2). This consideration can be viewed by the superscripted numbers [*1 –* 7].

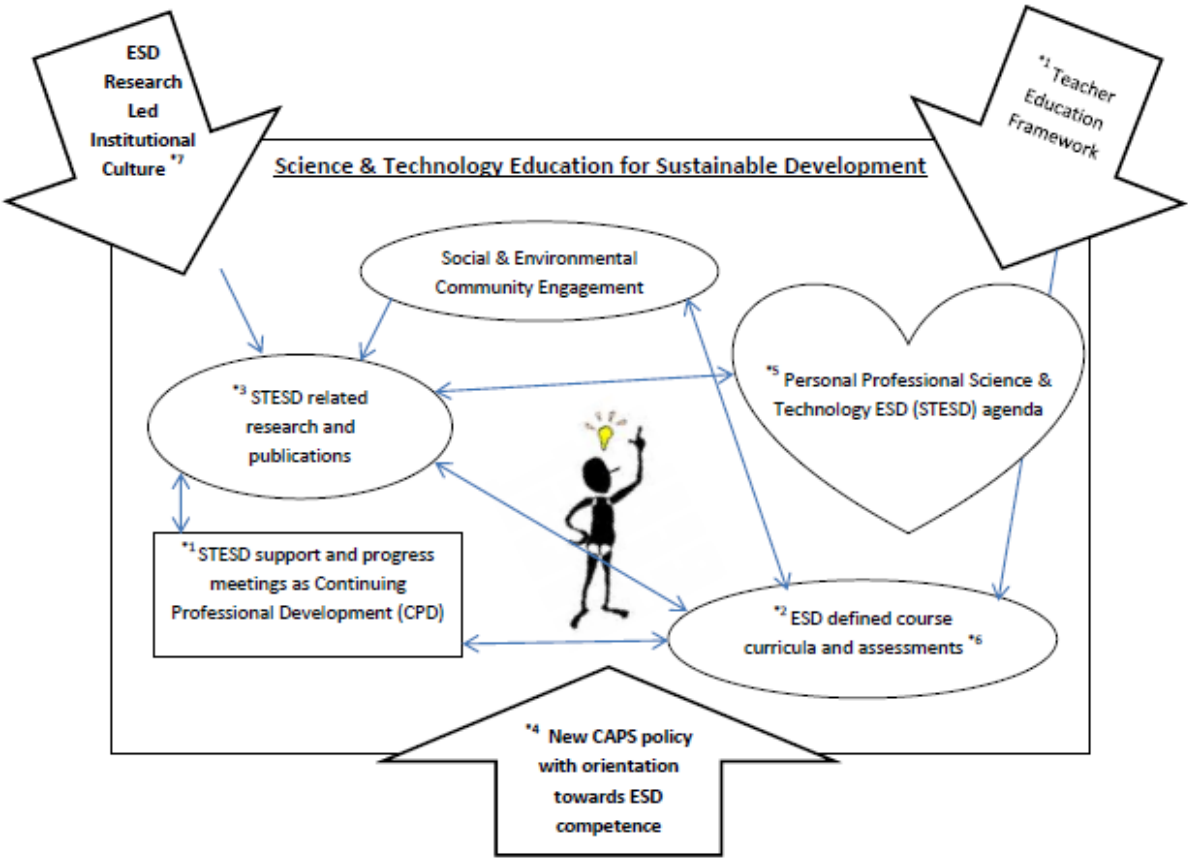

Figure 2. A notional system of Science and Technology Teacher Education for Sustainable Development

Figure 1 and 2 were revealed to teacher educators through a power-point presentation during the focus group. Knowledge of the situation (as depicted in Figure 1 and Table 1) and knowledge of ESD support structures (E.g. ESD oriented curricula and research) assisted the researcher in creating Figure 2.

