Exploring Change-Oriented Learning, Competencies and Agency in a Regional Teacher Professional Development Programme's Change Projects

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by

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Abstract

This aim of this study was to explore the mediatory role of the Rhodes University (RU) / Southern African Development Community (SADC) International Certificate in Environmental Education course in developing capacity for reflexive mainstreaming of environment and sustainability education in teacher education in southern Africa. This course was a change-oriented intervention to support capacity and agency for mainstreaming environmental education across many sectors of education. The discourse of the course included environmental education and education for sustainable development and for this study this was referred to as environment and sustainability education (ESE). Environment and sustainability education is a developing notion in southern Africa and the SADC Regional Environmental Education Programme (REEP) was set up to support capacity for mainstreaming ESE. ESE was one of the responses taken by the SADC region to respond to prevalent environment and sustainability issues across the region. This study focused, in general, on establishing the mediatory roles of the reflexive mediatory tool, the change project in the course. More specifically, the research explores the mediatory role of course interventions and activities that were used to develop understanding of and to frame the change project in fostering agentially motivated changed practice in the teacher education sector. Drawing on realist social theory, which is a form of critical realism, especially the work of Margaret Archer, the study used the principle of emergence to interpret changes in the course participants' practices.

The study was framed using the research question: How do mediated actions in a regional professional development programme and the workplace influence Environment and Sustainability (ESE) competencies, practice, learning and agency in Teacher Education for Sustainable Development (TESD) change projects? The following sub-questions refined the study:

- What mediated actions on the course influence ESE competences, practice, learning and agency on the professional development programme?
- How do these identified mediated actions influence ESE competences, practice and learning on the professional development programme?

- What mediated actions in workplaces influence ESE competences, practice, learning and agency in the change projects in teacher education institutions?
- How do these identified mediated actions in workplaces influence ESE competences, practices and mediated actions in the workplace?

Notions of practice, agency, reflexivity, competences and capabilities were used to sensitise explanations of features emergent from course interactions; the process of analysis was under-laboured by the theoretical lens of critical realism and realist social theory. Mediation theory was used to explain the role of interventions across the course. The study used a case study approach with three cases of teacher educators from two institutions in two southern African countries. Data were generated through document analysis of course portfolios, semi-structured interviews with research participants, observations of participants during their teaching and through group discussions in a change management workshop to establish features that emerged from the course and change project interactions. The principle of emergence recognises that any interactions result in new features of characteristics that are different from the original. In this case, the study investigated those features shown by participants after being exposed to the course's mediatory tools. In order to describe the cases, a narrative approach was used.

The study was conducted at the interface of the United Nations Decade of Education for Sustainable Development (UNDESD) and the Global Action Plan for Education for Sustainable Development, therefore the outcomes have implications for capacity development for ESE during and beyond the Global Action Plan for Education for Sustainable Development. The key finding is that capacity development for ESE needs to foreground reflexive engagement with one's own practice for it to be meaningful and relevant. The change project provided course participants with the opportunity to engage with their own practice and particularly their competences and capabilities through its mediatory tools. Course participants showed emergent properties that were evidence of expanded zones of proximal development (ZPD) in competences, capabilities and agency. The study illustrates that meaningful learning happens when immersed in context and when learners are able to make connections between concepts, practices and experiences (their praxis). The study also illustrates that capacity building creates opportunities for

practitioners to expand their repertoire through the course activities. Some of the course activities stimulated, enhanced and gave impetus to their agency or double morphogenesis for them to continue to expand that repertoire by trying and retrying changes in practice that they value on their own and in communities of practice. Capacity development courses need to be structured to involve a variety of mediatory activities as some of these are relevant and are valued for different teacher education contexts.

The study also shows how knowledge and understanding of classical Vygotskian mediation can be used to frame and structure courses for developing the ZPD retrospectively and how the repertoire which forms the ZPD has potential to be expanded and to keep expanding, whether at individual level or in community with others, as an object in the post-Vygotskian mediation process. The change project provides the starting point, the vehicle and momentum to teacher educators to critique and to reflexively transform competences or aspects of their practice that they value.

The study showed that capacity development through the change project generated momentum for potentially morphogenetic changes in teacher education practice. The course initiated interactions at the phase T2-T3 that disrupted teacher educators' habitus. On-course phase activities such as assignments, lectures, discussions, practical tasks, excursions and regional knowledge exchange groups contributed smaller morphogenetic cycles to the main cycle.

Reflexive engagement with one's own practice becomes a useful tool for building capacity for scaling capacity for mainstreaming ESE during and after the Global Action programme for ESD. Contributions of the study therefore go beyond the SADC region to contribute insights into capacity development for ESD in similar conditions of teacher education across the world.

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Acronyms and Abbreviations

APD	Academic professional development
EE	Environmental Education
EEASA	Environmental Education Association for Southern Africa
ESD	Education for Sustainable Development
ESE	Environment and Sustainability Education
ESSA	Education for Strong Sustainability and Agency
GAP	Global Action Programme for Education for Sustainable Development
GCE	Global Citizenship Education
MESA	Mainstreaming Environment and Sustainability in African Universities
OECD	Organisation of Economic Co-operation and Development
RCE	Regional Centre of Expertise
RU	Rhodes University
SADC REEC	SADC Regional Environmental Education Centre
SADC REEP	Southern African Development Community Regional Environmental Education Programme
SADC	Southern African Development Community
SARUA	Southern African Regional Universities Association
SDGs	Sustainable Development Goals
SWEDESD	Swedish Centre for Education for Sustainable Development
TTISSA	Teacher Training in Sub-Saharan Africa
UNCED	United Nations Conference on Environment and Development
UNDESD	United Nations Decade of Education for Sustainable Development
UNEP	United Nations Environment Programme
UNESCO	United Nations Education Scientific and Cultural Organisation
ZPD	Zones of Proximal Development

Chapter 1:   Locating the study

1.0   Introduction

Chapters One, Two and Four introduce the study by describing the context in which the study was conducted. The study is located in the southern African region and in the field of teacher education. It describes two teacher education institutions from which the research cases were drawn. Concepts that influence thinking on the study are introduced. The research problem that prompted the study and research questions that were used to understand the problem are laid down in this chapter. The chapter ends with a synopsis of the chapters in the dissertation.

1.1   Location of the study

This study was conceptualised through engagement with participants who were drawn from a diversity of teacher education contexts in the fifteen southern African countries that make the regional economic inter-government community called the Southern African Development Community (SADC). The organising institution for environmental education and sustainability education for the southern African countries is the Southern African Development Community Regional Environmental Education Programme (SADC REEP). SADC REEP was mandated by the SADC Secretariat to support environmental education practitioners in the SADC region to strengthen environmental education processes for equitable and sustainable environmental management choices (SADC REEP, 2008).

One strategy to achieve the regional mandate involved establishing partnerships and working in communities of practice (Wenger, McDermott and Snyder,1998) for developing capacity for environmental education. The SADC REEP required a centre (SADC Regional Environmental Education Centre - SADC REEC) that was based at and managed by the Wildlife and Environment Society of South Africa (WESSA) headquarters in Howick, South Africa. WESSA is an environmental non-governmental organisation whose initial role was driven by a strong focus on conservation of natural resources. This focus was widened to include environmental education as a vehicle to build understanding of the environment and particular contexts where conservation methods and processes could be conducted. SADC REEP coordinated and facilitated short professional development courses in

Environmental Education for participants from the SADC region. Some courses drew participants from SADC countries to the SADC REEC while other courses were facilitated in SADC member countries. The following map shows the SADC countries from which participants were drawn.
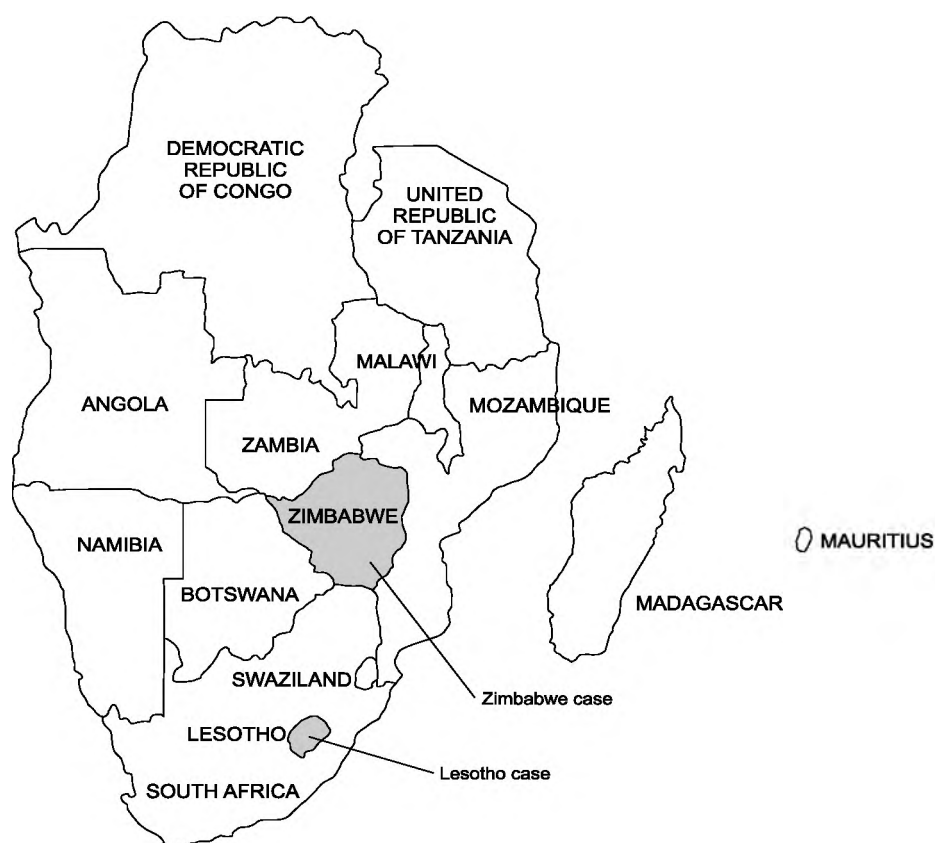
Figure 1.1: Map of the SADC countries showing the location of the Lesotho and the Zimbabwe case studies

To implement effective capacity development, SADC REEP established partnerships with specialist institutions, such as Rhodes University's Environmental Learning Research Centre (ELRC, earlier named the Environmental Education (EE) Unit). Through this relationship the Rhodes University/ SADC International Certificate in Environmental Education course was developed and conducted. Rhodes University had research and theoretical capacity in environmental education and thus provided the academic and conceptual framework for the course. WESSA, supporting SADC REEP, had a more practice-based approach to environmental education. Although participants were drawn from many institutions in the fifteen SADC countries over the years, this research focused on two institutions in two SADC countries. The discourse of environmental education on the Rhodes University/ SADC International certificate in EE course was recognised to contribute to education for

sustainable development and for this study the two discourses were represented by the term 'environment and sustainability education' (ESE) (see Section 2.1).

1.2   My context

I taught secondary school Science and Biology for seven years before I taught in Biology Education in teacher education for the subsequent ten years. I spent another four years coordinating capacity development in Environmental Education for SADC REEP and this position provided the context for this research. My experience as a teacher and supervisor in the school where I was Head of Science Department and during teaching practice supervision as a teacher educator, as well as assessments at school level, showed that learners grappled to make sense of certain science concepts therefore had a superficial understanding of classroom science, even where the school was well equipped with laboratory materials. I deduced that one possible reason was because the science they learnt was detached from their daily experiences. This is where my interest in understanding and supporting teacher education developed.

My Masters study explored the integration of indigenous knowledge and skills (indigenous knowledge practices) into classroom science. I found that teacher educators and learners possess and bring to the classroom, indigenous knowledge skills and practices, which include things that they know and things that they do very proficiently often without conscious thought (Mandikonza, 2007), reflecting what Bourdieu (1998) terms the *habitus,* in this case, the habitus of educational practice (Grenfell, 1998; Wight, 2006). Recognising this, I explored the possibility of using these knowings and doings (Kemmis, 2009a) to enhance understanding of classroom science and the results showed that it was possible to use what learners already knew very well in their everyday life (indigenous habitual practices) to open up certain scientific concepts in classroom science (habitual practices of classroom science) (Mandikonza, 2007).

Using the lens of habitus, I observed during the contextual profiling of this research that teacher educators in southern Africa acquired competencies for teaching that constitute their habitus and practices in their specialised field (Grenfell, 1998). The Southern African Development Community Regional Environmental Education Programme (SADC REEP) conducted professional development courses for teacher educators to integrate the

principles and practices of environmental education (EE) /education for sustainable development (ESD) into their existing practices and programmes. The relationship between environmental education and education for sustainable development in this study and the choice of the term environment and sustainability education (ESE) is described in Section 2.1.3. Teacher educators came to the course with different forms of habitus for doing their work. The course, being interested in change oriented learning, sought to disrupt the teacher educators' habitus and taken for granted practices that educators brought to the course with the intention of supporting them to develop or acquire a new habitus for their practice that incorporates ESD. As pointed out earlier, as an employee on the SADC REEP, I worked on this course as a course manager and co-ordinator.

In this research I sought to understand this change oriented learning, in two teacher education cases which included one teacher training college in Lesotho and one case of university teacher education in Zimbabwe. The teacher training college is affiliated to the national university. The university setting has both postgraduate and undergraduate teacher education courses. Research questions laid out in Section 1.10.2 were used to interrogate how the teacher educators from these institutions who participated in the Rhodes University/ SADC International Certificate in Environmental Education course responded to course expectations.

1.3 Teacher education in southern Africa and the Rhodes University /SADC International Certificate in Environmental Education Course

1.3.1 The notion of teacher education

In this research I have used the term 'teacher education' as inclusive of the whole programme that is involved with development of teacher proficiency and competence that would ultimately enable and empower the teacher to meet the expectations of the profession of teaching and be able to handle the associated challenges. Teacher education here includes the institutions, structures and processes that prepare students to teach meaningfully in class by enabling them to engage with theories of development, of education, social theories and theories of learning. Ultimately teachers must be able to justify any activity involving learners using the theories they have learnt; thus theory needs to be used with a purpose (Chivore, 1992). By basing their learning on various theories,

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teachers should be able to deal with different learners and their social, psychological and development issues. The teacher therefore should be someone who not only teaches curriculum content in class but teaches it in particularly reasoned ways.

The reasoning is often guided by the theories the teacher was supposed to have studied during the period of being a student teacher, which in turn are part of the whole purpose of teacher education. In his argument on the nature and purpose of teacher education, Perraton (2010, p. 4) identified four elements: improving the general educational background of the trainee teachers; increasing their knowledge and understanding of the subjects they are to teach; pedagogy and understanding of children and learning; and the development of practical skills and competences. He did not however interrogate the roles of the acquired skills and competences in society. In all cases, these are the roles expressed in the form of competences expected of teacher educators in many institutions in the southern African countries and especially for this research, in Zimbabwe and Lesotho.

1.3.2 Teacher education, the teacher and society

The United Nations Educational Scientific and Cultural Organisation (UNESCO) argued that due to roles related to both individuals and the community, teacher education institutions potentially play a key role in re-orientation of education towards sustainability as teachers and teacher educators are in a position to influence educational systems (UNESCO, 2015b) through the knowledge and skills inherent in practices of the education systems. Teacher education institutions have responsibilities that include:

- educating new teachers at the pre-service level;
- providing in-service professional development opportunities for practising teachers by updating their knowledge and skills;
- creating new education curricula in response to contemporary issues;
- contributing to shaping and reviewing national schools curricula;
- carrying out research;
- contributing to textbooks;
- providing expert advice to local schools upon request;
- providing expert opinion to provincial and national ministries of education;

- educating and certifying headmasters, principals, and other school administrators (UNESCO, 2015b).

The Department of Education (2000) in South Africa set out key expectations of a competent teacher as one who is a specialist in a subject or learning area; a specialist in teaching and learning; a specialist in assessment; a curriculum developer; a leader, administrator and manager; a scholar and lifelong learner as well as a professional who plays a community, citizenship, and pastoral role. The teacher therefore is more than merely a classroom practitioner.

A teacher is ultimately a social being, a member of society who accounts for his or her teacher role to the learners and to society and moulds learners in certain ways for the benefit of individual learners and for society (Jobo, 2013; Monjane, 2013; Shumba and Kampamba, 2013). Chivore (1992) further asserted that teacher education is constituted of programmed activities and experiences that are developed by an institution, the teacher education institution responsible for preparing people intending to take teaching as their profession. Capacity of the teacher education institutions and teacher educators in these institutions to embrace and implement change within roles relevant to their students and to society (as described above) depends on how the institution is structured and whether the teacher educators feel the need to change. If they do, it also depends on whether they have the agency to implement changes to their practice.

Contextual profiling for this research revealed that the initial training of teachers in southern Africa differs from one country to another. I observed that in South Africa and Namibia, where teachers' training colleges were amalgamated into university colleges, teachers are trained mainly in universities and university colleges and graduates exit with a degree and then have to take educational courses after their first degree. South Africa however has a few remaining teacher training colleges which train diploma holders. It also emerged that in the majority of SADC Member States including Botswana, Lesotho, Swaziland, Zambia and Zimbabwe, initial training of teachers is done in some universities as well as teacher training colleges that are affiliated to national universities. The contextual profiling also revealed that teachers qualify from colleges with a Diploma in Education. For those who qualify from universities, the general trend is that they have a degree in a discipline, such as science, business studies or geography that is combined with education.

There are also many other teacher education processes involving short courses for supporting teacher educators' capacity to handle their teaching, also known as Continuing Professional Development (CPD) programmes.

The need becomes more pertinent with the call to build capacity to rethink education (UNESCO, 2015a) as a common good for the common good (see Section 2.1.2).

1.3.3   Teacher education, relevance and quality of education

All these teacher training institutions in the SADC region operate under similar socio-ecological and educational challenges including HIV/AIDS, climate change, malnutrition, shortage of conventional teaching and learning resources, lack of information on current issues and lack of appropriate methods to effectively teach about the issues (SADC REEP, 2008). The concern for a better education was taken a long way with one landmark, the Jomtien Declaration for Education for All in 1990. Concerns on issues of quality were further strengthened by the Dakar Framework which focused more on teachers and teacher education (UNESCO, 2000a). Countries have made great strides to respond to one measure of quality education, increasing the numbers of children attending school, access or provision (Bangay and Blum, 2010), by expanding the number of schools and school infrastructure, by availing themselves of resources such as books and teachers, and at times using transport to school and feeding schemes in response to the universal education drive and the Millennium Development Goals. More work needs to be done on the other indicators of quality education and learning, that is improving their classroom experiences (UNESCO, 2014a).

The vision of the recent Incheon Declaration (UNESCO, 2015c) which set the platform for Education 2030 Agenda "… is to transform lives through education, recognizing the important role of education as a main driver of development and in achieving the other proposed SDGs." The vision of the Incheon Declaration was developed to contribute to implementation of the Sustainable Development Goals (SDGs) which themselves were set up with a transformational intent and in particular to guide implementation of SDG Number 4: "Ensure inclusive and equitable quality education and promote life-long learning opportunities for all" (United Nations, 2015a). Targets for SDG 4 speak directly to quality education with 4.1 focussing on "… equitable and quality primary and secondary education",

while 4.2 focussed on "… access to quality early childhood development …" and 4.3 projected "… quality technical, vocational and tertiary education, including university." Teacher educators need requisite capacity to be able to generate curricular learning experiences that support transformative learning in their classrooms because all institutions should be able to innovate their practice so that they keep pace with social, political and technological change (Vahasantanen, 2014).

Teacher education curricular experiences themselves are often decontextualised from the lives of learners, with the result that pedagogic experiences frequently perpetuate a disjuncture between school and community (Jobo, 2013; Shumba and Kampamba, 2013). Shumba and Kampamba's observations in Zambia were typical of many SADC countries: national policies are silent on the need to ensure equitable and quality education through focusing on meaningful classroom experiences. These are experiences that enable learners to appreciate the relationship between scientific thought, action and technology and quality of life, social values such as tolerance, and valuing and respecting other people's rights and views while allowing for various forms of participation in issues affecting quality of life. Such learning is 'rizhomatic' (Lotz-Sisitka, 2004). However, it was also noted that learning, teaching and training practices lag behind this need.

Lotz-Sisitka (2010a; 2010b) argued that quality education entails learning for a sustainable future, where in order to enable learners to 'learn for the future' it was important for educators to consider the content in relation to the context. Lotz-Sisitka, drawing on research undertaken in the SADC REEP, focusing on Education for Sustainable Development and Educational Quality suggested that a "… third discourse on educational quality (i.e. socio-cultural discourses) further deepens notions of inclusivity, or inclusivity concepts of quality – to be inclusive of culture, local context and issues and practices that have meaning in local societies such as environment and sustainability practices, health education practices, life skills and citizenship practices"(Lotz-Sisitka, 2010a, p. 6). Lotz-Sisitka summed this up by using the term 'learning as connections', the implication being that for meaningful learning to take place, the learner must be able to connect classroom knowledge and experiences to personal and societal life. By making links, learners would be able to find relevance in what they were learning and make meaning of it. Lotz-Sisitka's view was affirmed by UNESCO (2015b, p. 3)

expressing that the world needs a form of education that responds to the current needs by building in sustainability and that creates conditions for a sustainable future:

> The world is changing – education must also change. Societies everywhere are undergoing deep transformation, and this calls for new forms of education to foster the competencies that societies and economies need, today and tomorrow. This means moving beyond literacy and numeracy, to focus on learning environments and on new approaches to learning for greater justice, social equity and global solidarity. Education must be about learning to live on a planet under pressure. It must be about cultural literacy, on the basis of respect and equal dignity, helping to weave together the social, economic and environmental dimensions of sustainable development. (UNESCO, 2015b, p. 3)

This is the view that guides global education that has passed through the Decade of Education for Sustainable Development (DESD: 2005-2014) into the Global Action Programme (GAP: 2015 onwards) for Education for Sustainable Development (UNESCO, 2014d). Goal 4 of Education 2030, described earlier, has Target 4.7 that considers how education can respond to the GAP agenda and contribute to sustainable development:

> By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development. (United Nations, 2015, p. 21)

The call for Global Citizenship Education (GCE) (UNESCO, 2014b; 2014c) whose goal was "… to empower learners to engage and assume active roles both locally and globally to face and resolve global challenges and ultimately to become proactive contributors to a more just, peaceful, tolerant, inclusive, secure and sustainable world" (UNESCO, 2014b, p. 15) is one vehicle for mainstreaming education for sustainable development. Global citizenship education is deemed to be transformative because it creates platforms for learners to exercise their rights for promoting a better future (UNESCO, 2014b). Transformative education is achieved through global citizenship education's ability to utilise other forms of education and in particular draw from other transformative education processes including human rights education, education for sustainable development, education for international / intercultural understanding, and education for peace (UNESCO, 2014b).

The diversity and dynamic nature of socio-ecological issues in the region calls for ongoing capacity building processes and the Rhodes University/ SADC International Certificate in Environmental Education Course was a regional response to such a need.

1.4 Reflexivity and change through the change project

The reflexive model of professional development and the associated course contents outlined above, was informed by ongoing research. For example, Motsa (2004), researching the Swaziland version of the Rhodes University/ Goldfields Environmental Educators' course (see Section 2.3), found that course assignment processes supported praxis-based learning among course participants, but that there was a stronger need to support links to institutions (hence the new emphasis in Unit 3). The course continued to engage participants on praxis-based tasks that supported them to reflect on their ESE. Other research focussed on more depth in institutional structural factors in the workplace that impinge on reflexive agency in curriculum change contexts. Raven (2005) studied how reflexivity emerges in and through course-based professional development on the Rhodes University/ Goldfields Environmental Educators' course. She noted that reflexivity is a social process and that reflexive competence constitutes the evidence of engagement with changes in practice. She differentiated reflexivity from reflexive competence. Reflexivity was defined in many ways, but in this research, reflexivity is viewed (at least initially at proposal stage) as "… action for change initiated through a critical review of practice" as described by Raven (2005, p. 37). Archer (2012) described reflexivity in a similar, but more broadly sociological way: "Reflexivity has been advanced as the process mediating the effects of our circumstances upon our actions" (p. 6). In her work on reflexivity, Archer recognised the primacy of practice from which and to which reflexive deliberations refer and relate (see Sections 3.6 and 3.10.1).

Change is perceived to occur when dominant knowledge frames and the powers embedded in them are ruptured (Raven, 2005). These ruptures are partly shaped by agents and their reflexive deliberations (Archer, 2012). An agent cannot achieve agency alone but in a social context that is structured and layered (Wight, 2006). With such knowledge, the Rhodes University /SADC International Certificate in Environmental Education course constantly evolved to respond to such findings. The framework of the course did not have fixed

standards for reflexive competence but was constantly negotiated between the participants and their contexts. It remained open-ended and enabled reflexive engagement with issues in a way that unravelled what is known and what is not known. The take-home assignment was one of the artefacts used to engage with the workplace.

As the course framework evolved, so did the take-home assignment which transformed from a home assignment to a home-based research project, an educational response project and was later named a 'change project'. An individually driven, institutionally situated change project framework was used. This framework was expanded to the International Training Programme that was conducted between Sweden and African countries as well as another southern African specific variant, Regional Training Programmes that were led by other universities such as the University of Botswana, University of Swaziland and University of Zambia (SADC REEP, 2011a).

The SADC Regional Environmental Education Programme was established "to **enable** Environmental Education (EE) and Education for Sustainable Development (ESD) **practitioners** in the SADC region to **strengthen EE and ESD processes** for equitable and sustainable development choices and poverty alleviation" (SADC REEP, 2008, p. 1, my emphasis). Consequently, and as noted above, SADC REEP conducted a number of professional capacity development courses in the SADC region which drew on the reflexive professional development model which used the change project concept outlined above. The change project development process was considered a key component of the course because it linked individual professional development to institutional context and practice in reflexive ways that were change oriented. The ESE change project was designed to involve the institutional staff as reflexive agency is a social process involving engagement with structural constraints and enablements, and deliberations (Raven, 2005; Archer, 1995; Archer, 2012; Lotz-Sisitka and Hlengwa, 2012; Lotz-Sisitka and Hlengwa, 2015). This work was contextualised through narratives which steered teacher education practice in SADC.

1.5 Narratives steering ESD teacher education practice in SADC region

1.5.1 Policies and competence for teaching

Formation of the African Union and New Partnership for Africa's Development (NEPAD) influenced the developments in education in the SADC regional economic community. SADC

drew from the key global agreements including the UNESCO Education for All (UNESCO, 1990; UNESCO, 2000a), Millennium Development Goals (UN, 2000) (SADC, 2008) and lately, the Sustainable Development Goals (SDGs) (UN, 2015) as well as Africa-wide guidelines such as the recent Africa Union's Agenda 2063 (Africa Union, 2014). SADC is mandated to implement these guidelines from these meta-bodies in Africa. One of the thrusts of the UNESCO's Action Plan for achieving the Decade of Education for Sustainable Development and the Global Action Programme (GAP) (UNESCO, 2014d; 2014e) as well as the Global Citizenship Education Movement (UNESCO, 2014b) remains teacher education and teacher development (UNESCO, 2010-TTISSA report). One of the priorities of SADC on education is teacher development which seeks to "ensure the provision of sufficient teachers to meet the demands of education systems and to ensure that all teachers are properly qualified and possess the relevant knowledge, skills and attitudes to teach effectively …" (SADC, 2008, p. 14).

In essence, the teachers must be adequately equipped for the contexts in which they teach. One of the strategic interventions necessary to achieve this goal is "Improving competences of teachers" (ibid.).

The United Nations European Commission on Education (UNECE) (2011, p. 3) defined educator competences as relating to "what they should know, what they should be able to do, how they should live and work with others, and how they should be if they are to contribute to ESD". Therefore competences go beyond the individual performance or expertise, especially in ESE which by its nature, involves more than the individual only, and also engages aspects of society. Competences in this context have a strong social component. It is for this reason that the SADC REEP worked with not only the idea of competences, but also the idea of capabilities to guide their thinking (SADC REEP, 2008). Capabilities of a person in this study were defined according to Amartya Sen (1999, p. 75) as "… the alternative combinations of functionings that are feasible for her to achieve". Functionings are made possible by existence of conversion factors (Elliot, 2007; Hill, 2005; Gasper and Staveren, 2005; Robeyns, 2005). Elliott (2007) defined capabilities as capacities to perform functions in accordance with standards of excellence that are unique to that activity and these standards are valued by the performer as contributing to better performance.

The views on competencies and capabilities in this research were guided by Elliott's (2007) perspective on the relationship between the two concepts. He argued that any human capital development process aims at developing capacities which are specific functional skills which are also by their performative nature, competences. However, according to Sen (1999), capabilities are much wider than competences. They include how people value what they do. Therefore competencies and capabilities are closely linked and intertwined in many ways. Teacher educators enjoy professional development in order to perform better (that is to become more competent in their teacher education practice) but they do not get any recognition for this from their institution or the education system of their country. Better performance for them gives them greater ability to handle their teacher education work and this raises their fulfilment of achievement in their practice and is no doubt a clear and powerful link between competencies and capabilities (see Sections 1.6, 1.7 and 1.8)

The SADC (2008) strategic intervention doesn't suggest ways, however, by which competences of teacher educators could be improved. SADC REEP professional development courses were one initiative developed to enhance ESE teacher education competences. This research sought to understand whether the courses did enhance teacher education ESE competencies and capabilities both at individual and institutional levels as envisaged (see Section 1.10).

In the absence of similar existent frameworks for southern Africa at the time of this research, I drew on the UNECE competences framework (UNECE, 2011) and the OECD competences framework (de Haan, 2010) and Wiek, Withycombe and Redman's (2011) analysis of Competences for Sustainability as well as the notion of capabilities (Sen, 1999; Gasper and van Staveren, 2005; Hill, 2005;Robeyns, 2005; Elliot, 2007; Flores-Crespo, 2007;) to provide insight into exactly *which* competences were developed by the courses (if any); and *how* the course contributed to enhancing teacher educator and institutional ESD capabilities (if at all). This process of using the international frameworks allows for a critical review of these competence frameworks by assessing their relevance and value in a southern African context. The study sought to establish how mediation actions influenced development of capabilities and competences in teacher education practice for ESE (see Section 1.10.2).

Based on the call for quality education as expressed earlier by Richmond (2010) and the interests in southern Africa in a new meaning to educational quality (Lotz-Sisitka, 2010a; Jobo, 2013; Shumba and Kampamba, 2013), there is greater need for innovative approaches to support teachers and teacher educators to enhance their competencies. The SADC REEP project evaluation (Mukute, Marange, Lotz-Sisitka and Pesanayi, 2012; see Section 1.6) found that environmental education practitioners in various sectors including teacher education needed capacity to understand and mainstream policies on environment and sustainability. Therefore teacher educators needed more assistance to understand the concepts of sustainability, education for sustainable development and the methods that could be used to promote it as well as support teacher educators to initiate change for sustainability at institutional practice level. In the UNECE competences framework these institutional practices are recognised as clusters of essential characteristics of ESD, namely, a holistic approach; envisioning change; as well as achieving transformation. De Haan (2010) stated that the competences of educators for ESD that support active participation, modify and shape the future of society as well as guide its social, economic and technological along the lines of sustainable development, should fall into the three categories: 1) subject and methodological competence, 2) social competence, and 3) personal competence. This is not unlike recommendations in the SADC REEP (2006) research on what is needed for education for sustainable development (ESD). One way to develop such competences is through practice (Lotz-Sisitka and Ellery, 2010), a concept which is discussed in more detail later in this research.

As noted above, the change project enabled participants to reflexively work on their practice and shift from normalised education practices to show characteristics of education for sustainable development, in other words from the 'habitus' of education to a new 'habitus' and eventually the 'habitus' of Education for Sustainable Development (see Sections 2.7.2 and 2.7.3).

1.6   Capacity needs in the SADC region

A study commissioned by the SADC REEP on the capacity needs for the region to mainstream policies on education for sustainable development found that at an institutional level there was need to enhance capacity for: inter-sectoral and multi-stakeholder collaboration; fostering linkages along the implementation chain; environmental

governance, environmental justice and environmental management; and mobilisation, deployment and absorption of science, knowledge and technology development (Mukute et al., 2012). The study also revealed that human learning is necessary for enabling transformation to a sustainable future and that individuals needed competences for mainstreaming ESD through development of integrative skills that allow individuals to work with other sectors and other stakeholders in a participatory and symbiotic manner (Mukute et al., 2012; SADC REEP, 2012). This call was not different from Lotz-Sisitka, Olvitt, Gumede and Pesanayi's (2006) observations that environmental education practitioners constantly critiqued their ESE practice and had ideas of what constituted excellence in their practice. SADC REEP (2011b) argued that practitioners needed to strengthen their capacity for curriculum-based environmental education work.

There was also a need for strengthening environmental leadership skills that enable individuals to move beyond their disciplines and mobilise distributed knowledge, skills and attitudes to address complex environment, sustainable development and education needs. Resource mobilisation and accountability skills were also needed to enable individuals to identify and tap into international and local funds available for supporting fair and sustainable development.

Additionally there was need to strengthen policy development and review skills that both enabled individuals to mainstream new developments in a coherent and holistic manner, and provide a framework for different sectors to work together effectively. Working with new knowledge to shape new actions and values, and to mediate risk and reflexive learning were also identified as important in the SADC region. As already indicated above, the Rhodes University/ SADC International Certificate in Environmental Education course had a framework that sought to respond to many of these capacity gaps, but it is not clear how and if it actually responded, hence this research.

1.7   UNESCO DESD and teacher education

In 2002 the United Nations General Assembly through the Johannesburg Implementation Plan of the World Summit on Sustainable Development (WSSD), declared that the period 2005-2014 be the Decade of Education for Sustainable development (DESD). It designated the United Nations Education, Scientific and Cultural Organisation (UNESCO) to lead the

implementation (Richmond, 2010). The Decade aimed at integrating "… values, principles, and practices inherent in sustainable development into all aspects of learning – in all types, levels and settings of education – to encourage changes in attitudes and conduct which will help to create a more viable and fairer society for all" (Richmond, 2010, p. 20). Inherent in Richmond's assertion is respect, a basic value of ESD and this includes respect for others, for present and future generations, and respect for planet Earth (van Ginkel, 2010). UNESCO, the agency leading the implementation of the UN Decade of Education for Sustainable Development recognises the important role of teachers as agents of change and that one of the strategies for "… effective implementation of the DESD requires engaging the world's teaching force (made up of over 70 million teachers and countless numbers of non-formal educators in professional development) to learn the pedagogy, content, values and good practices associated with ESD" (Richmond, 2010, p. 22). In SADC, working on environmental education/ education for sustainable development during the Decade added focus and relevance to current efforts on responding to policies such as Education for All (EFA), Education for HIV/AIDS and the UN Literacy Decade goals (Lotz-Sisitka et al., 2006). To further the aims of the Decade, UNESCO established a UNESCO Chair on Re-orienting Teacher Education to Address Sustainability based at York University, Canada.

The Chair established the International Network (IN) of Teacher Education Institutions mainstreaming ESD into their education and training practices. In association with this chair UNESCO supported the establishment of a regional network for Africa. The regional network was set up as an umbrella body for all initiatives supporting mainstreaming of Education and Sustainability in teacher education institutions in Africa. The body was called the African Network for Re-orientation of Teacher Education for Sustainability (UNESCO, 2010a; 2010c). A number of initiatives including the Teacher Training Initiative for Sub-Saharan Africa (TTISSA) and the SADC REEP Teacher Education Network fall under AFRETEIS (AFRETEIS article of formation, 2010). Affiliated to AFRETEIS and the UNESCO IN, in 2009 SADC started a network of teacher educators, the SADC REEP Teacher Education Network, with a group of 13 participants from 10 countries (SADC REEP, 2010b). Various efforts have included the SADC REEP-SWEDESD partnership which was extended to 120 participants from 42 teacher education institutions across the 15 SADC countries. The ultimate aim was quality education for a sustainable future.

The next sections give the background of the case institutions in which the units of analysis operate. A clearer picture of the institutions provides the contextual setting and influences of the institutions on teacher education practice and how these contextual factors further influenced development and implementation of the change project for environmental education/ education for sustainable development. The case from Zimbabwe is discussed first, followed by the case from Lesotho.

1.8 Zimbabwe case study

1.8.1 Overview of the Zimbabwe education system

The Republic of Zimbabwe was under colonial rule from 1890 when the borders of the country were defined by Cecil John Rhodes and his team of initial British colonists who named it Rhodesia. Political struggles persisted until the colony was usurped from Britain in a Unilateral Declaration of Independence (UDI) by locally based colonisers in 1965. The change from direct British rule to local British leadership did not bring much positive change to the majority of people in the country until the advent of majority rule in 1980.

As in most African countries, the new political and socio-economic dispensation inherited problems of under-skilled and un-skilled manpower in the majority of the population. These combined with housing shortages, differential incomes and opportunities, illiteracy, health and sanitation and underdevelopment of rural areas. In addition, HIV and AIDS, gender disparities, environmental degradation, worsening poverty and reduced access to ecosystem services further created difficult conditions for local people. These are the issues the government has been tackling through education since 1980. Upon gaining majority rule in 1980, education was proclaimed a human right. It was made compulsory at primary level and has been freely provided to all citizens with state support through grants and various forms of welfare assistance since 1980 (Zvobgo, 1994; MoESC, 2008). This post-colonial education was meant to enable national reconciliation, unity, patriotism, socialism and living in harmony with others (Zvobgo, 1994). The curriculum, though modelled around the British (Cambridge) system has been responding to local and national needs of the people by continually transforming and responding to contemporary issues, mostly with the aim of redressing inequality. This means the Zimbabwe government started off with the aim to redress the education divide of the pre-independence period rather than with a

development aim to education (ibid.). This trend of pursuing the redress agenda has persisted while environment and sustainability issues have worsened, meaning that there is need for education to continue to transform and respond to emerging and yet very important issues for individuals and society.

Despite the good intentions, equal access to education did not translate to equal educational experiences across the schools as the government grappled with, among other problems:

a) some schools had scant infrastructure while some were already established;
b) too few qualified teachers to man our schools, colleges and the supervisory ranks;
c) poor communication infrastructure
d) irrelevant curricula;
e) wrong attitudes instilled over a long period of cultural imperialism.
   (Zvobgo, 1994: ix)

One national response to inequality in access to education was massive expansion of primary and secondary schools that was equally matched with expansion of the teacher education sector and reduction of monopolies of the single national university to allow more national universities. All public colleges are affiliated to a university, therefore the university has considerable influence on the curriculum of its affiliated colleges. Some of the teacher training colleges are affiliated to Institution X (a focus of analysis in this study). Graduate teachers from universities and colleges teach in a society where socio-ecological issues abound. The nature of the curriculum and curriculum experiences had to tackle emerging issues in society. Integrating Environmental Education into curricula of secondary teacher training was deemed one response to the national environment and sustainability issues (ST2EEP, 2003).

Environmental Education was promoted through curriculum review and integration as well as through extra-curricular activities by ST2EEP from 2004. Extra-curricular activities are those activities that learners can embark on outside regular lesson time. Environmental clubs were formed in schools and colleges as extra-curricular activities, in addition to what educators were experiencing in class (ST2EEP, 2003).

In line with its post-independence policy, Zimbabwe embraced the Education for All initiative as represented in the Jomtien Declaration of 1990, the later Dakar Convention in

2000 and even more recently, the Incheon Declaration on Education 2030 as well as education imperatives of Africa Union's Agenda 2063 (see Section 1.3.3). The earlier policies foregrounded the basic learning needs for learners as acquisition of communication skills (language skills and/or literacy), number concepts or mathematics and numeracy, appreciation of social and natural phenomenon (social studies and natural sciences), acquisition of creative and other manipulative skills such as arts and crafts, technical skills, etc. It is around these broad skills areas that the basic learning needs were identified and developed in the EFA plan of action for both formal and non-formal educational programmes (UNESCO, 2015c). The Incheon Declaration on Education 2030, as a response to quality education with a focus on education for sustainable development (see Section 1.3.3 above), built on developments from the earlier policies. Notably, Education for Sustainable Development seeks to build on the EFA goals and create an enabling process for quality and relevant education for the learners. Teachers are trained at Institution X and at teacher training colleges that are spread across the country.

1.8.2 Institution X

This institution has a long history of tertiary education in the country. The Faculty of Education is one of the ten faculties that include Agriculture, Arts, College of Health Sciences, Commerce, Engineering, Law, Science, Social studies and Veterinary Science. Teacher education is the responsibility of the Faculty of Education.

1.8.3 Teacher education

Teacher education in the Faculty of Education is conveniently divided into two options:
- *Initial teacher training / education* (a pre-service course before entering the classroom as a fully responsible teacher); and
- *Teacher development* or *continuing professional development (CPD)* (an in-service process for practising teachers).

Initial teacher training is provided to undergraduate students who want to leave the university with a teaching qualification. Continuing professional development (CPD) refers to the support given to certified teachers who wish to gain more knowledge and earn higher qualifications in the subjects that they teach. In this study, CPD is also referred to as academic professional development (APD).The assumption is that a teacher with higher

qualifications is able to work better and more easily in the classroom. At times the university offers very short unaccredited courses simply to support practising teachers with a particular component such as technology for teaching, teaching new science concepts in the curriculum or innovative ways of teaching particular topics and promotion of particular methods of teaching and learning, such as collaborative methods.

1.8.4 Departments

The Faculty has six departments, namely, Adult Education; Curriculum and Arts Education; Education Foundations; Science Education; Teacher Education and Technical Education.

1.8.4.1 The curriculum

The Teacher Education curriculum generally has the following four aspects:

- Educational foundations that develop knowledge in education-related aspects of philosophy of education, history of education, educational psychology, and sociology of education.
- Technology Education entails skills in using technology to improve teaching and learning, supporting students with special needs and assessing student learning.
- Content-area and methods knowledge and skills – often also including ways of teaching and assessing a specific subject, in which case this area may overlap with the first ("foundational") area. In order to respond to contemporary challenges, the methods must enable student teachers to think through their practice of teaching as they work across different disciplines and must encourage the student teachers to use more learner-centred and participatory methods.
- Teaching practice and teaching practice supervision entails supporting student teachers in the skills of working in the real classroom. Students are observed during practice and are supported to do better (Institution X, n.d.).

1.8.5 Mainstreaming environment and sustainability education

Institution X is a member of the UNEP/ SADC REEP initiative, Mainstreaming Environment and Sustainability in African Universities (MESA), and is a member of the Southern African Regional Universities Association (SARUA) which is promoting mainstreaming Education for Sustainable Development and is promoting mainstreaming of climate change education

across its membership. SADC REEP supported the MESA initiative of mainstreaming of ESE by providing funds that enabled university personnel to conduct a capacity building workshop on the notion. Institution X received such funding and conducted a workshop. Members from this university joined the SADC REEP and the Swedish Centre for Education for Sustainable Development (SWEDESD) partnership project, the Education for Strong Sustainability and Agency (ESSA). ESSA promoted use of specific tools such as the closed ecosystem or mini ecosystem (an enclosed bottle that demonstrates a self-sustaining ecosystem) to illustrate sustainability in teaching.

1.8.6 Teacher education competences in the Faculty of Education

Institution X has a list of specific competences that teacher educators in the faculty are expected to demonstrate and teachers graduating from the Faculty of Education are supposed to have (Teacher Education Specific Competences). The list of competences are classified into four categories, namely, Knowledge and Understanding; Educational Practice and Skills; Values and Ethics; and Interpersonal and Intrapersonal abilities. In the list below are selected competences which I observed to have direct relevance to professional development in ESE and especially the way they resonate with aims, objectives and practices of the Rhodes University/ SADC International Certificate in EE course:

Knowledge and Understanding:

- the local and international social, political, economic, cultural and environmental contexts of education
- national and institutional policies relating to education

Educational Practice and Skills:

- select, adapt and use appropriate teaching methods and learning activities
- use a range of assessment skills to set, mark and grade learners' achievement
- manage learners both inside and outside formal classroom contexts
- create conducive learning environments that encourage learning
- use language appropriately in the classroom and in the subject
- participate in basic educational research
- critically reflect on their work to improve practice
- adapt to change

Values and Ethics:

- care for and support the well-being of all learners
- maintain equity and fairness among leaners and promote inclusive education
- continuously upgrade their own knowledge and skills

Interpersonal and Intrapersonal Abilities:

- collaborate and network with others including peers, head teachers, professional groups, parents
- communicate effectively with different audiences and using appropriate tools, including ICTs, and relevant forms of discourse
- lead and manage groups

Teacher educators are motivated to look for professional development opportunities in order to develop or perfect some of these competences. The vision and mission statements of the Faculty of Education aspires to lead in production of quality educators who are knowledgeable, skilful, critical and creative to develop capacity for sustainable development in Zimbabwe. Therefore teacher educators seek capacity development so that they develop the capacity to develop educators. That is why they would be keen to participate in any capacity development opportunities. The notion of sustainable development has been around since the United Nations (UN) Conference of the Human Environment in 1972 (UN, 1972). It was defined in the Brundtland Commission Report (1987, p. 39) and later in a background paper for the High Level Panel on Global Sustainability (Drexhage and Murphy, 2010) as "… development that meets the needs of the present without compromising the ability of future generations to meet their own needs" and page 136 called for education to "… focus on the environment and be integrated into other disciplines in the official curriculum at all levels in order to develop a feeling of responsibility toward the environment". Chapter 36 of the action plan, Agenda 21, adopted by the United Nations Conference on Environment and Development (also known as the Rio Summit) in 1992 (UN, 1992) positioned environmental education within the framework of sustainable development. The conference further called for establishment of national education programmes for sustainable development by 1996. Thus, the notion of sustainable development introduced a new narrative and new discourse of education for sustainable development that was carried into education through the Bonn Declaration (UNESCO, 2009) and the Decade of Education for Sustainable Development of 2005-2014 (UNESCO, 2005a). The result is that teacher educators are encountering this kind of discourse in their practice

but without any experience of it during their schooling and training (such as the individual cases described in this study) and they tend to reflexively seek capacity development.

The contextual background of the Lesotho case study is developed in the next section, starting with an overview of the country's education before focusing on the nature of the curriculum in the case institution.

1.9 Lesotho case study

1.9.1 Overview of education in Lesotho

The Kingdom of Lesotho, formerly known as Basutholand was founded in the late 1700s under King Moshoeshoe. It arose from tribes that avoided wars and retreated to the mountains. The country exists today as a generally mountainous country that is wholly surrounded by South Africa. It became a British Protectorate after King Moshoeshoe died in 1868. Lesotho became an independent state in 1966. However, education in the country was mainly led by missionaries from the Catholic Church, the Anglican Church of Lesotho and the Lesotho Evangelical Church (formerly Paris Evangelical Church), accounting for more than 90 percent of the primary school enrolment (Gill, 1993; Raselimo, 2012) but under the Ministry of Education. Such ratios have persisted over the years of development of education in Lesotho. But the government of Lesotho has, through its vision 2020, been investing in people as a viable long term public investment that has social benefits. The government has taken more responsibility for education from churches and introduced Free Primary Education (FPE) in 2000 (Government of Lesotho, 2008a; Government of Lesotho, 2008b).

Education in Lesotho has passed through many years of transition from the mainly utilitarian focus, for development of basic communication and labour skills, to higher industrial skills for national economic development. However, most of the school leavers end up being absorbed by neighbouring South Africa. The main economic activity has been farming, cattle rearing and arable agriculture. Decades of farming, together with population growth, have created pressure on the natural resources and especially the land-based resources. Recognition of the importance of vocational subjects for the development pathway of the country has necessitated introduction of vocational subjects such as agriculture in the schools, combined with a need for additional training programmes in

teacher training. To this end, the Lesotho National Constitution proclaims "… that education be directed to the full development of the human personality, as well as a sense of dignity and strengthening of respect for the human rights and fundamental freedoms of the Basotho" (Jobo, 2013, p.1). Human rights include the right to a good life, right to a decent life, right to clean water, right to healthy food, right to good health and the right to live in a healthy environment.

1.9.2 Teacher training

Teacher training in Lesotho was initially provided by colleges that were governed by missions. In 1947 there were four colleges and by 1959 there were seven colleges that were operated by different churches. All these were amalgamated in 1975 when the National Teacher Training College was opened and renamed (Institution Y in this study). The college trains primary school teachers and junior secondary school teachers. It is affiliated to the National University of Lesotho that was founded by the Catholic Church in 1945 but which became a national institution in 1975. The university has seven faculties, including the Institute of Education that produces graduate teachers for senior secondary school. It also offers courses for up-skilling of practising teachers by offering higher qualifications.

1.9.3 The curriculum

The taught curriculum is in the subject form that was inherited from the Cambridge system when Lesotho students were examined by a British examination centre. The National Curriculum Development Centre (NCDC), an arm of the Ministry of Education, was established in 1990 to design school curricula and work closely with the Examinations Council of Lesotho to conduct the examination of learners. The NCDC operates through national subject panels comprising representatives of teachers, teacher training institutions, the inspectorate, and teachers' associations. Subjects with a strong theoretical background such as Sesotho, English, Mathematics, Science, and Social Studies are considered core at secondary school level while practical ones such as Agriculture and Carpentry provide a vocational component to the secondary school curriculum. This subject-based approach is also evident in the teacher training college which trains both primary and secondary school teachers for schools. Therefore, any change in the school curriculum such as mainstreaming

of HIV/AIDS, Gender and Environment and Sustainability Education (ESE) influences the structure and implementation of the teacher training curriculum.

In 2006 the government developed and approved the integrated National Framework for Curriculum Development and Assessment in response to the MDGs, Education for All (EFA), HIV/AIDS and Gender. This policy seeks to make education and the primary and secondary school levels accessible, relevant, efficient and of best quality (Government of Lesotho, 2008b). The framework focusses on Effective communication; Awareness of self and of others; Environmental Education and Sustainable Development; Health and healthy living; and Production and work-related competencies. On teaching and learning strategies, the framework suggests:

> ... a need to shift towards methods that can develop creativity, independence and survival skills of learners. There is need to move from teaching to facilitating learning; from transfer of knowledge to learner construction of knowledge; from memorising information to analysis, synthesis, evaluation and application of information; from knowledge acquisition to development of knowledge, skills, values and attitudes; from categorisation of knowledge (traditional subjects) to integrated knowledge (broader learning areas); from didactic teaching to participatory, activity-based and interactive methodologies. (Government of Lesotho, 2008b)

Introduction of compulsory and free primary education in 2000 saw an influx of learners and has called for increased enrolment of teachers at both the university's education department and the teacher training college. However, as noted by Gill (1993) and Raselimo (2012), due to paucity of resources and facilities, teacher educators and teachers tend to teach practical work and vocational subjects theoretically.