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 1 and 2 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

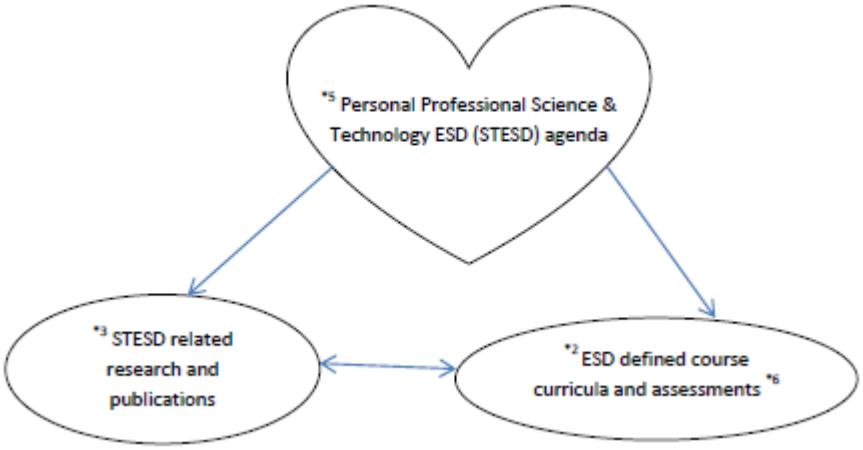

Figure 3. Linking research to curriculum development

Figure 3 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 2 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

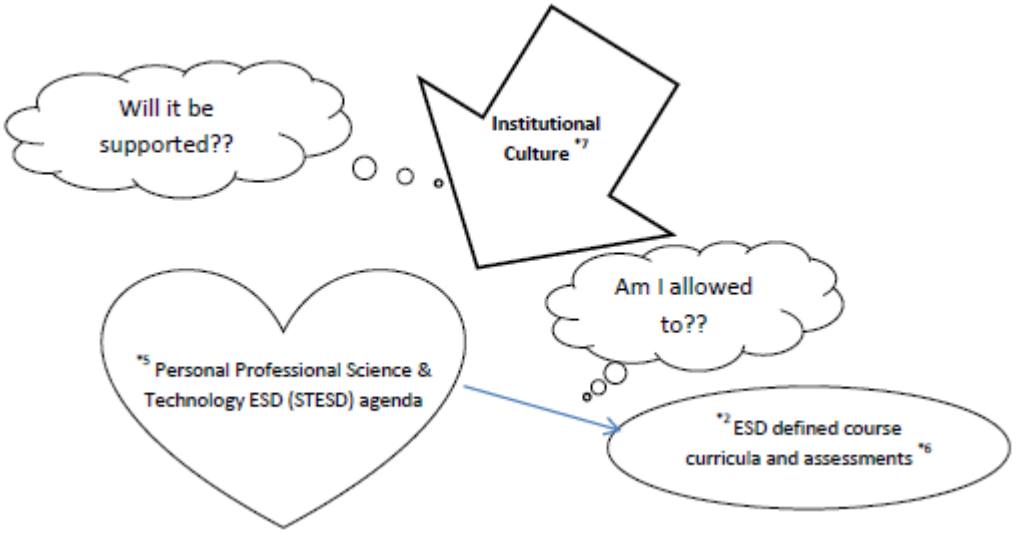

Figure 4. Teacher educators question their autonomy to change the status quo

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-curriculation 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.

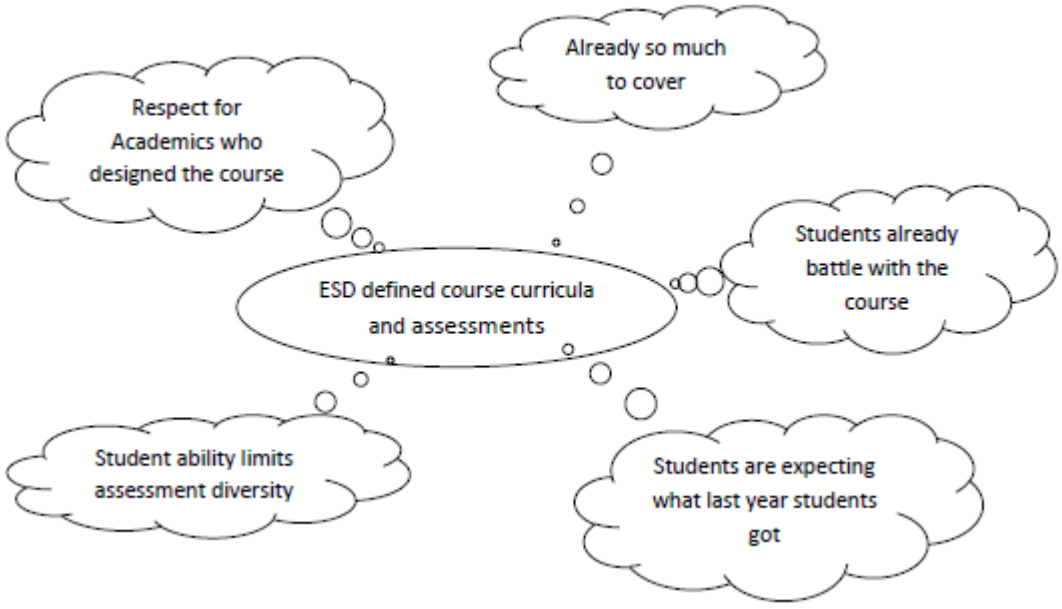

Figure 5. Teacher educators' thoughts on the barriers to embedding ESD

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 2. 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 2, 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.

References

Astley, W.G., & Van de Ven, A.H. (1983). "Central Perspectives and Debates in Organization Theory", *Administrative Science Quarterly,* Vol.28 No.2, pp. 245-273. http://dx.doi.org/10.2307/2392620

Checkland, P. (1981). *Systems Thinking: Systems Practice*, Chichester, John Wiley and Sons.

Checkland, P., & Scholes, J. (1990). *Soft systems methodology in action*, Chichester, John Wiley and Sons.

Chisholm, L. (2003). "The politics of curriculum review and revision in South Africa.", paper presented at the Oxford International Conference on Education and Development, 9-11 May, London, available at: http://www.hsrc.ac.za/en/research-outputs/view/843 (accessed 8 April 2014)

Cohen, L., Manion, L., & Morrison, K. (2007). *"Research Methods in Education (6th edition)",* London, Routledge.

Hall, A.D., & Hagen, R.E. (1969). "Definition of a system", in Litterer, J.A. (Ed.), *Organizations* (Vol 2), Wiley Publishers, New York.

Hannan, M.J., & Freeman, J.H. (1977). "The population ecology of organizations", *American Journal of Sociology,* Vol. 82, pp. 929-964. http://dx.doi.org/10.1086/226424

Hatch, M.J. (2012). "What is Organization Theory?" In Hatch, M.J. with Cunliffe, A.L. (Eds.), *Organization Theory: modern, symbolic and postmodern perspectives (3rd Ed)*, Ashford Colour Press Ltd., Great Britain, pp. 3-23.

Huckle, J. (2014). Education for Sustainable Citizenship: an emerging focus for education for sustainability. In J. Huckle & S. Sterling (Eds.), *Education for Sustainability* (pp. 228-243). Oxford: Routledge.

Huckle, J., & Wals, A.E.J. (2015). The UN Decade of Education for Sustainable Development: business as usual in the end. Environmental Education Research, 21(3), 491 – 505, http://dx.doi.org/10.1080/13504622.2015.1011084

Jain, S., Aggarwal, P., Sharma, N., & Prateek, S. (2013). "Fostering sustainability through education, research and practice: a case study of TERI University", *Journal of Cleaner Production,* Vol. 3, pp. 1-5. http://dx.doi.org/10.1016/j.jclepro.2013.04.021

Jansen J.D. (2004). "Changes and continuities in South Africa's higher education system, 1994 to 2004", In Chisholm,L. (Ed.), *Changing class: Education and social change in post-apartheid South Africa*, HSRC Press, Pretoria, pp. 293-314.

Jones, P., Trier, C.J., & Richards, P. (2008). "Embedding Education for Sustainable Development in higher education: A case study examining common challenges and opportunities for undergraduate programmes", *International Journal of Educational Research,* Vol. 47, pp. 341-350. http://dx.doi.org/10.1016/j.ijer.2008.11.001

Kitwood, T.M. (1977). Values in adolescent life: towards a critical description, Unpublished PhD dissertation, School of Education, University of Bradford.

Kruss, G. (2008). *Teacher Education and Institutional Change in South Africa. Teacher Education in South Africa Series*, HSRC Press, Cape Town.