The Lesotho Environmental Education Support Project (LEESP) was a Danish funded intergovernmental initiative that supported teacher educators and teachers to engage with environmental learning. Approaches advocated included a holistic view of the environment, the need to foreground the notion of action competence as the ultimate end of education while environmental education had to be integrated across all the subjects and through a thematic approach (Mokuku, 2012). In order to promote lifelong learning, LEESP narrowed their work to integrate the following four pedagogical aspects: Content knowledge that was considered to be the lowest form of knowledge, that asks 'who, when, where'; Explanatory knowledge that seeks to give reasons as to why things happen the way they do by asking 'why, how'; Judgmental knowledge that facilitates estimation, evaluation, assessment or

judgment of matters is done through asking 'is it good or bad..., is it acceptable..., do we want to...?'; and finally, Action knowledge that was considered the highest form of knowledge, where one is able to act using one's experience in different matters, it asks 'what can I do..., what could be done?' (Jobo, 2013).

1.9.4 Mainstreaming ESE at Institution Y

The country of Lesotho has produced an ESD policy that advances efforts towards mainstreaming of environment and sustainability education in all sectors in 2010. To facilitate this agenda, a network of institutions that are interested in mainstreaming education for sustainable development (Mokuku, 2012) called *Lehae la rona* (translated to 'our home') was formed and the Lesotho College of Education is a member. The network has, since its establishment, met every two months for members to share experiences, support each other and plan for collaborative actions. Despite changes in the school curriculum to integrate environmental education through the LEESP, mainstreaming of ESE at Institution Y was a voluntary activity that was led and implemented by individuals with an interest. This trend has persisted and the research subjects involved in this study are teacher educators who were interested in mainstreaming ESE in their practice. At the time of the study, the institution's leadership had recently developed an interest in mainstreaming ESD after an orientation workshop in February 2013, on the concept with the partnership project between SADC REEP and the Swedish Centre for Education for Sustainable Development (SWEDESD). This interest is evident in the support now given to the research subjects in collaborative actions. The college is yet to respond comprehensively to the new national school curriculum changes that have integrated education for sustainable development.

From the contextual profiling of this research, I discovered that all educational institutions were striving for excellence, which in my view implied quality education, in their educational practice. This research in one way sought to understand whether change projects were contributing to the intended quality education through enhanced ESD practices. However, there arose a need to develop a deeper understanding of mediation of change oriented learning, if the research was to be more than a simple evaluation, and if it was to deepen our knowledge of the intended change oriented learning processes and outcomes.

1.10 Socio-history of the Rhodes University/ SADC (RU/SADC) International Certificate in Environmental Education (EE) course

1.10.1 Rationale for the course

The Rhodes University/SADC International Certificate in EE course started in 1997 and was funded by the World Wildlife Fund (WWF) and known as the Rhodes University / SADC Environmental Education International Certificate Course at that time (Janse van Rensburg and le Roux, 1998; Raven, 2005). This course was an adaptation of the Rhodes University/ Goldfields (RU/GF) course that started in 1992 and was conducted by Rhodes University in partnership with national stakeholders such as WESSA, with funding initially provided by Goldfields, a private mining entity. As part of their Corporate Social Investment, Goldfields set up environmental education centres around South Africa. In order to strengthen the capacity of staff in these centres, Goldfields provided support to Rhodes University and partners to start the course (Janse van Rensburg and Le Roux, 1998; Raven, 2005). The course was later adapted and offered in Namibia, Swaziland, Zanzibar and Zimbabwe where, due to context-specific adaptations, it had different names. In Namibia, South Africa and Swaziland, the course continues to be used to build capacity of practitioners for environment and sustainability education.

Characteristics of the RU/GF course that were taken into the Rhodes University/ SADC International Certificate in Environmental Education course were mainly defined by the need to strengthen capacity of the pioneering environmental educators whose individual and professional interests steered the framework, structure and implementation of the RU/GF course. They had different educational backgrounds and were working in different contexts, politically, socially, economically and physically diverse conditions, so the course had to respond to these backgrounds. Professional development at that time was mainly guided by the interest to develop competences that enabled environmental education practitioners to do their work better and reflexively in their context (Janse van Rensburg and le Roux, 1998; Raven, 2000). Janse van Rensburg and le Roux (1998) found that professional development led to, among other things, renewed excitement with, and commitment to one's work as well as the confidence and capacity to the work; it entailed a change in

attitude to work practices, enhanced criticality through one's work as well as the ability to develop skills to use resources more appropriately and more effectively in the workplace.

Although the course was initially meant for EE practitioners who worked in environmental education centres, by the advent of democracy in South Africa when environment became the organising feature of learning in the curriculum of schools, the course drew practitioners from formal education contexts such as pre-primary, primary schools, high schools and universities; centres and organisations offering educational support to schools that included the National Botanical Institute, Kirstenbosch Centre and Delta Environment Centre, state departments that had environmental education as part of their work, such the Department of Environmental Affairs, Department of Water, Forestry and Agriculture and Department of Land Affairs. To this end, the course was one of the ways used to support community development (Janse van Rensburg and le Roux, 1998; Raven, 2000).

1.10.2 Nature of the RU/GF course
Recognising the often complex, diverse nature of the environment where each course participant was an adult learner who experienced particular environmental challenges, some of which were immediate concerns, the course had to be responsive to all course participants. Even though most of the environment and sustainability issues experienced in most southern African countries and across national institutions in the respective countries were the same, the course facilitated participants to respond to what was of immediate concern to them, in their own workplaces. Ontologically, the course recognised that participants understood their environment through their experiences of it as well as interactions with others. Environmental issues exist within socio-historical contexts so environmental education had to contribute to social change particularly for those contexts from where participants came, creating a new socio-ecological history through environmental education (Janse van Rensburg and le Roux, 1998).

Being a course for adult learners, the socially constructed ontology of knowledge (Vygotsky, 1978; Engeström and Sannino, 2010) influenced epistemology on the course and that also influenced pedagogy which in turn tended towards constructivist approaches and collaborative teaching and learning methods (Janse van Rensburg and le Roux, 1998). Interaction of all forms was paramount and practitioners who enrolled on the course were

considered as participants and not students, with a view to developing their desire and ability to work in collaboration with other individuals and institutions with whom they shared practice (Janse van Rensburg and le Roux, 1998; Motsa, 2004; Raven, 2005). Using their experiences and cultural backgrounds, participants were involved in co-development of the course; all their contributions were valued and were used to enrich the course since all participants were considered as both learners and educators (United Nations, 1992). Course activities opened opportunities for participants to share their ideas, experiences and practices thereby co-constructing meanings on the course.

One steering feature of the course was the recognition that theory and practice shape each other through praxis (Bourdieu, 1998; Raven, 2000). Activities during the on-course sessions focussed on providing a platform for participants to interrogate their own practice. Participants had to critique their own practice by identifying ESE practices and by understanding why they are done that way. In particular, their assignments were practice-based and oriented towards improvement of practice which Raven (2000) described as a reflexive process.

The notions of praxis and reflexivity influenced the course framework which was structured to facilitate an understanding of the theories that inform practice to enable participants to critically and reflexively engage a variety of educational responses to environmental crises and risks in their work contexts (Raven, 2000; Motsa, 2004).

1.10.3 Structure of the course

The RU/GF course was completed over a year, with work on-course and work-away sessions. Three intensive national workshops where participants met with facilitators and tutors, were separated by an interval of four months. National workshops were conducted from Friday evening to Sunday afternoon. During the four months interval, participants briefly met in their regional groups and shared their understanding of the theory (from the course sessions) in relation to their practice, worked together on work-based assignments and were given tutorial support. This structure was necessitated by the course intention to slowly but methodically develop reflexive critique of and engagement with participants' own practice, especially reflecting on one's job and the ideas and practices that shaped the job description as environmental educators. Participants had to spend considerable time

looking into their work using the lens of the course and generate educational responses, something usually only achievable in a long rather than short course.

1.10.4 Course content

The on-course content was divided into four themes in order to cater for the spectrum of contexts of participants' knowledge and experiences. In addition to participants' specific needs, the course had to deepen participants' skills generally to work with all issues and crises and more ably respond to them. The themes were set up to progressively develop and depend on earlier themes. Course materials were organised into a course file that was divided according to the four themes.

Theme One which was entitled *The Environment: A crisis and responses* was for exploring the nature of the environment as constituted of interacting dimensions. This theme also explained the gravity of the situation and why the environment was in crisis as evident in the environmental issues experienced in various contexts. Emphasis lay more on the interrelationships of non-biophysical aspects of the environment with social, political and economic dimensions. Emphasising interrelationships was appropriate as environmental practitioners did not traditionally know the environment in this way from an interrelated perspective (Janse van Rensburg and Le Roux, 1998). Impacts of environmental issues and relationships to these dimensions of the environment were illustrated. The theme further opened up a wide range of environmental responses, including historicising their development. This focus is still evident in the Rhodes University/ SADC International Certificate in Environmental Education course except there has been a shift towards sustainability and more sustainable practices over time as the sustainable development discourse evolved after 1992 (United Nations, 1992). Course processes were represented in the steps diagram (see Figure 1.3 below), a metaphorical illustration of capacity development during the course where each step contributed to climbing a 'capacity' staircase.
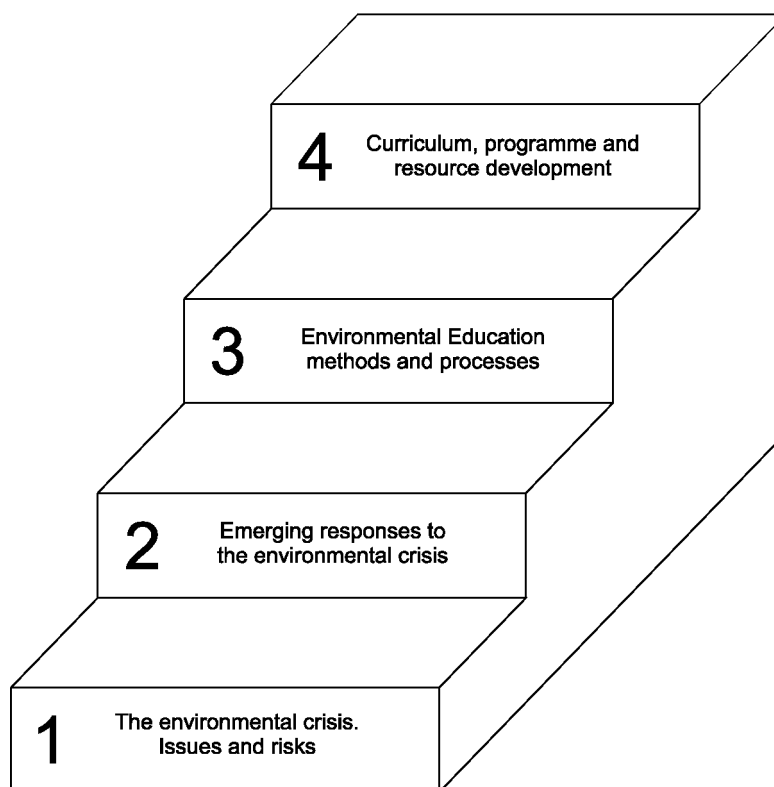
Figure 1.3. Stepwise capacity development on the course (SADC REEP, 2008)

Environmental Education as a Response to the Crisis was the title of the second theme which explored environmental education as a response to the environmental crisis. International agreements were mapped out to show the developments and constellation of policy responses to environmental issues. The origin of environmental education was traced back to the publication *Silent Spring* (Carson, 1962) and the way it has been expressed across the international policy guidelines was discussed.

Theme Three focussed on *EE and Theories of Education, Development and Evaluation.* This theme delved into deepening knowledge on environmental education for practitioners. It looked into social theory as determining how people live and interact among themselves and their environment as well as influencing how people come to learn and how this relates to environmental education. In addition, the theme looked at learning theories with a view to supporting environmental educators to see how learning and social theory influenced the thinking about and the actual conducting of learning processes in environmental education. In this theme participants were introduced to the theory and practice of evaluation. They needed to be able to conduct monitoring and evaluation of their own projects and

programmes. This theme was carried across into the Rhodes University/ SADC International Certificate in Environmental Education course.

The last theme was *Curriculum Development, Resources and Programmes.* This theme encouraged and supported participants to develop organised programmes in their work contexts, especially as most staff in centres did not have adequate capacity for their ESE work and did not have structured (clear and justified curriculum) educational programmes. The programmes were well reasoned using the course interactions and resources. Participants were expected to develop context specific resources for use in their work (Janse van Rensburg and le Roux, 1998; Raven, 2000). The resources component was carried over as an assignment in the RU/SADC International Certificate in Environmental Education course. However the Rhodes University/ SADC International Certificate in Environmental Education course foregrounded planning for implementation, monitoring and evaluation of the ESE change project in this section of the on-course session.

Assessment was a key tool to support learning and development of reflexivity on the course. The following section will give details of the assignments and their roles.

1.10.5 Course assessment

The role ascribed to assessment in the course was oriented towards praxis-based reflexivity (Janse van Rensburg and le Roux, 1998; Motsa, 2004; Raven, 2005) rather than for standardised progress or placement. It adopted an orientation of using assessment to enhance learning rather than simply assessment of learning (Biggs, 1999; Boud and Falchikov, 2007). Assessment criteria were deliberated and agreed on with participants when they received the assignment brief to the effect that participants wrote up the assignment against the set, clarified and agreed on criteria. This means participants were able to assess themselves and their responses in the process by foregrounding reflexivity. Participants would submit their initial draft write-up of the assignment to tutors who helped to shape it further. They then re-wrote the assignment incorporating comments from the tutors, in so doing enhanced their understanding of the issues concerned and demands of the assignment (Janse van Rensburg and le Roux, 1998). This approach to the assignments and assessment was carried over into the Rhodes University/ SADC International Certificate

in Environmental Education course as it was found to be productive in enhancing reflexivity and praxis (Raven, 2005).

1.10.6 Pre-course assignment

Each of the themes was assessed to enhance understanding of concepts as well as to establish participants' conceptual understanding in relation to their work practices. A pre-course assignment involving institutional colleagues and leadership was a tool for facilitating reflexive engagement (Raven, 2000) with course participants' role as environmental educators in order to enable them to understand why their job was set up the way it was and how well they were performing in it. The ultimate aim was to improve their ability to engage reflexively in that job. The pre-course assignment enabled course tutors to ascertain the nature of environmental education practice of individual participants so as to facilitate response engagement with participants. The pre-course assignment provided a platform for course tutors to group participants according to their work contexts and interests individually to assist the participants responsively through the four assignments.

1.10.7 Assignments 1- 4

In Assignment 1, participants were expected to identify an environmental issue within their work context and critically analyse its nature, causes, impacts and indirect effects in terms of biophysical, social, political and economic dimensions. Through this assignment response, participants would demonstrate their understanding of a particular issue with the hope that they would be able to identify any environmental issue and critically analyse it. Assignment 2 was meant to facilitate participants to reflexively understand their work programmes by laying out its aims, objectives and principles as well as critiquing these against theoretical ideas developed on the course and in the course modules. In Assignment 3 participants were expected to identify, describe and critique the educational methods they were currently using on their programmes. In addition, participants were requested to motivate for new teaching and learning methods that could be used on the programme or course to complement the ones currently used. Assignment 4 required participants to develop a programme or resource that would be used in their practice. As part of the assignments, they had to justify this production and use of the product on the proposed programme or course. Since the initial role of the course was to support capacity of practitioners in

environmental education centres, the assignment was set up to produce programmes (to respond to the paucity of structured programmes) and basic yet quality resources (to support environmental learning).

The four assignments and their rationale were adopted by the Rhodes University/ SADC International Certificate in Environmental Education course as shown in Section 4.2. The differences are mostly attributable to the framework of the Rhodes University/ SADC International Certificate in Environmental Education course which was three-tiered: participants spent three weeks working on a pre-course assignment; two months attending an on-course phase; and had to implement the last assignment in their practice. Participants had to report back to course tutors on their experiences of reporting back to their colleagues and initial engagement with workplace practices. Due to this difference in structure, the pre-course assignment on the Rhodes University/ SADC International Certificate in Environmental Education course was structured to help participants to identify issues influencing their practice and start building a community of practice in preparation for implementation of the last assignment, the change project implementation. One noticeable difference with the Rhodes University/ SADC International Certificate in Environmental Education course, and especially during the phase of this course that I was researching, was a change in language which more explicitly included the notion of sustainability, sustainability practices and education for sustainable development. All assignments included statements and phrases that had environment and sustainability in their statements, a feature which is evidence of a shift that expands environmental education towards education for sustainable development. This study was located in the field of environmental education (EE) as expanded within the global discourse on education for sustainable development (ESD) (see Sections 2.1.1 and 2.1.2).

This research thus studied a course that focussed on enhancing the ability of environmental education practitioners to reflexively engage with their teacher education practice in their efforts to mainstream environment and sustainability education. The next section introduces the notions of mediation, practice and reflexive practice.

1.10.8 Overview of the Rhodes University/ SADC International Certificate in Environmental Education course

The Rhodes University/ SADC International Certificate in Environmental Education course was a participatory course (no examinations) that sought to enable participants to understand issues affecting society and the environment, and be able to deliberate and promote more sustainable alternatives and solutions. It ran for 15 years as a professional development programme for environmental educators in SADC involving 163 participants from 15 SADC countries and a few non-SADC countries such as Sweden and Kenya. In addition to strengthening environmental educators' agency or capacity for change during the on-course period, it intended to strengthen their agency in their lived contexts (SADC REEP, 2010a). The course was expected to contribute to the capacities and capabilities that people have in their lives and practice. Capabilities are interpreted as the abilities that people have to make choices about what they value being and doing (after Sen, 1999). To facilitate such deliberations and actions, the course foregrounded reflexivity by which practitioners were supported to work with course processes to produce innovations, materials and tools that responded to socio-ecological issues, and which supported them to do their work better.

As discussed in detail in Chapter 4, the course was implemented in three parts. The first part was completed in the participant's workplace as a pre-course assignment (see Section 4.2). The second part was the on-course session which aimed at deepening understanding of issues, including those identified by participants, in order to strengthen understanding of their change projects (see Section 4.2.1). During the on-course session participants were afforded opportunities to develop skills for materials development, skills for using ICT in education and skills for trying out and using new methods in their teaching practices (amongst others). The final part involved implementation of their self-defined 'change projects' in their institutions, involving others in the workplace, constituting the community of practice for each change project (see Section 4.2.2.6). The course structure is illustrated in the framework that follows as Figure 1.2.
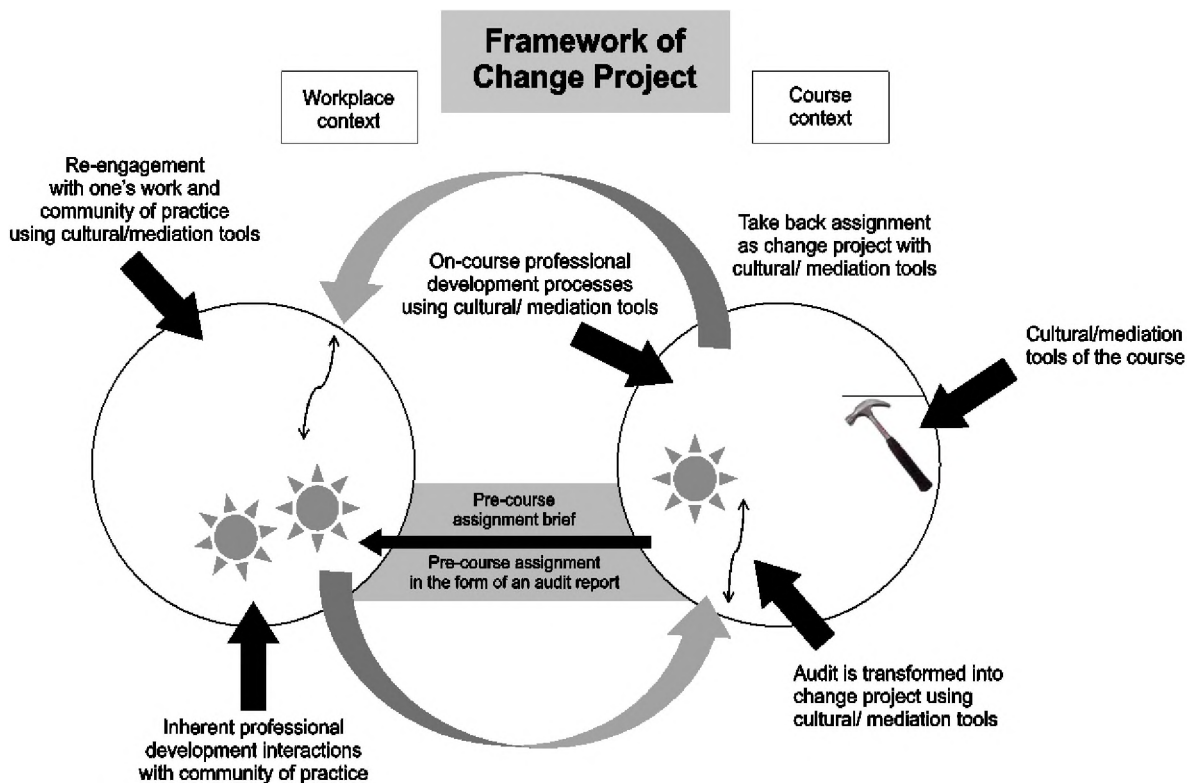
Figure 1.2: A framework illustrating the Rhodes University/ SADC International Certificate in EE course structure

Through the pre-course assignments, it was expected that participants would start to interrogate their practice, together with colleagues in their workplaces. They identified areas that needed improvement in ESE in their practice and prioritised these. The highest priority was brought to the course by the participant, together with justification of their choices. This pre-course assignment presentation contributed to the reflexive orientation of the course. Facilitators worked with the programme in such a way that it responded as much as possible to all participants' backgrounds and contextual interests, while offering new knowledge and new and critical ways of thinking about practices (Lotz-Sisitka, 1999).

The on-course activities were covered in three units, namely:

- **Unit 1: Environmental Issues and Risks, Unsustainable Practices and More Sustainable Alternatives**: This unit supported participants to reflect on issues identified in their contexts, and to develop deeper knowledge of these issues and what alternatives might be;

- **Unit 2: Methods for Mediating Learning and more Sustainable Alternatives and Practices**: This unit required reflexive engagement with methods of teaching and sharing information;

- **Unit 3: Reflexive Implementation of Environmental Education Projects in Communities of Practice**: This unit encouraged participants to think of working with others in their institution and in other institutions, to implement and evaluate their teaching practices, thereby promoting collaboration and wider forms of reflexivity at various levels. (Course units are described in Section 4.1.1.)

A summary of course processes whose purpose was to support development of a reflexive change project focussing on improved / new practice is shown in Figure 4.1 in Section 4.2.1. During the course, all assignments and activities were designed to challenge the participant to reflect critically on his/her own practice; various processes were put in place to support this, including the way that assessment was conducted (see Appendices 1-5 and 13). Participants compiled a portfolio of evidence showing changes in thinking and practice during the on-course phase. Part of this study entailed examination of portfolios of evidence submitted by participants as part of the course processes to discern ways that the participants reflected changes in their practices emerging from their interactions with the course (see Section 1.10 and Section 4.2.1). These emergent characteristics were also analysed to establish whether participants showed any competences that were relevant to ESE (see Section 1.10 and Section 2.10).

1.11 Mediation, practice and reflexive practice

In order to understand how a course's culture contributes to changes in practice of participants and how the changes in practice on the course relate to changes in practice in the workplace, it was important to discuss the meaning of mediation. It is very important to note that the change project was supposed to happen at two levels which can be summed up as (1) the agent's practice and (2) the institution's practice. The first is the individual-social level, where the participant acquires changed practices that he/she uses to develop and plan to implement the change project in a social context. The institutional level is second but is key since individual practice is embedded in institutional social practice. The course comes with mediating tools for supporting changes in practice, therefore the course

aimed at mediating practice which crosses the individual-social boundary and recognises the socially or embedded nature of individual practices. The pre-course process was meant to enable the participant to engage reflexively with institutional and individual social practice by looking at aspects of their practice that could change to mainstream environment and sustainability education. The participants considered potential changes of practice in the workplace and reflexively engaged with changed practices from the course into the workplace using some of the tools from the course to mediate change there (see Section 4.2). The Zone of Proximal Development (ZPD) developed by Vygotsky (1978) was a key aspect in furthering understanding of the mediation processes (Daniels, 2008; Scott, 2008) (see Sections 4.4, 4.5. and 4.6) but all these happened within a reflexive and expansive learning (Engeström and Sannino, 2010; 2011) process (see also Section 4.6).

1.12 Mediation

Daniels (2008) defined mediation as a means by which the individual is supported by mediators to act and be acted upon by social, cultural and historical factors in the course of ongoing course of human activity (see Section 4.2.2.6). As such, mediation of practice is a social process. According to Daniels, the notion of the ZPD acknowledges that learners have a level of potential development for solving problems but normally will reach only the actual development that may be the same as the level of potential development or lower. But they cannot reach that stage of potential development unless they receive support and guidance from adults or unless they are working in collaboration with peers (Vygotsky, 1978). The adults and peers therefore provide the scaffolding for solving problems, whether present physically or in memory of how some problem has been solved. An understanding of this notion of scaffolding in relation to development of higher mental functioning and ESD practice is key in this research as it enabled investigation of how the mediation tools and processes supported participants in their desired change of practices or not. However, Daniels (2008) asserted that meditational means are imbued with power and authority and are also imbued with cognitive values. Cognitive values explain why certain knowledge and solutions are readily accepted as opposed to others in relation to habitus and matters of concern (Latour, 2004). Issues of power, authority and cognitive values tie in closely with Margaret Archer's notion of structure and agency and Pierre Bourdieu's 'structured structures' that are highlighted in the next section. Actors' choice of course of action then

falls into their Zone of Proximal Development (ZPD) making mediation an important part of this study. An understanding of practice is also necessary to understand how it is related to what and how people do the things they do. Practice was understood as an individual's sayings, doings and relatings as well as such notions as capabilities (see Sections 2.8.2 and 2.9) and competences (see Section 2.10) that were developed.

The study was organised around the goals, research question and sub-questions that are listed in the following section.

1.13 Goals of the research

1.13.1 Objectives

The study sought to understand whether and how the course processes (tools and artefacts; lectures, assignments, tasks and excursions) contributed to learning by course participants. It also sought to understand how the workplace (teacher education institution) took up the change project by looking deeply at how workplace practices influenced and shaped implementation of the change project as well as mediation of the institutional change project by the participant. The research sought to unravel, among other aspects, skills gaps, process gaps, resource gaps that impinged on the on-course experiences and participants' institutions' ability to support change in practice for mainstreaming environment and sustainability education. An understanding of these experiences and conditions influencing the change project contributes to knowledge on the influence of capacity building initiatives in individual-social and institutional-social ESD Teacher Education practices on mainstreaming of environment and sustainability education. This understanding is necessary for change project-based scaling of capacity building processes that feed into the Global Action Programme (GAP) on mainstreaming education for sustainable development and the Global Citizenship Education (GCE) movement.

1.13.2 Research question

How do mediated actions in a regional professional development programme and the workplace influence Environment and Sustainability Education (ESE) competencies, practice, learning and agency in Teacher Education for Sustainable Development (TESD) change projects?

Sub-questions

- What mediated actions on the course influence ESE competences, practice, learning and agency on the professional development programme?

- How do these identified mediated actions influence ESE competences, practice and learning on the professional development programme?

- What mediated actions in workplaces influence ESE competences, practice, learning and agency in the change projects in teacher education institutions?

- How do these identified mediated actions in workplaces influence ESE competences, practices and mediated actions in the workplace?

With a view to understanding:

- How mediation on an ESE reflexive capacity building programme influences development of capacity (competences, capabilities and agency) for mainstreaming environment and sustainability education and how that programme can contribute to upscaling of capacity for environment and sustainability education.

1.14 Summary of the dissertation

Chapter Two describes the sensitising concepts, concepts that situate the study in the context of the research. The concepts are described in relation to what they would mean in the study. The notion of environment and sustainability education is described together with the notions of change, practice, agency, competences and capabilities. The chapter ends with a brief justification of the use of both competences and capabilities in this study.

Chapter Three presents the analytical theory of the study. Critical realism and realist social theory were used as the under-labourer. Ontological and epistemological positions of basic critical realism and realist social theory were described as the foundation on which the research was designed and provided analytical tools. Realist social theory and particularly the notion of emergence was used as a lens to look into the data and to explain characteristics of data. Emergence at the structural, cultural and people levels was understood to influence practice, including change in practice over time, a condition of societal practice which, if there is structural and process change, is termed morphogenesis or morphostasis when there is tendency to retain the influencing structures and processes.

Chapter Four defines and describes the process of mediation. Mediation was described in relation to detailed activities on the RU/SADC International certificate in EE course. The chapter therefore contributes to the contextual description of the course while deepening an understanding of the notion of mediation. The concept of mediation was described using classical Vygotskian perspectives but reference was made to post-Vygotskian views on the meaning of the zone of proximal development.

Chapter 5 presents the research methods for the study. It sheds light into the research design decisions and data generation methods selected. The study uses a case study design and describes the narrative technique of presenting data. Issues of ethics and trustworthiness were described and the ways in which reflexivity influenced the research process were discussed. The chapter ended with a description of how the data were analysed for emergent properties.

Chapter Six, Seven and Eight are presentations of the three case studies. Structural, cultural and people emergent properties were described as they arose out of each of the mediatory tools, particularly the milestone activities given on the course such assignments. Each of the stories ended with a description of what these emergent properties meant for competences and capabilities.

Chapter Nine presents a summary of the research in order to lay out the findings of the study. Findings of the study were laid down at different levels. Recommendations on the study were divided into two sets: those that were discerned from the findings and those derived from the research process. Reflexivity during data analysis was described before the chapter was concluded.

Chapter 2:   Orientating contexts and concepts

2.0   Introduction

In this chapter I have reviewed the literature that enabled a deeper understanding of the concepts that influenced the content and structure of this study. Concepts developed in this chapter were used as 'sensitising concepts' (Mukute, 2010b) in the study, that is, they were used to enable the researcher to take note of, describe and explain different aspects of teacher education practice in relation to mainstreaming of environmental education/ education for sustainable development. Since this research was located in the field of environmental education/ education for sustainable development, the next section will explore understanding of the notions of environmental education and education for sustainable development that form the core of this research. Due to the intricate relationship between the two notions, they will be combined and referred to as environment and sustainability education (ESE) in this study.

2.1   Concepts: Environmental Education and Education for Sustainable Development

2.1.1   Environmental education (EE)

Life forms, including humans, get their requirements from their environment and have since time immemorial developed sophisticated methods to extract some of these requirements; in the process they have modified the natural environment while deriving benefit from it (Vygotsky, 1978; Engeström and Sannino, 2010). Much of this modification was a consequence of the development agenda that drove modernist and postmodernist eras where human influence on the environment was guided by the idea of progress through such drives as industrialisation, expanded intensive commercial agriculture, technologically enhanced transport methods and urbanisation (Sauve, 1999). Consequently the environment is now degraded and the rapidly increasing human population is facing environmental challenges such as degraded landscapes, polluted air, polluted water sources, polluted terrestrial environments, reduction in biodiversity, overharvesting of resources like forestry products and marine resources, climate change, global warming, rise in atmospheric carbon dioxide levels and higher frequency of extreme weather events such as droughts, heatwaves, cyclones and hurricanes (IPCC 2014). These climatic conditions are

understood to be anthropogenic or human induced as they are attributable to effects of development (Steffen et al., 2015). Related to these changes in the natural environment are negative developments in the social, economic and political aspects of human life. Of note are such issues as extremes of poverty, strife, broken families, poor national and global performance as well as poor governance and general lack of accountability among institutional leadership (IPCC, 2014).

Environmental education emerged at the interface of education and environmental sciences to inform humans of their intricate and incontrovertible relationships with and dependence on the biophysical component of the environment. To this end the environment was understood in terms of the biophysical, socio-economic and political considerations or dimensions and the interrelationships between these dimensions as these constitute the fabric of human life (Stapp et al., 1969; Rhodes University, 1997; Ekins, Hutchinson and Hillman, 2004). This reflected a holistic view of the environment. The relationship between aspects that make the environment was illustrated by O'Donoghue in the Rhodes University/ Goldfields course notes (Rhodes University, 1997), later elaborated with a drawing on the work of Ekins et al. (2004) and shown in the following diagram (Figure 2.1).
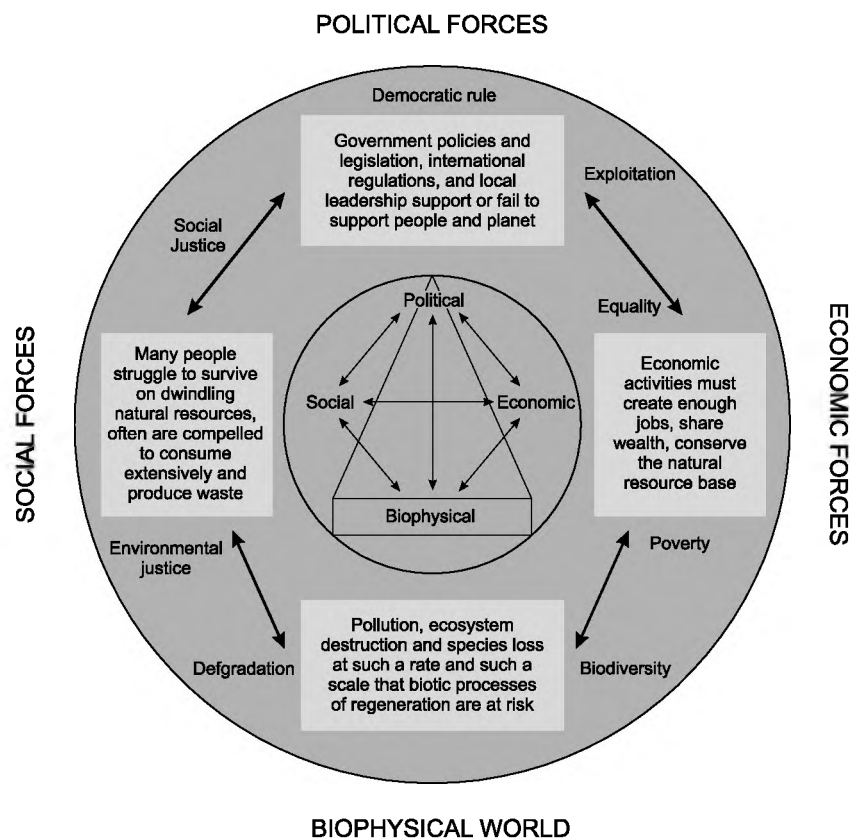
Figure 2.1: Interrelationships of aspects of the environment (Adapted from Ekins et al., 2004)

This perspective of the environment provided the guiding framework for understanding the nature of environment in relation to sustainable development and helped in guiding educationists in southern Africa to generate learning experiences that would enable the learner to see how the environment and environmental issues related to the four dimensions of the holistic nature of the environment (Chikunda and Mandikonza, 2014). In other words, if the environment was constituted of interactions of biophysical, socio-economic and political components as illustrated in Figure 2.1, environmental education needed to respond to include these in ways that enabled critical and deepening understanding of the environmental challenges (Janse van Rensburg and Le Roux, 1998). Environmental education had to include learning 'about' the environment, while physical engagement and contact experiences with the environment constituted learning 'in' the environment, and learning experiences 'for' the environment entailed developing agency for protecting and conserving the environment, through the dimensions of the environment (Tilbury, 1995). This meant that environmental education was a platform for enabling learners to understand that environment went beyond merely the biophysical and any responses to environmental concerns and issues had to be inclusive of the dimensions. Arguably, by working with the four dimensions of the environment, environmental education in southern Africa was already responding to human and development issues (Lotz-Sisitka, 2006).

Environmental education was oriented to provide humans with knowledge and capacity to deal with the challenges arising from human influence on the environment (Lotz, 1999). The RU/GF course intended to fulfil the role of building capacity for meaningful environmental learning. The course sought to go beyond awareness raising and endowed participants with capacity for action developed through implementing projects, programmes and curricula that went beyond raising awareness but generated and enhanced agency to promote or implement social change.

The steering tenets for the environmental learning discourse were expressed through many international conferences and ensuing international agreements between many global partners. These conferences and agreements provided guidelines on what was seen to be legitimate forms of environmental education. The gatherings were also a commitment platform for countries and institutions to engage with environmental education. Of note

were the UNESCO organised and facilitated Tbilisi Conference of 1977 (UNESCO, 1978),

Belgrade Conference of (1975), the Thessaloniki Conference of 1997 (UNESCO, 1997) and

the UNESCO Ahmedabad Conference of 2007 (UNESCO, 2007).

The aims of the Tbilisi Declaration continue to be significant. They noted the complexity of

the interrelationships of the different aspects of the environment with a view to promoting

critical thinking, problem solving, informed decision-making on environmentally related

issues and active responses. The declaration advocated for education that built

understanding of the influence of humans on the holistic nature of the environment through

the following goals:

1. to foster clear awareness of, and concern about, economic, social, political, and ecological interdependence in urban and rural areas;
2. to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment;
3. to create new patterns of behaviour of individuals, groups, and society as a whole towards the environment. (UNESCO (Tbilisi Declaration), 1978)

These goals were pivotal in creating a narrative of environmental learning that was evident

on the RU/GF course. Through engaging with participatory approaches, environmental

education was therefore meant to change and manage change of the socio-politico-

economic and biophysical history of the interactions in the environment, and especially

enable humans to be cognisant of the effects of human actions on the nature of the

environment and enable humans to be aware of the effects of altered relationships in the

environment. I used "nature of the environment" here to recognise that there is no one

particular environment and it is the factors of the environment that are affected by human

influence. The effects of altering relationships in the environment are understood to end up

negatively influencing the nature of the environment and quality of human life. In such a

context environmental education seeks to help people participate in anticipating problems

and collectively devise responses to these problems (UNESCO, 1978; Gaudiano and

Larenzetti, 2013; Robottom, 2013; Akenji and Bengtsson, 2014).

The call for environmental learning continued through the conferences held in Moscow in

1987, Thessaloniki in 1997 and at Ahmedabad in 2007 that argued for environmental

education to support education for sustainable development. A southern African

environmental education movement, the Environmental Education Association for Southern Africa (EEASA), started in 1982, developed the Gaborone Declaration in 2002 on Environmental Education Processes during its annual conference held in Gaborone, Botswana. The Gaborone Declaration (EEASA, 2002) was used to inform and guide mainstreaming of environmental education based on the holistic nature of the environment across the SADC region. Development of capacity for teaching as well as teacher education are some of the key sectors identified in the Declaration; hence capacity building initiatives have been influenced significantly by the Declaration guidelines. The Ahmedabad Declaration (UNESCO, 2007) recognised that environmental education processes in the context of the Decade for Education for Sustainable Development (DESD) were a vehicle to implement education for sustainable development. This declaration was very important as it bridged policy on environmental education and education for sustainable development by requesting the world's people to pursue the principles of sustainability through education.

The following section gives an overview of education for sustainable development.

2.1.2   Education for sustainable development (ESD)

The notion of sustainable development as a global policy concept started with the UN Conference on Environment and Development (UNCED) in 1972 that focussed on the human environment and recognised that human actions were altering natural environments significantly. The notion of sustainable development raised in this conference sowed the seeds for future developments in education. Sustainable development was at the core of later conferences such as the UNCED (Rio Summit) of 1992, with Agenda 21 as a pivotal influence on the growth of education for sustainable development, the World Summit on Sustainable Development (WWSD) of 2002 and recently, the Rio+20 Summit in 2012. Coupled with this notion is the discourse of education for sustainable development as education was recognised to play a key role in preparing the world for sustainable development (UN, 1987; UNESCO, 2009a; UNESCO, 2014c; UNESCO, 2014d). However, since there are so many ways to define and describe sustainable development, it follows that there are as many variations in education for sustainable development.

The notion of Education for Sustainable Development (ESD) in this research was understood as a form of education that enables all humans globally to acquire knowledge, skills,

attitudes and values that can be used to resolve the current challenges facing society that are arising from unsustainable patterns of production and consumption as well as shape a sustainable future (UNESCO, 2006a; 2006b; Ideland and Malberg, 2014). Richmond (in UNESCO, 2010, p. 19) noted that ESD aims at shaping a world where "education works with methods and contents that encourage learners to question unsustainable development patterns, find innovative solutions to new emerging issues and adapt lifestyles according to the criteria of sustainability". In so doing this kind of education seeks to enable learners in all sectors of society to develop appropriate knowledge, skills, views, attitudes and practices that empower them to create and enjoy a more sustainable world, including changes in behaviour that tend towards more sustainable forms of consumption and production, all of which constitute the epitome of quality education (UNESCO, 2010a). Clause 9 of the Incheon Declaration (UNESCO, 2015b) foregrounds the role of education for sustainable development (ESD) and global citizenship education (GCED) (UNESCO, 2014b) as key contributors to quality education. Quality education is defined as that which:

> … fosters creativity and knowledge, and ensures the acquisition of the foundational skills of literacy and numeracy as well as analytical, problem-solving and other high-level cognitive, interpersonal and social skills. It also develops the skills, values and attitudes that enable citizens to lead healthy and fulfilled lives, make informed decisions, and respond to local and global challenges. (UNESCO, 2015b, p. 3)

This concern for quality in education was also raised in the African Union (AU)'s collective agenda and vision entitled Agenda 2063 (African Union, 2015). A UNESCO DESD report (2012b) on progress of implementation of the DESD (entitled Shaping the Education of Tomorrow) posited that ESD seeks to enable citizens around the globe to deal with complexities, controversies and inequalities arising from issues pertaining to the environment, natural heritage, culture, society and economy and it is essential for promoting quality education and requisite transformation for a better future. The DESD report distinguishes four lenses for perceiving ESD: the *integrative* lens gives it a holistic perspective, the *critical* lens that focuses on questioning the predominant and taken for granted and unsustainable patterns in human actions, the *transformative* lens looks at building capacity and empowering people to go beyond awareness to real change and transformation, while the *contextual* lens emphasises the reality in which the people live and that they need to embark on changes that are unique and appropriate to their contexts. These lenses were echoed by the DESD final report (UNESCO, 2014e) (entitled *Shaping the*

Future We Want) and are similar to the features of quality in higher education as suggested by Tam (2001), meaning that ESD can contribute to quality higher education. UNESCO (2009) recognised that learning in ESD has to incorporate learning to ask critical questions, clarifying one's own values, envisioning more positive and sustainable futures, thinking systemically, responding through applied learning, and exploring the dialectic between tradition and innovation.

UNESCO (2006a) recognised that ESD is implemented in various forms across the world. There is no single form of ESD that can be that can be considered typical. For example, in Zimbabwe, environmental education was in the curriculum but it started off much earlier as environmental science under the banner of the Better Science Teaching (BEST) programme. Child-friendly schools are a new dimension that has influenced teaching and professional practices in educational institutions. Even though the discourse of Education for Sustainable Development was still growing, the nation was using child-friendly schools, a notion that embraces features of ESE as guided also by the Education for All imperatives. A feature of the different forms of education for sustainable development is their being located in the national culture of their education systems (Bengtsson, 2014) and their aiming at developing a new brand of learners with different forms of capabilities and competences for sustainability related to their future and the country policy priorities and environment and sustainable development concerns.

What is most important in this wide diversity of forms of ESD is that there should be evidence of this education across all levels and sectors that contribute to knowledgeable people, betterment of society and lifelong learning through a quest for:

- pursuing principles and values that underlie sustainable development within a local and locally relevant context using a multi-perspective approach;
- dealing with the well-being of all four dimensions of sustainability – environment, society, culture and economy;
- use of a variety of pedagogical techniques that promote participatory learning and higher-order thinking skills;
- the recognition that responses to local challenges and needs has global effects and consequences;
- participation and decision-making that take account of equity, equality and respect, qualities that enable them to appreciate, and live together with others, to live in and with diversity;
- and enabling learners to envision a better future and create opportunities for changes towards such a future.

(McKeown, 2002; UNESCO, 2006a; UNESCO, 2009a; Richmond, 2010; UNESCO, 2012) Most recently, UNESCO (2015b) has more explicitly stated that education for sustainable development is aimed at producing capacity for enabling people across the world to think and work for a "global common good" (UNESCO, 2015b). Humans are concerned about the future through such social interactions as better citizenry, social justice, equity, peace, harmony and social stability (Chikunda and Mandikonza, 2014). Education for sustainable development is perceived to have the potential to offer opportunities for the world to respond to issues arising from development, and teachers are supposed to be key actors (UNESCO, 2005b; UNESCO, 2006a; UNESCO, 2014c). UNESCO has also recently coupled their commitment to education for sustainable development to the notion of the 'common good' (UNESCO, 2015a).

The notion of the common good emerges from the premise that if knowledge prepares better citizens and knowledge is shared through education, then knowledge developed through education is a good for the society (UNESCO, 2015a). Education that provides opportunities for developing knowledge that is good for society is also deemed a common good. Since the Jomtien Conference of 1990 (UNESCO, 1990; 2000; 2015a), access to education has been a human right, and education in itself was seen as a common good. The notion of the common good is further influenced by the premise that all living things have life in common and all need to have a good life. The assumption is that if humans understand life as a common good, they can ethically strive to enable all other life forms to live their good life. Once humans live harmoniously and in solidarity with each other while upholding such values as respect, truth, love, peace, right conduct, social justice, tolerance, they start living a better life (UNESCO, 2015b). These values acknowledge that life is made of interdependent relationships between humans, non-human living things and the non-living things give conditions for these different dimensions to flourish. The concept of the common good, understood in this way, becomes a guiding concept for education, as it fundamentally transforms the Nature-Culture dualism on which modern forms of development that have caused environmental destruction and social disruption have been constructed.

Education for sustainable development, when framed within a focus on the common good, seeks to enable participation in 'common good' social practices, involving knowledge for the 'common good' based on values of equity, respect for life forms, future generations, and sustainability of the planet (UNESCO, 2015a). By emphasising learning from context, education for sustainable development is also a humanising concept as it takes account of people's views, cultures and ways of being (Kapoor, 2009; Neocosmos, 2012; Lotz-Sisitka et al., 2015). It also prepares learners to learn to live justly, equitably and sustainably in the world; this is not learning for the sake of human capital development to serve the market.

For meaningful learning for this capacity to occur, teacher educators have to develop competences for mediating this kind of learning.

2.1.2.1 Education for sustainable development (ESD) and teacher education

In addition, Richmond (2010) asserted that the role of education for sustainable development was to promote an education where the content and methods facilitated ability of learners to interrogate the current unsustainable development patterns while generating solutions to emerging sustainability challenges. Further to this, the learners should ultimately embrace and choose to live sustainable lifestyles. Richmond (ibid.) further argued that principles, values and practices of sustainable development must be found in all levels and sectors of learning (Holdsworth, Thomas and Hegarty, 2013; Sarabhai, 2010). To this point Richmond posited that educators play a steering role in fostering transformative and participatory learning, critical thinking and reflexivity on practices that empower learners to assume responsibility and transform practices for a sustainable future for the good of current and future generations (Hopkins, 2010; Lotz-Sisitka, 2010).

Change and the quest for change are the key motive for education for sustainable development. In order to support constant change there is need to support constant learning, therefore education for sustainable development includes life-long learning. Paramount to this is the need to ensure that educators have adequate skills to handle the content and methods that guide learning in ways that enable the learning processes to generate the tendency towards sustainable development among learners. The learning must provide learners with adequate and relevant knowledge and skills, appropriate opportunities to live a good life and be sufficiently motivated to try out and live the life they

aspire to (Appadurai, 2004; Jutvik and Liepina, 2005). UNESCO (2014d) characterised ESD as that which:

> ... requires participatory teaching and learning methods like critical thinking, imagining future scenarios and making decisions in a collaborative way in order to empower learners to take action for sustainable development.
> ESD learning also refers to:
> - learning to ask critical questions;
> - learning to clarify one's own values;
> - learning to envision more positive and sustainable futures;
> - learning to think systemically;
> - learning to respond through applied learning; and,
> - learning to explore the dialectic between tradition and innovation. (p. 20)

Countries in southern Africa took up and emphasised some of these features of ESD depending on what they value. Since most of the population in southern Africa depends directly on natural resources, the tendency is to emphasise ESD with a strong biophysical or natural resources interest while not neglecting social justice, economics of the dimensions including politics. Efforts were made to ascertain the competences that teachers and teacher educators must have if they are to teach for sustainability (Rychen and Salganik, 2001; Sleurs, 2008; De Haan, 2010; UNECE, 2011; Wiek et al., 2011; AdomBent and Hoffman, 2013). This research is looking into a professional development programme that was aimed at developing the knowledge and skills of educators to facilitate understanding of education for sustainable development and further build capacity to create futures that are sustainable through unlocking agency of their learners for taking social action.

2.1.3 Environmental education and education for sustainable development as environment and sustainability (ESE) education in this research

This research did not seek to distinguish between environmental education and education for sustainable development (Kopnina and Meijers, 2012; Robottom, 2013; Ideland and Malberg, 2014) or to distinguish between the various forms of education for sustainable development. It sought to establish how teacher educators work with curriculum practices to support sustainability learning among their students and in their institutions (EEASA, 2002).

Lotz-Sisitka (2006) argued that the environmental education discourse in southern Africa was already responding to education for sustainable development but needed to further

embrace sustainability concerns. She recognised that environmental education was a way of implementing education for sustainable development. This view was in relation to the framework (see Section 2. 1.1) on the nature of the environment that influenced approaches to environmental learning and practice. To this end it was not necessary for the discourse to shift drastically from environmental education to education for sustainable development. Lotz-Sisitka (ibid.) suggested that the terms could be used together, not to indicate that they are synonymous but to show awareness of the historical development of the discourse of education for sustainable development in southern Africa. Environmental education is recognised by the Ahmedabad Conference of 2007 as one way to approach education for sustainable development. In this research, I have used the term environmental and sustainability education (ESE) as recognition of the role that environmental education in southern Africa played in developing the discourse and practices towards sustainability. I also used education for sustainable development to mean the same as ESE in the context of this research. This shift was in recognition of and was influenced by the global call to review all education systems so that they enable all current forms of education to become education for sustainable development (UNESCO, 2005; UNESCO, 2012; UNESCO, 2015b).

However, this struggle to relate environmental education and education for sustainable development is pervasive in all aspects of professional life; hence the need for capacity development on what makes education for sustainable development practice and how to conduct it (Robottom, 2013). This research was contextualised via the Rhodes University/ SADC International Certificate in Environmental Education course, one professional development tool of the SADC REEP programme for enhancing capacity on mainstreaming environmental education/ education for sustainable development capacity among practitioners.

Specifically, this study sought to understand the influence of mediation actions on a professional development course for change in practice for environmental and sustainability education (ESE) in teacher education institutions. Therefore conceptualising change and how I thought about the changes involved is the focus of the next section.

2.2 Conceptualising the notion of change in teacher education ESD practice

Change or transformation denotes a process that seeks to alter all or some of the characteristics of a system and implies a complete overhaul that cannot be reversed (Gass, 2014). The overall aim of ESD is a transformation that includes policies, institutional structures and institutions themselves and regulatory mechanisms, with a strong emphasis on change in attitudes and practices, lifestyles, policies and power relations towards sustainability (AdomBent and Hoffman, 2013). This research is based on the SADC REEP institutional change project, an output of the Rhodes University/ SADC International certificate in EE course. The assumption of the change project was that an individual who participated in the course would develop agency to change aspects of her practice and would be equipped to lead such change processes in the institution, hence the name 'institutional change project'. The framework of the change project also assumed that all institutions were amenable to change processes, to change in practice and to changed practice. But it is important to understand the wider context of change and management of change among individuals as well as in institutions where change may happen. An understanding of change management would enable identification of potential resistance and ensure that motivators are built into new processes and structures (Paton and McCalman, 2006).

2.2.1 Notion of change management

One way of seeing institutions is as generally stable because they have inherent patterns that tend to be reproduced by an institution's ability to conform to certain rules and guidelines, especially those to which it owes its existence (Mahoney and Thelen, 2010). These rules and guidelines can either enable or constrain possibilities for change. Once individuals are socialised into the institution, and if they understand the rules and guidelines, they can reproduce the ethos and logic of that institution in many ways (Mahoney and Thelen, 2010). However change can still happen if there is an exogenous force that disrupts the reproduced pattern of practice that makes up the institution's culture of practice.

For most institutions, such sudden disruptions come as a new directive from the responsible government Ministry. For example, the Ministry of Higher and Tertiary Education in

Zimbabwe pushed for gender to be mainstreamed into the curriculum. Teacher education institutions enrolled more female students to balance the male students, at times taking in female students with lower qualifications (Bunyi, 2003; Aina, 2013; Mareva, 2014). In some instances, due to affirmative action, it didn't matter if the subject combination ended up with more female than male students (Mareva, 2014). Another example is the change of the structure of the course. At Belvedere Technical Teachers Training College, a two-year diploma course had a 3-1-2 structure. Three terms were spent in the college, one in teaching practice and the last two back in college. Now it has been changed to a 2-2-2 structure, with first two terms in college, two for teaching practice in schools and two back in college (P.C. Chinhoro, personal communication, June 5, 2013). The change was quickly adopted. These types of changes can be rapid and drastic. Other government bodies develop worthy initiatives as in the case of Population and Family Studies which was mainly headed by Ministry of Economic Planning in Lesotho. This was not well taken up into education as envisaged since the implementing Ministry of Education did not view it in the same way as the Ministry of Economic Planning (Monaheng, 2007).

Change can still happen in situations where the rules governing the patterns of practice cannot change and even when the gatekeepers of those rules (in this research those in administrative positions, see Sections 6.7.1; 7.7.1 and 8.7.1 on institutional leadership support) make the rules inflexible and difficult for agency. Despite strict following of rules, there is usually some disjuncture between rules and how they are interpreted in practice; usually it is in this interpretation in practice that opportunities for transformation exist. These gaps create ambiguities in the interpretation of rules and regulations and agents take advantage of and use some of these ambiguities as spaces for enacting changes into existing patterns of practice in small and at times very subtle ways. Mahoney and Thelen (2010) observed that enforcers of rules and regulations decide when to implement the institutional rules but at times these enforcers misinterpret the guidelines or apply them wrongly. Alert agents find opportunities for leading change when such opportunities arise.

All forms of change, whether led by individual agents, or directed through policy, involve people and influence how they think about and do their work as well as how they relate to each other and the organisation, and therefore how they should be managed (Brown, 2002;

Harvard Business School Publishing Corporation, 2003). Observations are that institutions working to change tend to be goal directed regarding the form of the desired change but do not recognise that the institution is made up of people who make things happen; change can only happen when the same people understand and appreciate the desired institutional change (Hiatt and Creasy, 2003). Change management therefore entails supporting individuals whose practice is influenced by the change through their own processes of change from their own current state to their own future state that has been facilitated by and in relation to the new project or initiative. The SADC REEP institutional change project was carried into an institution by an individual. The individual was expected to have initially engaged colleagues and institutional leadership in an institutional audit on ESD practices as well as identification of the desired change (see Section 1.10.6 on pre-course assignment). It is not known how much this engagement process prepared the colleagues and leadership for the change project, hence the need for this research.

2.2.2   Drivers of change

Some changes are triggered by the individual or by the institution; others start from outside the institution. Organisations have been known to institute change and change processes in response to such issues as changes in technology used; changes in customer expectations or tastes; changes as a result of competition; changes as a result of government legislation; changes as a result of alteration in the economy locally or abroad; changes in communications media; changes in societies' value systems; changes in the supply chain; changes in the distribution chain, among many others (Paton and McCalman (2008). Brown (2002) suggested that one needs to do a PEST (Political, Economic, Social, Technological factors) analysis on the status quo of the organisation in order to find out the drivers of change and identify potential opportunities. Even with all pointers towards change, the Harvard Business School emphasised that for change to happen, individuals in the organisation must be fully dissatisfied with the status quo in order for them to aspire for a different condition.

2.2.3   Typologies of change

Mahoney and Thelen (2010) cited Streeck and Thelen (2005) on the possible typologies of institutional change. *Displacement* entails removal of existing rules and replacing them with

new ones. This process can happen slowly or abruptly, depending on whether the old rules are still favoured by the users. This type is usually caused by changes in leadership or changes in ideology. At times new rules are attached to old rules and this may lead to changes in behaviour patterns in a change called *layering* (ibid.). Such a change can involve a revision of existing rules. In so doing the institution is able to maintain its core values but with rules allowing patterns of behaviour that are determined by both the old rules and the new rules. A *drift* is a change that happens when the same rules and regulations are used in a different environment. The change in environment may be due to a change in the population size and structure. Lastly, a *conversion* is a change that occurs when the same rules are interpreted and enacted in new ways. Taking advantage of the gap caused by ambiguity of interpretation and implementation of rules and guidelines, agents use the same rules to bring innovations to their practice. Drift and conversion seem the mostly likely types of change possible to be influenced through the ESE change projects since the rules governing patterns of teacher education practice of the ESE practitioners were not at all different from those of all teacher educators in the institutions (see Chapters 6, 7 and 8).

As discussed earlier (see Section 1.10), the framework of the change project was designed by course providers, SADC REEP and Rhodes University. Individual participants were supported by their supervisors to participate in the ESE course through the permission granted to attend the course as well as assurance that the change project would be supported in the institution. The change project was introduced to the institution and into the institution through individuals. Therefore the change project approach assumed that the rules and regulations allowed for changes in practices that would enhance enactment of the same rules and regulations. The change project took an individual from an institution, enhanced their capacity in ESE outside the institution and then supported the individual to take the assignment for change in practice into his or her work practices that included his or her immediate community of practice. The rules did not have to be changed, only the practices had to change for environment and sustainability learning. The change project approach assumed that all institutions were amenable to change and that they would be willing to accept ESE into their patterns of educational practice by extending the rules or interpreting them differently. According to Mahoney and Thelen (2010), the assumption was that institutions were susceptible to either drift or conversion.

However, institutions experience change *as agents change their practices* so Mahoney and Thelen (2010) observed a few forms of agency in institutions as detailed below. An *insurrectionary* is an individual who actively and visibly works to oppose any rules and guidelines or institutions that govern his or her practice. This agent is usually linked to situations where some groups are disadvantaged and the desired outcome is to equalise the playing field. Change may happen fast if the institution they are fighting is susceptible to that kind of change but it will happen slowly if there are inherent inhibitors to change processes. The change envisaged through this agency is a complete make-over, hence a displacement. The change is made possible by one or more of many possible ways. These approaches to change include the symbiont and the subversive.

The *symbiont* uses the rules of the institution they did not write to their benefit (Mahoney and Thelen, 2010). A parasitic symbiont exploits the institution for personal gain. They carry out activities that contradict the purpose of the institution while getting benefit from its smooth running. On the other hand a mutualistic symbiont uses the rules in order to support and improve on the purpose of the institution. In so doing symbionts promote the robustness of the institution and practice. Symbionts are usually associated with the drift form of institutional change.

The *subversive* agent seeks to displace the rules of an institution but does not necessarily break the rules (Mahoney and Thelen, 2010). He or she works within the system but promotes institutional change by encouraging review of the old rules in ways that seek to improve them. In so doing the subversive agent causes the layering type of institutional change. *Opportunists* do not seek to change the rules but seek to exploit all possibilities within the rules to achieve their ends. They utilise ambiguities in the interpretation and implementation of rules to cause a conversion type of institutional change.

Rules, guidelines, norms and standards constitute regulatory structures for any practice. So I deepened my understanding on the concept of practice since teacher educators' actions arise from and are part of teacher education practice.

2.3   The notion of practice

In my research that involves teacher educators, the notion of professional practice was understood as involving contextualised activities, contextualised in terms of the teaching profession and spatial considerations that include the teacher education institution (Kemmis, 2009a). If practice can be professional then it is constituted of what is in the minds of individual practitioners as well as how these individuals interact with the social order, hence recognising the existence of practice at both individual and extra-individual levels. Green (2009, p. 7) affirmed that practice is "engaged action, or activity", which is goal directed, involves experience and is always contextualised but Green also warned against the danger of confusing activity alone with practice, where practice has a perpetual or continuous notion, rather than distinct activities. This view explains the individual nature of practice but does not give any reference to the part of practice which involves the society outside the individual. What individuals do and how they do it is guided by individuals as well as institutional goals, in a community of practice.

Kemmis (2009a) identified the notion of practice as a way of knowing made of *sayings, doings* and *relatings* that happen within an exoskeleton of *practice architectures*. *Sayings* include the ways of thinking around that practice together with the discourses that are unique to that particular practice. *Doings* involve the different forms of activities that practitioners in the practice are involved in or activities that are a result of practitioners being engaged in the practice. *Relatings* are the complexes of relationships, networks and communities of practices that are developed as practitioners engage with the practice. Therefore if practice depends on the performative expertise developed through experience within the boundaries of the knowledge, norms and conventions of the particular practice (Green, 2009; Evetts, 2011; Fenwick, 2013), one way to understand teacher education practice is to listen to teacher education experiences as told by teacher educators themselves. This research looked into understanding mainstreaming of education for sustainable development in teacher education practice through establishing what and how they say about their practice; what they do as part of their social action; how they relate to each other, members of their communities of practice and how they relate to the practice architectures that define and perpetuate the practice (see Chapters 6, 7 and 8 that are accounts of emergent properties).

This notion of practice therefore influenced the research design where teacher educators' voices and actions were taken to represent the reality of experiences of the teacher educators in mainstreaming ESE.

2.3.1   Practice architectures

As shown earlier, at the same time that practice (beings, doings and relatings) is influenced by individual agency (Bhaskar, 1989; Archer, 1995), practice exists within bounded space. This space is bounded by an 'exoskeleton' of mediating preconditions of practice (Kemmis, 2009b). The term exoskeleton implies that these features that determine and influence practice are fixed, inflexible and unchanging like the hard exoskeleton found in arthropods. A big shift is required for them to allow change, as when an arthropod needs to grow, it has to undergo ecdysis or moulting. In their critique, Dladla and Moon (2013) concluded that teacher education is the most conservative component of education systems in that curricular and pedagogic practices are seldom reviewed against societal needs, including curricula needs in schools, as a result of sluggish political and bureaucratic governance systems in the administration of curricular and curricular practices. In addition, the nature of a skeleton evokes the implication of it being constituted of many parts. Practice is therefore influenced by a wide variety of interacting factors, a system of interacting mediating preconditions such as cultures, discourses, socio-political structures, as well as material and economic conditions under which the practice happens.

Mediating preconditions for teacher education include considering expectations for the field (Bourdieu, 1998; Webb, Shirato and Danaher, 2002) of teacher education that include competences for teacher educators. However, these competences are exercised in an ontological reality explained by Bhaskar (1989) to be constituted of the Real, the Actual and the Empirical. Structures in the real and the actual realms have generative mechanisms that influence practice in many ways. Archer (1995) argued that structure, culture and temporality influenced agency and practice whereupon temporality is the key influence of social interaction. Even though the said structures and cultures may not constrain or enable practice, they form the background or context in which the practice is enacted and constitute the same influences that determine and influence the nature of the habitus for that practice (see Section 2.5.2). My assumption here is that teacher educators perform in

certain ways and tend to conform to expectations that are largely dependent on the habitus and culture of the institution.

As stated earlier, socio-political and material arrangements exert influence on practice. In the next section I discuss the social arrangements which are relevant to the scope of my research.

2.3.2   Practice is social and related to identity

Shatzki (2000) argued that being social is a human phenomenon and that the social context of any individual is constituted of numerous activities. Therefore an individual's actions cannot be understood in isolation from the aspects that make the individual's context. The assumption is that teacher education practice, though researched from the individual point of view, recognises that these individual teacher educators do not exist in a vacuum (Shatzki, 2000). The institution in which teacher educators work and of which they are part is a social entity. Development of professional identity is one way of showing practice (Evetts, 2011). Further to this, individuals develop collective professional identity as they share knowledge, practices and aspirations, usually after attending the same or similar capacity development opportunities (Evetts, 2011).

Professional identity is understood as the ways in which individuals and groups position themselves in relation to particular discourses, particular knowledge of the field, their teaching and learning experiences, such as ways of thinking about teaching and learning, and contextual influences that include the ability to deal with change (Beijaard, Meijer and Verloop, 2004; Hooley, 2007; Sachs, 2010; Chong, Ling and Chuan, 2011) as well as their personal histories that emerge from their interactions with their practice and other such professionals (Chandra, 2014). The research process therefore sought to establish how the individuals in teacher training institutions were working as individuals in a community with others. To gain these insights I interviewed superiors and colleagues as well as members of the community of practice who lie outside the case institutions as part of the data generation process (see Sections 5.8.2 and 5.8.3 on group and personal interviews, respectively).

2.3.3 Reflexive practice

Archer who worked on the concept of reflexivity in 2007 defined reflexivity as the "regular exercise of mental ability, shared by all normal people to consider themselves in relation to their (social) contexts and vice versa" (p. 4). Archer emphasised the process of excercising mental ability as a key component of reflexivity in humans. She explained that reflexivity is the process of weighing up possibilities and alternatives in relation to one's experiences in order to determine future courses of action. The process of considering possibilities is what Archer termed the "internal conversation" or "reflexive deliberation" (Archer, 1995; Archer, 2010). Therefore reflexivity is the result of internal conversations or reflexive deliberations of individuals and their inner selves. The notion of reflexivity also denotes the self-referential nature of action and practice. By referring back, reflexivity engages what has happened, whether it was done in the best way and if there are better options with regard to that action and practice. The outcome of the deliberation should enable greater ability to respond to the social constraints and necessities that influence practice. Reflexivity happens when the observations or actions of actors and observers in the social system affect the very situations they are acting on or observing.

Archer in Vandenberghe (2005) argued that all people have three concerns, namely, physical well-being, performative competence, and self-worth. She further claimed that we order these through internal conversations that we have with ourselves about our social practice. When we bring Bourdieu's (1998) ideas on habitus as a form of culture in a field together with Archer's, internal conversations should be coming to intervene between the habitus and the field, to review the appropriateness of a habitus in a field. This internal conversation is one form of reflexivity that develops through ruminating with ourselves. Internal conversations take place in the minds of actors.

The SADC REEP course sought to support participants to engage in internal conversations about their work but also facilitated sharing of life stories, concerns and their visions on these concerns. As noted above, Raven (2005) conceptualised reflexivity as constituted of social processes of change with reflexive competence providing evidence of engagement within these social processes of change. In this context, reflexivity is not a once-off activity that the agent engages in. It involves the ongoing internal conversations put forward by

Archer (1995, 2010) but over extended periods of time. Raven (2005) further contended that ruptures in dominant knowledge frames and power relations cause changes and that reflexive competence is key when working with knowledge and unawareness or uncertainties (as is the case with environmental issues). Reflexive competence is the backbone for the process of carefully considering what is known or not known about environmental issues and risks, as well as considering why and how knowledge about environmental issues and risks comes to be known or not known.

Any practice and reflexive practice happens in a field (Bourdieu, 1998), which is part of the pre-conditions of the practice, so I use the next sections to explicate how the field influences practice through determining the habitus (Bourdieu, 1998) of that field.

2.4   The notion of field and habitus

These two notions are crucial for this study since they enabled me to gaze into what teacher educators were doing, why they were doing it, as well as the social and structural contexts in which these activities were happening; this can also be referred as the relationship between structure, culture and agency (Archer, 1995). My interest was to understand the social practice of teacher educators in mainstreaming environmental education and education for sustainable development. The notions of field and habitus influenced data generation for this study where I engaged with the participants of the research, institutional leadership and their colleagues in the teacher education institutions and some members of their communities of practice (see Sections 5.9.2 and 5.9.3 on workshop-based groups and semi-structured interviews). The aforementioned groups of people constituted the community of practice of their teacher education and ESE fields. The purpose of developing the relationship with all practitioners involved in mainstreaming of ESE relationship was to develop a deeper understanding of the cultural context of the teacher education practice in mainstreaming ESE, in line with Bourdieu (1998:2) who suggested that any social interaction can be deeply understood "only if one plunges into the particularity of an empirical reality, historically located and dated, but with the objective of constructing it as a 'special case of what is possible'…". I had to interact with members directly in the field of teacher education and those in sectors that work with members from teacher education in order to construct a valid interpretation and description of the change project in teacher education.

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2.4.1   The field

Swartz (1997, p. 9) asserted that society is constituted of an array of physical and social spaces which surround individuals. These spaces are "relatively autonomous, but are structurally homologous fields of production, circulation and consumption of various forms of cultural and material resources". The field is dynamic in nature and consists of institutions, rules, practices and the interactions between these. Webb et al. (2002) suggested that a field was constituted of institutions, rules, rituals, conventions, categories, designations, appointments and titles that are in a particular order. The order influences the discourses and practices emerging from interaction of the different components. This means the field in Archer's (1995; 2010) view has structures and cultures that influence the nature of the discourse that makes it and interactions that constitute it. In Archer's view, the field is not as deterministic as suggested by Bourdieu but agents also have a role in shaping and reshaping structure and culture (the 'parts'). In addition, Bourdieu (1998) thought the field (as constituted by historical agents in institutions) has some form of power that tends to regulate whoever enters in it; these include political power, economic power and social power. Grenfell (1998) and James and Grenfell (2004) described the field as a structured space with recognisable boundaries and like Bourdieu recognised the power relations that govern the field. Thus a field is a means by which society mediates the relationship between the social structure and material resources influencing agents but not completely determining their agency (as per Archer). Examples of fields include professions. In this research, education is a field; institutions, their physical nature, and interactions in them determine what educational processes and practices should happen and actually do happen. One could even consider teacher education more narrowly as a field since it is a specific discipline that has specific governing structures and people in this field are expected to take specific teacher education field related actions. In this study environmental education/ education for sustainable development is a field as well since it influences interactions at various levels, even with other fields. Therefore, this study was in the field of EE/ESD and yet was recognisable in the field of teacher education.

2.4.1.1   Field, power and capital

People such as lecturers in the field of education have a certain amount of power and the power depends on their position in that field as well as the cultural capital they possess (Archer, 1995; Bourdieu, 1998; Archer, 2010). People in higher positions in the field have more power. Lecturers tend to have less power than their supervisors who hold positions of authority in the institutions. However, as lecturers as agents are not wholly determined by structure (Archer, 1995; 2000; 2010), they tend to seek to avoid these constraints by enabling themselves to gain more power in the field or through gaining more capital.

Cultural capital in this sense entails all the material and symbolic goods that are necessary for functioning in that field (Webb et al., 2002). Bourdieu (1977; 1998) further argued that individuals and groups tend to be unwittingly in conflict with what constitutes capital and content of that capital in what he termed 'symbolic violence': the violence which extorts submission, which is not perceived as such, based on collective expectation or socially inculcated beliefs and this situation seems to be the natural order of things. This conflict places them in the position of gaining more capital in order to resolve the symbolic violence. The violence is symbolic because it is not material; it is abstract and imaginary.

Teacher educators exist in a field that has cultural capital which is expressed as norms and standards of performance. The teacher educators usually start off as teachers in schools or they work in other sectors of education before they gain more cultural capital (knowledge and skills) for becoming teacher educators through gaining higher educational qualifications. Even though the capital they have is adequate for their positions, they tend to feel inadequate as they fail to bridge between the education prescribed in the syllabus or curriculum and contemporary needs of society. This tension between being qualified and capable for the post and feeling inadequate represents one form of symbolic violence in teacher education practice.

The symbolic violence is worsened and perpetuated when the teacher educators recognise that they live in a world that is faced with new and constantly evolving socio-cultural and socio-material challenges that should be attended to by education. Yet at the same time, the curriculum cannot easily be transformed in tandem with changing socio-ecological

conditions. Teacher educators grapple with curriculum practice and curriculum transformation especially in view of ESD since this transformation should represent hope not yet achieved and should help in creating a future that is not yet there (Kayira, 2013). The tendency is for them to change some of their practices and continue to operate within the slowly changing curriculum. In order to be able to trace changes in practice, I deepened my understanding of the notion of habitus, as it relates to practice.

2.4.2 The notion of habitus

In this study, I argue from the perspective of teacher education practice as a cultural practice. As earlier stated in Sections 2.7 and 2.7.1.1 above, the teacher education field exerts a set of conditions as well as dispositions, values and a form of culture that is unique to the institution field and can be traced back to the teacher education institution and its history. These conditions influence the development of a system of practices that conform with and are unique to the field. These practices, such as the competences for educators in Institution X (see Sections 1.8, 1.9), become a repertoire of enactments that tend to perpetuate the field and the system. These practices that become a repertoire constitute the habitus of the person in that field. A person's habitus includes the different ways of doing things, the inclinations and dispositions, values and rationales that one acquires from the various developmental contexts such as family, educational and social class contexts (Bourdieu, 1977; Webb et al., 2002; Elder-Vass, 2007). Some of these become embodied and therefore become unconscious in their enactment (Axelsson, 2004).

Wight (2006) posited that habitus was derived from thoughtlessness of habit and habituation. All these constitute the habitus but despite their being embodied and durable, they are usable across different contexts. Teacher education practice in Zimbabwe and in Lesotho is represented by a compendium of performative competences that teacher educators are expected to have and be able to show and at the same time be able to transmit to their students (see Sections 2.1.3 and 2. 2.3). The assumption is that when teacher educators are able to perform proficiently, they develop a habitus for the curriculum specific competences. When they are dissatisfied by their own performance in that habitus and aspire to go beyond good performance or are dissatisfied by their failure to

perform certain competences, teacher educators can then move out of their habitus, not for the purpose of destroying but in order to disrupt it. Thus they can get to another form of habitus that includes new values, practices, knowledge and norms that then enhance the original habitus. This reference to old practice and aspired practice is a reflexive process (Raven, 2005).

2.4.3   Practice and habitus

As alluded to earlier in Section 2.4.3, teacher educators spend much time performing teaching activities which they end up knowing very well and these become part of their daily repertoire (Axelsson, 2004). Bourdieu (1998) and Bourdieu in Grenfell (1998, p. 12) called this repertoire a *practical sense* and this becomes part of the normalised routine that he termed a *structured structure* (Grenfell, 1998, p. 11). Bourdieu (1998) suggested this structured structure is constituted of a *field* which in this case is teacher education, and a *habitus,* implying "habit, un-thinkingness in actions and 'disposition'" (Grenfell, 1998, p.14) that happens in a certain context (Green, 2009). It becomes imprinted and encoded in socialising processes and is inculcated more by experience in our social involvements. According to Elder-Vass (2007), who built on the work of Bourdieu (1977), habitus refers to systems of durable, transposable dispositions, structured structures predisposed to function as structuring structures in such ways that they are enacted without prior thought. In this view the notion of habitus offers no opportunity for agency of individuals in human action since it stresses society as being a structured and structuring structure determining individual behaviour. Bourdieu thus provides a deterministic view of agency.

However Elder-Vass (2007) argued that Bourdieu positioned habitus as an explanation for categories of actions rather than as a principle covering all actions by an individual that include rational thought and calculation. This implies that individual action and in this case habitus, entails personal motivation, prior thought and decision making. These qualities are essential for agency (Emirbayer and Mische, 1998; Archer, 2000a; Etelapelto et al., 2013). Therefore, in this view, habitus is related to doing or performing and is driven by agential powers. If an agent is able to decide on the course of action to take then he or she is able to consciously decide on what should be done next. In such a situation, the unthinkingness is

at the level of expertise of performativity. Bourdieu also understood that, while at the same time as habitus is a structured structure, a framework of particular form, it also serves to organise practice and perception of that practice. Therefore, habitus can change, especially when practitioners modify their practice due to reflexivity of experience involving Archer's (1995; 2012) reflexive deliberations as teacher educators become more specialised at particular ways of thought and performative actions. Archer's work sought to differentiate reflexive agency from structuralist, determinist accounts of agency.

2.4.4   Habitus in teacher education

My contextual profiling revealed that teacher educators develop experience, guided by policy documents that direct the form of expectations of their field and institutions. These become normalised (Ketlhoilwe, 2007) into their teacher education or lectureship practice and constitute the habitus (ways of conducting teaching and learning) of their teacher education practices. According to Bourdieu this comes to constitute their *capital* (thoughts, actions, objects, any product of human activity). My contextual profiling revealed the presence of unthinkingness in their proficiency, such as question and answer sessions that were interspersed with lectures, which had become their teaching habitus. However, as the same individual who has a particular habitus also has rational thought, there is ongoing potential for choice, reflexivity and motivation. The notion of habitus in this study was used to explain the taken for granted, normalised teacher education actions of teacher educators as they did their work in ways that they chose to do or ways that they were used to. This was important to establish change emerging out of the ESE professional development interactions.

If teacher educators chose to participate in a professional development course, as those who participated in the Rhodes University/ SADC International Certificate in EE course, they were thinking about innovating their EE and ESD teaching practices, even though they may not, prior to the course, have been aware of the actual innovations that they would incorporate into what they are already doing well. In addition, institutions have a set of criteria that educators are expected to show and educators reflexively assess their own performance against these criteria, norms and standards. When they cannot fulfil the

expectations or when they are not satisfied with their current performance, teacher educators seek professional development opportunities so that they enhance their competences. Enhanced competences facilitate the ability to achieve expectations and norms of their institutions and practice while achieving individual satisfaction (Appadurai, 2004).

Bourdieu however says that any changes in practice in a habitus are not pre-meditated but spontaneous. This notion is opposed by Archer (1995) who argued that individuals are constantly concerned with their practice and work on projects to innovate their practice and influence the structures and cultures that constrain them (Vandenberghe, 2005; Archer, 1995; Archer, 2010). Individuals constantly engage in a process of prioritising and discriminating between options to take, a process she called the 'internal conversation' (Archer, 2007).

2.4.5   Practice, habitus and mediation

Previous sections have shown that teacher educators seek out professional development activities in order to improve elements of their practice. The improvement calls for an intervention that seeks to break their habitus and create a new habitus, requiring a change in practice. This premise of this research arises from the purpose of the Rhodes University/ SADC International Certificate in EE course which was to support practitioners to develop agential powers in the field of environmental education and education for sustainable development. Therefore the course sought to provide tools and artefacts that could potentially transform teacher educators' practice through mediatory actions and activities (Vygotsky, 1978; Wertsch, 1991; Engeström and Sannino, 2010). The purpose of the course was to facilitate development of changed teacher education practices for environmental education/education for sustainable development (SADC REEP, 2009).

2.5   Defining the notion of agency in relation to practice

As I strove to establish what influenced course participants to take certain forms of action in relation to their practice and habitus, I considered the notion of agency as one attribute that I then used to describe and explain some of the teacher education practices. The term

'agency' is loaded with meaning but in this research, my understanding of agency and the way I used the concept was influenced by conceptions of the role of agency in influencing the choice and nature of actions that constitute teacher education practice and are taken by agents (Archer, 1995; Emirbayer and Mische, 1998; Archer, 2000a; Archer, 2005; Archer, 2010; Etelapelto et al., 2013). Kapoor (2009, p.4) observed that agents have "capacity to know, act on and change oppressive realities", realities that constitute the agents' contexts. The term 'agency' implies that an individual or agent or group of individuals takes some action also known as agential action after weighing up options. Inherent in this action is some thought, reflexivity and choice, self-identity, intentional action, purpose and volition. In addition to this definition, Wiley (2010: 23) summarised agency as:

1. The mental construction or design of a possible action;
2. The actual choosing of this or perhaps some other action from the options at hand; and
3. The behavioural carrying out of the action.

Agency is thus understood as a process that at times entails what and how one thinks about an issue, concern or event. The process of choosing or reflexivity is part of agency. Agential action is the visible part of the process. Since individuals in an institution are in society with others, visible agential action becomes part of the actions in society and is termed 'social action'.

Social action and change are usually the outcomes of individual agential action. Agential action is exercised in and as part of institutional practice, in a field. Agential action therefore takes place in relation to institutional and professional practice. This means that the individual operates within the context of practice but must also be in a certain frame of mind and must have the ability to do certain valued things that enable him/ her to take action; these have been referred to as capabilities (Sen, 1999; Walker and Unterhalter, 2007) (see Sections 2.5.4, 2.5.6 and 2.6). Teacher educators operate within a framework of professional expectations and institutional competences (see Sections 1.8.6 and 1.9.3). Agential action can be exercised by an individual, alone or in community with others.

2.5.1   Individual and collective agency

Individual agency arises when an individual decides to take up forms of action and respond to a concern. A group of individuals that get together to exercise their agency for the good of the collective, constitutes corporate or collective agency (Evetts, 2011). The nature of agency at both individual and collective levels is the same. Iversen (2005) and Emirbayer and Mische (1998) concluded that agency was in part evident through performative indicators as an individual or groups of individuals freely engaged in action; in the motivation behind their taking action; in what it means for them to take that action; in the purpose of engaging in that action or activity; in the power they have as individuals to engage in the activity as well as in the creativity they bring to the activity. It is in the way the individuals and groups engage in activities that agency is exercised and is discernible. Agents may even have a concern for the well-being of others, respecting social and moral norms, or acting upon personal commitments and the pursuit of a variety of values. Key aspects that drive individual agency include what a person acts on, how the person acts or refuses to act and the motives behind choosing one action over another.

Iversen viewed agency as a mix of visible and invisible aspects that take the form of "bargaining and negotiation, deception and manipulation, subversion, as well as more intangible, cognitive processes of reflection and analysis" (Iversen, 2005, p. 105). Agency not only includes motivation to take action but also to think in certain ways (Wiley, 2010). The ability to think about what and how one thinks and what one does is reflexivity (see Sections 2.3.3, 3.6 and 3.10.3). Reflexive engagement with one's practice is a key element in the notion of agency. I was particularly interested in the agential actions of teacher education from the point that they started to engage with the Rhodes University/ SADC International Certificate in EE course to at least one year after beginning of the post-course period. By this time, participants were expected to have implemented their change project ideas and either continued or discontinued their ESE work. Recognition of participants' experiences influenced the design of this study where teacher educators were 'insider-practitioners' (Kemmis, 2009b) who provided the data of their experiences of ESE experiences, rather than having an outsider tell their stories from observed teacher education actions.

Archer argued that agents think of and take up particular courses of action because they value their actions as contributing to certain practices (Archer, 1995; 2000b). The following section looks at how the value that people put into certain practices can influence their agency to participate in mediation activities.

2.5.2   Capabilities, agency and mediation

From a capabilities standpoint, agency is important for pursuing one's well-being and a good life (Sen, 1999). It enables an individual to set goals and interests, set up ways of implementing them and conduct the implementation process (Peter, 2005). Any agential action takes place within space and requires time. Emirbayer and Mische (1998) drew similar conclusions to Archer (2000b) and Bhaskar (1979) that time is an important function in describing agency. The conditions which include structure and culture in which the agent exists together with the agential powers of the individual, keep changing with time. Conditions of culture and structure may enable or constrain agency. The changing nature of conditions influencing agential powers described above is in many ways similar to Vygotskian thinking that psychological tools develop with more experience and hence new tools contribute to an ever expanding zone of proximal development over time (see Section 4.10).

The Rhodes University/ SADC International Certificate in EE course sought to enhance development and exercise of agency of course participants as outlined in the Course Orientation: "All assignments are therefore also oriented towards *strengthening people's agency* in context, which includes strengthening the agency of environmental educators (on the course), and application of relevant education and training programmes and ideas in own country contexts" (SADC REEP, 2009) The aim was to achieve this through expanding the zone of proximal development of course participants. Sections 3.4 and 3.5 explicated how Margaret Archer (1995) recognised the emergence of agential properties at three levels that she termed Personal Emergent Powers (PEPs), Cultural Emergent Properties (PEPs) and Structural Emergent Properties (SEPs) over time. To this end, I decided to generate data for this research at least a year after course participants had gone back into

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their workplace and started to implement their change projects. My view was that after a year it would be possible to see whether an individual would have at least started to engage with individual agential action in her/his practice and potentially also social and collaborative action.

2.5.3 Institutional agency

Agency is affected by the past, present and future. In institutional terms, agency depends on history of that institution, on how the institution has in the past responded to agents being creative and taking action. At the same time history affects the structure and culture of the institution (Archer, 1995). Bhaskar (1989) posited that structure and culture are not fixed since some of their powers are vulnerable to change. This vulnerability depends in part on time as agents are themselves reflective agents in an ever changing context (Archer, 1995; Emirbayer and Mische, 1998) and can alter structure and cultures.

The present is mainly influenced by the emergent properties (Archer, 1995) arising from interactions of casual factors/mechanisms and changing mental functioning as individuals accumulate more psychological tools or mental capabilities through intersubjectivity or interpersonal relations (Vygotsky, 1978). The role of development of higher mental functions in development and exercise of agency is related to and contributes to teleological action, which implies choice of action, volition and intentionality of actions taken by agents (Wertsch, 1991). It includes the way agents, when faced with a situation, think about practical aspects of their actions, together with how they consider alternative actions, as illustrated in Sections 3.10.3, 3.11 and 3.12 as well as their reflexive engagement with their practice.

Development of agency is not spontaneous but rather a gradual process where agents pass through a process of sensitisation, or they pass through an experience that awakens their powers of observation so that they notice issues of concern in their environment, their practices and their actions; without the sensitisation these issues would have remained habitual or normalised (Ketlhoilwe, 2007) and not worth noticing. Sensitisation develops conceptual understanding of environment and sustainability challenges as well as practical competence that provides them with tools for taking action. However, the knowledge and

action are inadequate if they are not coherently linked through reflexive competence (Raven, 2005; DoE, 2000). After reflexive deliberations that challenge one's thinking and doing in relation to alternative courses of thought and action, agents choose one or a few potential options (Archer, 1995; 2000b). This ability to make useful observation, the ability to carefully think through options, to take or avoid action on aspects that the individual agent and the society values, are elements of reflexivity. Simply put, agents are reflexive beings who tend to influence others to be reflexive too.

The future aspect of agency entails how agents creatively reconfigure their thoughts and actions in relation to their uncertainties and hopes for a desired future that can be reached by achieving their lifetime goals (Emirbayer and Mische, 1998), what Archer termed "their ultimate concerns" (Olvitt, 2012; Lindley, 2014). Agency within an Ubuntu philosophy is guided by humanistic values among the Bantu language speaking people of southern Africa. Shona speakers say *"munhu munhu ngevanhu",* literally translated as 'a human is a human due to other humans' and philosophically implying 'I am because you are, and we are'. This idiom recognises that although individuals have agency, they tend to recognise the existence and roles of others. They may conform to society's norms or simply respect other ways of being, knowing and doing. Ultimately, Kayira (2013) posited that through observing this philosophy there is no absolute knowing as everyone has knowledge to contribute, with the recognition of multiple centres of knowledge. These arguments point to the necessity of mediatory processes such as those inherent in the Rhodes University /SADC International Certificate in EE course, to develop higher mental functioning that could be used to exercise agential powers for experiences of the present and models of the future in a knowledge environment that permits multiple centres of knowing, thinking and taking action.

2.5.4   Agency and mediation in the workplace

In a synthesis of agency professionals in their workplace contexts, Etelapelto et al. (2013) established that adult learners and workers show new practices as they learn new knowledge and skills that are needed in their work; they feel for others and for their work; they are cooperative and take voluntary action and reflect on what is worth for their own lives and their future at work. They also actively reflect on, then construct and reconstruct, reform, renegotiate and reshape their identities at their workplace as well as their

conceptions of who they are and their belonging (ibid.). Individual workers have unique knowledge, competencies and experiences of their work that facilitate personal development and enhanced capital for their agency in the workplace. As the adult learners and workers gain more cultural capital for their work, they then seek to mediate this new capital into their practice, in their institutions. Working with novice professionals, Olvitt (2012) proposed that environmental education practitioners choose what to be, what they want to be through ethics-orientated reflexive deliberations depending on what they consider as matters of concern in their lives, work and the way they relate with the wider world (Archer, 1995; Latour, 2004).

However, as raised in Section 2.3.2, individuals work in social contexts so that understanding individual agency without the social context may give only a partial view of the processes taking place. Agents have natural (embodied), practical and discursive relations to their work (Archer, 2000a; 2005). As illustrated in Sections 3.9 and 3.11, these relations develop over periods of time as individuals interact and experience their work. Agential properties develop and enable agents to actively engage with immediate colleagues, the wider communities of practice (Wenger, 1998) and professional learning communities (DuFour, 2004; Harris and Jones, 2010; Kemmis et al., 2014). Social context can only therefore be analysed separately from individual agency using the principle of separability, also termed analytical dualism, developed by Margaret Archer (2000a) as illustrated in Chapter 3; in reality, however, these are interrelated in thought, experience and practice.

2.5.5 Teacher education institutions as social contexts

Participants of the Rhodes University/SADC International Certificate in EE course in this study are inherently social beings in that they do not work as individuals, they work with others. Their institutions are inherently social institutions in that they have norms and standards that tend to enable individuals to work with others in and outside the institution. I purposively identified some interviewees who constituted some of the communities of practice, guided by the names and roles that research participants raised during interviews. My choice of individuals and institutions to interview was also guided by my knowledge of the environmental education field in the countries that developed from my professional

level interactions with the institutions during my tenure as the coordinator for capacity development activities in ESE at the SADC Regional Environmental Education Programme.

In order to relate the observed teacher education practices to what motivated teacher educators to participate in professional development courses as well as how they felt as they implemented the change project in the context of their practice, I drew on the capability approach described in the next section. The capability approach provided me with some of the language to qualitatively describe teacher educators' experiences and feelings about their lived realities, how they understood themselves individually and how they interacted with others (Kemmis, 2009b).

2.6   The notions of functionings and capabilities

The capability approach was initially developed by Amartya Sen (1999), as a normative framework for evaluating and assessing individual well-being as well as the social arrangements around that individual (see also Robeyns, 2000; Agarwal, Humphries and Robeyns, 2005; Peter, 2005; Robeyns, 2005). The approach aims at providing a more intrinsic meaning of human well-being. It is basically about freedoms people have to achieve at a wider scale but at a more specific level, the freedom to function; and the freedom to achieve what the individual upon reflection considers to be valuable (Walker and Unterhalter, 2007). The individual is therefore not an automatic being but a reflective thinker who considers options (Vygotsky, 1978; Archer, 1995). Upon engaging judgement rationality, it is the options that are most valued that the individual takes up or acts upon. Greater variety of options to choose from denote more capabilities. Recognising that teacher educators are individuals working as experts but also in community with others in an institution, I found the capability approach a relevant lens to look into teacher education professional practice and the exercise of agency by the research participants. Teacher education practice involves choosing immanent practice for a particular context and purpose from a range of possibilities. The aim of the RU/SADC International Certificate in EE course was to widen these choices for teacher educators to enable better and high quality teaching and learning that engenders attitudes and behaviours of sustainability in the society (UNESCO, 2015a).

Functionings (the beings and doings) constitute the core of capabilities (the real or effective opportunities to achieve the beings and doings). A person's well-being is defined in terms of the beings and doings (the functionings) a person achieves as well as her capability to choose among different combinations of such functionings. Well-being is therefore described and explained in terms of how the people concerned see themselves doing things and feel about themselves being able to do these things, their effective opportunities to undertake the actions and actions they want to engage in (doings) and be whom they want to be (beings) (Robeyns, 2000; Flores-Crespo, 2007). Therefore, an individual who has more functionings in a field has more capabilities.

Functionings denote the achieved outcomes in any endeavour. They can refer to elementary doings and beings such as reading, being adequately nourished and being free from avoidable disease to rather complex ones, such as being able to take part in the life of the community, having self-respect and a voice (Sen, 1999; Robeyns, 2000; Robeyns, 2005). In teacher education contexts, being able to successfully use a variety of teaching and learning methods or being able to successfully assess learning using a variety of methods are examples of functionings. In this research, I related functionings to what the teacher educators could do and what they felt about themselves being able to do during implementation of the change project as well as any other efforts they made in mainstreaming ESE in their institutions. Valuing is a critical component of capabilities theory.

2.6.1 The notion of capabilities

Capabilities for an individual denote the potential to achieve functionings. For example, for a person to achieve the functioning of reading, that person needs capabilities, including having been taught to read, having books or newspapers available to read and having the permission and freedom to read materials that enhance the skills of reading. Even though capabilities and functionings are closely related they are distinct. Walker and Unterhalter (2007) argued that the difference between the two concepts is like that between potential and outcome.

> A functioning is an achievement, whereas a capability is the ability to achieve.
> Functionings are, in a sense, more directly related to living conditions, since they *are*
> different aspects of living conditions. Capabilities, in contrast, are notions of freedom,

in the positive sense: what real opportunities you have regarding the life you may lead. (Sen, 1999 in Barker, Panzironi and Sparrow, p. 92)

An individual develops more potential to do things when empowered to do so. Therefore capabilities imply what a person is able to do and how the person is able to feel about him/ herself over doing things that the person values and can achieve to perform effectively in their practice.

Ultimately, being able to do one thing tends to increase the potential of the individual to do others by creating more opportunities for the individual to do and to be. An individual's capability becomes the various combinations of functionings that a person can achieve, or what is potentially achievable once one has adequate functionings (achieved capabilities). Sen (1999) and Robeyns (2000) expressed that all the achievements constitute an individual's capability set; a set of vectors of functionings, reflecting the person's freedom to lead one type of life or another, which Sen (1999, p. 75) described as "the substantive freedom to achieve alternative functioning combinations". Key to this argument is the need to enable individuals to have many opportunities and possibilities.

My argument is that teacher educators must have substantive opportunities to lead the kind of lives they would like to lead, do what they want to do, be the person they want to be in and about environmental education/education for sustainable development in their teacher education practice and above all be able to use and to choose what they value most among different alternatives. The examples of functionings given in Section 2.6.1 of successfully using a variety of teaching methods and assessment techniques are part of what constitutes a good educator. When put together, the two examples contribute to the potential of making a good educator and hence enable the teacher educator to potentially better respond to such expectations of the institution as the competences for educators. Becoming a good educator is the capability that is enabled by being able to use a variety of methods to teach and to assess effectively.

Development of capabilities involves individuals making use of commodities, conversion factors, and demonstrating functionings. The next section details the relationship between the four notions.

2.6.1.1 Development of capabilities

Given the same commodities, individuals are most likely to achieve different functionings and well-being. This happens because individuals have different capacities to interact with commodities available to them. These capacities are determined by the personal, social and environmental influences on this interaction and the variety of functionings that emerge from the interactions. Iversen (2005, p.96) used Robeyns' (2000) diagram to illustrate the development of capabilities as in the figure that follows:
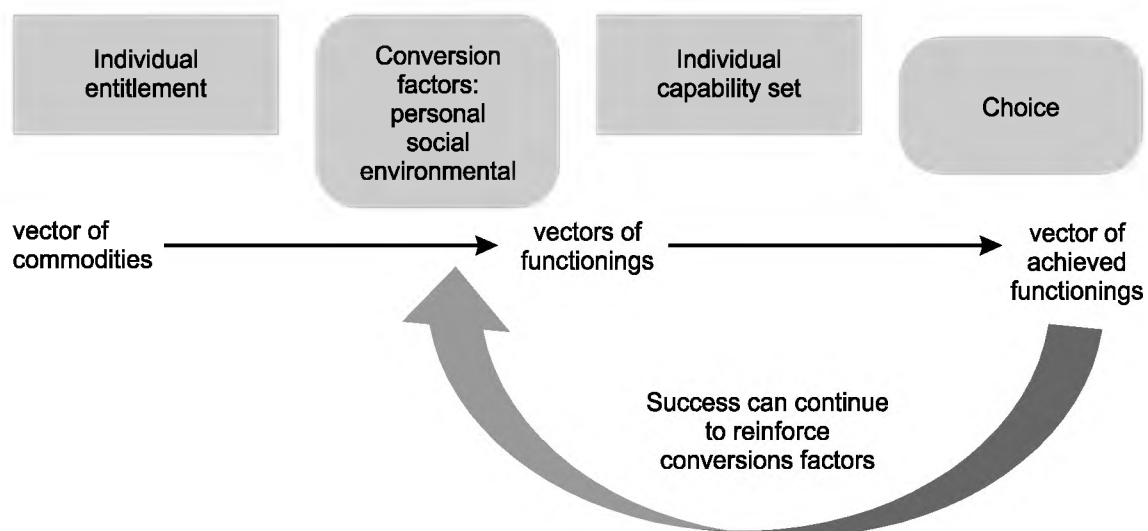
Figure 2.2: The capability approach (Adapted from Iversen, 2005, p.96**)**

I have added an arrow to the figure above to indicate that once an individual experiences well-being, she is in a better position to continue to want to do better; hence achieved functionings in turn influence conversion factors.

A teacher educator is entitled to physical and non-physical commodities that are inherent in the role of a teacher educator. Some of these entitlements are the curriculum, regulations governing the process of teaching, learning and assessment, students as well as teaching and learning resources. They are some of the means to achieve good teaching. But teacher educators have personal conversion factors and are influenced by social and environmental conversion factors in the way they use resources.

Personal conversion factors include the desire to learn new things and the desire to try new teaching and learning as well as assessment methods. Social conversion factors include the social arrangements among the faculty staff that influence teaching and learning such as

issues of support and collaboration. Environmental factors are those that depend on environmental factors, such as distance between the teaching and learning institution and a demonstration site, weather conditions influencing the way one teaches, the presence or absence of electricity that influences use of certain spaces and gadgets. All the functionings that an individual can achieve by converting commodities using conversion factors, constitute the capability set of that individual. However, being reflexive, the individual has freedom to select relevant functionings at any one time. The later groups of functionings that the individual chooses from the capability set are the achieved functionings.

2.6.1.2 Commodities, conversion factors and functionings in teacher education

The curriculum in tertiary education is called an outline because it is wide enough to allow for teacher innovation for depth of content and the methods used to teach and assess that content. Teacher educators usually have knowledge for teaching and assessing in their disciplinary areas. Through their differential agential properties, teacher educators may use the flexible curriculum to integrate activities and concepts that they think and believe enhance the teaching and learning process. Teacher educators bring in different methods of teaching and use a variety of tools to support the teaching and learning process. In teacher education, the curriculum is a commodity that teacher educators use as the background for their teacher education practice. If one wants to use the commodities, a computer and data projector, for PowerPoint lecture presentations or for showing a video, she should be able to set up the technology and operate the technology. The PowerPoint lecture is her achieved functioning while the ability to use the computer is a personal conversion factor. If the room to be used has inappropriate lighting and is not conducive for use of the data projector, this is an environmental conversion factor. However, use of PowerPoint depends on how that approach is perceived by the rest of the teaching staff. If this method is held in high esteem, educators tend to want to use it; if it is not socially approved and not preferred to other methods such as group work, educators tend to use it less. In this case, teacher educators' prior perceptions of the methods to be employed are a social conversion factor on the functioning of lecturing using PowerPoint.

One famous example by Sen on the relationship between commodities, conversion factors and functionings is linked to the functioning of mobility (being mobile). In order to achieve this, the individual has to have command over certain commodities (e.g. a bicycle) and must

be capable of using such commodities (e.g. riding a bicycle). In summary, these examples illustrate that an individual's capability is determined by her resources (represented by the budget set) on the one hand and her talents, skills and handicaps (her conversion factors) on the other. Those ways of life that are feasible for the person, in terms of both material conditions and her personal features, constitute the elements of her capability set. The functionings the person actually chooses from this set are called her achieved functionings (Argarwal et al., 2005). The person's well-being is now taken to be a function of these achieved functionings as well as of the capability set, i.e. all functionings that are feasible for her. Put differently, in capability approach, the well-being of a person depends, on the one hand, on the functionings she achieves and on the freedom of choice she enjoys, on the other hand.

Individuals can place what a collective values ahead of what they value as individuals. They probably value interdependent values (the interdependence arising from the various connections) or collective values (they value the collective effort put into anything that is valued).

2.6.1.3 Interdependent capabilities

Individuals may realise that their capabilities are inadequate and that they need to complement them with those of other individuals or groups in order to achieve their well-being. Argarwal et al. (2005), Iversen (2005) and Peter (2005) argued that at times there is an interdependency of capabilities using the example of a married couple where agency, freedom and choice depend on the capabilities of the other members of that household. The freedom arising from interdependence can be positive, the capacity to be and to do, or negative, and the freedom from constraints which does not necessarily provide capacity to do and to be (Gasper and van Staveren, 2005).

Capabilities are viewed as 'opportunities' that one has and a woman in marriage's well-being does not only depend on her own opportunities but a combination of hers and those of her marriage partner. However, the interaction of these opportunities depends on the nature of power relations in the relationship. If hierarchical, the woman's opportunities will not matter as much as those of the husband but if equally distributed then the extent of

interdependency is more pronounced. A woman's opportunities for well-being will be determined by the basic aspects of her agency.

It follows that households are usually constituted of many family members who have individual opportunities and choices but that constantly depend on each other's opportunities and choices. To this end, I reiterate that individual agents also consider their relationships with other people as they exercise their agency. With reference to teacher education contexts, hierarchical social and power arrangements in an institution would yield different interpersonal agencies compared with less hierarchical arrangements where differences in power are less noticeable (Robeyns, 2005). The less hierarchical arrangements would normally permit more interpersonal connections and hence tend towards more interdependent and collaborative capabilities and agency.

2.6.1.4 Collective capabilities

Since opportunities and choices of one influence those of others in a less hierarchical and more interdependent social arrangement, the aggregation of opportunities and choices is termed 'collective capabilities'. Collective capabilities can take the form of a group's collective choices and opportunities around an idea or thought. In addition to furthering what an individual values and has reason to value, collectives help individuals to reach what they aspire towards (Appadurai, 2004; Ibrahim, 2013). Group capabilities go beyond the sum or average of individual capabilities as individuals consider the benefit or effect their decisions have on the whole group. They are the result of collective agency that benefits the individual and the collective and individuals in so doing help the individual to achieve what he/ she would not be able to alone. An individual's perception of the good and ultimately, human agency, is also influenced by the group. Individuals engage in collective action, not only to pursue their individual goals but also to pursue those things that are considered to be good (Ibrahim, 2013). Ibrahim also argued that building individual capabilities is crucial for the success of collective agency. Individual and collective capabilities are iterative; building collective capabilities and agency can also promote a sense of public good in individual agency and enhance success of individual agency.

At times, the collective nature of capabilities and choices is constraining. Iversen (2005) argued that in interdependent and collective capabilities, not all individuals fully express

themselves in a group choice and usually the poorly expressed prevent the rest of the group from achieving their collective capability. Teacher educators work in institutions where each one has opportunities and choices that they bring into their work. They generally tend to work together with the rest of the institutional staff in such activities as planning the calendar of events for the year, the curriculum activities as well as on specific work related events and activities. In so doing, they bring their individual choices and opportunities into the work collective so that they end up with expanded individual capabilities that they brought into the collective and capabilities arising from their interactions at that level.