Lambrechts, W., Mula, I., Ceulemans, K., Molderez, I., & Gaeremynck, V. (2013). "The integration of competences for sustainable development in higher education: an analysis of bachelor programs in management", *Journal of Cleaner Production,* Vol. 48, pp. 65-73. http://dx.doi.org/10.1016/j.jclepro.2011.12.034

Lozano, R. (2013). "Editorial", *Journal of Cleaner Production,* Vol. 48, pp. 3-9. http://dx.doi.org/10.1016/j.jclepro.2013.03.034

Lozano, R., Lukman, R., Lozano, F.J., Huisingh, D., & Lambrecht, W. (2013). "Declarations for sustainability in higher education: becoming better leaders, through addressing the university system", *Journal of Cleaner Production,* Vol. 48, pp. 10-19. http://dx.doi.org/10.1016/j.jclepro.2011.10.006

Luhman, J.T., & Cunliffe, A.L. (2013). *Key Concepts in Organization Theory*, Sage Publishers, London. http://dx.doi.org/10.4135/9781473914643

Morgan, G. (1980). "Paradigms, Metaphors, and Puzzle solving in Organization Theory", *Administrative Science Quarterly,* Vol. 25 No. 4, pp. 605-622. http://dx.doi.org/10.2307/2392283

Parker, D., & Adler, J. (2005). "Constraint of catalyst? The regulation of teacher education in South Africa", *Journal of Education,* Vol. 36, pp. 59-78

Reddy, C. (2009). "Integrated tales of policies, teaching and teacher education: Reflecting on an ongoing process", *South African Journal of Higher Education, Vol. 23 No.*6, pp. 1161-1173.

Riechmann, M. (2012). "Future-oriented higher education: Which key competencies should be fostered through university teaching and learning?", *Futures,* Vol. 44, pp.127-135. http://dx.doi.org/10.1016/j.futures.2011.09.005

Samuel, M. (2002). "Working in the rain: pressures and priorities for teacher education curriculum design in South Africa: a case study of the University of Durban-Westville", *International Journal of Education Development,* Vol. 22, pp. 397-410. http://dx.doi.org/10.1016/S0738-0593(01)00061-X

Skyttner, L. (2001). *General Systems Theory: Ideas and Applications*, World Scientific Publishing, London.

Spencer, H. (1873). *The study of sociology*, Kegan, Paul & Trench Publishers, London.

Sterling, S. (2004). "An Analysis of the Development of Sustainability Education Internationally: Evolution, Interpretation and Transformative Potential.", In, Blewitt, J. and Cullingford, C. (Eds.), *The sustainability curriculum: The challenge for Higher Education,* Earthscan Publishers, London, pp. 43-62.

Sterling, S., & Scott, W. (2008). "Higher Education and ESD in England: a critical commentary on recent initiatives", *Environmental Education Research,* Vol. 14 No. 4, pp. 386-398. http://dx.doi.org/10.1080/13504620802344001

Stir, J. (2006). "Restructuring teacher education for sustainability: student involvement through a "strengths model".", *Journal of Cleaner Production,* Vol. 14, pp. 830-836. http://dx.doi.org/10.1016/j.jclepro.2005.11.051

Tilbury, D. (2011). Higher Education for Sustainability: A Global Overview of Commitment and Progress. In, *Higher Education's Commitment to Sustainability: From Understanding to Action.* Available at http://insight.glos.ac.uk (Accessed 31 October 2013).

United Nations (UN). (2002). Ubuntu Declaration. Available from http://www.ias.unu.edu/sub_page.aspx?catID=108&ddID=304 (Accessed on 31 October 2013)

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2000). *The Earth Charter: values and principles for a sustainable future*, UNESCO, Paris.

United Nations Educational Scientific and Cultural Organisation (UNESCO). (2005). *Guidelines and Recommendations for reorienting teacher education to address sustainability (Technical Paper No.2)*: UNESCO Education Sector.

UNESCO. (2014). Aichi-Nagoya Declaration on Education for Sustainable Development.Presented at the Education for Sustainable Development 2014 World Conference, Aichi-Nagoya (Japan), 10-12 November. Retrieved from http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/ERI/pdf/Aichi-Nagoya_Declaration_EN.pdf

Van Tonder, C.L. (2004). *Organisational Change: Theory and Practice*, Van Schaik Publishers, Pretoria.

Wals, A.E.J. (2013). "Sustainability in higher education in the context of the UN DESD: a review of learning and institutionalization processes", *Journal of Cleaner Production,* Vol. 3, pp. 1-8.

Waring, A. (1996). *Practical Systems Thinking*, Thomson publishing, London.

Weick, K.E. (1974). "Middle-range theories of social systems", *Behavioural Science,* Vol. 19, pp. 357-367. http://dx.doi.org/10.1002/bs.3830190602