In order to establish the capabilities of teacher educators related to their change projects implementation and their efforts on mainstreaming environmental education/education for sustainable development, I drew on ideas from Robeyns (2003) and Flores-Crespo (2007).

2.6.2 Capabilities for mainstreaming Environment and Sustainability Education (ESE) in teacher education

Sen did not develop a list of concrete capabilities because he argued that individuals experience different conditions across the world, so a list would fix capabilities and not respond appropriately to the subjects of assessment. But his assertion was that people's achievements are influenced by economic opportunities available; political liberties that they experience and contribute to; social powers that they experience are and part of; conditions of good health that permit the individuals to flourish; basic education that enables individuals to gain knowledge that they can use and exercise; as well as the existence of motivation for initiatives. Robeyns (2003) adopted Nussbaum's list of capabilities to make a 14-point list of capabilities for assessing gender inequality. Flores-Crespo (2007) also suggested a list of seven capabilities that incorporated the Nussbaum list and some of the freedoms (Sen, 1999) that he used to assess capability of university graduates. I found Flores-Crespo's list very useful because it divided Sen's conditions for achievements into personal achievements (beings) and professional achievements (doings) that were easy to work with. Flores-Crespo's list was also relevant for my research in that the capabilities that university graduates eventually show are a product of the capabilities as well as the interaction of capabilities of their educators. Combination of Robeyns' and Flores-Crespo's frameworks within Sen's proposed conditions for achieving functionings was

arguably one way to establish functionings and capabilities of teacher education professionals in mainstreaming education for sustainable development.

In accordance with the list that I consolidated from Flores-Crespo and Robeyns, teacher educators are one component of university education whose capabilities for mainstreaming environmental education and education for sustainable development include the following:

Personal achievements (beings)
1. *Being able to feel confidence and self-reliance about one's ESE work;*
2. *Being able to visualise the future;*
3. *Being able to continue to develop abilities and show desire for continuous improvement;*
4. *Being able to transform available commodities into valuable functionings for teacher education and ESE; and*
5. *Being able to be skilled, educated and to use and produce knowledge.*

Professional achievements (doings)
6. *Being able to acquire knowledge required for mainstreaming ESE;*
7. *Being able to be recognised, respected and treated with dignity by own students, colleagues and communities of practice;*
8. *Being able to be part of social and professional networks and communities of practice as well as to give and receive social support; and*
9. *Being able to participate in, negotiate and have a fair share of influence on political decision-making.*

Adapted from Robeyns (2003:71) and Flores-Crespo (2007:51)

I used this list as a framework to look into the emergent features of each of the research subjects to establish the functionings they achieved in order to gain these capabilities (see sections 5.2, 5.12.2 and 5.12.6). Some of these valued practices appear as competences. The next section elaborates on the meaning of competence.

2.7   The notion of competences

2.7.1   Defining competence

A competence is made up of a combination of mental representations of knowledge, physical dexterity, the motivation and ability to mobilise these in a particular context (AdomBent and Hoffmann, 2013; Rychen and Salganik, 2001). Therefore the notion of competences has an output orientation to practice which may be in the form of mentally situated knowledge or physical dexterity (Sleurs, 2008; Wiek et al., 2011; UNECE, 2011). An individual normally develops more than one competence so the tendency is to relate

practice to a number of related competences that can be shown in combination and in relation to each other or independently of each other.

The perspectives of the notion of competences I used in this research were guided by the goals of the Rhodes University/ SADC International Certificate in EE course. As a professional development opportunity for individuals with institutionally relevant outcomes, the course sought to provide:

> ...support for the development of environmental education knowledge, skills, values and competences for individual environmental educators, while strengthening their ability to improve the work that they are doing in the institutions in which they work. The course therefore has a very strong focus on the individual and the relevance of what they are learning in relation to the workplace... (SADC REEP, Course Orientation, 2009)

The purpose of the course was to support development of characteristics that teacher educators could demonstrate as part of their ability and I termed these 'competences'. These were attributes or competences that teacher educators could use to mainstream ESE in their context of practice. Besides being able to work individually to mainstream ESE they were expected to develop competences to work in community with others in the field, their communities of practice (Lave and Wenger, 1991). I therefore sought to establish those competences that they used and ascribed to their participation on the Rhodes University/ SADC International Certificate in EE course (see Section 1.13).

There has been no research to date to establish whether the Rhodes University/ SADC International Certificate in EE course contributes to mediation of Teacher Education practice for sustainability. In addition, no research has yet been conducted to ascertain whether and how the course influences its intended development of competences of ESE. Furthermore, there has not been any research to establish what the teacher educators who have been on the Rhodes University/ SADC International Certificate in EE course show competency in, in response to contextually located socio-ecological concerns or matters of concern (Latour, 2004) to them, in their institutions and greater society.

Teacher and teacher education competences for ESD developed by de Haan (2010) were in support of *Gestaltungskompetenz*, a term that implies the capacity to act and solve problems. The thinking was that capacity to act and solve problems was discernible through

three competence categories, namely, subject and methodological competence, social competence and personal competence. Twelve sub-categories were then listed as follows:

1. *Gather knowledge in a spirit of openness to the world, integrating new perspectives*
2. *Think and act in a forward-looking manner*
3. *Acquire knowledge and act in an interdisciplinary manner*
4. *Deal with incomplete and overly complex information*
5. *Cooperate in decision-making processes*
6. *Cope with individual dilemmatic situation of decision making*
7. *Participate in collective decision-making processes*
8. *Motivate oneself as well as others to become active*
9. *Reflect upon one's own principles and those of others*
10. *Refer to the idea of equity in decision-making and action planning*
11. *Plan and act autonomously*
12. *Show empathy for and solidarity with the disadvantaged.*

The United Nations Economic Commission for Europe Steering Committee on Education for Sustainable Development (UNECE, 2011) further developed the categories of de Haan's competences of educators into being able to *learn to know*, which implies that educators and learners are expected to know the environment and sustainability challenges the globe is facing; *learn to do*, that refers to the development of skills and action competence (Jensen and Schnack, 1997) to respond to the challenges of the world; *learn to live together in sustainable ways*, that appreciates interdependence, tolerance, pluralism, mutual understanding as well as peace, and *learn to be*, that promotes greater judgement rationality, ethical considerations and the ontology of being, from the individual level. These competences recognise that education for sustainable development should not only be about developing capacity to take action. The framework in which these competencies are implemented should go beyond reacting to pre-existing problems and allow for development of a holistic nature of socio-ecological systems, promote visioning of the future and be a stimulus for transformation and change.

This research seeks to establish how competences for sustainability education, developed by teacher educators during the professional development course interactions, were translated into their teacher education work. In order to identify specific competences for ESE, I drew on Wiek et al. (2011) who argued that over and above the usual competences for education, teacher educators are supposed to have and show competences for Education for Sustainability. In other words, competences for sustainability cannot be developed or treated in isolation from general competences for education but are supposed

to be clearly discernible from practice, as output in practice. I found this view particularly enlightening as it pointed to my research interests, the need to project competences for mainstreaming education for sustainable development that were shown by course participants during and as part of their practice (see Sections 6.10, 7.11 and 8.11). Wiek et al. proposed five competences for sustainability for any educational endeavour: systems thinking competence; anticipatory competence; strategic competence, normative competence and interpersonal competence.

Systems thinking competence denotes having knowledge, skills and attitudes that provide the capacity to analyse socio-ecological contexts and seeing different aspects as connected and related across socio-political and economic contexts while recognising the temporal and spatial scale in which the competencies are applied. This competence is related to Knorr Cetina's (2007) epistementality that recognises how knowledge and knowledge structures influence forms of practice. In this research, analysis sought to reveal those aspects of competence that show the ability of the participant to make connections across the socio-ecological contexts.

Anticipatory competence entails knowledge, skills and attitudes to use knowledge of key structures, components of structures and knowledge of dynamics of socio-ecological systems in order to envision new pathways to a sustainable future. In addition to establishing whether the course engendered course participants with skills to envision new sustainability pathways, the research also sought to establish whether teacher educators promote anticipatory competence among their students.

It was also important to research how the course contributed to *normative competence* of teacher educators, as well as how teacher educators strive to develop normative competence among their students. Normative competence entails knowledge, skills and attitudes to collectively use normative knowledge ideas including justice, all forms of equity, socio-ecological integrity and ethics to assess current sustainability trends and create visions of the future.

Strategic and practical competence includes knowledge, skills and attitudes that are necessary to assess viability, possibility, effectiveness and efficiency of interventions. This competence is driven by the degree to which teacher educators intentionally engage in

interventions or promote intentional involvement. It calls for their knowledge of pathways, hierarchies, barriers and relationships in their teacher education system or in socio-ecological contexts.

Having knowledge, skills and attitudes to be able to collaboratively engage in or facilitate collaborative and participatory problem solving constitutes *interpersonal competence*. Embracing and understanding diversity, working across different cultures, social groups, communities, individuals, perspectives and preferences is a key component of this competence.

This research looked at competences in terms of the five tenets suggested by Wiek et al. (2011) as they allowed me to discern competences that directly relate to making visible attributes of capacity for mainstreaming education for sustainable development in teacher education practice.

2.7.2   Why capabilities and competences in this study?

Sections 2.6 and 2.7 look in particular at the 'shopping list' of capabilities developed from Robeyns (2003, p.71) and Flores-Crespo (2007, p.51) and the list of competences developed by Wiek et al. (2011) that were used in this study, illustrated that both capabilities and competences have performative outputs. But what is significant is that capabilities are attributes that are valued by the individual or group. Therefore an individual can value an attribute but may not be able to perform it. On the other hand competences are primarily based on their performative role. A competent person is one who can perform to perfection. However, the attributes may not be valued by the individual. Noting this subtle difference between the two notions, I decided to treat them separately in the study.

2.8   Conclusion

This chapter was opened by contextually locating the study in institutions in Zimbabwe and Lesotho in order to illustrate the influence of macro-education systems on teacher education practice. The Rhodes University/ SADC International Certificate in EE course was shown to owe its conceptualisation, structure and content to the RU/GF Environmental Educators course. Concepts used to describe and explain teacher education practice in relation to capacity for mainstreaming environmental education/ education for sustainable

development were also explored in this chapter. Chapter 3 discusses the analytical theory from which the analytical lenses were derived. It discusses critical realism with particular focus on realist social theory in order to illustrate how the analytical lenses were arrived at.

Chapter 3:   Establishing a Social Realist Research Framework for the study

3.0   Introduction

As indicated in Section 1.13 the research sought to establish how mediated actions on a course and in the institutions from which course participants came, influenced development and exercise of teacher education competencies, teacher education practice, learning and agency during the implementation of change projects. In order to be able to track and explain change I drew on critical realism, a theory which guides the user to go beyond what is evident and obvious. Emerging from critical realism, I worked with Realist Social Theory in order to explain change in practice. Experiences of research participants on the course and in the change project are part of their reality. These experiences are related to evident and not so evident factors in this reality. A clear explanation of change or no change as expected by the course and the change project depends on characteristics of the individual participants, the social and cultural context as well as the social-ecological structures that influence practice.

The purpose of this chapter is to explain how critical realism was used in the research, with an emphasis on Realist Social Theory. As an underlabourer, critical realism provided the lenses through which to see the research problem, research design and the research process (Cruickshank, 2003). Realist Social Theory in this research was guided mainly by the work of Margaret Archer, particularly her view that individuals to some extent have free choice which is related to reflexivity but which is influenced (enabled or constrained) by conditions that influence and shape the social context of the individual and his / her community(ies) (Archer, 1995).

3.1   Critical realism

Critical realism as based on the work of Bhaskar (1979; Norrie, 2010 and Maxwell, 2012a) is a philosophy that seeks to provide explanations of experiences in the society. Society can be explained using a continuously transforming process that he termed the idea of natural necessity, where knowledge formation is dependent upon the society in which the knowledge is located and the people who are part of that society who consciously engage in

activities that ultimately transform the same society (Mezirow, 1990; Norrie, 2010). The term 'knowledge' in this statement acknowledges both what is experienced and the explanations given to those experiences through theories. It follows that there is a relationship between people's experiences of phenomena and construction of explanations pertaining to the phenomena and events that are evident in the world (Cruickshank, 2003; Norrie, 2010). Maxwell (2012a) recognised that critical realism combines the realist ontology that there is a real world that exists independently of our beliefs and constructions of it and the constructivist epistemology that recognises our knowledge of the world is our construction that is developed from a particular vantage point and that it is impossible to have one truth that is explained in simple ways. The observable and experienced phenomena and events are a result of structural effects and generative mechanisms. Some generative mechanisms are clearly evident while others have to be unearthed. In order to unearth the generative mechanisms, it is important to first understand the nature of reality and then follow these generative mechanisms through the various levels of reality.

Critical realism grew out of the observation that the world is differentiated, structured and changing (Bhaskar, 1998b). In this world, there is reality. Reality exists, despite the ways we think about it. The basic tenet of critical realism is that there is a real world out there independent of our knowledge of it. The implication is that the nature of the world is different from knowledge about the world. The nature of the world determines the knowledge we can develop around it (Bhaskar, 1998b; Easton, 2010; Norrie, 2010). Our knowledge of the real world is socially constructed and is fallible. It is fallible because we can interpret the world in many possible ways, depending on how we see and understand it. In addition, events will continue to happen in the world despite the way we continue to think about them and the evident explanations we have of them; this is because the world is not controlled by our thoughts only but by other factors that we do not know. Events and experiences are shaped by generative mechanisms and the formation of society should, according to Bhaskar (1979), be seen as an assemblage of interacting generative mechanisms, some of which change over time, in response to changes in the society.

Returning to the research, it is the nature of teacher education, teacher education institutions and the individuals in these institutions that determine events and experiences. Social structures have powers to govern and regulate activities; the nature of activities

influences agents' conceptions of the activities and agents' conceptions of what they do or can do in their activity. That is to say, the knowledge or theories which agents have to explain any activity depend on how social structures shape the activity. According to Bhaskar (1979, p. 41):

> Now, as social structures exist only in virtue of the activities they govern, they do not exist independently of the conceptions that the agents possess of what they are doing in their activity, that is, of some theory of these activities.

Knowledge about teacher education can only be developed and understood in view of the events and experiences that occur. Teacher education institutions and teacher education practice are a necessary pre-condition for experiences of teacher education, that is they have to exist first for any intentional social action in teacher education to take place and as such their casual power determines emerging social reality in teacher education (Bhaskar, 1979).

Summarily, there is a real world and we should not conflate it with our experience of it. What then is the nature of reality? The critical realist perspectives on the nature of reality are dealt with in the next section.

3.2   Critical Realist (CR) ontology (defined in Basic Critical Realism)

Critical realist ontology distinguishes three levels of reality, or the layered or stratified ontology: the real, the actual and the empirical (Delanty, 2005; Norrie, 2010). The real stratum contains everything that exists including the natural, physical and social. It is the realm of objects, their structures and their powers. The real covers those things that exist in the natural world and those that were created by society in social interactions. The real therefore has everything, including "experiences and events, and the underlying mechanisms that generate events and make them available to experience" (Norrie, 2010, p. 8; Pratt, 2014). One would think that an educational institution is a real object that was created by its society. Despite the physical or structured nature of objects in the real, the objects exist in open systems that make them amenable to change. Realists tend to identify aspects of the real objects that could change or be changed, by establishing what is necessary and what is possible for change in the world, while considering the nature of the objects (Sayer, 2000).

Based on this, the real entity of a teacher education institution has structures, including physical structures, human positions and vacancies as well as cultural structures and rules determining the operations of this institution. When these start operating they generate events and experiences for people, such as when the educational institution recruits lecturers, ancillary staff and enrols students, they create an actual realm. The interactions of the physical structures, positions and rules produce another level of reality called the empirical, which denotes the conscious experiences of the people in the institution. They consciously and purposely use events in the actual to generate observable and mostly practical experiences. These will include the course experiences, lectures, meetings and social interactions (Norrie, 2010). Norrie (2010, p. 10) highlighted the key and iterative role of society in conscious human action and of conscious human action in society:

> To the contrary, intentional human agency is inconceivable without society, and society is a necessary, structuring condition for its possibility. At the same time, however, society and social structures exist only by virtue of the intentional human agency that reproduces and transforms them. In this context, human mind and intentional agency are emergent properties of a certain kind of physiological matter...

In order to understand the constituent parts of social reality, critical realists identify transitive and intransitive dimensions of life (Delanty, 2005; Dean, Joseph, Roberts, and Wight, 2006). Intransitive denotes those aspects of the world that do not change, such as physical things and processes as well as knowledge of them that do not change. The intransitive dimensions are the more fixed rules and objects while the transitive are the experiential processes. The intransitive dimensions generate the transitive. Social structure is considered an intransitive dimension of human life that enables and constrains everyday experiences; in so doing social structure is generative of human experiences. However structures are not independent of the activities they produce but are dependent on intentional activities of the agents for their reproduction (Dean et al., 2006; Norrie, 2010).

Theories about how these work (epistemology) are transitive because they are not definite and are fallible (Scott, 2008; Norrie, 2010). Humans can theorise about the happenings of the world and these theories or explanations are fallible. Being fallible means that they are subject to change and can be replaced by more adequate explanatory ideas. According to Norrie (2010, p. 8),

Bhaskar was thus able to explain how science could be seen as a human achievement, prone to error and open to partisan argument, and therefore to deflection from the pursuit of truth, yet at the same time grounded in real-world events and structures.

Besides there being different theories that can be used to explain the same phenomenon, any one explanation can change when a more plausible explanation is produced. What is considered and accepted as truth changes as more plausible explanations and conjectures are generated.

In the context of this research, drawing on this philosophy, it is possible to propose that participants had their institutional social reality before they participated on the course and that this social reality interacted with the social reality of the course to potentially produce a different social reality, and at times, tensions in the participants. The participant's institution not only has a social structure but is also a structured structure that constitutes the social reality of the participant and in turn forms the social reality of the change project implementation process (see Sections 1.8 and 1.9; Chapters 6, 7 and 8). This research sought to understand how the transitive and intransitive dimensions of social realities on the course and in the institutions influenced the change project development and implementation (see Section 3.3).

3.3   Why critical realism in this study?

Critical realism ontology that separates being from knowledge of being allowed me to consider teacher education practice in isolation from knowledge of it. I could analytically identify different intransitive aspects that constitute teacher education, and also differentiate the transitive aspects and human experiences of teacher education in change processes. In so doing critical social realism provided me with social realist tools to understand the structure-agency relationship via emergent properties (Structural Emergent Properties (SEPs); Cultural Emergent Properties (CEPs) and People Emergent Properties (PEPs)). With the observation that social phenomena are generated by a number of factors, it follows that most of what social science studies reveal are emergent properties (Cruickshank, 2003). According to Bhaskar (1979, p. 42):

> 1. Social structures, unlike natural structures, do not exist independently of the activities they govern.

2. Social structures, unlike natural structures, do not exist independently of the agents' conceptions of what they are doing in their activity.
3. Social structures, unlike natural structures, may be only relatively enduring (so that the tendencies they ground may not be universal in the sense of space-time variant).

Bhaskar further considered the relationship between society, human activity and transformation. His assertion "Society exists only in virtue of human activity. Human activity is conscious. Therefore consciousness brings about change" (Bhaskar, 1998b, p. 219) means that society is built up and can be transformed through conscious human activity. Transformation emerges from human activity. Conscious human activity in teacher education may include the efforts at mainstreaming environmental education and education for sustainable development. Actions of individuals in teacher education potentially produce emergence that influences development of social structures in their institutions. However the social structures produced also and in turn influence individual teacher educators' actions. This means there is a perpetual iterative relationship between the outcomes of individual actions on the social structures and resultant social structures on how individuals exercise their agency. This ultimately influences development of social structures which may in turn enable or constrain individual agency.

According to critical realism, the nature of real objects can enable or constrain positions, practices, rules and institutional experiences. Delanty (2005) presented Critical realism as a model of explanation that brings to the fore mechanisms and processes by seeking to understand the complex underlying processes affecting what people do, that Delanty terms,

> … mechanisms by which effects operate, the powers and properties that they produce and the intricate inter-linkages between the different levels of structures which all make causation very complex and thus, irreducible to single factors. (Delanty, 2005, p. 47)

The quotation implies that there are mechanisms in teacher education that are interacting in various complex ways to produce or cause events. Any one event is a result of interaction between more than one mechanism. Some of the mechanisms are evident but there are also mechanisms that are not visible.

3.3.1 Reality is stratified

In critical realist perspectives stated earlier, reality is stratified and differentiated (Delanty, 2005; Shipway, 2010). What we see on the surface cannot fully explain what is happening. It is important to note that some of the causes are invisible until we see the results. There is much happening beyond what we can see so we cannot always ascribe explanations of events to what we can only see (Delanty, 2005; Shipway, 2010). Therefore critical realists argue that any result is not arising from the effect of a single factor but a combination of factors and that some of the effects in turn affect the processes that produce them in many ways (Delanty, 2005; Archer, 2005; Vandenberghe, 2005; Elder-Vass, 2007a). It is important to get deep into the multiple layers to understand what makes them and how they relate to each other. So critical realism attempts to uncover and explain what is seen and establish all the many factors influencing what is seen as only the outcome of many other mechanisms, processes and events.

Delanty (2005) asserted that critical realism was a model for explanation that brings to the fore powers and properties, their interlinkages, the different levels at which they influence causation and the mechanisms they use to effect their powers and properties. Such an approach to research is appropriate for open systems that cannot be adequately understood through experimental setup with a control. Education is understood as an open process, where experiments may not be an adequate means of explaining complex change processes in society as they tend to draw on positivist Humean forms of causality based on correlation. This implies that tools required at the beginning of an experimental process such as controls and identical conditions were not required in this kind of research.

Critical realism enables the researcher to establish how things are and how they came to be, making it a powerful tool for qualitative social research. In this research, critical realism was used to examine the nature of mediated actions, interactions and structures in the professional development course from the on-course session to the institutional implementation phase (see Sections 1.13). It also sought to establish how these mediated actions on the course influenced the teacher educator as agent in developing changed practices, changed competencies and agency that became mediated actions for implementing the change project in the context of reality (Sayer, 1992). The changed

practices are said to be emergent from prior structures and actions (Bhaskar, 1979; Robson, 1993). The following section delves into the concept of emergence and how it arises.

3.4   The notion of causation

If any event is a result of interaction of a number of factors, one has to consider the contribution of these factors. When two or more factors interact, they cause an outcome whose characteristics may not be reducible to any one of the causing factors. The outcome is said to emerge from the interaction (Bhaskar, 1979; Robson, 1993; Sayer, 2000) making critical realism a relational philosophy. As already shown, the real domain includes structures of physical and social objects. Structures are patterned arrangements with tendencies to influence interactions. The interactions in turn result in generative mechanisms that influence action. These mechanisms may or may not trigger events in the actual domain so are called generative mechanisms or causal powers. Social reality is therefore constituted of generative mechanisms that generate events (Bhaskar, 1979; Delanty, 2005). These generative mechanisms are in the form of laws and rules and are independent of the events they give rise to. Pratt (2014) referred to them as ways by which things act. The generative mechanisms are considered contingent and emergent since they are not fixed; they are contextual and keep evolving as people interact with them and as the society in which these mechanisms are inherent transforms.

The basic or underlying mechanisms causing an event are usually not clearly visible. They have to be unearthed in order to understand the causes of an event and in order to respond to that event. Structures are made up of related elements that have causal powers. When causal powers are combined, they cause an emergence; there will be emergence of properties that are different from those of the structures with the causal powers. It is important to appreciate that any event arises from a number of generative mechanisms, those that are clearly evident and those that are not evident. The notion of generative powers was used to denote the factors responsible for causing events.

In this research the hierarchical structure in an educational institution with intransitive and transitive objects is a real phenomenon. At the actual level, there are structures that distribute responsibilities and duties. The structures have powers that cause distribution of

tasks. The ways of distributing tasks are generative mechanisms that influence the way the institution operates. The way the tasks are distributed, whether democratically or autocratically determines or generates the way the tasks are performed and completed. This sharing might enable or constrain division of labour and sharing that affects efficiency in work output. Of course this is the influence of structure, but there are other factors influencing the sharing, including the culture of the institution, the culture of the people concerned and their personal positioning in the process of sharing responsibilities. But this relationship between structure, mechanism, individuals, community and the outcome takes place in a context where other mechanisms are influencing them as illustrated in the diagram that follows:
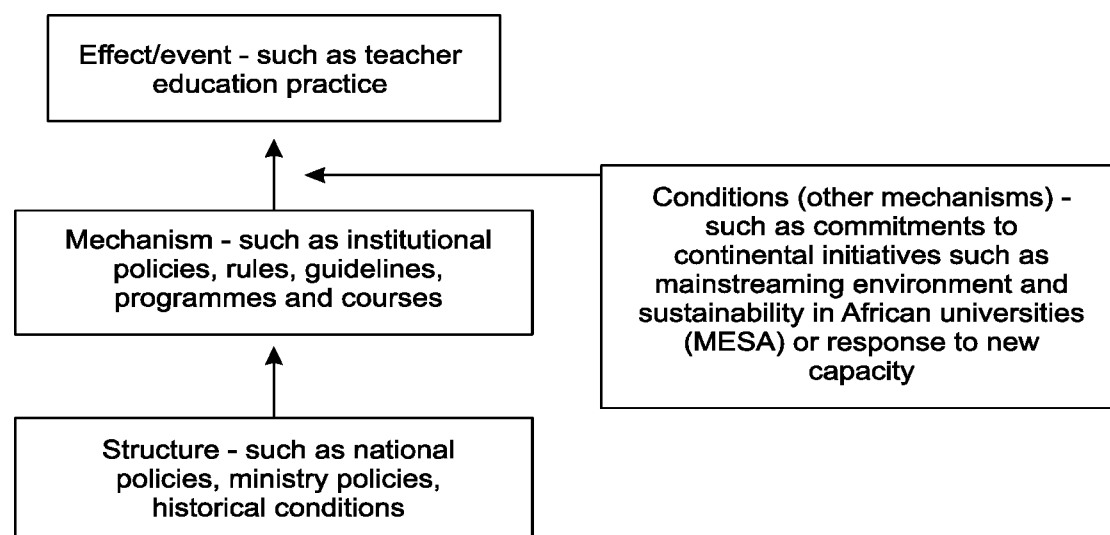
Figure 3.1: The relationship between structure, mechanisms and emergence (Adapted from Sayer, 2000)

Therefore, in order to explain what takes place during the division of labour, one has to identify casual mechanisms directly related to the event and those that are not directly related to the event but which influence development of that event as well as those that are hidden (Sayer, 2000). Change project development on the course and implementation in institutions are potentially influenced by evident and not so evident factors that need to be established in order for the research to explain the influence of the course on teacher education practice and to contribute to emancipation of the course participants and their institutions.

3.5   Notion of emergence

As spelt out earlier, Bhaskar's (1979) view on society, the individual and agency, was that society is a pre-requisite for conscious individual action where it either enabled or constrained individual action; individuals exercise their agency and the outcome of the individual actions influenced and at times transformed the society in which the actions took place. Following Cruickshank's (2003) assertion that the study of society tends to imply the study of emergent properties, this section was set up to deepen understanding on the notion of emergence especially as understood in basic critical realism[1].

The notion of emergence is one of the key concepts that influence understanding of social interactions. As shown in the previous section, critical realists believe in the notion of emergence, that is, when two or more components of a system interact, they give rise to new phenomena, a condition Elder-Vass (2005) called 'diachronic emergence'. Emergence denotes a contextual social condition where social reality emerges or is an outcome of the interaction of different processes (Bhaskar, 1989; Delanty, 2005; Archer, 2010). Interactions do not merely produce the same characteristics as the inputs. They result in a totally different outcome or more than one outcome and cannot be reduced to the inputs. The new phenomenon has properties that are totally different from those of the initial aspects. Elder-Vass (2007b) defined a property as something that is intrinsic and constitutive of an entity that can cause events in the world. One cited example is the compounds that are formed through reaction of elements, for example, water which has properties that are very different from those of its constituents, hydrogen and oxygen. The elements are reactive and exist as diatomic particles. The molecule of water has the two elements that want to exist in a combined state in ratios.   The water can exist in any of the three states of matter (liquid, solid and gas) whose properties are very different from those of oxygen and hydrogen. The argument is that social phenomena behave in the same way as the elements

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[1] Basic critical realism is about being, where things exist as events and phenomena in the real world. Dialectical critical realism is about being and becoming. It assumes that events and phenomena are relational and that there are inconsistencies or tensions or antagonistic contradictions during the manifestation of events and phenomena. Resolution of these antagonistic contradictions is achievable if the relationality between events and phenomena can be established. Meta-reality draws on dialectical critical realism and seeks to establish alethic (true) truth by building on the premise that such basic qualities that relate to humans as intelligence, creativity, love, a capacity to decide and take the right action and a desire for human self-actualisation have powers to sustain the current inconsistencies in the world. These human qualities also have the powers to influence evolution of the mind that leads to emancipation.

of oxygen and hydrogen where interaction between any two factors results in a totally different phenomenon that cannot be reduced to its causative factors.

Sayer (2000) identified social phenomena as emerging from biological phenomena. Biological phenomena in turn emerge from chemical and physical processes. Using an example of human discussions, Sayer concluded that the social practice of conversing depends on one's physiological state, including nervous transmission but conversing is never reduced to those physiological processes. In another example, to control birth and population growth which is a social process, humans depend on contraception, a physiological process.

3.5.1 Emergence is relational

The notion of emergence in society can also be understood in terms of relations. Individuals and institutions are in relation to each other or relate to each other. Elder-Vass (2005) distinguished between diachronic and synchronic emergence, the latter entailing relationships that are embodied between the parts and the whole. An example is of educational institutions that conduct their business through the relations they enact with the greater part of society and the relations between their constituent parts. There are relations that depend on the structures and there are relations that emerge from interactions generated from the structures playing out at the different levels of reality, this is part of the habitus of that institution and its components (Bourdieu, 1998). At times these interactions are disrupted when the institution or its components interact and therefore accepts inputs from an external relation. This interaction creates a new form of emergence that becomes a new form of habitus (see Section 2.4.2 on habitus) that becomes the source of new relations and practices. The new relations and practices in turn affect the interactions leading to new emergence and consequently, new structures and new cultures are developed (Bhaskar, 1989). The new relations, new structures and new culture bring societal change.

Even though new properties are independent of existing properties, the new properties actually exist because the components of the society had properties that could interact in certain ways. Time is also an important factor in emergence. Some emergence takes a long time to become evident while other emergence is quick to show (Zeuner, 1999). As noted in

Sections 2.4.2 and 4.2, the purpose of the Rhodes University/ SADC International Certificate in EE course was to bring in an external relation with potential to disrupt the habitus of the participants and hence disrupt the habitus of the institution when the participants implemented their change projects. When the participants engaged with the course they were expected to have emergent properties that could potentially constitute elements of the new and elaborated habitus. When participants implemented their change projects in the institutions with properties that emerged from the course, a new interaction with emergent properties in teacher education practice with a focus on ESD practice was anticipated. The new ESD practices, new thinking and new doings can, according to Margaret Archer (1995), be grouped into three categories, namely, People's Emergent Properties (PEPs), Structural Emergent Properties (SEPs) and Cultural Emergent Properties (see Section 3.8). These properties are actually layers of competences in the social order of the educational institution where change projects are being implemented.

Because time is a significant dynamic of emergence as described above, this research recognised that change can take a long time to show (Bhaskar, 1989) and sought to establish the developments and changes in the contingent reality of the participants. The research followed teacher education practices in institutions at least two years after participants left the Rhodes University/ SADC International Certificate in EE course allowing for a two-year window for observation of emergence. In this time, it was anticipated that participants could have made efforts to exercise their agency in one or more ways.

3.6   Social reality

As one of the most influential people in theorising social realism[2], Archer (2010) recognised that social reality is stratified and exists in the form of three orders and that these orders have associated forms of knowledge as shown in Table 3.1 that follows.

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[2] Any event is determined by interactions between structure, the social conditions prevalent at that time and individual motivation of persons involved in the action. Some theorists including Margaret Archer were driven by a stronger inclination towards social reality giving birth to Realist Social Theory critical realism or social realism.

Table 3.1: Three orders of natural reality and associated knowledge

	Natural order	Practical order	Social order
Relationship	Object/object (*natural objects and artefacts interacting as in chemical reactions in the body*)	Subject/object (*humans interacting with objects and artefacts*)	Subject/ subject (*interactions between human subjects*)
Knowledge type	Embodied	Practical	Discursive
Emergent From	Co-ordination - *of parts of the body through various reactions and responses*	Compliance - *to structural and cultural influences*	Commitment - *to matters of concern*
Importance of reflexivity	Minimal	Moderate	Maximal

The natural order is composed of the physical being. This physical being exists because the parts have interactions in them and interact amongst themselves producing a coordinated body. Knowledge is part of the embodied being of these objects. Archer argues that there is not much need for reflexivity in the natural order because the body naturally responds to environmental conditions. The practical order is experiential in that it involves people who are the subjects working with objects from their social reality. Objects can be human or non-human and are related to Vygotsky's notion of tools and artefacts (see Section 4.8). Knowledge that grows out of practical engagement and experience is overtly practical. There is limited reflexivity as the competencies for performance are often fairly fixed unless new tools or artefacts are introduced as is proposed by Vygotsky (see Section 4.8). Reflexivity may entail the need to use an object or its alternative and to choose between possible ways of doing. The social order is created when individuals interact with each other. Their interaction produces knowledge that is context dependent, therefore can change. The potential for reflexivity is high since there are a wide variety of options to choose from. Teacher educators are living beings with a body that is natural. They have practical competencies for their field of work that constitute their habitus (see Section 2.5.2). Above all, teacher educators are social beings that work in a socio-cultural context, so teacher educators' lives cannot be understood without referring to the socio-cultural contexts in which they are immersed.

Despite their being social in nature they have different experiences of the world that generate different perspectives of the same world. This plethora of perspectives creates differences in the way they exercise agency that carries forward reflexivity, knowledge and action. Teacher educators often operate in more than one order of reality at the same time. Therefore research on their practice has to interrogate how the teacher educators are interacting with reality at all the levels in order to identify the outcome of the interactions.

3.7   Interactions as the basis for actions

Archer recognised that even though human actions arise from the influence of culture, and structure, humans are capable of reflexive interest in the inactions which can drive human agency. Any action arises from the intricate interaction of culture, structure and human agency (Williams, 2012). The nature of reality influences the nature of our being, what we become, and what we understand as our being (Archer, 2000b), meaning that the world can influence what we become as human agents. Our experiences of the world also influence our interests in the world that then influence the properties and powers that we develop as agents in this world. Therefore Archer sought to explicate the relationship between structure, culture and human agency. In this quest for explaining society and social change she argued that in order to understand the relationship between structure, culture and agency, the three should be separated for analytical purposes and not conflated, as illustrated further in Sections 3.7.1 and 3.7.2.

Archer presented principles for social analysis of society: that there must be internal consistency between social ontology, explanatory methodology and practical social theorising and especially within the notion of emergence. In her argument she asserted that structure, and agency be kept separate from each other when analysing society. For each of the two, structure and agency, new properties can emerge on the basis of existing properties where emergence can appear independently and respectively over time in the two (Zeuner, 1999). Subsequent to this ontological position, it becomes methodologically possible to analyse the interplay between structure and agency by looking at the two without conflating them. This approach to analysis is repeated with culture and agency. This separation she termed Analytical Dualism which is further discussed in Section 3.7.1.

3.7.1   The notion of conflation

Conflation is a word that Archer used to describe the tendency to put together and analyse structure and agency such that they cannot be clearly described. The tendency to foreground the individual and how he or she influences his/her agency in determining the nature and characteristics of society, she describes as voluntarism, or upward conflation. Archer described as downward conflation the tendency to put prominence on how structures and culture alone enable or constrain human actions because the society forms and determines the individual being and hence determines the nature and extent of agency that is determinant. Central conflation is the situation where structure and agency are seen as being co-constitutive i.e. structure is reproduced through agency which is simultaneously constrained and enabled by structure (Archer, 2000a; Sibeon, 2004; Johnson, 2008). Structure and agency are therefore analysed simultaneously, so that the analysis fails to tease out the interactions between them. Archer used the example of Giddens' Structuration Theory where the individual's practice is inseparably controlled by both structure and agency. This presents a conception of social structure as an external, deterministic frame of reference for action in such a way that only serves to reproduce that society (Raven, 2005; Elder-Vass, 2007a; Archer, 2010; Porpora, 2013). In failing to adequately separate these during analysis, Giddens therefore, according to Archer, conflated structure, culture and agency. Archer (1995; 2004) objected to Structuration Theory because it is analytically flawed. Conflating structure and agency by emphasising co-constitution uses central conflationary approaches that do not provide for analysis of the influence of each of the aspects (ibid.). She then argued for analysis that looks at the interactions between structure and agency as well as between culture and agency, an approach to analysis of properties and powers to explain the outcome of either or both that make society, which she called 'Analytical Dualism' (Archer, 2004, p. 44).

3.7.2   Analytical dualism

While agreeing with Giddens that structure and agency influence each other, Archer (2004) argued against 'duality of structure' as put forward through the theory of structuration. Although she accepted the interdependence and iterative relationship of structure and agency (i.e. without people there would be no structures), she argued that Giddens underplays the role of temporal relations by not recognising that structure and agency

operate on different timescales. Archer (1995; 2004) further argued that it is possible to isolate structural and/or cultural factors, 'parts', from 'people' analytically (Zeuner, 1999). The parts provide a context of action for agents, 'people' creating an interplay of casual powers and properties (Archer, 1995). This approach of separating analytically makes it is possible to investigate how those factors shape the subsequent interactions of agents and how those interactions in turn reproduce or transform the initial context over time. This is Analytical Dualism.

However one needs to draw out the relationships between the theorisation by Giddens, Bhaskar and Archer more clearly. Bhaskar (1979) developed the Transformational Model of Social Activity (TMSA) by building on the work of Giddens. Archer acceded to structure and agency being iterative as presented by Giddens but only differs with him analytically. In the end the notion of structure and agency between the three theorists has subtle but key differences. King (2001) posited that Archer's theory of morphogenesis is based on ontological individualism that only uses structures as heuristic devices. He proposed that Structuration Theory explains society better, even though he did not come up with tools for analysis. In this research, I used morphogenesis because it offered the tools with which to explain teacher education practice with respect to transformation and continuance (Pratt, 2014) of practice through one intervention tool for mainstreaming of education for sustainable development, the change project. King's argument of focussing on society rather than on individuals only was not deemed necessary in this research where course participants were individuals who were part of a teacher education collective and who worked in community when implementing the change project. I therefore analysed individual practices, as shaped by and in societal contexts.

The following sections will expand on the notions of structure, culture and agency and will show how Margaret Archer worked with them to develop a social realist theory that explicates agency and change.

Vygotsky (1978) and Bhaskar (1989b) explained that human beings to have a natural motive or intentionality to make use of the world and, in so doing, change it. This is echoed by Archer (2010) who suggested that people tend to improve their conditions all the time. She termed this desire 'agency'. But their agency cannot operate independently of the

structures governing action and the culture in which this action in enacted. The following section will look at deepening of the relationship between structure and agency.

3.8   Emergent properties

As illustrated in Section 3.7.2 Bhaskar discussed the perspective of emergence at the societal level and in terms of factors that influence society but he posited that events and generative mechanisms at one level influence events and generative mechanisms at another level. That means the Real has events and generative mechanisms that influence events at the Actual level. Events and generative mechanisms at the Actual level in turn influence events and experiences occurring at the Empirical level. In other words, the events occurring at the Actual emerge from structures and mechanisms at the level of the Real. Experiences and events at the Empirical emerge from the Actual which have, in turn, emerged from structures and mechanisms at the level of the Real. Margaret Archer (1995) took this ontology further by arguing that research should tease out and describe the structural factors in society (the structural emergent properties (SEPs) and cultural emergent properties (CEPs)) and then discuss how these condition the socio-cultural agency of individuals and groups before describing how the structural factors have been modified (giving us 'morphogenesis'), or reproduced (giving us 'morphostasis') (Cruickshank, 2003). Archer (1998, p. 192) defined emergent properties as those that: …refer to those entities which come into being through social combination. They exist by virtue of interrelations (although not usually interpersonal ones) and not all social relations give rise to them.

In addition, in order to properly analyse the emergence, reproduction and transformation of cultural systems and social conditions, it is important to focus on the dynamics between the system and social interactions (Vandenberghe, 2005). Archer's approach provides the tools to analyse the changes within the factors of society. CEPs, SEPs and PEPs are in reality but they are separated for analytical purposes only.

Archer (2010) noted that individuals have personal powers to cause certain outcomes of their actions. These powers are influenced by structural or cultural properties, which are rules, regulations and other cultural attributes that determine and guide action, in the time and space where the agent is working. The agents are also influenced by their interests and

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habitus to be working in certain ways. According to Archer (2010), agents, in this case course participants, engage in an internal conversation about how structures constrain and enable their practice within a social context. Working with the social context calls for a dialectical deliberation process revolving around five identifiable steps: identifying partners to dialogue with, sharing the same concerns, elaborating social networks in the light of the concerns, refining and reinforcing the concerns together with the elaborated network and finally, attaining a way of doing which is consistent with the participant's original context and practice.

Ultimately, Archer (1995; 2000a) argued that agential powers can be manifested at three levels: Structural Emergent Properties (SEPs), Cultural Emergent Properties (CEPs), the 'parts' and People's Emergent Properties (PEPs), the 'people'.

3.8.1   Structural Emergent Properties (SEPs)

Structural Emergent Properties (SEPs) arise from interaction of and in relation to the human and non-human material resources such as rules, regulations and guidelines, in addition to situations where the interactions further result in rules, regulations and guidelines. They generate casual powers that are unique to and in relation to the structure and are irreducible to the people (Archer, 1995; Cruickshank, 2003). Structural factors that can have powers in this research included rules, curricula, frameworks and policy guidelines.

3.8.2   Cultural Emergent Properties (CEPs)

Culture is understood to be a medium that influences human action and it also becoming a product of that human action in the same ways as structure influences and is influenced by human action. Archer (1995; 2004) described Cultural Emergent Properties (CEPs) that are a result of interaction of the cultural features (including cultural systems – relations between components of culture and socio-cultural interactions – relations between cultural agents) and on the agent's actions in social space. Socio-cultural influence is expressed on people and through people. Cultural systems and socio-cultural life overlap, intertwine and are mutually influential (Archer, 1995). Culture refers to any item which has the dispositional capacity of being understood by someone. According to Archer (ibid.) cultural systems, such as religious doctrines can be viewed as having cultural emergent properties that go beyond

the individual believers or members of the church. Cruickshank (2003) used the example of the doctrine of Catholicism as a cultural system and as emergent properties that enable researchers to explain why such systems have been able to endure the test of time. This is different from analysing Catholicism from the point of different believers who themselves have differences between their beliefs that would have either made the church crumble or transform into another culture. Cultural factors in this research entailed those aspects of teacher education practice concerning relations between people (of interpersonal influence) and their relations with rules, norms, beliefs, values, dispositions and actions.

3.8.3   People Emergent Properties (PEPs)

In her description of People Emergent Properties (PEPs) that depend on the interests and power of the agent, Archer (1995) focussed on the powers generated by agent-based relations. Her assertion was that at the same time PEPs modify and transform capacities of associated members (their consciousness, commitments, affinities and animosities), they also affect the relations between the members with respect to the agency of individuals and groupings (including such features as association, organisation, opposition and articulation of interests). Archer distinguished between the actor and the agent. An actor is an individual, but agents are part of collectives. Archer further divided agents into primary and corporate agents. Primary agents are groups who share a situation and interest, but do not mobilise to pursue their goals. On the other hand corporate agents do mobilise to pursue their goals. Actors operating as agents are at times assigned roles but they can choose how to perform their allotted role. According to Archer (1995; 2004), the agential features of PEPs are the outcome of prior morphogenetic cycles. The Rhodes University/ SADC International Certificate in EE course suggested a morphogenetic cycle and sought to produce course participants as agents for morphogenetic cycles in their respective teacher education institutions (see Section 4.2). To this end, this research included such personal characteristics as individual motivation, personal interpretations of expectations, individually driven actions as some of the PEPs of teacher educators.

3.9   The morphogenetic cycle

The premise for morphogenesis is that structure and action operate over different time periods. Elder-Vass (2007a, p. 238) laid out two principles that influence the morphogenetic cycle:

1. Structure logically predates the action(s) which transform it; and
2. Structural elaboration logically postdates those actions (as illustrated in Figure 3.2 that follows).

At any one time in the world, pre-existing events create conditions that may enable or constrain contingent events. The interactions of contingent events, whether through enabling or constraining conditions on agents' intentions and properties result in consequences, some of which are intended at the onset of the interactions and some of which are unintended. Archer asserted that "... structures (SEPs and CEPs) fundamentally exert their effects in relation to and actually through the (SEPs and CEPs) projects entertained by agents (1995, p. 200).

These consequences lead to structural elaboration that tends to transform the properties of the initial structure, *morphogenesis*. At times, the outcomes of agents' actions do not cause change but tend to reproduce the status quo, a condition known as *morphostasis*. Whatever the case, that new condition provides initial conditions for the next cycle of events. The series of events described here is a morphogenetic sequence (Archer, 1995; Elder-Vass, 2007a; Porpora, 2013).

The constituents of a morphogenetic sequence are ordered in time antecedents creating conditions for the subsequent. In analytical dualism, Archer separated structure, culture and agency on a time scale in order to be able to respectively describe them across the *morphogenetic cycle.* Since end conditions of one morphogenetic cycle are raw materials for the next morphogenetic cycle, endless morphogenetic cycles of systemic and socio-cultural conditioning, socio-cultural interaction and systemic elaboration are produced. Margaret Archer (2010, p. 228) posited morphogenesis as: "...the complex interchanges that produce change in a system's given form, structure or state (morphostasis being the reverse), but it has an end-product, structural elaboration ..."

Social interactions produce a new order which becomes a basis for new interactions.
These changes happen over time, hence are not spontaneous but emergent (see Figure 3.2).
A brief definition of the four phases follows in Figure 3.2:

Social conditioning (structure)

T_1 —————————————————→

Social elaboration (action)

T_2 —————————————————→ T_3

Morphogenesis or morphostasis (structural elaboration)

—————————————————→ T_4
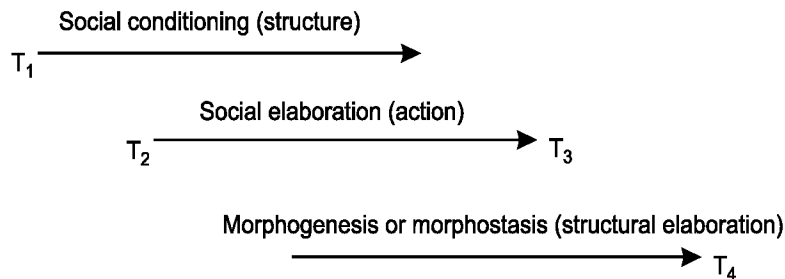
Figure 3.2: The morphogenetic cycle (Archer, 1995, p. 157)

T1 involves the large structural and cultural contexts in which agents take shape and act at
T2-T3. T4 represents a new formation (elaboration) of a complex of structural and cultural
conditions. The transformation produced by the structural elaboration is not mere
eradication of the prior conditions or replacement with a new one. Structural elaboration
entails a host of new possibilities which arose from interactions during the social
conditioning, the phase that describes the structural and cultural contexts in which
individuals engage their practice in their institutions with a new idea or skills or when new
practices are introduced, during period T1. Individuals with interests, motivation and group
identities interacting and striving to realise outcomes that satisfy those interests and
identities determine the practices during T2 and T3. The social elaboration at T3 will
potentially bring a new elaboration to the whole system at T4. The morphogenetic cycle
illustrates some form of stratification between the levels of structure/culture, action and
structural elaboration. If a positive feedback mechanism takes place, there will be change,
morphogenesis. If however the social relations create negative feedback loops, the result is
maintenance of the structure, morphostasis (Archer, 2014). This cycle will be continued in
normal life. The three lines are continuous but because analysis takes account of intervals,
the lines are broken to fit into the phase being analysed. As Elder-Vass (2010, p. 238) put it:
"…given the problem and accompanying periodization, the projection of the three lines
backwards and forwards would connect up with the anterior and posterior morphogenetic
cycles".

Most of the time, agents who work on projects reproduce and transform the structural and cultural conditions that impinge on them but at the same time are themselves invariably transformed from involuntarily placed agents into social actors and individual persons (Vandenberghe, 2005). In so doing the agent will personalise their role in terms of his or her concerns. This is called double morphogenesis (Archer, 1995). This research probed morphogenesis and double morphogenesis in the change project development and implementation in teacher education.

3.10   Structure and agency

Archer (1995; 2010) put forward the idea of morphogenesis to explain the interaction of structure and agency following recognition that individuals are constantly concerned with their practice and work on projects to innovate their practice and influence structures (Bourdieu, 1998; Vandenberghe, 2003; Archer, 2005; Archer, 2010). The morphogenetic theory is built from the premise that human interaction in the present takes place in social contexts (Bhaskar, 1998; Archer, 2005). The current social contexts are themselves outcomes of human interactions in the past. Therefore social contexts provide the raw materials for human interactions whose outcome is carried over into the future to provide new social contexts for further interactions.

The system and socio-cultural interactions as expressed earlier in this chapter are only separated for analytical purposes but in reality are intertwined; the separation of both structure and culture in relation to agency occurs only via analytical dualism (Archer, 1995). Since this research looked at the interactions teacher educators are involved in their institutions, it was imperative to separate the relationship of structure and agency from culture and agency during analysis.

3.10.1 The notion of agency

This research was guided by the thinking of Archer (1995) who argued that agents voluntarily or involuntarily find themselves in conditions where they need to think about their situation. Tikly (2015) observed that humans have such properties as self-consciousness, reflexivity, intentionality, emotionality and cognition which they use to formulate and plan projects as well as pursue personal interests and ambitions when

immersed in a certain context. This thinking about their circumstances generates *vested interests* on 'matters of concern' and it is in pursuance of these interests that agents take some form of action. Stetsenko (2008) termed the position taken by people in a situation, the 'transformative activist stance' meaning that people position themselves in relation to matters of concern and their interests in those matters of concern. In other words, pre-existing social conditions are the fertile ground for agential action or agency. I argued in Section 2.6, that agency or agential action entails one or more of some kind of thought, some form of reflexivity and choice, self-identity, intentional action, purpose and volition (Archer, 1995; 2000a; 2005; 2010; Emirbayer and Mische, 1998; Wiley, 2010) and Etelapelto et al., 2013). Teacher educators work in teacher education institutions which have structures and cultures that create conditions in which teacher educators conduct their practice. That practice and the ways that it is conducted are seen in this research as an outcome of interaction between their individual interests, the social conditions and the way individuals respond to the conditions around them.

As indicated briefly above, when describing how humans interact in their social conditions, Archer (1995) distinguished between two levels of agency, 'social agents' and 'social actors'. Social agents generate new rules and more activities for social actors to get involved in. Social actors reflect in their views on the situation, devise strategies and embark on action deemed to achieve their interests. As such, a social agent (e.g. SADC REEP) creates conditions in which a social actor (e.g. course participants) can operate. The social agent has power and ability to transform some of the social conditions. The presumption in this research is that the individual teacher educator or an educator working in collaboration with others could potentially create conditions that enabled the same individual or group to mainstream education for sustainable development. This research therefore sought to find out who was involved during these interactions, what conditions were set up for these interactions to take place, how they were set up and how they ultimately influenced practice, particularly focussing on the features that emerged from the change project. Agency operates within a social structure.

3.10.2 The notion of social structure

Structures are deemed to denote internally related objects (Archer, 1995). This implies that there has to be an order or a pattern of arrangement of objects and a pattern of socially organised events but is subject to change when the human actions in the events influence it. The pattern arises from an inherent organisation of things, objects and actions. Therefore because of the various possibilities of social patterning and the complexity of this patterning, the term 'social structure' refers to one or more of many aspects of this patterning, so cannot be easily defined or confined to any one particular form of social patterning (Archer, 1995). Social structure in this research referred to policies, rules, curricular and influential roles such as those of supervisors (Dean and Department Chairperson) and roles of educators whose functions tend to guide practice in the institution. I considered roles in teacher education as part of structure since they are responsibilities and are more fixed while the people or personalities that occupy them can change over time (Archer, 1995). An agent weighs a number of options before choosing one course of action. This consideration is called the internal conversation by Archer (1995; 2000b).

3.10.3 The internal conversation and reflexivity

Dean et al. (2006, p. 11) acknowledged that humanity has the ability to think and make choices that enable them to cause happenings in certain ways which they term "... unique casual powers for imaginative intentional free agency", that make them choose to do things the way they do. So people tend to want to do things (agency) in certain ways but are guided by the social conditions around them. This implies that agents weigh out courses of action in relation to the structuring and cultural conditions. Such conditions as emotions, personal choices, religious, scientific and cultural beliefs, ethical and moral considerations are influential in deciding courses of action. The course taken should in most cases consider ensuring success, what one would do in the event of failure and such considerations as effectiveness of resources and time issues amongst many others. In addition, agents decide on a good justification of their ideas and in their planned actions take into account such issues as individual, group, or institutional reputation, authority and safety. The thought processes that one undergoes to discriminate amongst possible options and settle for one

or a few alternatives, taking into consideration the various factors is what Archer (1995; 2004; 2007) termed the 'internal conversation'. It is internal because it happens inside an individual's mind. This process of choosing is part of agency since it is part of the process that results in taking a position even to the extent of taking action (Stetsenko, 2008). The internal conversation is an intensely social conversation in that it deliberates action in relation to practice, history, society, identity, culture and culture and is the basis for reflexivity.

3.11 Double morphogenesis

As mentioned earlier in this chapter, people pursue interests that are related to matters of concern in their social context in a bid to perpetuate, avoid or transform the conditions in which they exist. If the emergent society is morphogenetic, it means that people must transform their needs, interests and actions, which is their agency, in order to conform into the new society. The conditions created by the new society call for people to perform differently in the same role (Archer, 1995; Archer, 2000b). Ultimately, for them to be able to perform in the roles of a new society, the roles have to be re-defined and re-configured and people must undergo personal transformation. The following diagram (Figure 3.3) shows how Archer explained the transformation of agency.

Socio-cultural conditioning of groups
T_1 →

Group interaction
T_2 → T_3

Group elaboration
→ T_4
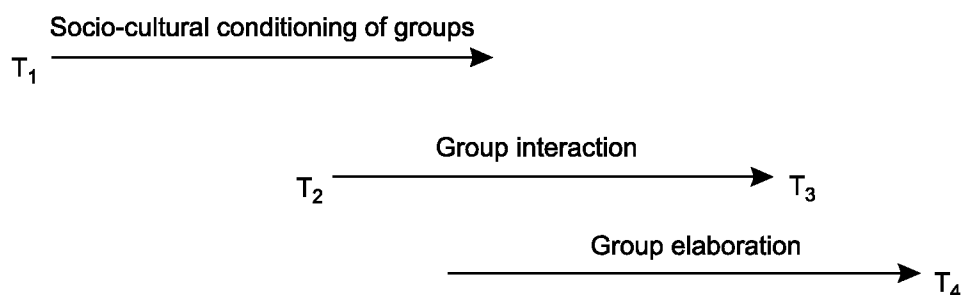
Figure 3.3: The morphogenetic cycle of agency (Archer, 1995, p. 248)

This process where the agent changes roles in response to conditions that the agent caused to change, that is, the agency of people or groups is caused to change in response to the transformed society, is termed double morphogenesis. The interest of this research was to establish how the change project course could have contributed to morphogenetic change or reproduction of social action in relation to mainstreaming of ESE.

3.12   Identity development as double morphogenesis

The purpose of this section is to develop a deeper understanding of the notion of identity using a social realist lens. Social realists contend that identity emerges out of practice, a perspective that is crucial for this research which is looking at changes in practices (Archer, 2000a; 2004). Identity can be used as a lens to look into changes in practice. It is important to notice that the title 'teacher educator' is a form of identity because it signifies someone who can be identified using a set of criteria that are derived from the field of education, the teacher education profession and from individual institutions. These criteria include competencies for their work.

Beyond the exercise of competencies for a good teacher educator as a form of identity, the teacher educator recognises him/herself by their personal interests within their work; these are the niches they carve for themselves in their field and the way they work together with colleagues on educational and professional issues. Teacher educators align themselves along such interests as Environmental Education/ Education for Sustainable Development, HIV/AIDS Education, Rights Education, Inclusivity Education and Gender Education, in addition to specific subjects or levels of education, e.g. Foundation Phase or Science Education. Some forms of identity do not change while others do. For example, being a teacher educator is intransitive but the specific interests of teacher educators are transitive. Therefore, seeing that teacher educators have identity that spans across the field, the profession and the institution and then other identities that are derived from their interactions with new concepts and initiatives, one can safely say that teacher educators have a range of identities that are related to their practice. This section seeks to open up the nature of identity, how it arises and how it transforms over periods of time (see Section 3.11).

Archer (2000b; 2004) distinguished between two forms of identity in an individual. The wider one is the sense of self. This is the way one identifies himself/herself as an existing and living entity among other entities. Through participatory engagement with tasks, an individual develops a form of identity that distinguishes him/ herself from others. When the living entity interacts with the world, a new form of identity emerges and this is personal identity. Personal identity develops from the way an individual reflexively works with experience in the natural, practical and social orders, especially focusing on what he/she has

interest in and finds value in, a person's ultimate concerns or capabilities (Sen, 1999). Archer (2000b, p. 17) viewed identity as " ... the being-with-his-constellation-of-concerns", meaning that an individual always prioritises personal interests and then interacts with the world at the three orders (natural, practical and social) in order to satisfy those interests. Through these interactions, personal identity determines the life that the person wants to live, what the individual cares about most as well as what one commits to, making the individual unique. In other words, personal identity is emergent from the subject/subject interactions amongst humans in society. People's Emergent Properties (PEPs) arise due to the personal nature of interests, motives and capabilities. Teacher educators may choose to join any intervention they find suitable for their work and in which they might be successful. They can show care about innovations and interventions that matter most to their area of expertise, to their practice and to their personal vested interests in relation to their practice (see Sections 3.8 and 3.10). It is from interactions associated with these personal interests that PEPs emerge. Personal identity may also therefore transform into social identity when teacher educators realise that they can do much more together. Archer (1995; 2004) saw the individual agent transforming into a collective agent through working with others. Through working as an individual and as a member of a collective, the personal identity of the agent is elaborated (Archer, 2000a). Agency in and as member of a collective is termed corporate agency. Archer represented these interactions in a morphogenetic cycle shown in Figure 3.4 that follows.

The conditioned "me" - the primary agent

T_1 ⟶

The elaborated "you" - PI and SI

T_2 ⟶ T_3

The interactive "we" - the corporate

⟶ T_4
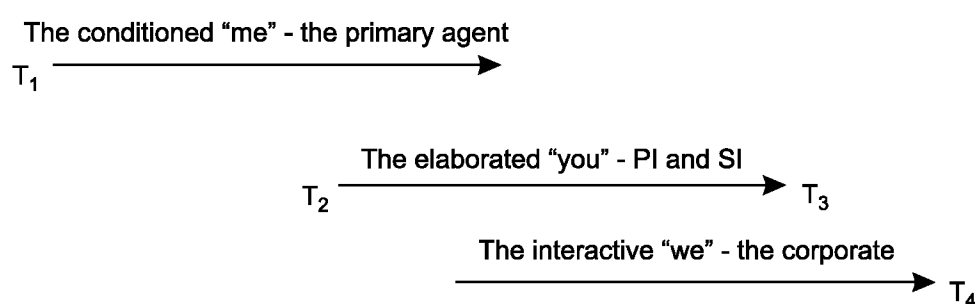
Figure 3.4: The identity morphogenetic cycle (Archer, 2000a, p. 19)

Course participants work in a context of practice that includes other such practitioners. The course was structured to challenge participants to engage their communities of practice on ESE work more than they did before the course, while retaining their disciplinary and knowledge uniqueness. This research looked into how individual agency developed and was

exercised, how it transformed into collective agency and how that related to personal identity of the research participants in their practice in the process of mainstreaming education for sustainable development.

3.13 Conclusion

This chapter has discussed the theoretical framework behind this research illustrated in Figure 3.3 that provided lenses through which the study was structured and analysed. The study was influenced by basic critical realist ontology that enabled the researcher to separate teacher education in general from knowledge, practices and experiences of research participants and to focus on the latter. Margaret Archer's (1995; 2004) realist social theory of morphogenesis was used to explain social actions on the study. The theory proposes that social change occurs on a temporal and linear scale, T1-T4. Archer acknowledged that people are born in or enter a system that is constituted of structures and cultures. These prior existing structures and cultures at T1 at times constrain or enable agency. The agent tends to interact with structures and culture during T2-T3 to make them more enabling by transforming the structures and cultures. If structure and culture are adequately enabling, agents act to reproduce them. Transformation of structures and cultures at T4 is morphogenesis while perpetuation of the status quo is morphostasis. Archer argued that in the process of changing structure and culture through interactions, agency is also transformed. Agency which manifests in changes in practices and agency of individuals involved is intricately linked to changes in structure and culture. This is double morphogenesis. During double morphogenesis, transformation of agency can be shown through change in identity. Individual practice can be described in terms of its relationality with other individuals, institutions and interrelations between these. Participants can become more like corporate agents (Archer, 1995; Archer, 2000a; Lindley, 2014) that show collective and collaborative tendencies.

In order to enable interactions in the period T2-T3, processes of mediation are necessary. Mediation processes facilitate the use of tools and artefacts that enable agents to develop emergent properties and powers, to interact with structure and culture influencing their practice. The next chapter focuses on how the change project interactions were framed to

facilitate mediation processes that would potentially disrupt teacher education habitus and enable mainstreaming ESE that would take place in the morphogenetic phases T2-T4.

Chapter 4: Establishing mediatory practices on the course

4.0   Introduction

The structure and content of this chapter emerged from the quest to understand mediated actions that influenced teacher education practices for environment and sustainability on the environment and sustainability education (ESE) change project especially at T2-T3 in the Archer morphogenetic framework (Archer, 1995; 2004). Archer did not provide frames for analysing the actual socio-cultural interactions in an educational situation, where mediation is a core process and in this research, was a core process and a core feature of T2-T3 processes. This chapter was developed with the aim of deepening my understanding of the concept of mediation. The concern for understanding mediation more deeply arose from the desire to investigate the ways in which the course framework and course activities were mediated practices that became mediated practices of course participants, mediated socio-cultural interactions at T2-T3 in the pre-course as well as the on-course phase and translated through an ESE change project into institutionally based teacher education practices during the post-course period.

The Rhodes University /SADC International Certificate in EE course will be used extensively in this chapter to illustrate how the thinking behind the mediatory role of the course influenced the structure and implementation of the course framework (Davydov and Radzikhovskii, 1985).

4.1   The Rhodes University/ SADC International Certificate in Environmental Education course

As alluded to in Chapter 1, the Rhodes International Certificate in EE course framework supported the development and the growth of the thinking and planning of change projects (see Section 1.3.4), a tool for strengthening reflexive practice in ESE. The strengthening was to provide course participants with tools for understanding their contexts, for responding to socio-ecological issues, starting with one which the participant prioritised. In so doing, the intention was to change their institutional practice for better teacher education environment and sustainability practices when they returned to their institutions. During

the on-course phase, participants deepened their knowledge of the chosen issues and on how education could be used to respond to identified issues through their practice in the institution. Participants further chose the most appropriate action, deepened their knowledge of it and planned for implementation of the change project during the on-course phase. The course therefore sought to provide the platform for expanding the desired knowledge and skills on the socio-ecological issues chosen by the course participants. Knowledge and understanding of concepts together with skills were considered as prerequisites for enabling learning which was necessary for facilitating development of mental dispositions that contributed to social action (Hasan, 2004).

In addition, the course sought to show participants that the environment and sustainability issues that they found in their institutions were related to the wider context in the ways they affect the environment and the ways they affect people, animal and plant life (SADC REEP, 2010a). By building the wider context into the course, participants could gain a greater understanding of the factors that influenced their educational practices and their abilities to respond to the factors. The on-course programme and course materials were divided into three units whose purposes and contents are outlined in the next section.

4. 1.1 The course units

Unit 1 covered **Environment Issues and Risks, Unsustainable Practices and More Sustainable Alternatives**. As highlighted in Sections 1.3.4 and 4.1, the purpose of this unit was to deepen and clarify the unsustainability issues that participants were responding to through providing historical and conceptual perspectives as well as conceptual tools and frameworks that could be used to clarify the knowledge on the issues. As participants clarified knowledge on the issues, they deepened their understanding of the issues and risks in question which enabled them to interrogate the unsustainability practices from which the issues and risks emerged. Deepening participants' knowledge on the sources of environmental challenges helped them to explain the emergence and spread of environment and sustainability issues which were of concern to their lives and which ultimately influenced their practice (Archer, 1995; 2000). The first unit supported participants to understand some of the perspectives of what counts as knowledge and why it is important to know more about issues in environmental education work (SADC REEP,

2009). Through the course, participants were able to deliberate on why it was important to enable others to get to know through various learning processes, rather than simply to teach them.

Exposition on global, SADC and national level responses to environment and sustainability policy responses showed participants that their individual and institutional practice was located within a wider context of responses as well as indicated the priorities at these levels. The aim was to enable participants to be more knowledgeable and confident to take social action through their chosen change project, knowing that their responses fell within the framework of one or more national, regional and global policies.

Unit 2 covered **Methods of Mediating Learning and More Sustainable Alternatives and Practices**. This unit marked a shift from knowing about the issues in Unit 1 to how to support learning about the practices. The unit provided a platform for participants to reflect on feasibility, efficiency and effectiveness of teaching and learning methods advocated for by global environmental policy developments in relation to the complexity of their local contexts. It sought to support participants' abilities to further reflect deeply on their contexts of practice and interrogate the appropriateness of methods for mediating learning that are in current use while justifying the choice and use of a variety of teaching and learning methods. The unit recognised that different socio-ecological contexts emerged from different histories, therefore the way educators should think about teaching and learning and sustainable alternatives would not be the same for different contexts.

Unit 3 on **Reflexive Implementation of Environmental Education Projects in Communities of Practice** recognised that participants are not islands of practice and that they would gain momentum of practice if they collaborated with other individuals and institutions. When they went back to their institutions they needed to work with others on the change project. The notions of participation and communities of practice were central to the discussions. With these notions, participants were expected to plan for implementation of the change project as well as plan for evaluation of the change project. The following diagram is a summary of the mediatory activities on the course.
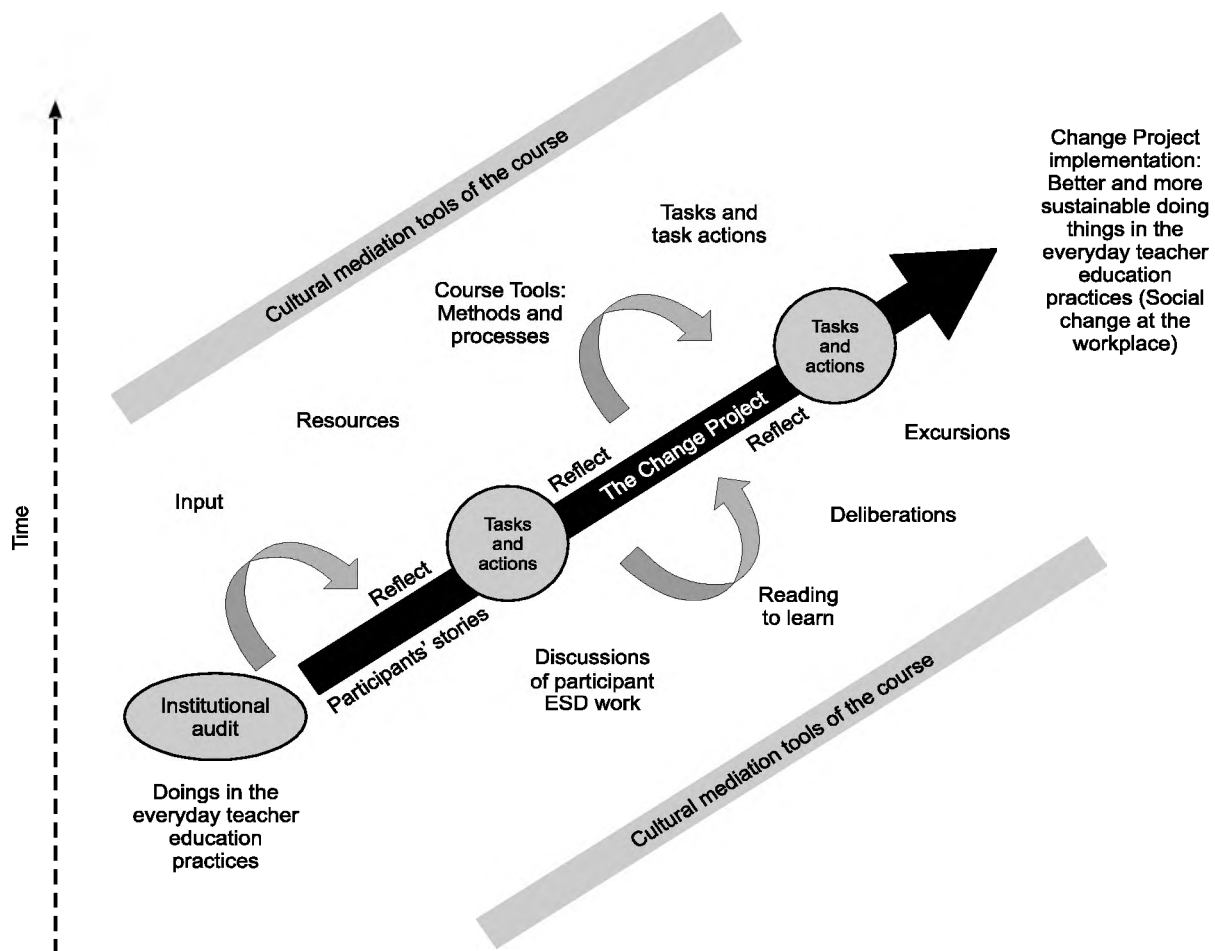
Figure 4.1: Mediation activities on the Rhodes University / SADC International Certificate in EE course

These mediation activities were implemented through daily programmes. Each day was structured to strengthen theoretical understanding of environmental and sustainability concepts, support enhancement of specific skills that could be relevant for mainstreaming of environmental education and education for sustainable development.

4.1.2 Daily programme

The programme for each day was divided into four sessions: the first or morning up to tea break; second or mid-morning; third or early afternoon; and finally the fourth or late afternoon (see Appendix 7).

4.1.2.1 Session 1: Daily reflections

Participants started off by reflecting on the previous day's activities that included excursions, practical activities, presentations and readings in groups but shared their individual reflections in plenary. Reflections focused on key points, particularly on their individual understanding of the concepts they had learnt on the previous day and what

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these meant to their developing change project ideas. They also reviewed the nature of the teaching and learning that took place.

4.1.2.2 Session 2: Informative episodes

The second and first half of the mid-morning session began after tea. This session was intended to enhance conceptual understanding of participants in the areas they were covering on the course; this was thus an informative episode (Hasan 2004). Input of new conceptual content was provided through exposition methods such as lectures from facilitators, lectures by experts working on the particular concepts as well as through videos. Content and experiences were shared through PowerPoint presentations, plenary discussions and group discussions that enabled participants to engage with the concepts. Hasan (2004) emphasised Vygotsky's view that language is key to developing meaning of experience, a view that supports the need to enhance the language of the field of environment and sustainability education. Further to this Maxwell (2012a) argued for enhancement of content knowledge of practitioners that they need in order to consider individual and social action in environment and sustainability education, while Sfard (1998) argued that for anyone to meaningfully participate, one needs to first acquire the requisite knowledge. The process of enhancing this content knowledge was intended to build the appropriate language for the discourse while providing the knowledge that enabled participants to function in their ESE practice. Maxwell (2012a) further asserted that meaning-making takes place in a medium of discourse, the discourse of which is environmental education and education for sustainable development. The relationship between discourse and meaning continues since when meaning is made, the discourse is better understood. Therefore if meaning develops, language for that discourse should also develop (Vygotsky, 1978).

Some of the content enrichment sessions such as bread-making and making *mahewu* (fermented drink) were done practically in class while some practical work such as compost making were done through excursions.

As stated earlier the purpose of the Rhodes University/ SADC International Certificate in EE course was to develop knowledge and practices for environmental education in teacher education. Environmental education (EE) tends to have a strong focus on environment

while education for sustainable development (ESD) tends to have a stronger development focus (Pavlova, 2013; 2015). Environment and sustainability education (ESE) advocates that concepts be dealt with in different ways to the current content driven approaches with a transformative intent that fosters quality education (McKeown and Hopkins, 2003; UNESCO, 2009b; Pavlova, 2013). This implies that the two concepts constituting ESE in this study were developed in ways that cultivated the culture of ESE as different ways of working with education to the current content-driven ways. The role of content enrichment sessions is supported by Hasan (2004) who found that informative episodes have the power to convey decontextualised knowledge of the discourse by bringing in terms and examples that originate beyond the social plane of the individual learner proposed by Vygotsky. Discourse in this regard is understood as the verbal experience and the content of that verbal experience. Hasan (ibid.) also argued that these episodes are conducted mainly through verbal action.

The ultimate aim of deepening content knowledge of course participants was to support their agency. On this role of knowledge, Hasan (2004, p. 160) posited that conceptual knowledge is penultimate to the development of agency by stating that:

> If the mediation of meaning is the basis for internalization of concepts, and if meaning is mediated wherever cultural practice of discourse occurs, it follows that discourse of any order is a site for the semiotic mediation of culturally based mental activity…

The argument is that once concepts are understood through internalisation processes (see Section 4.9.1), they influence the way people think about that discourse. With insights from Hasan (ibid.), the course therefore sought to engender mediation of environmental education and education for sustainable development in the minds of teacher educators who already had knowledge and experience that constituted their education practices. According to Hasan (ibid.), mediation of the mind is understood to contribute to mediation of culture and of cultural practices, and in this study, mediation of teacher education practices for ESE.

4.1.2.3   Session 3: Reading to learn

The third and second half of the mid-morning session that ended at lunch time was used for 'reading to learn'. During this session, participants read through the core texts of the course and extra readings, together with the recommended readings in the reading pack at the end

of the course file that were related to concepts presented earlier during the informative episode sessions. Participants read the resources individually and then shared the meanings they understood in groups, either in pairs, threes or bigger groupings as appropriate. This session was intended to build understanding of the concepts but it also enabled participants to learn to read to get facts from more than one source in order to critically engage with concepts and be able to build a sound argument.

Developing content in this way to influence engagement with and participation on the change projects accords with Hasan (2004) who pointed out that interpersonal relations are developed, maintained and transformed in a medium of discourse. This view was also supported by Sfard (1998) who argued for acquisition of knowledge before people could be expected to participate, while Maxwell (2012) argued that people's actions in the physical world are derived from the meanings they make of things. Working on development of language, Martin and Rose (2005) thought a phase of deconstruction in which facilitators open up new concepts prepares learners for participatory activity which in turn leads to individual understanding and further activity. Deconstruction starts where learners are and then builds new levels of knowing. Therefore, discourse is considered a prerequisite for semiotic mediation to occur, but semiotic mediation is also indispensable for development of interpersonal relations (Hasan, 2004). When these relations have developed, they influence the type of interactions that take place to in turn influence meaning making and semiotic mediation (ibid.).

4.1.2.4   *Session 4: Developing and supporting the change project*

The fourth session that came after lunch was for developing and supporting the change project. During the first week, participants presented their pre-course assignment and their change project to the whole group. Inherent in their exposition were their change project ideas. This session was, as Martin and Rose (2005) argued, for joint construction of the change project and consequent individual construction when participants reflected on the comments from colleagues and the concepts that were developed during the sessions.

Participants were expected to develop a PowerPoint presentation. Participants who were not familiar with computers or PowerPoint were therefore forced to engage with them. In addition to sharing their assignments, participants were also assessed on presentation skills,

as these skills were important in the practice of educators and leaders in the field. Peer assessment and critique of presentations was emphasised as the rest of the course participants contributed to clarify the assignment and the change project. During a presentation of a change project, the other participants jotted down notes that they used for critiquing the assignment and change project ideas. After presenting to and receiving feedback from the group, a participant reviewed his/her change project ideas and would present the new thinking in the next round of presentations. Change project ideas evolved and became richer in feasibility and structure as the rest of the group sought clarifications from the presenters and at times contributed practical advice arising from their own institutional experiences.

4.1.2.5 *Session 5: Regional Knowledge Exchange groups (RKE)*

The second afternoon and last session of the day followed the afternoon tea break. During the last session, each day, participants worked in regional knowledge exchange groups. These were voluntary groupings of participants that were designed to enable participants to develop knowledge and skills in areas that were not necessarily covered in the course content but could be useful in their practice as environmental educators. Four groups were chosen at the beginning of the course and the choice was dependent on the mentors available. The **evaluation group**, with support from a facilitator who was mentor, looked at monitoring and evaluation of the course. The group researched what evaluation meant in the wider sense, explored knowledge that they used to justify the approach to monitoring and evaluation that they used during the on-course session. They conducted regular monitoring activities on the progress of the course. At the end of the on-course session, they submitted a monitoring and evaluation report for the course.

The RKE on **photography and video use** for EE was provided with a still camera and a video camera. They were supported with basic skills for taking photographs and video recording as well as video editing. Members of the group took turns and mostly worked amongst themselves to use the devices as they sought to capture important moments and crucial presentations each day. They would ultimately make a compilation of course photographs for participants. Editing skills enabled them to use the video footage to produce a ten-minute video that summarised the course activities. The practical experience was intended to develop participants' skills to use these technologies in their own practice.

The **EE articles** group was guided on how to write articles for the Environmental Education Association of Southern Africa Bulletin. Participants were supported to capture moments of learning on the course and develop them into short articles for publishing in the EEASA Bulletin and EEASA Journal, now the Southern African Journal for Environmental Education (SAJEE), but mostly they supported each other. Participants learnt to identify moments of learning that could be shared with the wider world, so that they became more sensitive to subtle but key learning moments in their practice as well as learning to identify them and document them in ways that would interest readers. Members met occasionally to review their experiences of the course sessions and discussed how to write the articles. The articles also served as one way of recording some of the key learning moments of the course.

With the advent of ICTs, the programme was too full to have an ICT core unit. The RKE group on **ICT**s was therefore constituted to work on enhancing the ability to develop and use materials for ESE through ICTs. Even though this group struggled to find its niche because of the diverse nature of ICTs, participants were able to practise and document some of the ways ICTs could be used to support teaching and learning in the classroom or field.

4.1.2.6   *Course framework and implementation*

The course progressed following units as discussed in Section 4.2.1 but Unit 3 in particular was concerned with planning the framework for implementing the change project and planning for evaluation. Participants produced a change project implementation plan together with a change project monitoring and evaluation plan. These were used during implementation of the change project which was their 'take-home assignment'. To this end, participants took with them outcomes of mediated actions in the on-course phase to their institutions where they mediated mainstreaming of ESE through conducting the change project activities. Figure 4.2 that follows illustrates the places of mediation and mediated actions.

On-course activities   Post-course activities

Capacity development in a socio-cultural context

Mediated actions through an ESE change project

Workplace institution as another socio-cultural context of practice

Reflexive mediated actions on practice

Course-based mediated practices and actions
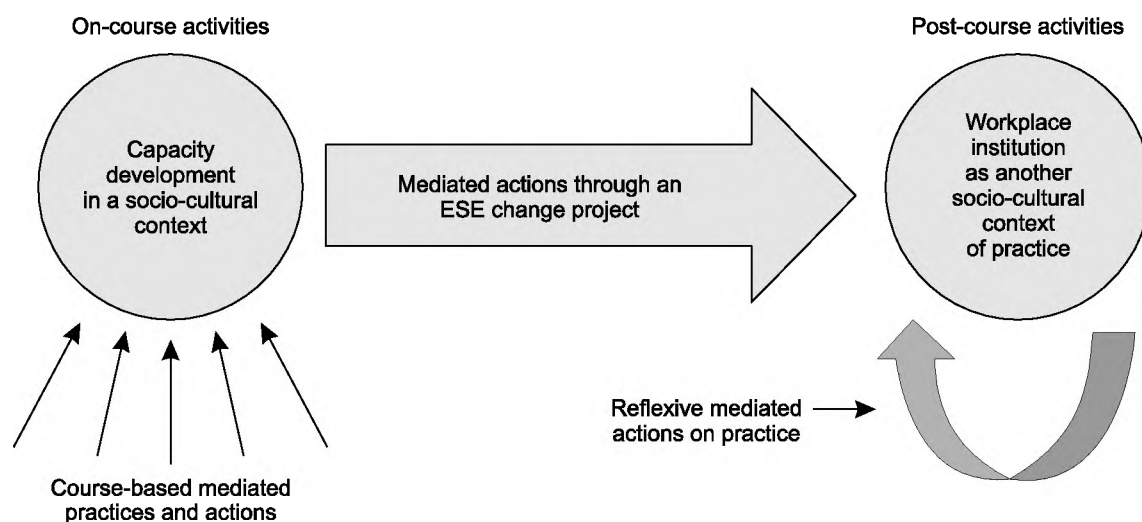
Figure 4.2: The relationship between on-course and post-course mediation activities

Figure 4.2 illustrates that during the on-course session, participants were taught through encounters with new knowledge and experiencing practices and learning about them. At their workplaces they were responsible for and were expected to mediate their ESE practices and actions into their teacher education practices. The study focussed on individuals working in community with others in structured space; it also focussed on the course framework and curriculum as well as activities that were part of an institutional educational culture since they happened in the context of educational institutions.

The on-course component happened in one educational institution while the off-course component happened in another. The socio-cultural space in these institutions was formed by teacher educators who were individuals interacting in a social context with diverse histories. The on-course component of the course had facilitators interacting with participants in one educational institution that had its own culture over a period of time (Rhodes University/ SADC REEP partnership). The post-course session was implemented by participants interacting with their colleagues in another educational institution from which participants came. Educational institutions are structured and have unique cultures that influence the ability of course participants to exercise their agency of implementing mediated practices in their work during the post course component of the course (Archer, 1995). The socio-cultural approach to mediation as a lens to establish the role of the Rhodes University/ SADC International Certificate in EE course in mediation of mental development and praxis for environment and sustainability in teacher education was most appropriate

since it recognises that participants do not exist in isolation of their colleagues and their institutions.

Understandings of socio-cultural mediation emanate from the classical work of Vygotsky, who produced a theory of mind, mental functioning and learning. In this study, classical Vygotskian work is extended through post-Vygotskian work on expansive learning by such leaders as Engeström (1987; 2001), Daniels (2008), Stetsenko (2008) and Engeström and Sannino (2010).

 This chapter provides insights into aspects of Vygotsky's work, especially focusing on how understanding of concepts and practices can influence mediation, mediated actions and practices, and learning is expanded in the Zone of Proximal Development (ZPD). This theory is considered in the context of the potential of the ESE on the Rhodes University/ SADC International Certificate in EE course and its change project.

4.2   Introduction to Vygotsky and his work

The form of mediation discussed here and guiding this research has its origin in the work of Lev Semonovich Vygotsky (1896-1934), which was taken up and further developed by other researchers including Davydov, James Wertsch, Harry Daniels and Yrö Engeström.

Vygotsky was a Russian of Jewish decent. He was born into an intellectual family that discussed issues such as art, literature, history and theatre. Despite his love for teaching, he wasn't allowed to train as a teacher since this opportunity was not permissible for people of Jewish decent. At his time, Jews were a minority community in Russia with fewer opportunities for schooling than the upper-class Russians (Wertsch, 1985). The journey to establish how learning takes place enabled him to think of mediation and ways of implementing it through the Zone of Proximal Development (ZPD) which was subsequently linked with and popularised via the notion of scaffolding developed by Bruner (Haenen, 2001; Hasan, 2004).

4.2.1   Why study learning?

The politics in Russia at that time held that people from poor communities could not learn well in school and didn't deserve similar schooling conditions as the upper class Russians. Vygotsky sought an explanation of learning that was divorced from social and political discrimination; he proposed that learning is mediated using tools and signs, and not socio-political or socio-economic class-based backgrounds. The outcome of his research helped to mediate impediments to access to schooling and mental development. This helped people to transcend injustices faced by discriminated communities in Russia at that time. He graduated with a law degree as well as a historical-philosophical degree from two universities at the same time. These qualifications provided him with the tools to interrogate the human mind. He then became a leader in educational psychology, providing a robust theory of how the mind works for learning and consequent cognitive development or thought to occur (Kuzolin, Gindis, Ageyev, and Miller, 2003).

Despite Vygotsky's focus on children's learning, the results have had wider applications to learning at all ages as they sought to explain the nature of learning and what would be necessary for learning to take place. The difference between adults and children, according to Vygotskian thinking, is that adults bring more knowledge and experience to any learning endeavour. In this chapter and in this research, I will use terms such as children, adults, individuals and people interchangeably in relation to mediation, mental development and learning.

4.2.2   Learning precedes development

Vygotsky (1978)'s premise was that learning precedes or leads cognitive development. This means learning is a prerequisite for higher mental development. He further asserted that teaching and learning are prerequisites for cognitive, social, and affective development (Vygotsky, 1978; Stetsenko and Arievitch, 1992). Development is therefore inseparable from teaching and learning because learners develop mental and physical abilities to use cultural tools as a result of the teaching and learning process (ibid.). Vygotsky spent most of his life studying how children come to learn to think using higher order thinking processes and how they express what they think through speech (Daniels, 2006). He posited that humans have

innate and acquired abilities that they use to explore and modify their environment for their benefit.

4.2.3   Humans use tools and signs to explore and understand their environment

This implies that an individual has to experience the environment and that experience leads to the human influencing the environment (Del Rio and Alvarez, 2007). Unlike other organisms, humans engage in activities that are socially meaningful to them, meaning that they have the capacity to regulate their behaviour by using thought processes, making human actions directed and purposeful (Archer, 1995; 2000; Latour, 2004).

The learned abilities to experience and explore the environment involve derivation of tools and how to use them. Tools can be material in nature, such as an axe or a spoon, or they can be mental abilities, such as words representing particular things or particular processes. These tools are derived from the culture in which the individuals reside. A tool can be in the form of a sign. Davydov and Radzikhovskii (1985) defined a sign as a symbol that has a definite meaning and this meaning would have evolved during the history of a culture. One sign that Vygotsky worked on was language.

4.2.4   Quest for understanding higher order mental functioning

Vygotsky's interest was mostly in how mental abilities can be improved. He sought to establish how material tools and psychological tools can enhance development of higher order thinking processes (Wells, 1994). He proposed that mediation facilitates the use of tools so that humans can better understand and exploit their environment as well as better interact with nature (Vygotsky, 1978; Wertsch, 2007; Daniels, 2008). He believed that individual development or acquisition of abilities could not be understood without considering the social and cultural contexts from which this development was taking place. That is, for individuals to acquire abilities, what they learn exists in a social context before they internalise the knowledge into their individual minds. Knowledge is then understood as arising from internalisation of social activity. Vygotsky's work on internalisation and learning in general grew out of the way he worked with and found meaning across the binaries such as internal and external, the individual and the social, the material and the symbolic, the static and the evolutionary, offering a relational process oriented theoretical perspective

(Del Rio and Alvarez, 2007). Vygotsky summarised his work on mediation into the following three themes:

1. A reliance on genetic development or developmental analysis;
2. The claim that higher mental functioning in the individual derives from social life; and
3. The claim that human action on both individual and social planes is mediated by tools and signs. (Wertsch, 1991, p. 19)

Vygotsky's thesis that learning leads development foregrounds mediation. A learner only develops through experience of interacting with others and with relevant tools and signs such as language that are part of the culture. Through mediation, the social and cultural context of the learner therefore contributes to the cognitive development of that learner.

4.3 Two planes of learning

According to Vygotsky, learning, which is evidenced by children's thought and behaviour, originates from their social lives and continues to increase when they are engaged in social interaction. This is so because mental activity starts off being distributed or shared amongst members of a group and is later internalised by individuals. After Vygotsky found children doing much more when they participated in collective action than in individual action, he posited that, "human learning presupposes a specific social nature and a process by which children grow into the intellectual life of those around them" (1978, p. 88). Children showed that their cognitive development was influenced by interacting with those around them. In this view, individual thought and action can be understood by looking at the society in which the individual interacts.

Using the premise that one can understand individual action by analysing society, Vygotsky developed the following maxim: "general genetic law of cultural development" which states that,

> Any function in a child's cultural development appears twice, or on two planes. First it appears on the social plane, and then on the psychological plane. First it appears between people as an interpsychological category, and then within the child as an intrapsychological category. This is equally true with regard to voluntary attention, logical memory, the formation of concepts, and the development of volition... (I)t goes without saying that internalization transforms the process itself and changes its structure and functions. Social relations or relations among people genetically underlie all higher functions and their relationships. (Vygotsky, 1981 in Wertsch, 1991, p. 26)

Based on this, individuals first get experience of the world. The experiences generate symbols (language and prior concepts) and the learner needs to make connections in her mental structures. She orders them into certain patterns and connects these during development of thought and thought processes (a process that Vygotsky terms internalisation) (Wertsch, 1991). Internalisation is more than just transfer of the externally mediated functioning into the internal form but the mediated functioning undergoes a complex transformation process (Wertsch, 1991; Del Rio and Alvarez, 2007). Externally, a sign has an indicative function yet internally it has a semantic function. This means a sign such as language is, through social processes, used to illustrate what is on the mind. At the same time, what has been constructed is actually the cognition or mind of the individual. According to Del Rio and Alvarez (2007) this transformation process develops new referents that are no longer the physical external signs but concepts and meanings that are intricately linked to the physical sign. The following statement illustrates this point in that internalisation,

> ...involves not only the appropriation and individuation of the indicative function of the action externally mediated by words but also the construction of the virtual entities and actions mediated by meanings. (Del Rio and Alvarez, 2007, p.300)

These processes of internalisation and externalisation are interconnected and influence each other to cause transformational changes in the mind that become memory and thought that ultimately guides and steers individual and social action. Internalisation results in higher mental functionings that are externalised. They are externalised in the form of elaborated psychological tools that become elaborated cultural tools (Del Rio and Alvarez, 2007; Wertsch, 2007; Daniels, 2008; Lektorsky, 2009). In so doing cultural tools of the individual and society keep advancing reflexively and iteratively since they influence each other. The nature of reflexivity depends on the context in which the tools, individuals and the society interact (see sections 3.6 and 3.10). Using Vygotsky's ideas that what people externalise is evidence of what they internalise, I chose to analyse documents that participants produced and the processes they went through during implementation of their change projects. My analysis was intended to reveal individuals' minds, meaning making and practices that emerged due to individuals' learning and social interactions on the course.

Vygotsky also argued that humans have two forms of memory: natural and mediated.

4.3.1   Mediation and memory

Natural memory is innate, develops with age, but not independently from mediated memory. The change in mental thought that one undergoes due to internalisations and externalisations involves mediated memory and creates a continually developing mind, whose internalisations and externalisations continually influence each other to produce evolving tools, thought processes and knowledge (Wertsch, 2007; Daniels, 2008: Lourenco, 2012). Different kinds of externalisation include creation of new products, new ideas, even new standards, rules and norms of activity (Lektorsky, 2009).

Since action is a mental process that starts from the social (interpsychological/ intramental) plane, in order to develop mental functioning, a child needs to start off from the social level and develop understanding at that level before they can develop individual understanding (intrapsychological/intramental). For example, during the *Reading to Learn* session (sections 9.3 and 9.4) of each day on the Rhodes SADC International Certificate course, participants worked in groups to read designated parts of the core text and related extra readings. Each individual read for a few minutes in order to understand the text before engaging with the group. Group members contributed questions for clarification, at times had to clarify the task given to them before further discussion on the concepts required by the task. In groups, participants contributed their individual perceptions of the reading. Some supported their views with further readings while others used their experiences to deepen understanding of the concepts. When participants left the discussions, they had learnt diverse contributions and interactions what they would not necessarily have achieved alone as reported in Chapters 6, 7 and 8. Participants in most cases became more confident to discuss or use a concept in discourse or in their change projects after it had been discussed within a group. Therefore, group work during *Reading to Learn* activities provided for the interpsychological condition that is necessary for the intrapsychological learning.

The example of group work used here shows deepening of understanding of concepts and illustrates the process of enabling internalisation; externalisation is only evident when participants can use the concepts correctly to explain them to a class or group, or when describing their change projects (see Chapters 6, 7 and 8 for evidence of this process). The example points out that group work on its own is not adequate but must be combined with

a session for learners to express their understanding of the concepts. Such mediation provides an enabling platform for the process of internalisation and externalisation of knowledge and knowing from the collective to the individual.

The emphasis in all this is that participation in various forms of social interactions enables one to use tools (e.g., abacus, pencil, and hammer) and signs (e.g., language, pretend play and mathematical formulae). Tools and signs originate from the society and they influence the way individuals interact in society (Lourenco, 2012). An example of outdoor activity that course participants engaged in illustrates this process. During an excursion, participants went to a garden where organic farming was practiced where in addition to observing the variety of simple ways of growing crop plants, they also made a compost heap, compost and water being the heartthrob of a sustainable garden. Participants collected the required material from the confines of the garden. The facilitator organised intermittent informative sessions where he would tell participants what they needed to collect and explain why the compost heap needed material at a particular stage. All participants were involved in building a compost heap. This was a physical activity but given the size of the group, a compost heap could be ready in about forty minutes.

Some participants left this activity with a new view that it was possible to make compost and grow vegetables without spending money on chemical fertilisers (see Chapter 7). Some participants changed their initial change projects and aligned their new change projects to sustainable gardening (see Chapters 6 and 7). One of the interviewees of this study chose to integrate sustainable use of waste after this activity (see Chapter 8). She advocated for the re-use of waste which in teaching of physics was seen as re-use of parts of disused equipment (see Chapter 8).

One of the study subjects (see Chapter 7), who was working in the Photography and Video RKE group, was fascinated while working with the photographs and video clips for recording lesson progress and reflections on concepts. He decided to do a change project that combines the use of photographs and videos to capture organic farming in a rural community that he was working with and brought these to class to stimulate discussions on how climate change was affecting some rural communities. The resources also stimulated discussions on the different ways that communities were adapting to variability in climate.

Both course participants discussed above were able to convert the use of physical tools into psychological tools that they used to organise knowledge.

One of the key notions that drove Vygotsky to delve into the concept of mediation was "mental functioning" and the need to develop higher mental functioning during mental development. His argument was that any learning that did not develop higher mental functioning was useless to the learner (Vygotsky, 1987). The following section deepens understanding of the concept by distinguishing between two forms of mental functioning used by Vygotsky.

4.4 Mental functioning

This term arises from the recognition that humans have thought: mental abilities to perceive, interpret, decipher as well as the ability to construct and re-construct these mental abilities. According to Veresov (2010, p. 84) mental functioning denotes "...psychological systems comprising a complex nexus of elementary functions". Vygotsky (1978) posited that mental development was influenced by both lower and higher mental functions but higher mental functions were acquired through mediatory interventions. The purpose of learning is to develop higher mental functioning. The purpose of the Rhodes University/ Rhodes University/ SADC International Certificate in EE course was to develop higher mental functioning that would provide adequate capacity to enable the course participants to mainstream ESE, and in particular for this study, mainstream this in teacher education. This research sought to explain the extent to which the Rhodes University/ SADC International Certificate in EE course influenced understanding of ESE and development of higher mental functioning for the mainstreaming. The study therefore sought to establish whether the course processes and activities resulted in higher mental functioning by focussing on features that emerged during the course.

4.4.1 Lower order mental functioning

Lower or elementary functions are innate human natural and mental abilities that are genetically inherited from parents (Kincheloe and Horn, 2007). They include all the inborn properties that enable humans to respond directly to their environment, thereby limiting behaviour to direct environmental responses. An individual has little choice on how to think

and behave because the abilities are inherited and are part of the natural being. The individual therefore uses reflexes to respond to situations. Such examples include breathing, thirst and drinking water when thirsty, hunger and eating food when hungry as well as sweating when temperatures rise above normal and running away when one is anxious. On the other hand there are higher mental functions.

4.4.2 Higher order mental functioning

Higher order mental functions are those that develop through an individual's social interactions, hence are influenced by the culture. Having higher order mental functions enables an individual to think carefully before responding to a situation (Kincheloe and Horn, 2007). Higher order mental functioning includes thinking, voluntary attention and logical memory. It develops through social interaction, it being socially or culturally mediated (see section 4.3). Vygotsky asserted that what we see as the human psychological nature is an aggregation of "internalized social relations that have become functions of the individual's structure" (in Wertsch, 1991, p. 26). Therefore, instead of using impulsive behaviour to respond to the environment, individuals use intent and produce intentional action by using higher order mental functioning.

Bodrova and Leong (2015) contended that higher mental functions are behaviours that can be acquired through the process of learning. These mental functions are sign mediated, intentional, and internalised, and develop gradually from the social to the individual levels (ibid.). Higher order mental functioning is developed through the use of tools and signs of a culture. These tools and signs include language and symbols that are used to understand the relationship between the environment and humans. Language and symbols are found in discourse. All mediation seeks to enable individuals to develop and exercise higher order mental functioning. For Vygotsky it was important that anyone can internalise the tools, signs and artefacts of a culture if they are to develop higher mental functioning in that culture. Mediation therefore brings tools, artefacts and signs to facilitate that development. Such signs include language, mnemonics, algebraic symbol systems, works of art, writing schemes, diagrams, maps, mechanical drawings and all sorts of conventional signs (Vygotsky, 1981 in Wertsch, 1991).

Terms such as environmental education or education for sustainable development outlined in section 2. 1.3 are unique in their origin and nature. When education becomes environmental, it demands an understanding that is more than merely education. It is a different language to the ordinary education therefore it gives a different meaning to education in general. Language also plays a part in developing understanding of education for sustainable development. It is education but the education must be construed in the context of development.

The ESE discourse uses terms that are unique to the field, some of which are embedded in diagrams. Diagrams therefore are signs that are used to develop and illustrate concepts. They can be used as frameworks or models that provide key elements of a set of knowledge points that Hasan (2004) termed semantic features when dealing with language development. Semantic features in a diagram can trigger flow of information by representing knowledge in key words or shapes. The diagram is a sign that contains a wealth of information, making it a useful component of environmental education discourse. In order to illustrate the aspects of the environment and how the aspects are intricately related, diagrams such as the one by Ekins, adapted by O'Donoghue in 1993 and shown in Figure 2.1, are heuristics that are in continuous use in the environmental education field.

The diagram mentioned above enabled course participants to relate to the interactions between natural systems and social systems and recognise that what is seen as society is part of an assemblage of human and non-human beings and the relationships between these (Latour, 2009). Non-human beings can be living or non-living. By using this framework course participants appreciated that the environment is in constant flux due to changes in the factors in the diagram, particularly in the ways their criticality emerged on the issues they selected to work on (see Chapters 6, 7 and 8). Recognition that the environment is not static meant that the environment makes different demands on education at different times. The need for a rejuvenated and more inclusive form of education was justified by the need to consider ways of enhancing educational processes that respond to modern demands of the society. In addition to thinking about relationships, the heuristic became a tool for developing thinking about the nature of education and whether that education is adequate, given that most of the region's population is rural and depends directly on the natural environment (SADC, 2008). Beyond the model being a tool for organising knowledge

and learning about the environment, it also influenced the way people thought about individual and social action in response to environmental challenges (Maxwell, 2012a). Participants worked with the model to illuminate concerns in the society and at the same time used these concerns to explain curriculum concepts, building relevance of learning (see Chapters 6, 7 and 8 as well as sections 9.4 and 9.5). In addition, the model influenced the way environmental challenges are taught and responded to, in that the challenges do not exist in isolation to other aspects of the environment. The model has therefore developed a holistic consideration of the environment that prepared the SADC region for the education for sustainable development discourse. The SADC REEP 15 Year Report (2012) acknowledged this contribution by stating that:

> In particular, the programme has established an open process, social learning approach to education that is centred on deliberations of valued beings and doings of communities and stakeholders, while also taking environmental issues and risks into account. It also includes a focus on possible more sustainable alternatives. It has done so within a context of poverty that has not been narrowly interpreted. This is a context where agency of all (educators, policy makers, community members, women's groups, and children in school) is valued and recognised as being significant to the societal changes necessary for a sustainable future.   (p. 86)

One of the models illustrating sustainable development is the concentric circles or ellipses model developed by Hattingh (2004). This model portrays that sustainable development can only happen if the economy remains a subset of the society, which in-turn should remain a subset of the ecology. The model became a heuristic that was used to teach, using real life examples, about sustainability and unsustainability, rendering the concept of sustainable development accessible to course participants. The eco-meal is an example of a group action where participants were challenged to consider their daily actions in relation to sustainability of the planet and to social justice issues. This relationship was illustrated more clearly in Chapter 8 where the participant found the eco-meal seminal in the ways she thought about sustainability, sustainable living and social justice in relation to access to resources. Participants could only grasp these signs if they had higher order thinking skills (Vygotsky, 1987) and if they could also illustrate the concept using a number of examples. To develop these skills, the course had group activities where individual participants shared their views about sustainability and sustainability practices that they were involved in.

An individual who can understand and use signs and has the language is expected to apply high order functionings at both individual and social levels. As noted earlier in section 4.2, one can only tell if these tools and signs have been internalised by looking at how they are externalised in the context of society. This is a key point that guided my thinking on the research design, nature of the data and data analysis of this research.

4.5   Mental development can be seen in action

Though humans have a unique ability to develop higher mental development, the learning takes place across a social and an individual level as given in the assertion that, "...the social dimension of consciousness is primary in time and in fact, the individual dimension of consciousness is derivative and secondary" (Vygotsky, 1978 in Wertsch and Tulviste, 1992, p. 549).

An individual learns through discussions with others to develop knowledge and knowing at the social level. Through thought processes this learning at the social level is changed into leaning at the individual level. According to Vygotsky, the external world is a model of the mind therefore to him mind is activity, meaning that what one can do in social life is representative of what is going on in the mind. It also means that what one thinks can be interpreted from what one says and does.

Fernyhough (2009, p. 6) claimed that according to Vygotsky mind is an "activity that can extend beyond the skin to interpenetrate with other minds in interpersonal exchanges". In other words, in order to deeply understand thought processes (mental functioning) in an individual one has to go outside the individual by examining the social conditions from which the individual comes (Wertsch, 1991; Wertsch and Tulviste, 1992; Lektorsky, 2009). This was the beginning of a shift from Vygotsky's focus of understanding the mind through looking at how people or learners developed meaning to instead observing people or learners' actions, that later developed into Cultural Historical Activity Theory (CHAT) pioneered by leaders (as described in section 4.2.2.6) including Wertsch (1991; 2007), Daniels (2008; 2012) and Engeström (1987; 2001), Engeström and Sannino (2010) and Stetsenko (2008).

The view that when analysing individual mental processes priority must be given to social processes was supported by Luria:

> In order to explain the highly complex forms of human consciousness, one must go beyond the human organism. One must seek the origins of conscious activity....in the external processes of social life, in the social and historical forms of human existence (Luria, 1991 in Wertsch and Tulviste, 1992, p. 548).

This section has explored the shift from the use of meaning-making to the use of activity as evidence of mental development. Leontev (1981) suggested that activity is the concrete outcome of many small scale processes or actions.

> Human activity exists only in the form of an action or a chain of actions. For example, labour activity consist of labour actions, educational activity consists of educational actions, social interactions consist of actions (acts) of social interaction, etc. .... This may also be expressed as follows: when a concrete process - external or internal - unfolds before us, from the point of view of its motive, it is human activity, but in terms of subordination to a goal, it is an action or chain of actions. (p.7)

Drawing from Leontev's view of activity, Engeström (1987) suggested that an expansive learning activity can be deduced from expansion of the many actions that contribute to the new activity (see figure 4.3 below and section 4.10). The arrow represents the focus of mediation which defines the nature of knowledge around a concern or an activity. The arrow expands as it grows but the end of that arrow becomes the beginning of another level of interactions and knowing. This diagram acknowledges that there is expansion of the mind both at the level of actions and at the level of the consequent activity.
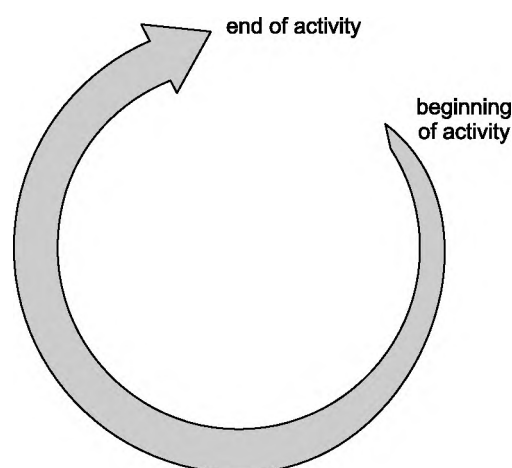
Figure 4.3. Illustration of expansion of learning in a spiral activity (Adapted from Engeström, 1996)

In this study, the activity was considered to be mainstreaming of ESE. All processes of the change project course were actions at different levels that were supporting the activity of mainstreaming ESE. These actions arising from learning are mediated actions (Wertsch, 1991). The following section seeks to deepen understanding of mediated actions and associated activity.

4.6   Mediation of learning

A deepened understanding of the nature of learning that was developed by Vygotsky provided the capital required by this research to look at how mediation took place on the Rhodes University/ SADC International Certificate in EE course and in institutions where participants implemented their change projects.

The socio-cultural approach to mediation is based on the view that the mind is mediated, meaning that mental or cognitive development cannot simply happen, emphasising the necessity of mediation in mental development and activity. As shown in Figure 4.4, mediation takes learning through an indirect route that is longer but is supported. Vygotsky (1978) posited that humans respond to the environment with interacting the tools and signs. Therefore, during learning the individual does not have direct relationship with the world but this relationship is mediated through the use of tools in social activity. This mediated form of learning, according to del Rio and Alvarez (2007) is equivalent to development of the human functional system as it constitutes the basis of the thinking processes that enable humans to live successfully in the world. The indirect approach to learning takes place across two levels, the social and the individual, and the next section expands on how Vygotsky saw the two planes influencing each other.

4.7   Mediated action

In this research, I have considered mediation of learning to include all the interventions that are brought into learning and practice contexts in order to provide stimuli that facilitate the process of thinking, learning, individual and social action. The interventions can be with the aid of tools, artefacts and signs. The tools can be material in nature (as in Leontev's task with coloured cards) or psychological (as in the terms identifying colours of the cards in an experiment described further in this section). Vygotsky (1981) thought the use of

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psychological tools introduces several new functions that are connected to the use of the tool, together with how its use is controlled. Use of psychological tools was also found to modify behaviour of the user, in the same way a material tool changes the way a labourer works (Daniels, 2008).

We can consider the use of tools in the example of a person who travels a greater distance when he/she uses a bicycle or travels faster between two points than if going on foot. The mediated action is travelling. Through experience of riding the bicycle between the two points, the rider also develops better ways of riding the bicycle. In the end the bicycle is used for more than merely riding between two places; it can become a vehicle for carrying heavy loads such as piles of wood and bags of charcoal in some African countries. Use of the bicycle in these countries has changed the way people think about transportation. Others have used bicycles as taxis, carrying passengers on the carriers, in areas where motorised transport is scarce or impossible.

It is easier to observe the outcome of mediation in the form of an action arising from the use of mediation tools than to establish psychological influence of the development. The point here is that the tool alone is not enough to conclude that it was used; one needs to take note how the tool was used to determine action. During the interaction between humans and their environment, it is the behaviour or action of humans arising from their use of signs as tools, not simply the humans or the environment that cause transformation (Wertsch, 1991). This observation influenced Wertsch (1991) to argue for a focus on mediated action as a unit of analysis, a shift from the Vygotskian focus on semiotic mediation or mental development (Daniels, 2008). The focus on mediated human action that guides design, nature of data generated and data analysis in this research is influenced by Wertsch's position that the unit of analysis is mediated action, not only mental functionings.

Engeström (2001) following Luria (Hasan and Banna, 2010) and Leontev (1981) also argued for use of human action as a unit of analysis after observing that the human mind can be understood by observing object-orientedness of action, which is evident in human action. Humans engage in meaningful actions or goal directed behaviour (agentic action). They

influence their world through the actions they choose to engage in. Their choice of actions from a range of alternatives is determined by their individual and group interests in that activity. An individual tends to choose an alternative action that most likely gives a successful result, teleological action (Wertsch, 1991). In this action the individual employs material and psychological tools from his or her culture. The role of psychological tools is to go beyond enabling what would have happened without it, by altering structure and flow of the mental function, and ultimately the consequent action (Daniels, 2008). It may cause this by speeding up the flow of information or entirely change the course of mental processes (Daniels, 2008). Different high order mental functions arising from different social experiences accumulate and also interact to form complexes that Wertsch (1991) called "interfunctions". Wertsch (ibid.) further asserted that it is only when high order mental functions are operating at the interfunctions level that the process of mediation is possible. In addition to using tools within socially organised activity, humans use language to mediate their relationship with their environment. Therefore language is one of the tools available in culture (see section 4.2.2.3 above). Vygotsky studied the interfunctional relationship between thought and language, what he termed word and thought as a way of understanding the role of language in mediating cognition.

4.8   The nature of mediation

Mediation entails a "situation where one entity plays an intermediary casual role in the relation between two other entities" (Fernyhough, 2009). In this intermediary role, the entity it is used to enhance understanding by providing a platform for individuals to learn from each other.

Vygotsky did not give any specific definition for mediation but believed that meaning develops (Wertsch, 2007). Meaning implies higher mental functioning. He believed that higher mental functioning can be developed if it is supported. The mediation triangle illustrated further in this section (see Figure 4.4) represents the process through which higher mental functioning can be assisted to develop. Material signs are used to develop sign meaning. As noted in the beginning section of this chapter, Vygotsky asserted that higher mental functioning (sign meaning) and human actions are mediated by tools (technical tools (tools) and psychological tools (signs)) that are derived from the culture of

the individual. One example of psychological tools is spoken or sign language. Tools are the mediators of development. These psychological tools are used during internalisation and externalisation to transform the relations between inputs and outputs from simple meaning and significance leading to a higher degree of sophistication (Fernyhough, 2009; Wertsch, 2007). In the following citation, Vygotsky has illustrated the role of mediation in development of mental functioning in a learner where it comes as an intervention that should enable better outcomes in the learning pathway A-B.

> In natural memory, the direct (conditioned reflex) associative connection A-B is established between two stimuli A and B. In artificial, mnemotechnical memory of the same impression, instead of this direct connection A-B, two new connections, A-X and B-X, are established with the help of the psychological tool X (e.g., a knot in a handkerchief, a string on one finger, a mnemonic scheme). (Vygotsky, 1981 in Wertsch, 1991)

Development of memory is supported by use of tools. The development takes place through an indirect route that creates conditions for better memory.

In defining the process of mediation, the Vygotskian mediation (first generation) triangle is used to show the relationship between the subject, the artefact and the object.
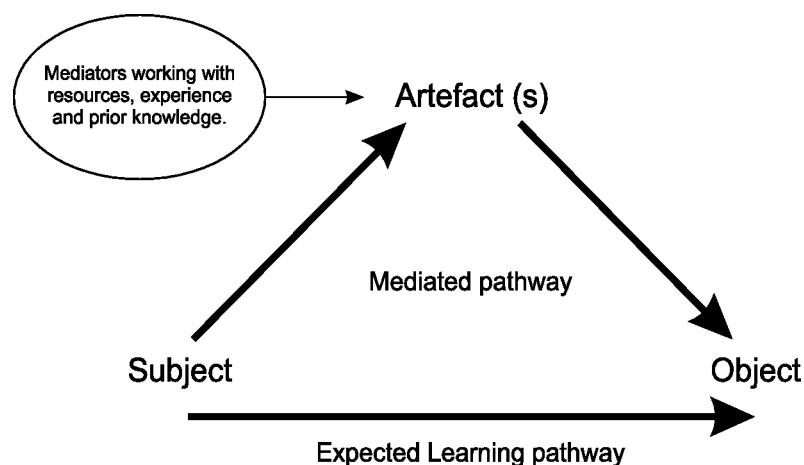
Figure 4.4: The Vygotskian mediation triangle (adapted from Wertsch, 1991)

Humans do things for desired outcomes; this is object oriented activity. The subject is the individual who is engaged in an activity. Artefacts are the cultural means. Mediation involves the subject using tools and signs (artefacts) in order to achieve a desired outcome (the object). The "individual is a free being, pursuing his or her own goals, forms his or her life projects, can cease to follow existing norms and rules and suggest some other ones ...

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an individual agent working with mediation tools" (Lektorsky, 2009, p. 79). This means an individual has agency to produce and to use tools and artefacts. Mediation is therefore understood as involving an individual working with mediation tools and artefacts to achieve a specific goal or objective (Engeström, 1987).

With this perspective, Daniels (2008) contended that the process of mediation must be liberating, freeing the learner from the individual or collective agency constraints and yet free the individual from the social, cultural and historical constraints. In so doing the learner can use the tools and signs freely, taking cognisance that the way the learner interacts with tools (material and psychological) is determined by the culture in which he/she resides. But in so doing, the user of the tools uses them in such ways that they potentially contribute to better or different use of the tools, hence contributing to expansion of the culture. So the relationship between the tools and the culture in which they develop is iterative: a culture determines the nature of a tool and how it is used, and the tool by the way it is used in context, contributes to the culture. This selection arises out of an inner or mental deliberation.

4.8.1 Internal conversation, choice and expression of activity

Due to inner speech or internal conversation, people convert their social relations into psychological functions, which in turn influence actions. The internal conversation involves transformational changes through egocentric speech that result in meaning-making (Jones, 2009). Egocentric speech in children entails verbalisation as a child speaks to him/herself to prepare for communication, to steady the self and give the self-directions. Meaning, in Vygotskian terms, entails understanding the structure of an activity, understanding the structural components of an activity, solving a problem through an activity and being able to express this activity. As a result, depending on their social and cultural background, people develop different types of language to mediate their minds and their environment, hence the manifestation of different actions and verbal representations.

 Speech and thought have an interlinked and iterative relationship intertwined. Vygotsky contributed to the development of thinking and consciousness by distinguishing and yet relating inner and external speech. External speech is recognised as a process of

transforming thought into its material and object form while internal speech is the opposite, transformation of speech into thought (Wertsch, 2007; Zinchenko, 2007; Damianova and Sullivan, 2011). Emphasising the relationship between thought and word, Wertsch (2007, p. 185) cited Vygotsky (1987):

> This central idea…can be expressed in the following general formula: The relationship of thought to word is not a thing but a process, a movement from thought to word and from word to thought. Psychological analysis indicates that this relationship is a developing process which changes as it passes through a series of stages… This movement of thinking from thought to word is a developmental process.

Children develop continuous changes in thought and behaviour through social interaction because children solve problems with the aid of speech (Kincheloe and Horn, 2007; Del Rio and Alvarez, 2007). The nature of the thoughts and behaviours would be influenced by the different cultures of the children together with the social interaction accorded to them and the way they use the tools that the society provides for them. Vygotsky (1978) argued that the cultural tools can be used collaboratively as children learn in a group in order to develop thought and speech. Therefore speech and thought also develop from the social plane to the individual plane through the process of internalisation as mentioned in section 4.3 above. Abstract language is an important action in determining development. Ability to use abstract language is indicative of the higher mental functions that have developed.

The process of choosing an option to take from a variety of experiences occurs through a process that involves deleting, distorting and generalising the events also expressed by Jones (2009) as "clipping, abbreviating or reducing expanded and complete utterance forms of external speech". What is seen from outside or experienced is the outcome of the process of internalisation of external events through filtration that manifests in the form of action or behaviour, which is one form of externalisation. It is this inner speech that accords individuals the ability to think in ways that are unique to the individuals, gives them ability to make decisions, to prioritise and to voluntarily act on issues that concern them.

By way of example and to illustrate how concepts on a course can influence individuals through the process of engagement, internalisation and externalisation, I will describe some of my own experiences from the time that I was a course participant on the Rhodes University /SADC International Certificate in Environmental Education course in 2002.

4.8.2 My course and institutional experiences with sustainable use of resources

The certificate course in 2002 was not very different to the one that the research subjects in this study participated in except that my course was not structured around the change project. The course nevertheless was meant to support individual and institutional agency for mainstreaming of environmental education. Five themes formed the pillars of the course: i) The environment; ii) Environment issues, crises and risks; iii) Responses to environmental crises and risks; iv) Methods and processes; and v) Monitoring and evaluation of environmental projects and programmes. Notions of sustainability, sustainable living and sustainable use of resources were discussed under the responses. In one of the course activities, participants used the Eco-Schools Resource Use pack to estimate the amount of water that they had used for all household chores for one week. This was one way to conduct a water use audit. The estimated amount of water that was used by each individual was phenomenal and shocking! Upon reflection, some of the water could have been saved if they had been more careful with water use. When the water used was costed, participants realised too how much expenditure that had potentially caused through unconscious use of water.

At the end of the course, participants took home an assignment whereupon they were expected to apply any of their learning in their practice and report back to the course coordinators on the implementation. I decided to do an audit of resources used at Mutare Teachers' College where I was teaching.

When I got back to my workplace, I realised that I could not talk to the whole student body about environment and promote changes in social practice alone. I needed a critical mass of student teachers who could be ambassadors for environmental education activities that I would work with. I led the formation of an environmental club for student teachers and interested lecturers for the college, starting with the Science students whom I was teaching. With our teacher student relationship, I had easy access to them and I had healthy relations and good rapport with most of them. They were enthusiastic to form the club. I put keen Science students at the forefront of the idea of a College Environment Club. With my support, the science students convinced the whole student body during their weekly assembly and announcements of the merit of the idea. In addition to Science students,

Geography students and lecturers soon found relevance in environmental education, and they came on board to make a club of about 40 student teachers.

I used the first few weekly meetings to build their understanding of the notion of the environment and environmental education. I made presentations on the nature of the environment. The O'Donoghue (1986) diagram (see Figure 2.1) was the tool I used to illustrate that the term 'environment' means more than merely the biophysical environment and is also construed in terms of the relations between the different components. Notions of sustainability and sustainable living were developed together with the need for sustainable use of resources. I used all the notions of environment, risks, crises, sustainability and sustainable use of resources as illustrated in the RU/SADC International Certificate in EE course, to argue for an environmental audit on the use of resources in the college. I helped the environment club to plan their activities for the term and share the plan with the Principal. This plan included a request for a slot to make announcements in the weekly assemblies. Permission was granted for students to engage in sustainability related activities on the college grounds.

As the environmental club, we decided to start with an audit of water use in the student hostels. Water use did not need prior understanding of underlying concepts and complicated measuring devices as would electricity; beakers, measuring cylinders and buckets were readily available in the Biology laboratory where I taught, pointing to the notion of teleological action (Wertsch, 1991). We chose one male and one female hostel as cases. Students had common bathrooms at the end of the corridor. Students did simulation of some of their practices when taking a shower, a bath, brushing teeth and when doing their laundry. They did laundry by hand. Water use practices were illustrated before and during a hot shower. Student teachers would start running the hot water tap as soon as they entered the bathroom and while it ran, they would brush their teeth. Once they opened the sink tap to brush their teeth, they did not close it till they had finished brushing their teeth. They would then return to the now steaming shower room and adjust the water for the right temperature. They would do all the stages of showering while the hot shower was running.

We measured the amount of water used during a five-minute period and then used this to estimate the volume of water used for a hot shower, hot bath or laundry using the time average time spend for each activity and estimated per month. We also located leaking taps in hostels and school grounds, numbered the taps and estimated the volume of water lost per month. We calculated the cost of the estimated volume of water used in each activity using municipal rates since the college is supplied water by the municipality. The quantity of water used per individual during one showering session was huge.

The club drew up a report that I supported the members to submit verbally and in writing to the Principal. The results were eye-opening and the Principal immediately took a walk to hostels where he observed leaking taps. He directed maintenance staff to repair all the taps immediately and he availed money for all necessary spares. Members also reported their findings to the student body and for a long time advocated for more diligent approaches to using water, especially when taking a shower.

The results made me reflect on water use practices in my household. My family behaved in the same manner as the students when they entered the bathroom. The monthly family bills for water and electricity were very high. I informed my wife of the results at college and requested her permission to carry out the same experiment with family members. We were wasting a lot of water through negligent practices, so paid huge bills. We promoted diligent use practices such as switching off the shower when soaping or scrubbing. We promoted using just sufficient water for a bath. We introduced water glasses for brushing teeth. Our water bills came down and thereafter my wife supported me in monitoring water use practices.

In the both cases, the college and my home, diligent water use practices were promoted by the desire to save on costs. The two examples point to the importance of identifying a response or action that is of value to the users. My experiences illustrate how my involvement in the water use audit on the course influenced how I personally perceived, felt and thought about use of water and other resources. The knowledge and experiences transformed how I valued water and water use practices. When I got back to my institution, I verbalised my experiences and my new values of diligent use of resources. My externalisation was in turn internalised by student teachers and my family who advocated

for changed practices in water use. However student teachers and my family were driven by different motives. Student teachers actions were more driven by the desire to promote ethical values of diligent use of communal resources while my family's changed actions were driven by financial value attached to changed practice. These are examples of some of the ways in which values, an internal feature, influence individual and social action.

My argument in the section was that the processes of internalisation and externalisation are dependent and what we experience as action is usually a result of internalisation, selection or deliberation and externalisation. After internalising people can imagine what is abstract, what does not exist, such as vision for the future.

4.8.3 Re-imagining as abstraction

My view here is also that ability to imagine is a form of abstraction. When people can re-imagine a different world, they are using the psychological signs they have to abstract another way of life. In Environmental Education/ Education for Sustainable Development people are expected to re-imagine the future or at least re-imagine or visualise sustainability practices or their use (UNESCO, 2009a; UNESCO, 2010b; UNESCO, 2015b). This is a high level of functioning which is not possible if they do not know the possibilities (Maxwell, 2012a). The possibilities may be created through lecture presentations, visits to places where the practices are in action or physical engagements with practices and alternative tools that are used for implementing the practices. Mental functioning is well developed if there is a link between the intention of the person or subject and the object in some form of action (Wertsch, 2007). If verbal expression is part of human action (see Section 4.4) and is a form of externalisation of understanding as argued for earlier (see Section 4.3.1), then mental functioning is evident from what the people speak.

Course participants had prior interests in environment and sustainability concerns and this was one of their motivations for applying to the course. When exposed to material signs such as sustainability and environment friendly technologies and concepts, they tended to take them up easily because it was the object of their attending the course. My observations over the years[3] pointed towards course participants being influenced more deeply by one or

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[3] My interaction with the concept of a change project started in 2002 when I was a course participant. In 2004, I supported the change project of a colleague who had participated on the course. In 2005, I was a co-tutor on

a few of the concepts and practices on the course around which they could re-imagine transformed conditions and practices in their work place. These re-imagined conditions and practices were usually an ideal or utopia for that particular concept or associated concepts. Engeström and Sannino (2010) termed this particular notion or practice a 'germ cell', from which all other actions developed. Participants' agency served to realise that utopia or at least elements of it. The re-imagined conditions and practices were an abstraction of reality that was necessary for development of human agency. Therefore the ability to abstract reality is dependent on human agency of the subjects. Vygotsky also asserted that verbal mediation means should be used as widely and as often as possible since they facilitate development of thought and abstraction that are expressed in speech (Wertsch, 1991).

In section 4.8.2 student teachers in the environment club got to understand equitable use of resources through the example of water use in the hostels. Shortage of hot water in the morning was a condition affecting them daily. They were then able to re-imagine conditions with equitably shared hot water, where all students would save hot water so that it did not run out. They imagined student teachers coming to take a hot shower at any time of the morning without fearing to find the hot water finished. For these re-imagined conditions, students developed agency to advocate for careful water use.

Facilitation of knowledge and skills seems to be key for development of agency happens in two ways (see section 4.2.2). One is explicit or visible, while the other is implicit or invisible mediation (Hasan, 2002; Hasan, 2004; Daniels, 2012). The forms of mediation arose from Vygotsky's thesis, that bringing a new tool into an activity improves a specific function and also transforms the tool. By implication, tools such as language that are brought into an activity improve mental functioning and this mental functioning transforms the language so that it becomes functional language.

I introduced the terms sustainable and diligent use of resources in a general sense. Student teachers understood sustainable use more in terms of equitable use. Even though the environment club advocated for sustainable use of water, they were more concerned with

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the course. During the period 2008-2012 I was Training and Capacity Building Manager for SADC REEP and the RU/SADC International certificate in EE course was key component of my work. During these six years I was involved in supporting approximately 50 (check this number, I have just guessed) change projects to various degrees.

the equitable use of hot water in the mornings. The initial words were transformed subtly from their initial generalised meaning to imply precisely what students were concerned with. The next sections will try to explain the process of mediation that causes these changes in knowing take place.

4.9   Two types of mediation

Thinking about how the mediation is supposed to influence the learner to develop higher mental functions in the first place is crucial. Vygotsky identified two interdependent types of mediation, explicit and implicit. The next sections will expand on these two notions even though the terms explicit and visible, implicit and invisible shall be used interchangeably.

4.9.1 Explicit mediation

Mediation is explicit in two ways: firstly if the one leading the process intentionally brings material forms of stimuli; secondly, when the material brought into the activity is obvious (Wertsch, 2007). The definition recognises existence of an external agent who brings visible or easily noticeable forms of mediation. They can be physical materials or they can be concepts brought into the activity.

Such mediation is useful for concept development as the tutor lays out specific tasks with specific expected outcomes. The example given from Leontev's Forbidden Colours experiment sought to establish memory development in subjects (learners). The cards were an artificial stimulus that was brought into the experiment and they were used to help learners to remember colour terms. The initial instructions gave children the colours and then guided them to use the cards. This is actually one process of enabling internalisation of information but it contributes an entry level mechanism that uses a material sign vehicle (Wertsch, 2007). An entry level mechanism facilitates intersubjectivity on tasks. Martin and Rose (2005) described visible pedagogy that has an explicit hierarchy, explicit sequencing rules, explicit and specific criteria. Visible pedagogy is in many ways associated with explicit mediation in that the ways of mediating depend on clearly planned and visible ways of teaching and learning.

4.9.1.1 *Explicit mediation on the Rhodes SADC International Certificate in Environmental Education course*

As reported in section 4.2.2.3, the third session on the daily programme for the Rhodes SADC International certificate course, was for content enrichment. The content in the informative episodes was clearly organised in particular ways, at a particular time and the methods of delivery were clearly stated. Therefore, these formative episodes mediated knowledge in explicit ways which could then be termed visible or explicit semiotic mediation (Hasan, 2004). The concepts in environment and sustainability education were introduced through lecture presentations. The concepts covered included what constitutes environmental education, considering that it involves looking at the interaction of biophysical, economic, social and political as well as cultural components, especially how they ultimately influence the biophysical environment and quality of life of humans. The presenter teased these out, described and explained them using diagrams and examples of possible ways of implementing environmental education. The obvious purpose was to build knowledge on environmental and sustainability education. The presentations also explored the steering discourses, such as how environmental education relates to education for sustainable development, and how both concepts have been used in the discourse of environment and sustainability (see section 2.1.3).

4.9.2 Implicit mediation

This notion denotes those aspects of mediation that are not intentionally brought into the mediation activity. These aspects are not the object of conscious reflection and are not externally or intentionally introduced to the activity, therefore, they are inherent in the processes of the activity. Implicit mediation is embedded in and is constitutive of everyday social practices (Daniels, 2010). Daniels argued that:

> Invisible semiotic mediation occurs in discourse embedded in everyday ordinary activities of a social subject's life. Bernstein (1990) argues that whilst the context for mediation is always the social practices of discourse an important qualification is that in such practices individuals take up specific social positions and are themselves positioned. The same context offers different possibilities for socially positioned actors. (2010, p. 5)

If mediation is part of everyday social activity, identification or singling out such key elements as communicative action, new words and new symbols that learners pick up in the

context of engagement with discourse during explicit mediation can be difficult. However, it is important to recognise the positioning alluded to by Daniels. After going through some concepts, participants may re-imagine as shown in section 4.8.3. In addition, they can potentially see themselves taking responsibility for certain actions. They are also able recognise their abilities and position themselves as agents in different ways. They can reflect on themselves and on what is possible given their social conditions, leading to possible agential action. Such a process entails recognising one's position in society and assessing how one can potentially contribute. Positioning ties closely with Wertsch (1991)'s notion of teleologic action, where people in their agentic action tend to choose options that are most likely to succeed. Therefore implicit mediation intervenes on mental dispositions, habits of the mind or typical ways of responding to situations from the visible form that targets some specific concept or some element of vertical knowledge structure and is evident of explicit mediation. As participants undergo course experiences, they develop understandings of concepts and potentially develop more interest in specific concepts and specific activities (Sfard, 1998; Hasan, 2004; Maxwell, 2012a).

Vygotsky (1987) in Wertsch (2007) found signs and especially language to be one aspect of the mediation that is not intentionally developed; learners pick up language in the context of discourse. Wertsch identified implicit mediation as that which:

> ...typically involves signs in the form of natural language that have evolved in the service of communication and are then harnessed in other forms of activity. Because the integration of signs into thinking, remembering and other forms of mental functioning occurs as part of the naturally occurring dialectic..., they do not readily become the object of consciousness or reflection. (2007, p. 185)

Wertsch (ibid.) then summarised that implicit mediation is something that unintentionally contributes to functional differentiation of thought processes, including thinking, remembering and other forms of mental activity. He argued that what people think can be identified from what they speak. In this research, I use his argument that thinking and speaking are related, so I looked for research subjects' verbalisation of environmental education and education for sustainable development as evidence of their thinking. Through identifying what participants thought, I discerned the mediatory role of external stimuli to their thinking and performance processes. However, the last part of the quotation is debatable because, at times what starts off as implicit may become the subject of

discussion. For example, while facilitating on the RU/ SADC International certificate in Environmental Education course, I used the word "unpack" in my assessment comments at the beginning of the course. I asked them to unpack any notion that needed expansion and explanation. The group spent one early morning session debating the meaning of the word 'unpack' and how it was used in my remarks. They went on to relate the marking rubric to different ways of unpacking as different ways of organising knowledge. For the duration of the course, the term "unpack" was used many times together with "pack" and "packed". So this concept was in my view implicit but became explicit when it became part of everyday discourse in social space.

Implicit mediation is related to invisible pedagogy that was found by Martin and Rose (2005) to have implicit knowledge hierarchy, implicit sequencing rules and implicit criteria. In this pedagogy, the structure is not certain and is emergent with time.

4.9.2.1 Implicit mediation during teaching on the nature of the environment on the Rhodes University/ SADC International certificate in EE course

In the example of the exposition of environmental education mentioned under explicit mediation (section 4.9.1), one notices that the order of sub-concepts and the ways they are developed influences the way participants understand them and the language they end up using in discourse. In explaining the relationships between the different components, a facilitator or presenter starts with describing them in turn but invariably finds that these components influence each other in ways that are more complex than can be easily described in a lecture (Maxwell, 2012a). Such terms as 'social-ecological' are generated and used to denote these complex relationships in environment and sustainability education. The term 'socia-ecological' helps to enable the learner to easily locate the relationships between the two sub-concepts; social and ecological and the other contextual components that relate to these. Hasan (2004) asserted that this form of mediation that develops meaning through providing structure and relationships of knowledge has more influence on human lives than mere knowledge acquired through explicit ways. It follows that in order to influence development of higher order mental functioning, any activity must more strongly include have elements of implicit mediation.

As illustrated earlier, implicit mediation is incomplete without considering the view that thinking and speaking are closely related. Vygotsky in Wertsch (2007) posited that there are two planes of speech involved in the process of learning, inner speech and auditory speech which, as referred to in Section 4.5, is externalisation. According to Wertsch (ibid.), the inner is the meaningful and semantic part of the speech. Inner speech is that part of thought that enables one to select between different forms of information that can either be used or discarded. Inner speech is considered basic to development of thought and thought processes. Vygotsky's inner speech is therefore related to the "inner speech" posited by Archer (2005) who argued that people engage in inner speech and internal conversation when they engage thought processes to determine the next course of thought and action.

In order to facilitate internalisation and externalisation that enable transformation between the interpsychological and intrapsychological, an educator has to take cognisance of the mind, knowledge and experience of the learner. Vygotsky (1978) observed that learners do not possess a uniform mind because they have different experiences arising from their social and cultural contexts. These different experiences culminate in learners developing different psychological tools and consequently different thought processes to any learning situation. Anyone organising the mediation, needs to take cognisance of these learners' differences. To explain the differences between what learners bring to a learning activity and how these differences could be considered during teaching and learning processes, he proposed the Zone of Proximal Development (ZPD) (Vygotsky, 1978).

4.10 The Zone of Proximal Development and mediation

It is important to always refer to the basic maxim from which Vygotsky developed notions of mediation: that meaning develops and that psychological functions of the learner (together with the tools for mediating them) are derived from the learner's social interactions with adults and peers or wider societal interaction (Vygotsky, 1978; Haenen, 2001; Daniels, 2008 Lektorsky, 2009). Therefore, meaning develops when knowledge is mediated by tools which can be physical and psychological tools (ibid.). This thesis advocates for a shift of pedagogy from the intermental by a process of internalisation that uses inner or egocentric speech to the intramental level (Vygotsky, 1978).

Instruction can contribute to mental development and can initiate and awaken many mental processes that are not yet mature but are already developing. In other words, development is an outcome of instruction and learning (Del Rio and Alvarez, 2007) as reported in section 4.3.2. As such, learning happens before development, hence development lags behind learning and instruction must be to advance intellectual development and creativity (Vygotsky, 1978; Daniels, 2008). As learning precedes development, learning is not equivalent to development, as noted by Vygotsky:

> ... properly organised learning results in mental development and sets in motion a variety of developmental processes that would be impossible apart from learning. Thus, learning is a necessary and universal aspect of the process of developing culturally organised, specifically human, psychological functions. Once these processes are internalised, they become part of the child's independent developmental achievement. (1978, p. 90)

If learning is a prerequisite for mental development it must therefore be well structured so that it matches the intellectual development of the learner. In order to structure instruction and learning, one needs to establish the mental development of the learner (Vygotsky, 1987 in Daniels, 2008; Allal and Pelgrims Ducrey, 2000). This perspective notes that the degree of sophistication of activities that learners can do is dependent on the intellectual development of the learner. This is particularly so because intellectual development is continuous, learners continue to accumulate psychological functions as they interact with their environment because older people would have had more time to interact with their environment while younger ones still have to interact and develop functions (Vygotsky, 1978).

The RU/ SADC International Certificate in Environmental Education course enrolled practitioners who were already experienced in their teaching jobs. The course recognised that participants had prior knowledge and experience on aspects of the environment and had prior knowledge and experience of education.

The Core Text of the readings file was structured with introductory text followed by a vignette of a case illustrating the concept in discussion (SADC REEP, 2009). Unit 1 was opened up using a case story of a former course participant who, through a mini-research process, identified the unsustainability practices in his workplace and practice (SADC REEP, 2009). The story illustrated how the participant used his learning on the course to develop

strategies to respond to the unsustainability issues identified. It further reported on the experiences that he reported back to course coordinators on the home assignment. Questions following the case story requested the reader to reflect on their own practices in their workplace. The story had the potential to enable them to think about the environment and sustainability issues that influenced their practice and think about possible responses (Sfard, 1998; Hasan, 2004; Maxwell, 2012a). Participants shared these experiences during content enrichment sessions. In these discussions participants reflected on whether their educational practices were adequate for the environment and sustainability issues they dealt with. Through this activity participants at times were able to identify the gaps in their sustainability practices and argue for environment and sustainability education processes, hence contribute to identifying their zone of proximal development (see Chapters 6, 7 and 8).

The psychological functions that have already developed in a learner constitute the actual development of that individual. When a learner has mature psychological functions for a particular task, he or she will be able to do the task easily without assistance, independently and within his/her control (Vygotsky, 1978). If a learner cannot do a task independently, that learner does not yet have mature psychological functions for that task, therefore still has to develop the mature functions. Vygotsky referred to this process to derive concept of the Zone of Proximal Development:

> … the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers. (1978, p. 86)

Actual or current development denotes what has already developed and which is in the learner's mind structure. The Zone of Proximal Development denotes a futuristic potential of the learner, the level that the learner could be capable of in future. Vygotsky (1978) thought the zone could be thought of as "buds" or "flowers" of development since it was not yet formed. But these buds require adult guidance in the form of an indispensable teacher, or such guidance can come from more capable peers. The adult or more capable peers have the role to ensure that the learner does not struggle alone to make meaning of concepts and help the learner to make meaning of the complexity of concepts (Wood and

Wood, 1996). The knowledgeable adult may or may not be physically present but provide tools such as tasks to help the learner to solve the problem (ibid.).

The Rhodes University/ SADC International Certificate in Environmental Education course recognised that participants have much to learn from each other. During content enrichment sessions, the facilitator would introduce   a concept in plenary, participants engaged with core text readings including the case stories and extra readings individually. After a period of time, they verbalised their understanding of the texts in groups and especially reflected on how the concept illustrated in the texts related with their individual and institutional practice and their change projects. Discussions among group members were meant to clarify or deepen their understandings by reflecting on citations. The facilitator's role was to consolidate the discussions.

The ZPD can also be represented in the form of a diagram that takes note of competencies as some of the psychological functions that learners develop (see Figure 4.5). Bodrova and Leong (2015) suggested that the ZPD signifies a learning space, a state of the mind where the learner is motivated, capable and can be facilitated to learn. This space is distinguished from the one with easy knowledge that has been already learnt and the other with difficult knowledge that the learner has not developed enough capital to tackle. Figure 4.5 illustrates the three zones that influence learning.
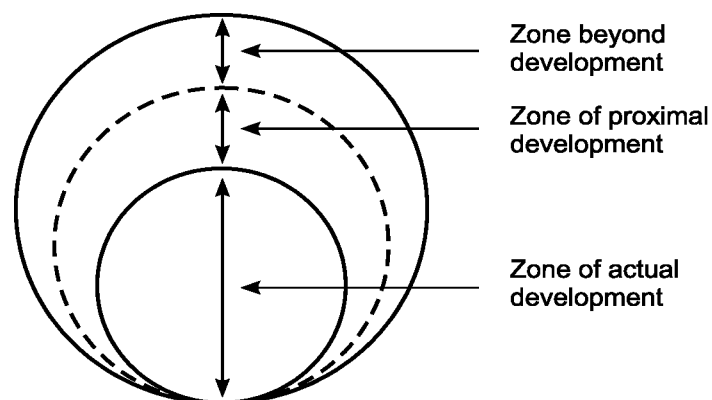
Figure 4.5: The expansive nature of the Zone of Proximal Development in concentric circles (Adapted from Denhere, Chinyoka and Mambeu, 2013)

Competencies that a learner has at any point in time can be grouped into three zones: those that the learner can do (actual competence level), those that the learner is capable of achieving with assistance from more capable mediators or from other learners, and those

that the learner will not be able to achieve in the immediate future but which may be valued or are valuable. Good teaching and assessment must therefore not end within the zone of actual development but must go into the zone of proximal development (Allal and Pelgrims Ducrey, 2000). The current zone of proximal development becomes the zone of actual development in future and part of the current zone beyond development becomes the wider zone of proximal development. The ZPD therefore shifts all the time with increase in intellectual ability, complexity and experience. Harland (2003) argued that it is learning that creates the Zone of Proximal Development through the process of continued expansion.

Engeström (1987) asserted that the ZPD is in fact expansion of activity through expansion of actions (see section 4.5):

> The essence of [expansive] learning activity is production of objectively, societally new activity structures (including new objects, instruments, etc.) out of actions manifesting the inner contradictions of the preceding form of the activity in question. [Expansive] learning activity is mastery of expansion from actions to a new activity. While traditional schooling is essentially a subject-producing activity and traditional science is essentially an instrument-producing activity, [expansive] learning activity is an activity-producing activity. (p. 125)

Drawing from the view of expansion of the ZPD as expansion of activity, Engeström and Sannino (2010) proposed that the key learning process, representing the object, is a cycle that keeps expanding, creating concentric circles of enhanced learning and actions represented by the big arrow in Figure 4.6 below. The expansive learning cycle is supported by various small mediatory cycles of learning experiences such as particular modules. According to Engeström and Sannino (ibid.), each module on a course is in turn constituted of small cycles of learning experiences and opportunities that include reading experiences, discussions, individual reflections, group presentations and reflections, practical activities, video clips and excursions. Figure 4.6 below shows the levels of learning cycles representing the learning cycles on an activity. The diagram also acknowledges that the actions that are aimed at developing an activity are expansive learning cycles that expand in their own ways that contribute to the main activity.

Expanded Learning on
mainstreaming EE/ESD activity

Initial Learning on
mainstreaming EE/ESDactivity

Smaller cycles of learning
opportunities and experiences
represented by smaller circles
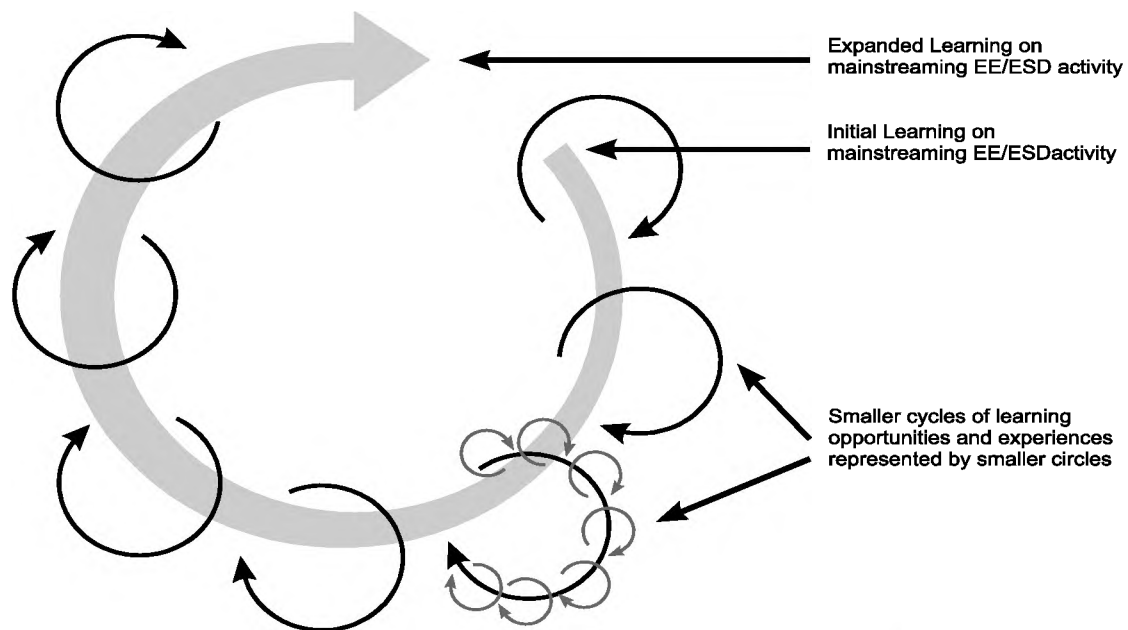
Figure 4.6: Expansive learning as ongoing spirals (Adapted from Engeström, 1996)

4.10.1 Experiences of movement in the ZPD during and after the course

In 2002 I was a participant on the Rhodes University/ SADC International Certificate in Environmental Education course. I was an experienced and knowledgeable educator and my zone of actual development on environmental education was expanded during the environmental education course. As I conducted environmental education activities in my college (see section 4.8.2), and on the national Secondary Teacher Training Environmental Education Programme (St2EEP), I felt inadequate. I needed more concepts and I needed to be able to assess and justify ideas that I was passionate about in more professional and academic ways. I then enrolled for the Masters in Environmental Education course hoping to fill this gap. For some time I thought I knew a considerable amount about environmental education and education for sustainable development. I changed jobs from teaching to capacity building for SADC REEP. I coordinated and facilitated capacity building for the fifteen (15) SADC countries. I participated in many conferences on education for sustainable development. I felt I did not know enough of the field and in a bid to know more I enrolled for a PhD in environmental education. I use my personal story here to illustrate my growing ZPD over the years and my constant quest to enlarge the circle at each stage. I recognise too an increased mental complexity in environmental education and education. I am not sure

how inadequate I will feel after I complete the PhD, since the ZPD denotes an ever expanding zone of possible learning and development (see section 4.10).

Del Rio and Alvarez (2007) understood the ZPD as describing a number of trajectories of mental development. A learner is viewed as developing more than one mental trajectory in the ZPD. A trajectory is not seen in the sense of a fixed pathway. It is a broad outlook of mental, experiential, competence and capabilities development that were illustrated in the expansion of activity (see section 4.10 above).

Two such trajectories are the cognitive and metacognitive domains identified by Karpov and Haywood (1998) as the purpose of mediation, with the greater interest being in the metacognitive domain, which according to Sfard (1998), Hasan (2004) and Maxwell (2012a) is necessary for the practice. The interest in ESE is in developing and supporting reflexive praxis for social and ecological concerns (Raven, 2005; Pradhan, Waswala-Olewe and Ayombi, 2015) a term that recognises the iterative relationship between content and theory (see section 1.10.2).

4.10.2 Cognition on the Rhodes SADC International Certificate in EE course

Cognition in this research pertains to having knowledge of objects and to knowing the signs representing objects, processing information which includes applying knowledge and choosing between options, in short, the way the mind works to process information (Vygotsky, 1978; Brandimonte, Bruno and Collina, 1996). Vygotsky argued for both socially based cognition, where knowing is distributed among members of a group and individual cognition where the individual is the knower. So Vygotsky's thesis was that cognition starts from a social level, including material and environmental conditions to become individual cognition, experience and practice after learning.

During content enrichment sessions (see section 4.2.2), participants on the Rhodes SADC International Certificate in Environmental Education course were encouraged to discuss the concepts that they understood from reading texts. The session was structured to enable participants to learn concepts from each other in order to develop confidence in their own understanding (Bodrova and Leong, 2015). But the penultimate was metacognition that related to higher mental functioning (see section 4.8).
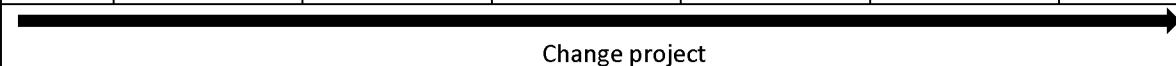
In the metacognitive domain, the various mental functions develop differently depending on the already developed mental functions. In the RU/SADC International Certificate in EE course, in addition to understanding of concepts during content enrichment sessions, participants were also required to relate the concepts learnt to their own practice during the sharing (see section 4.2.2.2). They were expected to relate these concepts to other concepts that they had learnt prior to the course and on the course (Vygotsky, 1978).

However, any particular mental trajectory is not uniform across a group of learners as each learner develops in his or her own way, depending on their actual development (Bordova and Leong, 2015). The Rhodes University/ SADC International Certificate in EE course recognised that participants came from different work contexts that influenced their experiences, knowledge and the way they thought about and responded to environmental and sustainability challenges. The recognition came out more clearly in the pre-course task and on-course assessment tasks.

As indicated in section 4.2.1, Assignment One required participants to deepen their understanding of a selected environment and sustainability issue. This task required participant to understand environmental issues through identifying them and describing them, describing why they are environmental issues and identifying policies; this was expected to mainly influence the cognitive element of their learning. Participants were also expected to show that they could relate the biophysical, social, economic and political aspects of the environment. Assignments on the pre- and on-course phases of the change project course are summarised in Table 4.1 that follows.

Table 4.1: The change project assignments framework

Phases	Pre-course	On-course			Post-course	Ongoing engagement
Assign ments	Pre-course assignment	Assignment 1	Assignment 2	Assignment 3	Reporting on	Ongoing activities
Key expectations	- Identify and critically review policy relevant to workplace educational mediating activities - Identify and critically review unsustainable practices - Consult with others in the workplace and work as a CoP to prioritise matters of concern	- Policies relevant to the management of environmental issues/s and risk/s - Identify appropriate and relevant sustainable alternatives - Use of knowledge resource and production	- Policies relevant to ESD are critically reviewed - ESD methods have been identified - Explain ESD methods relevant to your context of practice - The use of two ESD methods in a context of practice	- Policies and other factors influencing a shared interest in ESD are identified and discussed - Relevant ESD CoP described - Key factors necessary to strengthen the work of an ESD CoP identified and discussed - A strategy for evaluating learning in an ESD CoP developed	-Feedback on EE change project from workplace colleagues managers and CoP participants - Feasibility of the EE change project plans - The value of your knowledge resource - if and how your change project plans are changing	- Ongoing activities on the change project - Alternative pathways for mainstreaming EE/ESD - Any other courses attended emerging from the change project - Any contributions to networks and communities of practice
Period	1 month	One and half weeks	One and half weeks	One week	One month	Ongoing after the first month
	Change project →					

The assignment (see Appendices 1-5) was explained by the facilitator and the assessment rubric (see Appendix 12) was discussed with participants. Participants were given the assessment rubric together with the assignment so that they could use the rubric for self-evaluation on their assignment write-up and orient their responses to the highest expected standards. Each assessment criterion had three assessment standards. A border-line pass showed evidence that the task was understood and the participant could engage with the task by simply identifying the required factors. A good response showed evidence of clarity and depth of understanding on the content and substance of the task and the participant was able to do more than simply describe and could relate the content to the workplace

(see Appendix 12). The standard therefore encouraged participants to think about content and how to present it in coherent ways so that it became clearer to the assessor and to themselves. According to Martinez (2006), metacognition entails "thinking about thinking". The participant would have to think about content, what exists in his/her cognition and think about ways of making this clearer. A participant who could illustrate critical engagement with the task, drew on a number of sources, thought through his/ her workplace context and experience while pointing out possible areas for further improvement and change was rated as excellent. Critical engagement entails dealing with the content and subject matter as described earlier but drawing on a variety of sources, and building a clear and coherent argument thereby invoking high level thinking and relating skills that constitute metacognition and in the case of the RU/SADC International Certificate in EE course, reflexive metacognition and practice (or reflexive praxis).

Notions of cognition and metacognition are inseparable. They depend on each other and any activity to develop knowledge must be structured to not only facilitate knowing and understanding of concepts but to support learners to think about the concepts that they know and understand more deeply. Thinking more deeply implies an ability to find relevance of concepts in one's context and practice, to relate the concept to other concepts and to discriminate between different possibilities of using the concepts in one's context and practice.

The ZPD enables the teacher or instructor to devise learning activities that determine the course of development of the learner on their individual mental trajectory. The teacher or instructor must have a combination of skills of evaluating the different zones in the learners, designing the instruction and its activities appropriately for the learners, and teaching in order to be successful in the ZPD (Del Rio and Alvarez, 2007).

However it should be noted that the emphasis on the necessary knowledgeable adult or peers is not simply to use their wisdom but to provide social organisation and leading activities as a 'cultural amplifier' that promotes cognitive development in the learner (Bliss, Askew and Macrae, 1996; Griffin and Cole, 1984 in Daniels, 2008). Social organisation amplifies cognition which is a fundamental part of mental functioning and is a derivative of and part of social practices as illustrated throughout this chapter. The notion of scaffolding

provides inroads into understanding how this social organisation and these activities could be brought into the zone of proximal development as intermental functioning between the teacher, knowledgeable adult, peers and the learner.

4.11 Scaffolding

In this section I deepen my understanding on the notion of scaffolding and use some aspects of the RU/ SADC International certificate in environmental education course to illustrate the concept. Earlier on, I described the ZPD as the distance between mental functions that have already developed (actual development) and those that can still develop but with assistance from a knowledgeable adult or peers (potential development). A learner needs to undergo certain experiences that enable bridging of the gap. Scaffolding enables building of new skills by making things comprehensible without making them simpler by emphasising strategies (Hobsbaum, Peters and Sylva, 1996).The social and psychological experiences have to be organised in ways that enable the learner to reach maximum potential. That organisation is termed scaffolding (Allal and Pelgrims Ducrey, 2000). To illustrate the notion of scaffolding I will show some instructions in assignments of the RU/ SADC International Certificate in environmental education course and how they were constructed and presented to participants. An excerpt of Assignment One is quoted in Table 4.2.

Table 4.2: Excerpt of Assignment One on the Rhodes SADC International Certificate in EE Course

YOUR TASK IS TO DEVELOP A KNOWLEDGE RESOURCE FOR USE IN YOUR CHANGE PROJECT: • **Choose one key environmental issue or risk relevant to your work context.**   • **Define *why* it is an issue, and what risks are associated with the issue.**   • **Describe the nature of the issue or risk from a biophysical, social, economic and political perspective.**   • **Describe and analyse the unsustainable practices that have caused the issue or risk.**   • **Identify if there are relevant policy responses to the issue or risk in your (national or sectoral) context, in Southern Africa and internationally. Show how these are responding to the issue or risk.**   • **Describe what alternatives, more sustainable practices are possible.**   To do this, you will need to access *high quality information* on the issue or risk, and you will have to review various policies, and you will have to find information on relevant alternatives. However, not all knowledge on the issue will be available in books or on the internet. Sometimes knowledge of issues also exists in the local context. In dealing with risk, it is also not always possible to know the full scope or extent of the risk. As an educator it is important to try to establish what is not yet known, so as to 'keep finding out'.   **Describe how you will use this knowledge resource in your context, especially with reference to a) combining it with local knowledge that exists amongst people (not always in books); and b) the fact that not everything about the issue or risk is known yet. Develop an activity showing how you plan to use this knowledge resource in your Change Project.**

The assignment was broken up into sub-tasks to enable participants to understand the requirements of the task more easily. The third bullet from the top requests participants to

describe the nature of the issue since participants did not identify the same issues but the question went on to give them the perspectives that they were expected to use as lenses to analyse the issues. This way of setting tasks did not give the answers but provided participants with the scope of the coverage expected of them. The question made the task explicit and provided participants with the overall framework for responding to that part of the task. The last bullet requests participants to describe alternatives and more sustainable practices. The purpose of the course was to enable participants to think of more sustainable alternatives in responding to environment and sustainability challenges. Therefore this task supported participants to write about sustainable alternatives and helped them to think about even more sustainable alternatives. These instructions were complemented with verbal reading through and explanation of the tasks and relating those tasks to the assessment rubric by the facilitator (see Appendix 12).

Bliss et al. (1996) argued that working in the ZPD needed prior thought on structuring. They proposed that the ZPD should have modelling, contingency management and feedback. The facilitator helped participants to understand the tasks through using vignettes of case stories in the core text readings as models that ultimately helped with cognitive structuring of the responses. Since participants came from different backgrounds, the facilitator recognised these differences and how they would affect the assignment write-up and allowed for contextual interpretation and contingency management. Participants submitted two drafts of their write-up. Tutors made comments on the first draft and participants responded to the comments, in a bid to improve their presentation against the assessment standards, and their reflexivity, expanding their learning in the ZPD.

The socio-cultural view is that in order to have mental development in the ZPD, the use of mediation tools must be collaborative. Therefore, the experiences that constitute scaffolding are negotiated between the learner and knowledgeable adult or peers. A change in ownership of learning allows for the shift from regulation by others or distributed cognition and metacognition to self-regulation or individually based cognition and metacognition (Hobsbaum et al., 1996). But most important is the need to consider the key factors that are necessary for mediation, namely, ensuring that learners have ownership of what is to be learned – on this course participants selected their own issues to work on, in their context of practice; concepts were situated in context by ensuring that what is to be

learned is appropriate for the students' current knowledge, taking cognisance of spontaneous and scientific concepts of the learners; what needs to be learned has sufficient structure that takes account of the natural sequence of thinking and doing – this was achieved by use of broad and yet clear guidelines, especially writing, talking and getting feedback; there is collaboration between the teacher and student during the process of instruction – the course foregrounded assessment as a reflexive process; that there is gradual withdrawal of the support by teacher and peers so that the individual takes control of the learning – the course gave assessment criteria together with the task and this allowed contextual interpretations of the task and criteria (Daniels, 2007). The ZPD illustrates a field of meaning making processes that show through a variety of forms of communication and dialogue.

The ZPD of the RU/SADC International Certificate in EE course indicated what participants could achieve by the end of the course and these can be drawn from the course outcomes whereupon the course aimed to:

- Enhance the policy, institutional and contextual relevance of environmental education programmes and activities;
- Develop deeper understanding of unsustainability practices, and associated environmental issues and risks, and how to respond to them through educational mediating activities;
- Develop understanding of more sustainable alternatives and how to enhance them through educational mediating activities; and
- Improve the use of educational methods and materials for mediation of better learning and more sustainable alternatives (SADC REEP, Course Notes, 2009)

This research reflected on the wider implications of the ZPD on teacher education practices in the cases studied. The research site visits took place at least a year after participants left the on-course part of the course. The time lag helped to further locate the research in the socio-cultural context of the teacher education institutions. To this end, the research sought to establish the nature of the expanding ZPD of the participants and how that ZPD influenced their competences and capabilities, to identify agency and if and how it was continually transforming and expanding or not. Data for this research was generated both during the course and after a year since participants had left the on-course phase. This research is not a snapshot. As such I took participants' responses as expressions of reality over the period that they implemented the change projects (Maxwell, 2012a). In order to

establish where and how mediation takes place, I considered constructing research subjects' experiences on mediated actions and continuous emergence of new zones of proximal developments as evidence of mental development evidenced through implementation of their change projects over time (see Chapters 6, 7 and 8).

4.12 Conclusion

This chapter was developed in order to deepen applied understanding of the premise of the notion of socio-cultural and especially Vygotskian mediation, a process significant to T2-T3 in the Archer framework of morphogenesis. Socio-cultural mediation recognises that humans have interests as individuals or as groups to interact with their environment in certain ways (Vygotsky, 1978; Wertsch, 1991; Archer, 2010). Humans also have material, environmental, social and psychological tools derived from their culture that they use to mediate the human-environment interaction. Mediation of the interaction through use of tools starts off from the intermental or interpsychological plane until the tools are internalised to be intrapsychological tools of the individual. In the quest for developing higher mental functioning in the psychological tools, Vygotsky distinguished between the obvious and evident forms of mediation, differentiating the explicit from the implicit, which is part of the evident, and is mainly carried out through language.

Vygotsky (1978) thought mental development could be observed through looking at the way meaning is made by the learner (semiosis) seeing this as the primary unit for analysing mental development. But Wertsch (1991) argued, after the work of Luria and Leontev, that the outcome of mediation is some form of action and what the learner is able to express in words. The unit of analysis is mediated action which is easier to recognise as also taken forward by Engeström, whose work has focussed on the object of activity and the activity system as a unit of analysis. The process of learning involves mediatory activities that are structured in ways that should recognise the learner's prior knowledge and experience. The Zone of Proximal Development is a tool that was developed by Vygotsky to establish the relevance of mediation to mental development. Once the need for mediation is established, the mediator takes some steps to enable learning and mental development through scaffolding as proposed by Bruner (1985).

As shared in this chapter, the RU/SDAC International Certificate in EE course and its pedagogy and practice reflected and used core principles and tenets of socio-cultural theory as put forward by Vygotsky. These core principles and tenets reflect a similar transformative learning interest to that of Vygotsky, namely that all learners regardless of race, class or context have potential to expand their learning, cognition and action via social interaction and learning. Learning, cognition and action should be supported to expand in zones of proximal development that are challenging and that encourage learners to make sense of new ideas in context by engaging their reflexivity.

The next chapter is a discussion of the methodology used to generate data and to analyse the data in this study.

Chapter 5:   Selection of appropriate methodology, data generation techniques and analysis

5.0   Introduction

This chapter describes the research design and research methods that I used to establish how mediated actions on a professional development course for environment and sustainability education (ESE) translated into mediated actions in teacher education practice in three case contexts. The relationship between the mediated actions on the course and mediated actions in teacher education institutions was surfaced by following the traits of the course that participants made sense of and took into their own practice. The research sought to establish how participants responded to the course, as well as how they responded after the course during their teacher education practice back in their institutions (see section 1.13).

5.1   Orientating influences to research design decisions

Decisions on structure of the study, research process and data generation techniques were influenced by critical realism that recognises the existence of a real world, noting that "the ideas and meanings held by individuals – their concepts, beliefs, feelings, intentions and so on – as equally real to physical objects and processes" (Maxwell, 2012a, p. vii) and the ability to describe that world being socially constructed and describable from a particular vantage point (ibid.), in this case, the teacher education perspectives. I recognised teacher educators as experiencing the reality of their teacher education practice and that they were the best placed to describe their experiences. This chapter further describes and justifies the research methods as well as the theory that I used to generate data on features of the course outputs and outcomes that participants responded to while on the course as well as in their workplaces. The analysis framework for the study is discussed and justified in this chapter.

My own reflexivity was a key feature in determining my interactions with research participants and the data generation process. It was important to recognise that my engagement with research participants did not start with the research. I first interacted with course participants at the time when they applied to join the course, details of which I will

lay out in later sections. Participants then participated in a professional and capacity development course in environmental education that was facilitated by both Rhodes University staff and SADC REEP staff. When participants were on the course, I coordinated and facilitated the course as training coordinator of the SADC REEP, a course that I had done myself in earlier years (see sections 4.8.2 and 4.8.3).

The major goal of the course was to support participants to develop agency and prepare them to exercise agency for mainstreaming ESE in their institutions. When participants went back to their institutions, it was part of my job to follow up on and support implementation of the institutional change projects. I am raising this background because I will come back to it as I describe the possible validity and reliability implications of my relationship with the RU / SADC International Certificate in EE course participants who later became research participants in this study (see sections 1.3.4 and 4.2).

As part of my work as training coordinator for SADC REEP, when I visited any particular country for purposes that were not related to the change projects, I would make time to meet participants in the post-course period, in their institutions to give them support and encouragement. I would endeavour to meet the superiors and encourage the institutional leadership to support the change project implementation. Therefore when during the data generation phase of this research, I was still expected to mentor the participants and give technical support on implementation of the change projects. This meant that the participants and I had to be reflexive enough to continue to improve change project implementation and at the same time generate research data on the change project implementation. In later sections I discuss how I dealt with some of these dominant issues of reflexivity during data generation (see section 5.10.7).

Due to its complex social nature and its interests, the study used a qualitative research design for data generation and analysis.

5.2 Decision on qualitative research design

As indicated earlier, this study sought to understand the influence of the course on mediation of changed practices on both the course and workplace contexts by researching mediated actions of the course and the course participants in their work contexts. Caldwell

(2012) asserted that practices are more ontologically fundamental than human language and discourse, which in effect is a call for greater consideration of human actions which are constitutive of practice. Archer (1995; 2000a; 2004) made the same point in her primacy of practice argument. Rouse (2007) emphasised that we should guard against looking only at visible actions and strive to establish the inner aspects of practice, Rouse's view is in accordance with Kemmis's (2009a) notion of practice, which is constituted of 'sayings', 'doings' and 'relatings'; the notion of capabilities in work by Sen (1999), Robeyns (2000; 2005) and Nussbaum (2011) which are constituted of beings and doings; as well as to the notion of competences as put forward by Wiek et al. (2011) and UNESCO (2015b) as referring to the ability to use knowledge. The notions of practice, competences and capabilities used in this study can be developed and applied in social contexts. These notions are therefore consistent with Vygotsky's (1978) socio-genesis of mind, experience and actions, where these can be expanded in zones of proximal development via reflexive engagements with the world (see Chapter 4).

This study sought to unravel how mediation actions influenced the process of social change where participants as change agents facilitated mediatory actions during the development and implementation of the practice-based change projects. Social change was observable by looking at emergent properties during the period over which participants interacted with the course (see Chapters 6, 7 and 8). In order to understand interactions in teacher education contexts, the absence of obvious, identifiable and not definable variables that could be controlled or experimented with, influenced me to use a qualitative social realist research approach. The research needed an open-ended, inductive, and abductive and retroductive qualitative exploration framed within a critical realist and social realist approach.

A qualitative approach points to the development and use of methodologies that enable understanding human phenomena in context (Bassey, 1999; Terre Blanche, Kelly and Durrheim, 2006; Fouche and Schurink, 2011). As such, narrative and interpretive orientations guided the empirical research process. Guided by these, the study was able to explore the depth of the richness of ordinary language and expression in order to understand the empirical dynamics of the social world (Terre Blanche et al., 2006). Both

narrative and interpretive orientations allowed the participants to interpret their practices and ascribe meanings to their lived world through their experiences during the process of data generation, while providing me, the researcher with rich narrative accounts from which I discerned emergent properties, capabilities and competences for sustainability, following a critical social realist abductive and retroductive inference mode (Danermark, Ekström, Jakobsen and Karlsson, 2002) (see Section 5.2.4).

5.2.1 Interpretivist influence

Interpretivists when conducting empirical analysis view human actions as products of meanings emanating from interpretations of social interactions. Social interactions change all the time (Archer, 1995) and therefore meanings change too. Furthermore, interpretations of reality are mentally constructed, so people have different perceptions and mental constructions and hence, different understandings of reality. They also use various forms of language to express their understanding of this reality and this means that there always are differences in the way people represent reality in symbols (Bassey, 1999). Thinking about what this means enabled me to establish the empirical aspects of the research in this paradigm and allowed me to benefit from richness in language while developing what van Manen (1997) termed "anecdotes" of the change project processes and activities in the teacher education institutions. They were anecdotes in that I only described experiences that I was concerned with in this research. These experiences are only one part of research participants' teacher education experiences on implementing the ESE change project. Deeper analysis of these interpretations was obtained via abductive modes of inference discussed below.

In Willis's (2007) view, human action is influenced by both the environment and people's subjective perceptions of that environment, so an individual's actions are influenced by her view and experiences of the world around her as well as the subjective interpretations of her actions by others in her social and cultural context. Course participants had individual experiences that were influenced by their individual beings. In many ways these experiences and subjective contextual interpretations influenced course participants' views on the role of the course on their practice as well as the way they saw and interpreted opportunities for conducting changed practices in their teacher education work during the on-course session

and when they got back to their workplaces. Consequently, the social context as well as the institutional, social-ecological and environmental context (including the institutional cultural context) were assumed to influence implementation of the change project in their workplaces.

5.2.2 Narrative research paradigm influences

Teacher educators implemented change projects in the context of their teacher education institution and wider social-ecological contexts. As stated in Section 4.2, the change project implementation process contributed to some but not all their teacher education experiences. That is why I earlier referred to their experiences during change project implementation as "anecdotes" of their teacher education experiences where change project implementation was one part of their wider experience and practice.

Connelly and Clandinin (1990, p. 2) posited that "people by nature lead storied lives and tell stories of those lives", implying that people's experiences are stories and that people are able to tell them in many ways. Narrative research seeks to tell the stories or experiences of practitioners. Therefore narrative analysis is used for stories told chronologically and teases out the desired features, phenomena or elements in order to sequence the stories while being guided by reasons why that particular option is chosen. The story constructed must take into account past experiences, current experiences and include how these experiences influence views about the future (Clandinin and Huber, 2010). In this research I asked question of research participants, which guided them to tell stories of their experiences that I narrated in view of capacity development as an interaction from which manifestations of characteristics of capacity for ESD mainstreaming arose through implementation of the change project. I looked for underlying structural, cultural and people emergent properties to establish development of capacity for ESE. Use of a narrative approach in this research implies that the participants' experiences were presented as a story of emergent properties and also that the method used to generate the stories followed particular guidelines (Clandinin and Connelly, 1990). Clandinin and Connelly were concerned that narrative stories tend to individualise the experiences or limit narration to research participants. In order to avoid individualisation of experiences and narration or methodological individualism as referred to by Archer (1995), I strove to capture contextual influences on

change project implementation by using more than one data collection method and interviewing as many colleagues and members of the community of practice of the research participants as possible, and extended this with abductive and retroductive inferences, as is the tradition in social and critical realist research.

Flyvbjerg (2006) explicitly stressed that a case study needs to be told in ways that capture all the diverse experiences to show the unfolding and complicated aspects. In the end, the case is supposed to be very clear, but different readers should be able to relate with the narrative around the same case. One of the case institutions declined my request for institutional ethical clearance to name the institution and thereby prevented me from describing the institutional experiences. This made me focus more on practice of the individual course participants who were also the research participants for which I was granted ethical clearance. In this study, I re-named the institution as Institution X and for consistency, I named the other Y. Details of the case and how it was narrated were very important parts of design decisions in this research. I foregrounded the development of emergent properties in relation to mediation processes in the narratives.

Noting that people can describe their experiences as part of their stories of practice, I asked research participants to recount and tell their experiences of change project implementation. Of course it was important to recognise that the change project was only one part of teacher education practice. In other words the description of change project implementation was one small story in their bigger teacher education practice stories.

5.2.2.1   *Relationship with research subjects*

As alluded to in Section 5.1, my relationship with research participants started off when I, together with others, became involved in the selection process, read through applications and selected participants for that group in that year. We selected participants, based on the quality of a letter of motivation, indicating the relevance of their work to the course focus and content, particularly those who demonstrated evidence of ESE praxis and, or leadership. This exercise enabled us to understand course participants better, the practices that the participants were already engaged in and to have an idea of what was already happening in and around ESE in the course participant's institution. This knowledge prepared me, as facilitator and coordinator of the course, for the kind of support participants needed to

enhance their agency in the field and therefore gave me, and other tutors, the scope to think about what would best work in their institutional contexts as well individual and collective practices. This informed our curriculum and course preparations.

During the on-course session, I and other tutors worked together with the whole course group to shape and refine their ideas and plans for the change projects they had chosen. The implication is that development of the change project implementation plan was a collaborative effort of the participant, colleagues and facilitators, including myself. When I then followed up on change project implementation in their institutions, participants saw me as a colleague but also as a mentor. During my visits to the teacher education institutions, I strove to link institutional leadership with change project implementation as there was often disjuncture between practitioners' aspirations and their supervisors who themselves knew very little about the notion of ESE and consequently, the change projects themselves. This link facilitated a smoother interaction platform between the course participants and their institutional leadership. To this end, I was considered an integral part of the change project implementation process, which made the change project implementation story 'our story'. Evident in this approach is Connelly and Clandinin's (1990) assertion that narrative research should be a negotiated and shared unity. However, with my research expertise I used the lens of emergent properties to look into features of practice that were evoked by the course interactions so that I could re-tell the same story.

Listening to research participants alone give accounts of their experiences did not give me adequate information on the phenomenon of change project implementation. My relationship with research participants and the change project could have influenced research participants to give me the information they thought I wanted to hear about their efforts in mainstreaming ESE into their practice. To safeguard the data from such a bias, I interviewed their colleagues and managers to triangulate participants' accounts. That I was relationally close to the change project and participants helped in bridging this gap, but also influenced my presentation of the narratives since it incorporated my subjectivity. Therefore this position influenced the way the narrative was constructed and narrated as is the norm in narrative research (i.e. the narrator is not absent but present in construction of the narrative) (Connelly and Clandinin, 1990). These narratives are guided by my research interests and are shaped by the use of social realist theory and the notion of mediation. It

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was not easy to fully represent another person's reality as my narration took up only those features that appeared relevant for the study (Riessman, 1993).

5.2.3 My role in this research

My role in this research was to develop narratives on teacher educators' stories or experiences of implementing an ESE change project. I was to construct the interviews, discussions, observations and document analysis and relate these stories to temporally influenced change processes. This study relied on first-hand information from participants because the lived world of a person can only be understood from his or her account and perspective and described in rich detail and presented in a language that evokes meaning (Fouche and Schurink, 2011). I re-wrote teacher educators' accounts and perspectives as human phenomena in context, as they were lived, but using context- and theoretically derived terms and categories; structural emergent properties, cultural emergent properties and people emergent properties as described in section 5.2.4. These categories of classification arose from the way participants reflexively responded to tasks in the pre-course, on-course and post-course contexts.

This research sought to come up with an in-depth explanation of how a specific teacher education course influenced teacher education practice on mainstreaming of ESE in selected teacher education contexts. Therefore descriptions of the teacher education experiences required in this research were closely connected to the designated contexts (change projects in teacher education) and may not necessarily be generalisable to all teacher education professional development contexts (Lather, 1986b; Flyvbjerg, 2006), although generalisation is possible at level of interaction of mechanisms in critical realism research (Danemark et al., 2002).

5.2.4 Influence of critical realism

Even though critical realism rejects that there are multiple realities and that individuals socially construct reality, it is compatible with the interpretivist view that there are different valid *perspectives* of any reality, i.e. ontological realism and epistemic relativity (Bhaskar, 1979). The world we perceive and live in is structured by our concepts that are expressed in language. These concepts and perspectives, as held by the people and contexts I studied in this research as well as my concepts and perspectives of these concepts, are part of the

world that I wanted to understand. I believe that my research participants had views of knowledge and ontological and epistemic experiences that would enable me to better understand and explain reality. This research assumed that teacher educators' experiences are part of their real world and this reality could be understood by following their stories of experience together with analysis of underlying causal mechanisms which influenced their expressions and experiences. To this end critical realism and social realism as proposed by Bhaskar (1979) and Archer (1995) was used as underlabourers, providing a lens through which I was able to layer the interpretations in order to understand what constituted them and how they emerged and related to each other (see Chapter 3).

Willis (2007, p. 9) argued for the use of realism in social research in that it "re-legitimates ontological questions about the phenomena we study". Recognising the layered ontology of reality, critical realists suggest that the notion of *transfactuality* guides analysis in research (Danemark et al., 2002). That means empirical observations and events can be seen in relation to generative mechanisms at the actual and the real domains. A transfactual argument can be built using the four modes of inference: deduction, induction, abduction and retroduction, as shown in Table 5.1 below.

Table 5.1: Inductive, abductive, retroductive and deductive modes of inference (Adapted from Danemark et al., 2002)

	Deduction	Induction	Abduction	Retroduction
Fundamental structure	To derive logically valid conclusions from given premises.	To see similarities in a number of observations, concepts and experiences and draw the conclusion that these similarities also apply to non-studied cases.	To interpret and recontextualise individual phenomena within a conceptual framework or set of ideas. The phenomenon in this research was capacity for mainstreaming ESE that was analysed in terms of emergent properties.	From a description and analysis of concrete phenomena to reconstruct the basic conditions for these phenomena to be what they are so as to build transfactual arguments. This inference was used to refer back to conditions that influenced participants to interact with the change project course and teacher education practices the way they did.
Central issue	What are the logical conclusions of the premises?	What is the common element for a number of observed entities and is it true also of a larger population?	What meaning is given to something interpreted within a particular conceptual framework?	What qualities must exist for something to be possible?

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In this research, I used all four modes of inference. I used the theory of morphogenesis, particularly, emergent properties, to abductively analyse for emergent properties on the change project course and implementation. Emergent properties were inductively grouped into categories. Retroduction was used to relate emergent properties to generative mechanisms. I arrived at findings of the study by applying mostly inductive and deductive logic to the emerging trends in research participants' stories of emergence.

In order to analyse the experiences of teacher educators in implementing the EE/ESD change project, I used the case study approach.

5.3   Case study design

5.3.1   A multiple embedded case study design

Danemark et al. (2002) asserted that a case should be studied in its natural setting since that case tends to be defined and circumscribed by the context within which it occurs. In describing the features of a case study, Robson (1993, p. 136) claimed that by its nature, case study is a strategy or an approach rather than a method or technique such as observation or interview; case study is a research endeavour; case study is empirical, in that it depends on collection of evidence about what happens; case study is about a specific concern. In Johansson's (2003) terms such a concern must be current or contemporary and be focussed on a phenomenon in context. Case study uses multiple methods to generate evidence or data generation (Johansson, 2003).

Brown and Dowling (1998) and Johansson (2003) as well as Rule and John (2011) proposed that a case can be focused on a process of conducting an investigation of a single object, single actor, a single institution, a single enterprise (such as a classroom), usually in its natural conditions so as to understand it. A case may also denote the written up artefact such as a story, or a thesis (Rule and John, 2011.). In this regard, the notion of "case" in a case study denotes a bounded entity (a person, organisation, behavioural condition, event, or other social phenomenon) but usually the boundary between the case and its contextual conditions that are dependent on spatial and temporal conditions is blurred (Yin, 2009). In this research, the case is the teacher education institution within which teacher educators

are the units of analysis (Zinchenko, 1985; Yin, 2009; Yin, 2012). The phenomenon in the case is the change project while the boundaries of the study are defined by the teacher education context in which the change project was implemented and studied.

5.4   Multiple case studies

Sayer (2000) explained that in order to understand any unit, one has to break it into its constituents, understand how each of those parts is performing, and then make linkages for a wholesome account of the phenomenon. In my design, I treated the individual participants as cases and units of analysis, about each of whom I developed a narrative in order to develop a perspective of institutional ESE mainstreaming efforts.

I chose to work with two cases of teacher education institutions in two countries in southern Africa. This multiplicity of cases was not replication because the institutions are different, have different histories that influence the way they function and are in different contexts. Furthermore, critical realism indicates that each institution and the interactions and events are likely not to be replicable (Robson, 1993). I sought to understand the interactions that constituted the change project in two institutionally unique situations with two embedded cases in institution X and one case in institution Y.   Conducting the research at more than one site qualified the study as multiple-case (Baxter and Jack, 2008; Yin, 2012). One case has two participants from the RU/ SADC International Certificate in EE course, each of whom are cases in their own right. Having a number of cases in one case makes it an embedded, or nested case study (Lotz-Sisitka and Raven, 2004; Raven, 2005; Yin, 2009; Yin, 2012). The second case institution has one participant embedded, hence one embedded case and unit of analysis as illustrated in Figure 5.1 that follows:
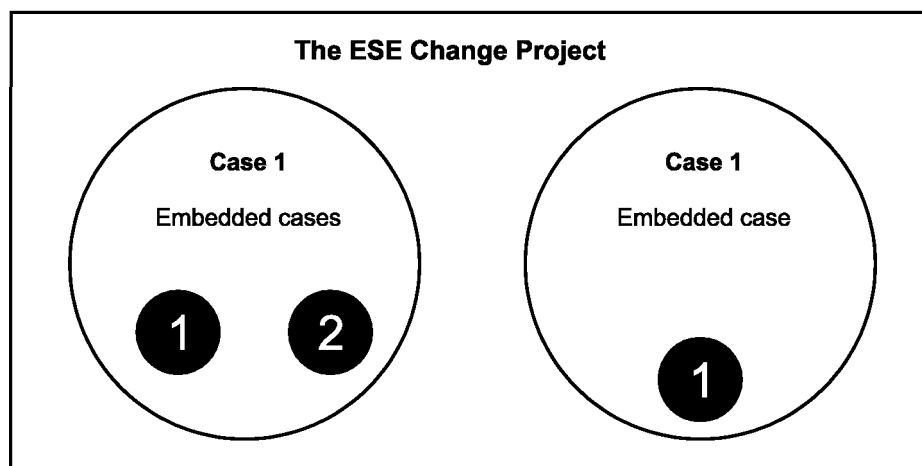
Figure 5.1: Distribution of cases in the study

In summary, I was working with a multiple and embedded case study design. The cases were similar in that they had participants who had been on the RU/SADC International certificate in EE course, who were implementing change projects and they were teacher education institutions. There were a different number of embedded cases the number of course participants from each institution varied. There were other individuals in the institutions earnestly working on mainstreaming ESE but I did not include them in the research since, even though they had participated in courses facilitated by SADC REEP, they were not participants on the particular course at the centre of this research.

Corcoran, Walker and Wals (2004) defined a case study as an appropriate strategy for answering questions about how and why, implying that a case can be used to establish the process as well as the reasons behind what happened in the process around a single phenomenon (Flyvbjerg, 2006; Baxter and Jack, 2008). In other words, it can answer descriptive questions relating to establishing what is happening or has happened or for answering an explanatory question on how or why something happened.

This research sought to establish how the RU/ SADC International Certificate in EE course prepared participants for the ESE change project implementation and how they ultimately engaged in mainstreaming ESE in their institutions. The research is partly a longitudinal study in that it starts from deepening understanding of mediated actions used on the course and follows practitioners into the teacher education institutions over at least a year after completion of the course. This case study focussed on what, how and why as explained in section 1.13.

Yin (2003) indicated that a case study is a method that investigates a contemporary phenomenon within its real life context and especially when the boundaries between the phenomenon and its context are not clearly defined and when the researcher has no control over the events. The case study method was appropriate for this study since I, as researcher, could not or had limited control of the learning that took place on the course and had little control on change project implementation in teacher education institutions.

5.5 A case as a seat of interaction of actions

Bassey (1999) referred to case studies beginning in a world of action and contributing to it, meaning that case studies are usually cases of some phenomenon, some form of action that is taken but the learning that comes out of the experience informs and enhances future similar action. In most instances what makes a phenomenon in any institution over a period of time is a mix of intentions and activities that are in relation to generative mechanisms (see section 5.2.4).

Recognising that institutions are made of groups of individuals that are constantly interacting through activities that constitute aspects of culture of institutions, Corcoran et al. (2004) and Lindegger (2006) argued that case studies enable the understanding of cultural systems of action, the interrelated activities between the actors. Bassey (1999) referred to these interactions that occur in real social life as the complexity and embedded nature of social truths. The different actors play roles in any activity or phenomenon under study and these contributions are actually sources of evidence that both deepen the understanding of the case as well as provide a way of validating the interactions in the case. It was therefore imperative that this case study research included those aspects of the context of the case that I deem integral to understanding the case(s) (Johansson, 2003).

This study went beyond isolating participants as functional units but also recognised them as part of a dynamic local cultural system of action. In this case study approach I argue for understanding of practice (Shatzki, 2001; Corcoran et al., 2004; Kemmis, 2009a; Caldwell, 2012) which implies looking at all players in the innovation (in this case EE/ESD/ESE

mainstreaming) regarding what they do, how they do it and what they think about what they do.

5.6   Selection of case institution and research participants

The Rhodes University/ SADC International Certificate in Environmental Education course started in 1997. Each year, it enrolled 14 to 15 participants from across a number of sectors and countries annually.

For this research I was not interested in the participants who were enrolled before or after my tenure as Capacity Building and Training Coordinator (see section 5.1). During my tenure, I was directly involved with coordination and facilitation of capacity development of 57 participants on the course. That means I assisted with developing ideas and planning for 57 ESE change projects. These change projects constitute my population. Of these, only 11 were in teacher education institutions. I decided to investigate course participants from 2008 to 2011. I chose this initial population from which to select the case study participants because I directly interacted with them and had copies of their portfolios so could trace their course work. However I was also mindful that change can take a very long time so I did not generate data immediately after a participant left the on-course session.

During the on-course session, I requested support from teacher educators for my research. They all agreed to be part of my research process but during change project support visits, I realised that some of the educators had changed their positions or had moved to new institutions which affected continuity of their change project work.

I identified teacher educators from six institutions who were stable in their jobs and had established themselves in change project implementation over more than a year. From the six, three institutions hosting ESE change projects were purposively selected. These cases were chosen as cost of visiting sites was high given the regional nature of the SADC REEP. Institution X, Department of Science and Mathematics Education was accessible when I went home. Institution Y was easily accessible by road from Rhodes University where I studied. I felt that the two types of institution, a university and a teacher training college, would suffice as sample institutions for this study. Three teacher educators from Institution X attended the Rhodes University/ SADC International Certificate in EE course while one

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teacher educator from Institution Y attended the course. These two institutions provided adequate information on development of the phenomenon (Flyvbjerg, 2006). I analysed four teacher education portfolios of evidence from these participants to look for enhanced competences and changed practices.

During the on-course sessions I introduced my research interest to all participants and indicated that I would be contacting them. As I developed my research proposal, I focussed on the field of teacher education and during support visits, I discussed with participants the possibility of working with them to generate research data on their change project implementation. All were willing to become research participants.

I undertook contextual profiling during support visits that were sponsored by SADC REEP, as part of my work. During these visits, I talked to the Dean of Institution X for an overview of how the faculty was dealing with ESE mainstreaming and how the institution provided enabling conditions for staff to innovate their practice through capacity development. When I visited Institution Y for contextual profiling, I met with the Rector and the Deputy Rector of Academic Affairs who both gave me information on how their college was handling ESE mainstreaming and supporting course participants to innovate their practice.

For the other institution, I wrote an email to the Dean of the Faculty of Education at Institution X to request permission and appointment for my support visit to that institution to which permission was always granted. During the discussions with institutional leadership that covered many issues on ESE support, I also mentioned my wish to conduct research with course participants in the institution. I kept in touch with research participants who were also my colleagues regarding their change projects. When I needed to generate data for this research, I wrote emails to request meetings with research participants which they readily agreed to and we set dates together.

Institution X declined my request to use the institution's name for the study. I therefore used X and Y to differentiate the institutions, despite one of them having agreed to use of the institution's name. This experience made me think more carefully about my unit of analysis. Initially, I had intended for the institution to be my unit of analysis but I then decided to make the individuals who were implementing the change project my units of analysis. In this way, the focus would be more on teacher education practice, with the

awareness though that this practice was conducted in an institutional context. Even though research participants agreed to have their names published, I decided to use codes CX, RX and LY.

5.7   Researcher position

Throughout this thesis, I have described how I was involved in implementing the Rhodes University/SADC International Certificate in Environmental Education course as Capacity Building and Training Officer at the SADC REEP. I always had two interests: one was to support implementation for the change project and the second was to generate data relating to teacher educators' experiences in implementation of their change projects. Therefore, I had to remain conscious of my engagement with research participants in their institutions and be able to isolate my two interests.

Studying my own practices in supporting Teacher Education ESE mainstreaming could have led to a tendency towards bias and the study could have lacked external critique (Lindegger, 2006). As such, I needed to implement reflexive measures such as engaging in disciplined research practices that allowed me to detach myself from my work (that I so much loved and was attached to, even after my tenure as Training and Capacity Building Coordinator), in order to critically understand it better. I also knew, however, that in order to get the most out of it, I had to immerse myself in my work. In addition there was the issue of attribution to consider: how to be sure that the practice changes that are observed are a direct, or indirect, result of the purposive capacity building processes. This led me to ongoing reflexive engagement with the goals of this study and required in-depth, detailed data engagement and analysis using multiple sources as is the tradition of case study as well as narrative research, the main methodological elements of this research (Connelly and Clandinin, 1990; Josselson, 2007; Yin, 2012).

However I understood too that my role as facilitator and researcher positioning had implications for the research design and the research process. One way of using that position gainfully was to include in my research design, a workshop that both shared and enhanced knowledge about management of change in practices (Lather, 1986b) while generating data about opportunities and challenges that teacher educators meet when they

have innovations to implement in their practice. Lather uses the term catalytic validity to represent all the support processes and mechanisms that are left behind during the research process. Catalytic validity has to be consciously considered because it rarely arises on its own during research. As stated in earlier sections, I knew that my position could give me power over the research participants and they could have felt indebted to me. However, by discussing their ESE mainstreaming processes, participants felt that my role during the data generation process was as supportive as it was during my tenure as Capacity Building and Training Coordinator. Therefore this research process continued to engage the community of practice in similar ways to support visits as I first engaged in data generation and then took time to engage reflexively with participants on ESE mainstreaming issues.

5.8 Case study protocol

In order to organise the research process more clearly, I developed a set of steps and procedures that I was to follow, a case study protocol (Yin, 1994; Maimbo and Pervan 2005; Yin, 2009). After determining my research problem and research questions, I had to identify the unit of analysis. I realised that teacher educators' experiences were part of institutional practice, hence my unit of analysis was course participants' practices in institutional contexts. This focus worked well.

I wrote down the data generation methods I was going to use and these guided me regarding information I required from research participants (Flyvbjerg, 2006). I also decided which cases to start with and when. I was able to set the dates sufficiently far apart for me to transcribe interviews from the first case before I generated more from the second case. I established time scales for finishing interviews and workshops and plans for piloting interview guidelines. Fortunately, one course participant who was not my research participant was willing to pilot the interview guide. While developing research instruments I had to work on literature review, to ensure clear association with the line of argument (Maimbo and Pervan, 2005). The literature review raised concepts that enabled me to better understand the phenomenon under study and to raise relevant questions for the study.

During the transcription phase, I had to do a preliminary analysis, a process that helped me understand my data better and decide whether I needed to return to the field to generate more data.

5.9 Data generation techniques

If data is material that is richly related to its context (Terre Blanche et al., 2006), the techniques of getting this material together must not disrupt the context in which the material is produced. That is to say, data generation techniques must be as naturalistic as they can be. In this study, data was generated from documents using document analysis, from people in interviews and from interactions between people via observations.

5.9.1 Document analysis

Using inductive and abductive approaches as outlined above (see Table 5.1), I systematically reviewed documents to gain an understanding of the concepts and skills that course participants were using, in accordance with the course outcomes of the Rhodes University/ SADC International Certificate in EE (Bowen, 2009). This meant I had to look into course portfolios of evidence, which were at the time of this research already historical records of the participants' involvement on the course. I sought to establish the content or deeper meaning of participants' development of knowledge and skills pertaining to ESE well as evidence of their developing agency by looking at their style and their coverage of concepts and skills set out in the course curriculum (Mogalakwe, 2006; Strydom and Delport, 2011).

I chose this technique because I wanted to follow up on those periods of the change project that I could not observe (Prasad, 2008; Bowen, 2009). Documents in the portfolio of evidence provided me with knowledge of abilities of participants that they could use in their institutional and teacher education practice. Documents presented both the historical artefacts of what happened and evidence of the course processes and research participants' experiences. Document analysis helped me to follow up on some of the evidence while constructing the narrative based on participants' accounts of their experiences. I analysed content (Mogalakwe, 2006; Prasad, 2008) on the presence of emergent properties (Archer, 1995; Lindley, 2014).

I analysed Portfolios of Evidence (PoEs) of the three research participants. This analysis enabled me to relate participants' practices in their workplace to any of the abilities or traits they seemed to have developed on the course. I also analysed some of the documents they produced in their work, such as syllabi, assignments, tests and teaching guidelines that I had collected during the data generation process, together with other institutional documents. Looking into institutional documents enabled me to gaze into the congruence of their institutional practice with intended outcomes of the course, as part of triangulation of the research (Bowen, 2009). It was appropriate to analyse documents in the PoEs compiled by participants since the documents represented the reality of the participants during the on-course sessions (Hsieh and Shannon, 2005; Maxwell, 2012a). The PoE had the final assessed assignment write-ups and a report of the individual's learning experiences in the regional knowledge exchange group. Table 5.2 below shows contents of the PoEs and their purpose in the study.

Table 5.2: Documents of the Portfolio of Evidence that were analysed

Document (acronym)	Contents	Purpose of analysis was to establish
PCA	Pre-course assignment write-up	Emergent properties stimulated by Pre-course assignment
A1	Assignment 1 write-up	Emergent properties stimulated by Assignment 1
A2	Assignment 2 write-up	Emergent properties stimulated by Assignment 2 with focus on teaching and learning methods
A3	Assignment 3 write-up	Emergent properties stimulated by Assignment 3 focusing on planning for collaborative and democratic practice and evaluation
RKE	Assignment 4 write-up	Emergent properties stimulated by working on group small directed choices

5.9.2   Change Management Reflective Workshop

Lather (1986a; 1986b) argued that the research process must, through its inherent processes, enable research participants to better understand their reality in ways that help them to transform it. By recognising research as praxis, the research process must be consciously set up as an emancipatory project for the research participants. During my literature search, one concept I found relevant was Change Management (see section 2.2.1). I decided to engage research participants in a workshop on reflexive change management in order to support participants with the process of managing change relating to change projects and also to generate data for the study through focus group discussions (Rule and John, 2011).

The workshop was framed to support participants to note that social change is a multifaceted and complex process, so they needed to be able to manage change processes. Such emancipatory knowledge increases awareness of misunderstandings in practice (Lather 1986a). This knowledge may lead to positioning which is the root of agency and social action (Archer, 1995; Stetsenko, 2008). My hope was that the workshop touched on those aspects that negatively affected change project implementation that participants would explore on their own.

The workshop had four phases: a lecture presentation; plenary discussion on local examples of change and how it was managed; a focus group session where participants responded to questions related to any curriculum changes introduced into their practice, including change projects (how they were introduced, how they were sustained, how they were received and how they were progressing); and finally, participants had to suggest how to work with challenges and opportunities that constituted change management (see Appendix 11). These suggestions could support the current change projects and provided ideas on how future change projects could be introduced for better effect. Suggestions and ideas were written onto a flipchart before presentation in the final plenary phase. Figure 5.2 below shows photographs of two of the flip charts that were used to record outputs of the discussions.
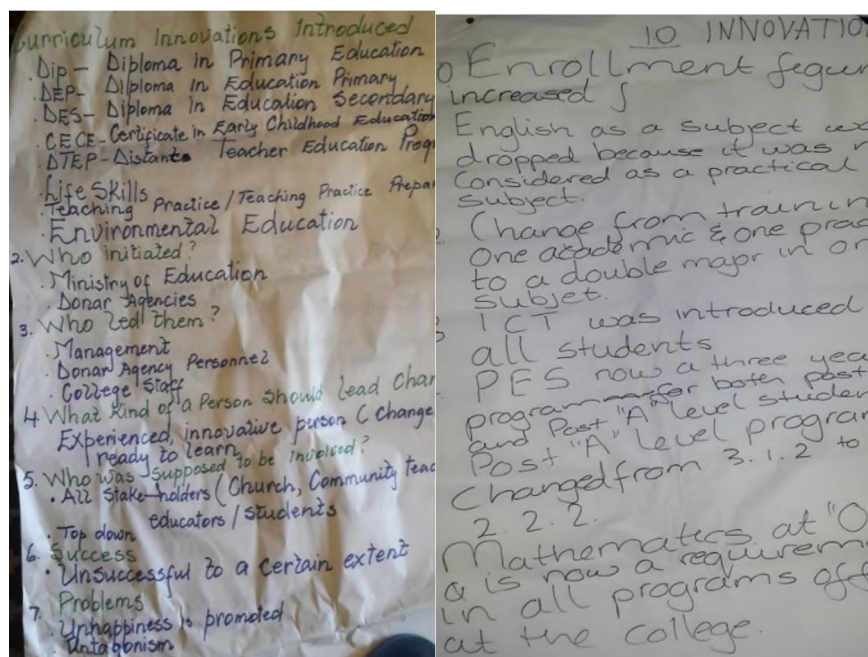
Figure 5.2: Extracts from flip chart records of outputs of the group discussions

I also conducted a reflective change management workshop with lecturing staff from each of the teacher education institutions involved in the study. Change management workshops included research participants, some members of their faculties or departments and some colleagues who were not necessarily in the ESE community of practice. Some participants attended the workshop because they were keen to hear about ESE. All were involved in teacher education and interested in the institutionalisation of the change projects; thus they shared common interests and goals which is important for successful focus groups (Kreuger and Casey, 2000). Interviewees shared their subjective and intersubjective experiences on implementing innovations into their curriculum. Those who were involved with the change project shared reflections on their subjective and intersubjective experiences of the change project (Terre Blanche, Durrheim and Painter, 2006) and suggestions were made in the workshop to collectively support change projects. Focus group discussions during the workshop were used to triangulate data generated from individual interviews, observations and from analysing Portfolios of Evidence (PoEs). Institutional leaders could not participate in the workshop but they agreed to be interviewed in their offices. A workshop was conducted in each of the two case institutions.

5.9.3   Semi-structured interviews

I used semi-structured interviews as a major data generation tool to complement document analysis. Some researchers, such as Connelly and Clandinin (1990) propose the use of unstructured interview in narrative; during my piloting I found, however, that unstructured interviews lacked focus (Clandinin and Huber, 2002). Thus I used semi-structured interviews but I also asked the research participants to narrate their stories of experience, their 'lived stories' (Rule and John, 2011). I asked participants to share their own experiences of how the change project was institutionalised at their workplace (see Appendices 9 and 10).

I conducted semi-structured interviews with colleagues of research participants in the case institutions as well as people in the wider community of institutions that work on ESE. By using interviews, which, according to van Manen (1997) and Greef (2011) are a naturalistic approach, this research enabled me to understand the change project experiences from the participants' points of view. I also considered van Manen's (ibid.) assertion that the interview and interview process would engage me and the interviewees in a conversation that deepened the meaning of the experiences. It was during these personal interviews that research participants asked me questions on the challenges they faced during change project implementation.

In each case institution I conducted an interview with the participants, at least two colleagues of the participant and a manager or more senior colleague of the participant. I used a voice recorder to tape the recordings. Individually, participants were interviewed on their learning on the course and how the processes of the course supported their agency.

Four course tutors were also interviewed on how the course experiences could have enhanced learning on the course, and how in their view the course prepared participants for workplace-based learning and agency as well as for critique of their own practices. Tutors set up the course curriculum, implemented the activities and were able to articulate and interpret the objectives of the course. Input from course tutors especially during the contextual profiling phase and early phases of the data generation process helped with construction of the research instruments. I used semi-structured interviews in all cases as these made it easy for me to analyse the data for the initial phases of analysis. I interviewed four tutors from Rhodes University and SADC REEP, the partnering institutions in conducting

the change project course. I also interviewed eight people including research participants in Institution X and six people in Institution Y detailed in Table 5.3 below.

Table 5.3: Interviews conducted to generate data for the study

Interview	Index code	Date	Purpose was to establish
Tutor 1	TUT1	20/03/2013	Purpose of the course, how it was framed, why it was conducted the way it was and perceived strengths and weaknesses
Tutor 2	TUT2	28/03/2013	Purpose of the course, how it was framed, why it was conducted the way it was and perceived strengths and weaknesses
Tutor 3	TUT3	16/04/ 2013	Purpose of the course, how it was framed why it was conducted the way it was and perceived strengths and weaknesses
Tutor 4	TUT4	05/05/2013	Purpose of the course, how it was framed, why it was conducted the way it was and perceived strengths and weaknesses
1-participant at X	CX	02/06/2013	Experiences and reflections on reflexive implementation of the change project
2-participant at X	RX	03/06/2013	Experiences and reflections on reflexive implementation of the change project
3-participant at Y	LY	02/09/2013	Experiences and reflections on reflexive implementation of the change project
4-supervisor at X	XS	17/02/2013	How the institution dealt with curriculum initiatives and how it was responding to the change project
5-supervisor at Y	YS	02/09/2013	How the institution dealt with curriculum initiatives and how it was responding to the change project
6-colleagues and members of CoP at X (1-6)	XCO (1-6)	4-5/ 06/2013	How the participant was engaging with members of the CoP and the ESE discourse inside and outside the teacher education institution
7-colleagues and members of the CoP at Y	YCO (1-7)	3-5/ 09/2013	How the participant was engaging with members of the CoP and the ESE discourse inside and outside the teacher education institution

5.9.4   Participant observations

Observation entails taking note of things as they happen. Strydom (2011) and Kothari (2004) saw observation as a way of generating data that is guided by a research question and includes the procedure of recording and observing natural conditions, events, feelings, physical settings and activities by looking rather than asking. I conducted participant observations of course participants doing their work in order to discern any changed practices that support ESE (Terre Blanche et al., (2006); van Manen, 1997). I observed lessons taught by participants as well as their colleagues. My interest in observing research participants during lesson delivery was to identify any changed ESE related practices that could be ascribed to the change project and the course in the community of practice. These observations were then related to the course and change project contributions that were raised during interviews. I used the observation data to triangulate the data generated in interviews (Bowen, 2009). I observed one lesson delivery for each participant to discern any competences I deemed relevant to ESE mainstreaming and followed these up in a report-back discussion with the participant. I did not analyse these observations but I used the observations to discern the ESE discourse in the lessons in relation to emergent properties that came out of the course and during semi-structured interviews. Table 5.4 below shows the list of observations made for the study.

Table 5.4: List of participant observations made

Observation	Index	Place	Date	Reason for observation was to establish
1. Classroom	LYO	Institution Y	02/09/2013	Any practices or actions relating to ESE competences
2. Classroom	MYO	Institution Y	04/09/2013	Any practices or actions relating to ESE competences
3. Classroom	MX	Former student of Institution X who lectures at affiliated TE institution and is keen on ESE and attended ESE courses	15/09/2013	Any practices or actions relating to ESE competences

5.10 Ethical considerations, validity and reliability

5.10.1 Ethics

Ethics are a set of moral principles suggested by an individual or group, which is subsequently widely accepted, and which offers rules and behavioural expectations about the most correct conduct towards research subjects and respondents (Thrift, 2003; Strydom, 2011). Jickling, Lotz-Sisitka, O'Donoghue, and Ogbuigwe (2006) as well as Possel and Ross (2015) used the term 'ethical quandaries', because ethical issues are not linear but multifaceted in reality. Possel and Ross (2004) thought the reality of research had 'ethical conflicts and conundrums' that often pose challenges for the researcher and the researcher has to respond to them. The following section reflects on some of the issues I responded to in this research.

5.10.2 Informed consent and voluntary participation

As detailed in earlier sections of this chapter, I was deeply involved with development of the change project implementation plan during the on-course session. I approached course participants during this time to request if I could work with them to generate research data on implementation of the change project. When they returned to their workplace, I wrote them letters reminding them of my request. I indicated that should they not be interested in the process they were free to withdraw. All the participants were willing to participate.

I provided information on the details of the research and particularly its requirements in order to enable them to decide whether they would wanted to participate (Yin, 1994). Research participants then formalised this agreement by completing forms to indicate their informed consent (see Appendix 7). I requested permission from their institutions too, to conduct the research in the institution (Strydom, 2011; Terre Blanche, et al., 2006). Section 5.6 contains details of my compliance with informed consent and voluntary participation. All respondents, whether they participated in the research individually or in a group, completed consent forms as evidence that they were well informed of the research before they got involved and were not forced to participate. All discussions during the workshop were confidential and were only used in this research.

5.10.3 Avoidance of harm

In my initial informative letters I explained that I would carry out interviews in order to explore how change projects were being implemented. This guided them on what I was expecting them to share with me. Preparing them for data generation in this way avoided any physical or emotional harm. Information generated with participants was kept anonymous in order to protect the confidentiality of research participants (Strydom, 2011; Terre Blanche et al., 2006). To further protect research participants, I made both teacher education institutions anonymous by referring to them as Institution X and Y, and I used codes to identify research participants.

5.10.4 Beneficence

My belief is that research participants benefitted from reflexive engagement with their own work during data generation as well as from reflections on their work that came out of processing of the data. My hope is that research participants were able to continue to reflect on and refine their strategies for change project implementation (Terre Blanche et al., 2006). In addition, the change management reflective workshop that helped me to triangulate ESE mainstreaming data from a group provided catalytic validity to the participants, to their colleagues and in some cases to the change project implementation process.

5.10.5 Debriefing sessions

After observation sessions and interviews with members of the community of practice, I made time to sit down with participants to share my emerging reflections on their change project implementation process as part of catalytic validity. This de-briefing session I hope helped participants to understand better the context in which they were implementing the change projects (Strydom, 2011). Interview transcriptions were shared with participants in order for them to comment. Research outcomes were also communicated to participants for member checking.

5.10.6 Validity or trustworthiness

According to McCabe and Holmes (2009), validity refers to the accuracy of what is being measured. In qualitative research the term 'trustworthiness' is preferred and refers to the authenticity accuracy of information and the interpretation of the data collected. Botes (2003) regarded validity as the best account of truth of a phenomenon while Yin (2009) noted that validity includes some of the key features determining quality of research: trustworthiness, dependability of the data, believability and confirmability of the data and research results. Terre Blanche et al. (2006) and Grbich (2004) suggested considering validity threats, the extraneous factors that can influence the outcome of the study and interpretation of results. Danemark et al. (2002) argued that in critical realist and realist social theory research where empirical phenomena are transcendental (phenomena that are influenced by time and space), the notion of transfactuality helps in validating data. This implies the study needs to use multiple methods to generate data, *critical methodological pluralism*, and also use all the modes of inference to make meaning of the data: deduction, induction, abduction and retroduction as used in this study (Danemark et al., 2002) (see section 5.2.4).

Yin (2009; 2012) identified four different ways to measure trustworthiness of data collected: construct validity, internal validity, external validity and reliability. The order, depth and relevance of theoretical concepts guiding thoughts and processes of the research, construct validity, is one such measure. Botes (2009) termed this theoretical validity. Building from the contextual profile to data generation, I carefully and systematically considered and put together concepts that developed my line of argument in relation to my research questions so as to enable research data to illuminate the phenomenon more clearly (Lather, 1986b). To this end the conceptual framework continued to develop across the period of the study. Constant reference to the theoretical framework guided development of questions used in research tools, handling of research tools during data generation and the approaches I used to conduct data analysis.

Internal or face validity also implies credibility of the whole research process (Lather, 1986b; Yin, 2009; Botes, 2003). Maxwell (2012a) argued that in critical realism, truth cannot be objectively defined in one way but through a variety of perspectives. In order to increase

trustworthiness of my study, I studied an extended period of participants' involvement with the change project course and mainstreaming of ESE in their practice. At the time of data generation, my involvement with research participants and the change projects was for at least two years and at most five years, including a period where I supported the change project implementation as part of my work. In addition, data generation techniques included document analysis of portfolios of evidence for the on-course phase as well as observations of the research or course participants at work and interviewing these participants and members of their community of practice. Data generation was only a small phase of my involvement with the change projects (Botes, 2003).

I recorded interviews using a voice recorder and transcribed them. After transcription I sent the interview scripts to research participants for their input. They were asked if the transcript appeared to be a correct record and if they happy with what had been recorded (Botes, 2003). Research participants either added details or changed some detail. One example is an interviewee who, at the time of the interview, indicated that the institutional leadership had different ideas on one change project. But when I sent the interview transcript, he changed this, indicating that the leadership had taken on board teacher educators' initial ideas, had supported them and teacher educators were involved in the institutional change project. I then asked their colleagues who confirmed the new development.

Working with a transcript supported my quest for descriptive validity (Maxwell, 2012a) because I would be using my analytical lens on the transcript, which was the actual record of the conversation. Having two research sites or cases facilitated some level of triangulation of the phenomenon of the change project implementation (Lather, 1986b; Botes, 2003; Yin, 2009) even though triangulation of cases is problematic, since no two cases have identical conditions. In addition to interviews that were my main tool for generating data, I conducted a workshop in each case institution. I used document analysis to establish changed practices as evidence of mental development on the course and back in participants' institutions.

I responded to the challenge of external validity or transferability by choosing and focussing my research in the field of teacher education and specifically on implementation of the

change project (Lather, 1986b; Botes, 2003). Transferability of this research is therefore easily possible in reference to change projects and teacher education. My research results revealed my views on the nature and meaning of a particular form of capacity development and change project implementation (see Chapters 6, 7 and 8). This research can only be used by people in similar contexts who want to understand similar phenomena (Connelly and Clandinin, 1990).

Lather (1986a; 1986b) argued that the research process must leave research participants more enlightened on the phenomenon. This she termed 'catalytic validity' and also highlighted the importance of considering research as praxis. Lather (1986b, p. 67) referred to catalytic validity as "the degree to which the research process re-orients, focusses and energizes participants in knowing reality in order to better transform it". At the same time as requesting accounts of practice during data generation, participants also asked reflexive questions on areas of their ESE practice that they wanted to probe further. I used my experience as Capacity Building and Training Coordinator and my experience with change projects to facilitate reflexive discussion with research participants.

5.10.7 Reflexivity in the research process

The notion of reflexivity relates to how one conducts the research and manages the research process, recognising that research is a social process where real humans interact in many different ways that may influence the validity and trustworthiness of data generated and subsequent analysis of the generated data (O'Gorman and MacIntosh, 2015). According to Watt (2007) the researcher is the primary tool for data generation and this means the researcher must all the time take careful consideration of the phenomenon being studied and always question how his/her own assumptions, actions, values and perceptions impact upon the research setting and can affect data collection and analysis. Knowledge of reflexivity enabled me to constantly reflect on how social interactions between me as the researcher and research participants impinged on the research process and nature of the data generated. I always noted with concern that I was researching the work that I had passionately contributed to and had always looked forward to successful implementation of change projects; this could affect the validity of the data generated. I was conscious of the

potential of my subjectivity to lead me to look at only one side of teacher educators' experiences.

I found it important to also think of the change projects as our co-construction, between the participants and myself as a member of SADC REEP. However, I had to consciously and reflexively focus the study on the processes that influenced the experiences. It was a challenge to separate the passion in my work from the research; even though I was no longer in the same employment some participants still needed support with their change projects. But I had to be cognisant that at the same time I had to support participants to do better and not employ an extractive method of generating data, I had to look at the implementation process as it was without being influenced by my own subjectivities (McCabe and Holmes, 2006; Mruck and Breuer, 2003). As pointed out in earlier sections, during data generation I had to distinguish between what constituted change project implementation and support and research data generation. I had to be consistent with my mentor and researcher roles in order to easily and conveniently move across these roles during data generation. I also had to remain conscious of my roles in order to distance myself from the data and reduce my subjectivity during data analysis.

Thinking through the notion of reflexivity, I focused reflections on my relative ability to be cognisant of my subjectivities while also recognising and considering the effect of my existing subjectivities on the research (Cluver et al., 2015). This meant I had to be aware of how my presence affected the research process and participants, as well as how the participants affected me in ways that influenced and transformed my assumptions and beliefs in post-course change project interactions, how the research process affected research participants and consequently, the research. It was useful to bear in mind that the research was influenced by my personal attributes, the research participants, the methods of data generation and approaches to data analysis. I reminded myself constantly of the processes of the research, including recognising participants as co-generators of data rather than sources of data and always considered about how my relationship with them could influence the data generation process (Swartz, 1997). For example, during data generation, one interviewee gave short answers making it difficult for me to find useful information. I requested a second interview to which she agreed and then confessed that she had not been in the mood to talk that day. She thought I was going to pester her with questioning

and had only come to the interview because she did not want to disappoint me. If I had proceeded with data generation on the first day, the data would have been scant and difficult to work with, and its validity and reliability would have been jeopardised.

Price (2013) suggested that reflexivity should enable a researcher to think about appropriateness of the research methods and research tools. Before the actual data generation, I worked on the conceptual and theoretical frameworks for this research. These gave me a gaze with which I could look at the items and particularly for document analysis. I piloted the interview questions with two former participants of the same course. I was able to refine the questions and question some of my assumptions on the questions that I developed.

I valued the supervision I was given during the research process. I was constantly reminded to refer back to my research questions during the process of analysing data. It is important to note that the researcher is an "'embodied', situated and subjective researcher carrying out the analysis" (Mauthner and Doucet, 2003, p. 414). At times I realised a tendency to be carried away by the data, not realising that the data, theoretical framework and research questions were reflexively interconnected (Mauthner and Doucet, 2003). With supervisory support, I was able to constantly reflect on how items in the research instruments were responding to the research questions and to the social realist theory that was guiding my research process. In addition, through supervision, I was able to avoid being too eclectic, or accumulating concepts that were not coherent. Supervision enabled me to see the role of the under-labourer, particularly the influence of social realism and how most of the research processes in my study depended on it.

5.11   Generalisations on case study work

Danemark et al. (2002) asserted that a critical realist or realist social theory case study is the most appropriate for understanding structures, mechanisms, powers and tendencies. They also claimed it is possible to generalise a case study to the level of structures, mechanisms, powers and tendencies. This study was conducted in the SADC region, with similar teacher education as well as environment and sustainability contexts. Therefore, the study has potential for generalisation since the teacher education as well as environment and

sustainability contexts across the region are similar.   Danemark et al. (2002) also suggested that inductive logic used in such case study approaches has potential for generalisation. Lindegger (2006) and Flyvbjerg (2006) added that case studies can be used to investigate phenomena around individuals and that they are usually descriptive in nature in order to generate rich longitudinal information about individuals, patterns of behaviour of research participants, and their lives and their institutions. Stake (1995), Yin (2009) and Bassey (1999) concluded that case studies tend to be introspective and grounded within one institution and lacked detail to learn from; Bassey (1999), however, thought that case studies allow generalisations about an instance or from an instance to a particular class.

Rule and John (2011) thought generalisability of case studies depends on their purposes. They went on to suggest that educational case studies tend to be conducted both for the interest of understanding the individual cases (intrinsic) and also for being able to understand the phenomenon more broadly (instrumental). This research falls into both an intrinsic and instrumental research because I researched the ESE change projects for their own sake but I also had interest in making inferences to ESE change projects at a broader scale.

Regarding generalisation, Cohen and Manion (1989, p. 124) wrote: "… the purpose of such observation is to probe deeply and to analyse intensively the multifarious phenomena that constitute the life cycle of the unit with a view to establishing generalisations about the wider population to which that unit belongs."

Generalisability according to Cohen and Manion (ibid.) was possible only when the phenomenon under study could be applicable to people in similar institutions and in similar positions. Connelly and Clandinin (1990) argued for and illustrated how transferability is a better concept to consider than generalisability. This research involved individuals trying out ways of mainstreaming education for sustainable development in teacher education. The research outcome was therefore useful for individual teacher educators in similar teacher education institutions. Institutions are never the same, however, and the study can therefore not be used to generate general theories but could point out possibilities for ESE arising from experience of course participants (research participants, see Chapter 9). To this end Corcoran et al. (2004) thought that if documented and described to depth despite their

lack of generalisability (Yin, 1994), case studies can have transformative value to others. Ruddin (2006, p. 1) added that "case studies need not make any claims about the generalisability of their findings but rather, what is crucial is the use others make of them – chiefly, that they feed into processes of naturalistic generalization".

The case study method in this research facilitated social interactions that enabled research participants, the researcher and the readers to mirror their practices and experiences with the case; this means that each case has the potential for transformative power. Corcoran et al. (2004) noted that a case study allows questions to be raised about how things happened and why they happened that way, "with regards to what may be important for similar situations" (p. 10), positing the potential for greater application of case studies especially through providing a mirror of possibilities.

Paying careful attention to these processes enabled me to develop a clear and coherent narrative of the data on emergent properties, experiences and processes in the cases. These precautions were requisite for developing the story of the change project in each institutional case (van Manen, 1997). Using a number of sources and instruments strengthened my case (Yin, 2003). By paying attention to these attributes, the case study therefore provided a platform for revealing the multiple factors that interact to produce the object in question, that is, change project implementation and mainstreaming of ESE and insight into mechanisms, which provides a platform for generalisability in critical realism research.

Recognising that institutions are different and have different ways of working with environment and sustainability issues, I did not expect the same ESE mainstreaming processes for the different cases prior to the research. Some of the differences were already evident during my change project support visits to the institutions. For that reason I did not seek to compare the findings from the three cases but simply reported on the practice and learning experiences that happened in each. In my view these were the more widely applicable elements of the cases on how an ESE change project can be a source of expanding learning in capacity building for ESE and how a change project can be implemented, being led by individuals, in teacher education institutional contexts.

5.12   Data analysis

5.12.1 Mode of inference

The four modes of inference (see Table 5.1) were useful in this study. In order to infer teacher education practices as emergent properties subsequent to course interactions, I used inductive and abductive reasoning. *Inductive* inference is that mode of reasoning that is derived from conclusions from repetitive results and tends to generalise (Danemark et al., 2002; Hammond and Wellington, 2013). I used induction in this research to consolidate the trends shown by the stories of emergence (see Chapters 6, 7 and 8). In order to make meaning of the data, to explain the formation of capabilities, competences and agency, in relation to the under-labouring critical realism and realist social theory, to derive emergent properties from the data, I used *abductive* reasoning. The abductive mode of inference allowed me to frame interpretation of the data, drawing on the notion of emergence and emergent properties, in order to explain the change project process over time (Danemark et al., 2002). Abduction is a mode of inference where an empirical event/ phenomenon is related to a rule in order to come up with a new supposition (Danemark et al., 2002). Danemark et al. (2002) argued that abduction enables the researcher to move from a conception of something to a deeper understanding through placing and interpreting the phenomenon in a frame of a new set of ideas. In this study, conceptions of practices were interpreted using emergent properties (SEPs, CEPs and PEPs). This process gave new meaning to data.

The following sections illustrate how these inferences were made to discern emergent properties from the data.

5.12.2 The analytical framework

Data analysis was framed as shown in Table 5.5 below. Structural Emergent Properties (SEPs) and Cultural Emergent Properties (CEPs) properties were discerned from on-course materials through document analysis and change project implementation through observations and interviews. Emergent properties were used to describe the competences and capabilities developed as well as the practice and agency.

	Mediation				Mediation: Course and its process (course design and practice centred expressed through course history and purpose)	Habitus and practice	Competences and capabilities	Agency
	Med 1	Med 2	Med 3					
	Context and Issues	Methods and Practices	Practices	Working in CoPs		Starting point/ what people bring	Competences: -policy -pedagogy -networking Capabilities: -valued beings and doings in the institutional context	Strengthen and enable agency for change
	Emergent properties							
Pre-Course assign	SEPs CEPs PEPs							
Assign 1								
Assign 2								
Assign 3								
RKE Group								
Change Project Implementation								
Extended ESD activities emerging from CP								
ESD Roles in Institution								

Process of mediation

5.12.3 Constructing 'emergent stories of emergence'

Induction was guided by the purpose of the Rhodes University/ SADC International Certificate in Environmental Education course that was established and conducted in order to enhance individual and institutional agency and subsequent institutional practice in mainstreaming environmental education and education for sustainable development. It was

presumed that the course would contribute to participants' changed practices for ESE. As consistently referred to in earlier chapters, the course was structured to enable participants to develop a change project. The change project was a tool designed to enable the course to engage with personal, individual and institutional practice by mediating interactions at T2-T3 of the morphogenetic cycle of change project implementation. Mediation practices conducted at respective stages of the course, starting with the pre-course assignment included in-depth facilitation into assignment activities, lectures, excursions, practical experiences and assignment write-ups that tended to consolidate epistemic understanding of the unit or stage. At the same time the participant was encouraged to position her/himself conceptually, contextually and consider the actions that could be taken in relation to the concepts developed, experiences undertaken and the change project that was being developed.

The interest of the study was to find those features shown by the participant to have arisen from interacting with the course processes, across the length of the course, from the pre-course assignment to change project implementation in the workplace. Retroductive inference was used to establish conditions, most of which were not visible at the actual and empirical domains of reality but are the pre-conditions for events and experiences at the actual and empirical domains (Danemark et al., 2002). The assumptions were that the emergent properties observed were an outcome of interactions of course processes and other underlying mechanisms both at the workplace and during the on-course period. Some of the mediation activities on the course span across the course, and across the change project. The research question focused on establishing how these mediated actions on a regional Professional Development programme and the workplace influence competencies, practice, learning and agency in Teacher Education for Sustainable Development (TESD) Change Projects (Mandikonza, 2012). It sought to establish features that emerged from course interactions and that influenced practice and learning by respectively constituting capabilities and competence as well and agency (see section 1.13).

In order to answer the research question, realist social theory, particularly the work of Margaret Archer (see Chapter 3) was deemed appropriate for this study as this allowed me to analyse the emergence of features or characteristics of practice that were influenced by and tended to influence structures, cultures and agency. Realist social theory posits that

what we see in society are features or properties emerging from interactions of underlying causes in a real world as explained in some detail in sections 3.3.1. The properties appear and can be narrated as real phenomena (Archer, 1995). To this Stetsenko (2008) added that emergent properties that reflect the real come to be narrated, and if narrated, the person uses agentive grasp, the ability to express one's agency because one is experiencing the real world and seeks to employ the agency in that real world.

Assignments and interviews were regarded as course participants' narrative representations of experiences in a real world, but each narrative itself was regarded as emergent from the course. This research sought to establish emergent properties, features or characteristics that arose due to the individual course participants being involved in course interactions as attributes of individual and institutional practice. My analysis of the documents was based on the four outcomes of the course (see section 4.11). I used the four features to decide on structural, cultural and people emergent properties which were in a way categories for my data (Bowen, 2009). I then looked into whether each participant responded to the demands of the task on that category. By describing the characteristics of content (Prasad, 2008) I related what they could say and do regarding expectations of the course. What participants said and did was used to establish their mental preparedness for ESE mainstreaming at their workplace, especially how they made sense of these aspects of the course (Chondracki, Wellman, and Amundson, 2002).

The following sections present how the emerging stories of emergence of attributes of teacher education practice in relation to the course and education for sustainable development practice were discerned from the data.

5.12.3.1   *Summary of emergent properties used in analysis*

5.12.3.1.1   Structural emergent properties

Structural emergent properties can be observed in relation to human and nonhuman material resources such as rules, regulations and guidelines, in addition to situations where the interactions result in further rules, regulations and guidelines (Archer, 1995) (see section 3.8). Structural properties predate human action but some emerge from human interactions. The study recognised the existence of an intransitive domain of social reality and participants' ability to influence social practice, and focused on those aspects that could

change due to course interactions (King, 2001). The research also delved into the ability of course participants to appreciate relationships between the policies and teacher education practice at the same time as recognising policies as structural features through whose interactions practice was influenced. These policies therefore operate at the level of the real and actual domains (Bhaskar, 1979; Tikly, 2015). In other words, teacher education practice is seen and understood as a phenomenon emerging from interactions of structures. Structural emergent properties derived from the data include the ability to identify policy and its relevance and the ability to locate a change project in a specific course framework.

5.12.3.2 Cultural emergent properties

These denote the ability of the research subject to take note of and appreciate features or attributes that arise from or result in interaction between people (Archer, 1995; Tikly, 2015). The research looked for the ability of the subject to identify any phenomenon that related to people-people interactions in context. Examples of cultural emergent properties included teaching methods such as field visits, networking via communities of practice and use of technology.

5.12.3.3 People emergent properties

These were characteristics that enabled the participant to show representation of the personal nature of interactions and relations. In addition, they recognised that a person exists in a society with other persons, so whatever decision is taken tends to influence how that person interacts with other persons (Archer, 1995). In this case, whatever the teacher educator or research subject decided, would influence interactions with other colleagues (especially teacher educators) and students. PEPs observed included reflexivity, ability to deepen knowledge, ability to appreciate and select more sustainable practices, criticality, increased tendency for social justice sensitivity and ability to work with others in a team.

5.12.4 Summary of expected emergent features of each assignment

5.12.4.1 Expected emergent properties from the pre-course assignment

The pre-course assignment facilitated participants to show their ability to reflect on their practice in relation to ESE by constructing a contextual profile of their workplace, the medium in which they practiced, and by identifying issues that influenced institutional and individual practice. This knowledge was necessary to develop an institutional change project

that they would conduct in that same institution. This is not to assume that participants did not have these features before they came to the course. The research was interested in establishing those features that were evident from the narratives.

5.12.4.2 Emergent properties from Assignment One

Assignment One expected participants to show ability to identify and prioritise an environment and sustainability issue that they wished to tackle for their change project, in their institutional practice, together with colleagues and the wider community of practice. They were expected to show their deepened understanding of the issue through its causes, effects and impacts. Ability to identify examples of current sustainable responses to that issue and recognition of more sustainable options were expected.

5.12.4.3 Emergent properties from Assignment Two

The second assignment recognised the role of education as a response to environment and sustainability issues. To this end, it was meant to support participants to demonstrate their ability to identify relevant teaching and learning methods and show deepened knowledge about them, including discussing their linkages to particular educational theories. Participants were expected to show appreciation of teaching methods as tools for mediating for better learning and for mediating more sustainable alternatives on the change project.

5.12.4.4 Emergent properties from Assignment Three

This assignment came at the end of the on-course session and was the last assignment that prepared participants to implement their change projects in the workplace. Having shown their ability to understand environment and sustainability issues and concepts more deeply in the first two assignments, and having demonstrated their ability to select and justify appropriate teaching and learning methods for use in the change project, this third assignment expected participants to demonstrate their capacity for planning for implementation of the change project. Participants needed to show capacity to visualise the whole change project and its reflexive implementation in the workplace in detail. They had to show that they thought about existing opportunities in programmes in the institution, capacity to identify existing policies that justify and support existence of the change project and mainstreaming of education for sustainable development in their institution. The participant had to be able to see the value of and capacity to think of opportunities of

working with other individuals and groups to develop or improve a community of practice in teacher education practice. The participant had to show ability to think of appropriate approaches to monitoring and evaluation of the change project implementation process.

5.12.4.5 *Emergent properties from the Regional Knowledge Exchange group*

The Regional Knowledge Exchange (RKE) group was meant to enable participants to develop skills that were part of the course and would be useful for change project implementation but were not formally taught on the teaching programme. Participants were organised in four groups where they mostly learnt from each other but at times with support from tutors. The group themes changed with the years but included the EE/ESD in Higher Education; Photography and video; EE articles and newsletter, Monitoring and Evaluation as well as ICTs in ESE. Participants were expected to demonstrate proficiency in the skills of their particular group.

5.12.4.6 *Emergent properties from change project implementation*

Change project implementation was the final phase of the course that was conducted by the participant back in the teacher education institution. Participants were expected to show ability to mobilise their institutional leadership, their colleagues and wider communities of practice to implement the change project as part of their practice in the institution. Participants were expected to demonstrate reflexive implementation of their change project by showing ability to use institutional policies, taking advantage and making use of institutional priorities and existing programmes to mainstream education for sustainable development into their practice through the change project. They were expected to show ability to deal with practical and intimate aspects of mainstreaming education for sustainable development, a feature which called on their agential properties, particularly to show their ability to take leadership for environmental education and education for sustainable development. During the change project implementation process, participants were expected to show their ability to reflect on the progress, the successes and failures and show how they modified their plans to suit contextual or institutional structural features.

5.12.4.7 An analytical landscape of emergent properties (Emergent properties evident across the course phases)

The purpose of the Rhodes University/ SADC International Certificate in EE course was to enhance development of agency for mainstreaming EE/ESD/ESE. Attributes of agency in this study were understood as properties that were emergent across the course, from the pre-course assignment to the interview on implementation of the change project. Looking across the assignments and the interviews that elicited experiences of change project implementation, this section sought to show the emergence of tendency, threads or trajectories of emergence, features or attributes of agency at the structural, cultural and people's levels.

5.12.5 Evident emerging attributes of competences

The purpose of the Rhodes University/ SADC International Certificate in EE course was to support development of agency for mainstreaming environmental education and education for sustainable development. In the process of supporting mainstreaming, the course was expected to influence teacher education practice to mainstream sustainability learning and practice, where evidence of attributes of ability to mainstream was discerned from practice. This study sought to establish the attributes of teacher education competence that could be associated with sustainability and education for sustainable development in relation to the matters that concerned the teacher educator (Archer, 1995) in his/ her teacher education practice. To this end, the research looked into the emerging features or properties in teacher education practice, which are real expressions of participants' experiences as evidence of emerging attributes of competence that showed up across the course, including the change project implementation process in the institution. As laid out in Section 2.7, competences as used in this study refer to both physical performative attributes and cognitively situated performativity. In this view, the research recognised the mediatory role of course activities and actions (Vygotsky, 1978) and consequent expansion of teacher educators' zone of proximal development in the mind (Vygotsky, 1978) and on the activity (Engeström and Sannino, 2010) (see section 4. 10). I used Wiek et al.'s (2011) competences for ESD, namely, normative, strategic, interpersonal, systems thinking and anticipatory competence (described in Section 2.7.1) as lenses with which to look into emergent properties to see the evident attributes of emerging competence and laid out in this section.

5.12.6 Emergent capabilities

In order to discern capabilities shown by the research subjects, I analysed the emergent features in the participants' practice across the course. I recognised that emergent properties are attributes of elements or specific features in the reality of teacher education course participants, and particularly for those involved in this research. Since the research dealt with human subjects who were working in the reality of teacher education institutional settings, I categorised the capabilities into Flores-Crespo's (2007) personal achievements (beings) and professional achievements (doings), with respective sub-categories.

5.12.6.1 *Personal achievements (beings)*

Personal achievements were discerned from the emergent properties that I understood to be emergent features of social interactions of the participant but were also features that are unique to individuals, to their sense of becoming.

5.12.6.2 *Professional achievements (doings)*

These were defined in terms of how the subject being able to perform certain teacher education activities in the delivery of her duties and in relation to environmental education and education for sustainable development.

5.13 Analysing mediated action

Del Rio and Alvarez (2007) developed a framework for analysing mental development by looking for mediated actions across the ZPD in relation to the following components of the mediation process: the subject (the individual who develops or whose mind develops); the object (what is developed); the mechanisms that account for development; and the conditions in which the development takes place. The framework is organised into questions: Who is involved in the mental development process? With whom does this mental development take place? What is developed, what ultimately changes, i.e. the outcome of the mediation process? With what? (a question that implies concern for the tools used for the development process). Where does this take place? (this emphasises where this development takes place and takes note of the external, the internal and boundary crossing) (Tsui and Law, 2007; Walker and Nocon, 2007; Akkerman and Baker, 2011).

A different framework was developed by Daniels (2008) who adapted Burke's (1969) pentad for framing analysis of mediated action looking at: what was done (act); where it was done (scene); who did it (agent); how it was done (agency) and why it was done (purpose). These five factors are so intricately linked that Daniels (2008) warns that using these questions may not always give a clear picture of the factors in isolation. But it is important to be able to identify the factors in relation to description of any mediated action.

I adapted the two frameworks, the one by del Rio and Alvarez (2007) and the one by Daniels (2008) described earlier to develop the following framework for analysing and presenting stories of mediated actions of the research subjects who are also course participants. This framework was structured to capture mediated actions, institutional cultures and institutional structures that influenced development and exercise of agency by research subjects.

1. What were the contextual settings and experiences that motivated the subject to attend the Rhodes University/ SADC International Certificate in EE Course?

2. Which of the on-course mediated action experiences did subjects find had direct relevance to their own practice and would be used as springboard for their change projects?

- What mediated actions did the subject plan to do in her practice and why?

- What changes in language, concepts and actions are evident in their on-course written work?

3. What mediated actions did subjects conduct on their practice, what opportunities were available?

- Which tools did they use and with whom did they work on the change project upon returning to their workplace?

4. What are the results and outcomes of their mediated actions on the individual, their institution and the education and the environmental education and education for sustainable development field?

- What changes in language and actions are evident in their current practice?

5.14 Conclusion

This chapter set out the research approach, research methods and data generation techniques used in the study. A qualitative approach was justified as appropriate since the phenomenon of the change project was conducted in an open system. The case study method was chosen to provide the platform to interrogate the change project using document analysis, interviews and observations. Issues of researcher reflexivity could have influenced the research design, particularly the focus of data generation and hence the unit of analysis that was shifted from the institution to individuals implementing change projects in a community of practice. Consistent reflexivity on the purpose of the research and research questions influenced validity issues by reduction influence of subjectivities. Ethical considerations influenced the research design and the case study protocol onsite. It was argued that case study research in critical realism and realist social theory research has potential for generalisation at the level of structures, mechanisms, powers and tendencies. Realist social theory provides emergent properties and powers as a tool to analyse social actions that represent capacity (competences and capabilities) in context. The chapter ended with a framework that was developed in order to discern emergent properties from data on teacher educators' practices of mainstreaming ESE. I now use the emergent properties to construct the stories of mediated emergence in Chapters 6, 7 and 8, as a response to questions raised in section 5.13.

Chapter 6:   The emergent story of emergence: LY

6.0   Introduction

This chapter presents one of the cases of emergent properties and powers associated with the RU/ SADC International Certificate in EE course. An understanding and exploration of emergent properties contributes to establishing how mediation within an academic professional development (APD) course and by the course have influenced teacher education practices (see section 1.13 on the Problem). The chapter explores the historical context of LY's teacher education practice in relation to mainstreaming ESE. The historical context shows that capacity development for ESE did not simply emerge from one course but developed through a number of course interactions as shown in Table 1 below (also see Sections 6.7.1 and 6.7.3). This history maps out the capacity development for mainstreaming ESE through the change projects in which LY engaged as part of her enhanced capacity for mainstreaming ESE in teacher education practice.

Structural, cultural and people emergent properties were narrated in relation to each of the mediation tools and artefacts of the course. Tools for mediation included participants' assignment write-ups and participants' engagement with their CoPs in context. A map showing a landscape of emergent properties and powers was used to illustrate the role of the course as a mediation tool together with the mediation tools and artefacts that were used on the change project course. This landscape also illustrates how emergent properties and powers on the course contributed as generative mechanisms for the change project implementation process.

6.1   A brief history of LY and her change projects

LY lectured in Agriculture Science Education at Institution Y. She taught student teachers (mostly been primary school and high school level) who specialised in Agriculture Science Education, teaching concepts in Agriculture as well as the methods of teaching Agriculture Science in schools. The syllabus that she used was seldom reviewed. As she participated in capacity development in ESE she realised that the easiest approach to curriculum review and change is through change in curriculum practices. To this end she decided to transform

the ways in which she taught her classes. In the process she also worked with institutional colleagues who taught in other disciplines.

Some of her colleagues had participated in training in ESE while some had developed an interest from report backs to the staff by her colleagues and herself. Outside college she was involved with *Le hae la rona*, a SeSotho term for "our home", a community of practice of individuals and organisations that meet to discuss environment and sustainability issues and developments in Lesotho. She was also a member of the National Curriculum Centre's subject panel on Agriculture Science.

As shown in Table 6.1, LY indicated that her involvement with ESE started in July 2009 when she was selected to attend a five-day SADC Teacher Education Network for mainstreaming ESE in teacher education. During this course, she developed a change project where she worked with her student teachers to invite an elderly member of the community to describe how part of the football field looked in the past before its current eroded state. Through this teaching and learning approach, she was able to motivate her students to barricade and reclaim the eroded part of the football field. In 2011 she joined the eight-week long RU/ SADC International Certificate in EE course where she developed a change project on teaching methods that facilitate change, which is the focus of this study.

LY enrolled for a 14-day RU/ SADC Leadership in mainstreaming ESE course in 2012, a course that aimed at enhancing agency for leadership in mainstreaming ESE in teacher education. In addition to continuing her previous change projects, her change project for the Leadership course was to coordinate formation of an ESD Team at Institution Y. In 2013 she enrolled for a five-day UNESCO course on mainstreaming climate change adaptation in coastal and riverine ecosystems and took on a change project to enhance reflexive social change in the way people relate to rivers and river systems, particularly the Mohokare River near Maseru. In 2014, a SADC REEP/ SWEDESD partnership course that aimed at mainstreaming ESE into teacher education, at institutional level was conceptualised. The partnership focussed on the Education for Strong Sustainability and Agency (ESSA) programme and sought to work with institutional teams to build capacity for mainstreaming ESE. LY was selected to join the institutional team from Institution Y for a five-day change project development workshop. This institutional and team-led change project sought to

offer institutional capacity development activities for colleagues.

Table 6.1: Overview of LY's involvement in mainstreaming ESE and associated change projects (represented by the arrows)

Date	2009	August-October 2010	August 2012	September 2013	2014 and onwards
Name of course	SADC TE Network for ESE course	RU/ SADC ICEE course	RU/SADC Leadership in mainstreaming ESE course	UNESCO Climate Change Adaptation for coastal and riverine systems course	ESSA mainstreaming ESD courses and workshops
Length of course	5 days	8 weeks	14 days	5 days	5 days at a time
Change project	Rehabilitation of eroded parts of college grounds	Using and promoting teaching and learning methods that facilitate change	Coordination of formation of ESD Team at Institution Y	Teaching methods to support mainstreaming of climate change education and climate change adaptation through caring for rivers and river banks, with focus on Mohokare River	Team led and institutional change project to develop capacity of institutional colleagues

As stated earlier, this study is focused on the change project experiences arising from LY's involvement with the RU/SADC International Certificate in EE course. The following sections present aspects of the course from which emergent characteristics were discerned. These aspects were used to build the case stories of emergence in LY's teacher education practice.

6.2.   Emergent properties from the pre-course assignment (LYPCA)

6.2.1   Structural emergent properties

When responding to the pre-course assignment, LY was able to identify "Chapter 36 of Agenda 21…" and the "Lesotho EE Strategic Plan" as the key policies influencing and guiding ESE practice and this justified her change project both at the institutional and individual levels. She was also able to locate the change project as her contribution to the role of the college which was to "… build the capacity of people to address environment and development issues". In addition to these policies, LY was able to relate the current change project to earlier efforts at mainstreaming ESE that involved an audit of the environment and development issues affecting the college. Furthermore, the pre-course assignment enabled LY to recognise colleagues who were already involved in ESE, the disciplines they were working from and how they could contribute to the change project implementation process.

6.2.2   Cultural emergent properties

LK recognised that engaging students in auditing environment and sustainability issues was a good starting point for responding to issues affecting the institution through teaching and learning processes, "… in this case an audit was conducted to identify eroded areas". She then demonstrated ability to identify participatory teaching and learning methods including audits, collaborative research projects, action projects and fieldwork as key to the environmental learning that she proposed.

LY recognised the change project as a coordinated programme that was to be shared among a number of lecturers and departments where "… collaborative teaching about soil erosion with development studies … technology department agreed to help with design of pavements…" and "… a range management course in my department will help to identify available plant species…" The sharing would help to relate environmental activities across the different subjects and disciplines, in this case, Development Studies, Technology and Range Management. In addition, LY was able to recognise that students in the college lacked knowledge and therefore needed to be taught how to protect, manage and reclaim resources that were available to them. She recognised that the teaching methods that they were all using at that time were dominated by lecture and other delivery approaches which

did not assist student teachers to engage with change in practice. She realised that "we as educators have to change our ways of teaching and encourage methods that promote change".

6.2.3 People emergent properties

LY was motivated to embark on an ESE change project after attending another short course where she learnt about ESE and developed an interest to know more. She noted that she had "... been engaged in a change project that was brought about by the educators' course that I attended in July 2009". She then demonstrated an ability to define her role in the change project and was able to start off by reflecting on her classroom practices which she saw as the platform for promoting change in practice among student teachers and the community. She thought her classroom practices would contribute to better social practices as her change project would "... strive to engage participatory methods of teaching to address the issue of soil erosion at the college" and "... emphasise more on new teaching methods that support learning that bring change". She was also able to define soil erosion as an issue worth responding to in the Ha Thamae community, and to relate this issue to other issues that were affecting the college that were already receiving some curriculum response, such as the institutional efforts to enable interdisciplinary and team teaching in addition to the issues of gender, HIV/AIDS and child-friendly institutions. LY realised that she could not embark on the change project alone, so she discussed her ideas with some of the colleagues who had agreed to collaborative teaching and team teaching: "From the discussion we had with my colleagues, it became very clear that collaborative teaching could help a lot to interrelate environmental activities across different subjects."

6.3   Emergent properties from Assignment One (LYA1)

6.3.1   Structural emergent properties

Policy analysis and relevance: Through engaging with Assignment One LY was able to identify global and national policies that influenced her teacher education practice, ESE and the change project including "... the United Nations Conference on Environment and Development; ... and the National Environmental Action Plan (NEAP); ... the national Paper on Environment and Development in Lesotho (1992); the National Action Plan to Implement Agenda 21; the national Environment Policy (1996); and the draft Environment Bill (1997);

… the National Environmental Secretariat; guiding principles of the Ministry of Forestry and Land Reclamation; … Lesotho Poverty Alleviation Strategy 2004-7; MDG 7; … Vision 2020". She was further able to discuss the issue of soil degradation that she had identified for the change project in relation to Chapter 36 of the National Constitution of Lesotho which states that "Lesotho shall adopt policies designed to protect and enhance the natural and cultural environment of Lesotho for the benefit of both present and future generations and shall endeavour to assure all citizens a sound and safe environment adequate for their health and well-being."

The change project was also framed as a response to the Lesotho National Environmental Policy of 1996 in which soil degradation was a major issue affecting the nation. The policy noted that "… the principal challenge that faces Basotho as a nation is accelerated soil erosion resulting in land degradation, loss of arable land and eventual desertification." LY demonstrated an ability to recognise that the country had high quality environmental legislation which was not always matched by implementation and was generally inconsistent with expectations. She said, "the only problem that hinders the government of Lesotho to succeed in soil conservation is lack of coordination amongst departments; therefore there is duplication of efforts that are not complementary and loss of funds." The result was dislocation of implementation of initiatives: "Existing statutes governing natural resource management and the protection of the environment are inconsistent, inadequate and unconsolidated. They also overlap and are often in conflict with one another." She further showed an ability to relate national policies on agriculture to national policies on poverty alleviation, as they applied to the people of Lesotho and considered how the change project could help in this regard.

In her view existing policies at times were not accessible due to linguistic barriers as they were only written in English. She noted that the policies were usually "reactive rather than preventive," so were not very useful for preventing development of such environmental issues as soil erosion. LY demonstrated an ability to locate the change project within the Agriculture Science course that she taught. In addition, she was able to assess resources available for teaching and learning of ESE and concluded that the college had very few such resources.

6.3.2 Cultural emergent properties

Consumerism: In her assessment of what people feed on LY recognised that people continue to consume products that generate waste that ends up as litter and pollution. These are products bought from shops because people seem to have lost their ability to produce their own food. She lamented that people loitering on the streets were buying products that led to littering: "The streets are very dirty because of littering which happens mostly in areas where youth meet and idle, if food production was still practised well some of this issue might have been eliminated."

Interconnectedness of resources: LY demonstrated an ability to recognise that large herds of livestock (that people saw as wealth) influenced soil quality and quantity, and in turn affected productivity of the soil, and in the end led to reduced food production and loss of livestock. She observed that people had traditionally lived off the soil but now they were unable to do this as it was unproductive. According to LY "Ha Thamae is a semi-urban village where majority of people still practise subsistence farming in their home gardens and keeping livestock" but at the same time she observed that "soil erosion ... has reduced the amount of land that was used for producing food and livestock." She linked the poor soils to low food security, famine and potential human conflict.

Resource exploitation: LY observed that people are dependent on the soil and continue to cultivate crops using improper methods such as monoculture and artificial fertilisers, with the obvious consequence of declining harvests. Monoculture, according to LY, was the main method of agricultural production: "people still engage in improper farming practices like monoculture (a practice of growing one crop year after year in the same piece of land) ... render soil to be vulnerable..." She was also able to acknowledge that the Ministry of Forestry and Land Reclamation promotes afforestation, agroforestry and land rehabilitation that tends to restore the soil through working in collaboration with individuals and communities, when she indicated that the ministry "advocates to rehabilitate degraded lands using appropriate agroforestry practices and increase of multi-use forest cover ... and encourages individual and community afforestation programmes."

Knowledge: LY demonstrated an ability to recognise that the knowledge in use among the farming communities tends to promote the use of monocultures that do not support soil

conservation. She observed that farmers grow a single crop that "... renders the soil to be vulnerable because they do not provide enough soil cover and therefore spaces that are left bare are washed away easily."

Innovating practice and collaboration: LY demonstrated an ability to appreciate efforts of the Ministry of Forestry and Land Reclamation to promote people to work as communities of practice for the afforestation programmes as they "... encourage individual and community afforestation programmes, by providing incentives and training to individuals and communities undertaking afforestation programmes on a self-help basis."

Change agents: LY demonstrated an ability to recognise the area around the college (Ha Thamae) as the appropriate place for implementing a change project on soil degradation due to the perceived need. She pointed out that her change project was responding to a relevant issue: "the environmental issue relevant to my work context is soil erosion which is seen in the urban areas of Maseru district particularly an area in which Institution Y is nearest to". She identified this spatial location as appropriate in that the inhabitants generally depend directly on the soil for livelihood.

Institutional reflexivity: LY demonstrated an ability to think about importance of other institutions such as Ministry of Agriculture, the Machobane farming system [4]and their programmes in order to base her own work and critique of how her own institutional practice is responding to those policies and programmes. She proposed that the government take up such sustainable practices such as Machobane: "... government aims to adopt appropriate farming practices like the Machobane farming systems which provide plant cover all year round."

Teaching and learning methods: LY observed that despite massive government spending on awareness campaigns and workshops to educate the nation on land conservation, people continue to engage with such practices as littering: "...The soil conservation department spent a lot of money on awareness campaigns and workshops to try and alleviate the problem." She concluded that these methods were ineffective for reducing littering and she

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[4] The Machobane Farming System is an integrated organic farming system used in some parts of Lesotho. In this system soil inputs come from a combination of crop and livestock remains or ash. The system includes intercropping, resulting in soil (see http://www.atpsnet.org/Files/pb35.pdf and http://afsafrica.org/wp-content/uploads/2015/11/Machobane_Farming_System_Lesotho.pdf)

thought teaching and learning methods that would encourage her student teachers to take action for change were more appropriate.

6.3.3 People emergent properties

Deepened understanding of issue: LY demonstrated a deepened understanding of the issue of soil erosion in context. She was able to discuss its causes and was further able to link the effects of soil erosion to other issues in the society such as poverty and disease, particularly, HIV/AIDS. In her view "…Issues of HIV/AIDS also are aggravated due to high levels of poverty…" She further was able to recognise the role and justify the importance of more sustainable alternative practices on land use.

Teaching and learning methods: This was included earlier as a cultural emergent property but I also raise it in this section to illustrate that LY demonstrated people emergent properties related to knowledge and reflections on teaching and learning methods used to raise awareness and to change practice.

Reflections on change: LY was able to demonstrate thinking about factors that influence change in practice among people. In particular, she noted that government departments tend to lack coordination and ultimately duplicate efforts when responding to issues, instead of complement each other's efforts: "Existing statutes governing natural resource management and the protection of the environment are inconsistent, inadequate and unconsolidated. They also overlap and are often in conflict with one another."

Social justice response: LY noted that the land tenure system was still based on heredity[5], with the result that land was not equitably distributed. Some people were without land, some owned small over-cultivated pieces of land, while others had large tracks of land. LY observed that the "Land tenure system is a socio economic factor where land is still being inherited and thereby neglected at times because of poverty." Despite this disparity in land size, people had freedom to use it and some people left their land idle.

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[5] In traditional land tenure systems, a family owns and inherits a piece of land that it shares among family members alone. Immigrant families tend not to have their own pieces of land as these would have been allocated to earlier inhabitants

Reflexivity: As the beginning of reflexivity LY was able to observe that the communities around the college live by subsistence and directly from the soil: "the majority of people still practise subsistence crop farming in their home gardens and keeping livestock." This made soil erosion an issue of concern. She was also able to realise that poor land use practices including keeping many livestock in the guise of wealth, soil erosion, unproductive soils, gullies and food insecurity are interrelated, which is evidence of reflexivity.

6.4   Emergent properties from Assignment Two (LYA2)

6.4.1   Structural emergent properties

Policy analysis and relevance: By working on Assignment Two, LY was able to demonstrate her ability to identify and describe global, regional, national and institutional frameworks and policy responses that included the Tbilisi Principles (UNESCO, 1978): "Enable learners to have a role in their learning experiences and provide an opportunity for making decisions and accepting consequences and ...develop critical thinking and problem solving skills,"; the NGO Forum and Guiding Principles (UNCED, 1992) [6]that asserted that among other things "environmental education whether formal, non-formal or informal should be grounded in critical thinking in any time or place promoting the transformation and reconstruction of society...use teaching methods that allow creativity"; and the Gaborone Declaration [7] of 2002 (EEASA, 2002) whose main thrust was to encourage individuals and institutions to:

> ... support environmental learning processes that reflect a commitment to action and that foster action competence through contextual open-ended inquiry and issue-based approaches to learning, ... recognize that environmental learning involves cognitive competence, critical thinking, values and social and individual competence as well as a mobilising of prior knowledge and experience (including indigenous knowledge).

She saw these guidelines as relevant for supporting new teacher education practice in and for ESE and they helped her to justify the role of the change project in the institution and nationally. She was able to relate specific sections of these policies to the teaching and

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[6] Global NGOs ran a parallel conference (commonly known as the NGO Forum) to the governmental UN Conference on Environment and Development forum and made a declaration to feed into the governmental declaration.

[7] In their annual conference that was hosted in Gaborone, Botswana in 2002, the Environmental Education Association of Southern Africa developed a declaration (Gaborone Declaration) on what the organisation would do through its membership to implement environmental education.

learning methods that she chose to use. LY was also able to demonstrate her ability to recognise learning theory as providing guiding principles for selection of teaching and learning processes because in her view the choice of methods was a consequence of the purpose of learning. She asserted that "Selection of mediating methods is dependent on the purpose of learning". In addition, LY was able to locate the change project in a specific area: Ha Thamae and the college grounds. She was also able to locate the actions of the change project into and as part of her own teaching and learning duties as a lecturer for Agricultural Science.

6.4.2   Cultural emergent properties

Critical and deepened understanding of teaching and learning methods: LY demonstrated an ability to discuss and critique implications of policies on educational methods that were used in the change project with an emphasis on those that tend to facilitate voluntary change in practice.

Teaching and learning methods: LY demonstrated an ability to identify some of her key teaching methods (lecture, demonstration, field trips and discussions) and an ability to critique these methods in the light of the issue of soil erosion. She was able to show her ability to identify, describe and justify new and relevant teaching and learning methods such as "exploring indigenous knowledge …, action research … and use of critical theories" that are responsive to societal problems such as soil erosion, which was the backbone of her change project.

Collaborative and democratic practice: LY chose teaching and learning methods that enabled students to work with others by deliberating the causes of the issue, suggesting more sustainable alternatives and taking social action. She proposed action research as it "promotes collaboration and deliberation among learners to decide on appropriate action which is value based and contextual like the use of intercropping to provide cover for the soil year round."

6.4.3   People emergent properties

Motivation: LY demonstrated self-motivation in embarking on the change project. She claimed that teaching and learning methods that promote change are useful in solving

environmental issues in such statements as "My change project aims to find root causes of soil erosion as an environmental issue by use of mediating methods that are change-oriented." In addition, she was motivated to select approaches to teaching and learning as one way to respond to environmental issues. She recognised the importance of teaching and learning methods saying "Learning is also mediated through observing and experiencing trends and through deliberations, collaborations and adaptation of ideas for action in different situations."

Processing and deepening knowledge with criticality: LY showed an ability to deepen her knowledge on the specific policies that promote and guide environment and sustainability interactions. In addition to identifying the relevant sections in the policy guidelines, she was able to show how the policy related to her classroom practice. She was also able to show enhanced capacity for processing and deepening knowledge by discussing and critiquing methods, as well as by summarising the theories of learning.

Structuring knowledge with criticality: LY demonstrated an ability to analyse policies that influence education with depth from global to national contexts and vice versa. She was able to expand the points that relate to and support work on ESE and relate them to the change project, to show her depth of understanding on appropriate aspects of the policies. She justified use of Action Research and Community Problem Solving [8]as providing real life learning experiences claiming "it is through the diverse learning environments and exposure to real situations that they can come up with solutions and actions to solve environmental issues."

Commitment to social justice and ethics: LY demonstrated an ability for social justice oriented ethical practice by relating soil erosion to lack of knowledge on sustainable soil conservation practices. She argued that soil erosion was partly a result of loss of the ability to value indigenous knowledge and practices as modern ways of farming come to dominate among rural farmers. These farmers are also the poorest and survive from the products of farming on the soil. She argued that "... it is evident that there has been a shift from

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[8] Action Research and Community Problem Solving is a method that was introduced in the course during the teaching and learning methods component of the course and through one of the course resources: *Methods and Processes to support change-oriented learning* by Rosenberg, O'Donoghue and Olvitt (2008) (popularly known on the course as the 'yellow booklet').

practices that were done earlier that were much [more] resilient to soil erosion, [compared to] when we embraced new innovation that has put more pressure on the soil which is now easily eroded." The point here is that soil degradation is attributable to a shift from indigenous knowledge practices to modern methods of farming and hence, there is a need to reclaim some of the traditional methods of soil conservation.

Collaborative and democratic practice: LY showed commitment to collaborative decision-making, collaborative social action and her valuing of collective capabilities using methods to engage students that enable them to deliberate on an issue and course of action. In justifying the role of some of the methods, such as discussions, LY valued the deliberations inherent in the method. As such she saw discussions as "… a method where learners share ideas and deliberate on them to understand them and to provide their point of views." Deliberation in this sense entails weighing of alternatives.

Ability to select and use teaching and learning resources: LY demonstrated an ability to select and use a variety of teaching and learning resources (printed media with case studies, electronic media with pictures and videos, workbook on teaching methods) to develop content through multifaceted mediation of learning. She identified printed media starting with a factsheet that she produced from the on-course session. She added that "A factsheet will be used as a knowledge resource that will be used by student teachers during their lesson … factsheet will be used together with the learning support materials." Her learners were also offered the opportunity to use "journal articles, magazines and books that provide information about the causes, effects and control of soil erosion." Electronic media included pictures and videos: "pictures, photographs and video … to support learning by showing the reality of soil erosion around them." The handbook on teaching methods (*Methods and Processes to support Change-oriented Learning*) that LY received during the on-course phase helped with change-oriented methods[9], which she described as "mediating methods that are change oriented … information that will allow them to respond to environmental issues through education." In this statement LY demonstrated faith in teaching methods and appropriate learning support materials.

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[9] This handbook on teaching and learning methods foregrounds deliberation methods.

Agency and visioning: LY demonstrated capacity for visioning by her ability to imagine reduced soil erosion as a result of her working to enable her students to carefully think about teaching learning methods that develop school-community relations and taking social action. Her vision permeated through her views of the teaching methods chosen such as the use of indigenous knowledge where she thought unravelling of the past practices could help redress problems of the present: "this method will help students to mobilise indigenous knowledge from the community of Ha Thamae village to inform and understand what has been lost and gained in the process and the implications of sustainability." LY's agency was fuelled by her vision to make use of indigenous knowledge practices to respond to current socio-ecological issues.

6.5   Emergent properties from Assignment Three (LYA3)

6.5.1   Structural emergent properties

Policy identification, analysis and relevance: As in Assignments 1 and 2, LY was able to show ability to relate and appreciate global and national policies that promoted working in communities of practice as well as to relate these to government expectations on collaborative projects. She chose to foreground these: Tbilisi principles that encourage people to use a wide variety of teaching and learning methods which she termed "diverse learning environments and … first-hand experience" and the Treaty of EE for Sustainable Societies and Global Responsibility that recognised environmental education as having the ability to respond to social justice issues by encouraging participation. She noted that the policy emphasised "democratic change and promote[d] participation" while the Lesotho EE Strategy promoted enhanced quality of education through enhancing learning materials for hands-on and experiential learning, that she considered more effective for learning in communities of practice. LY thought the development of materials promoted by the Lesotho EE Strategy "if developed locally tend to be relevant to learning needs of learner and communities." She was then able to consistently locate the change project in her Agriculture Science classroom, in the college, and in Ha Thamae village that is adjacent to the college.

Community of practice: LY showed an ability to identify constituents of a community of practice (community, shared practice and knowledge interest[10]) and expanded on them in order to be able to structure the change project more clearly. She further was able to identify with other lecturers in the college who had already engaged in ESE change projects with whom she would collaborate on mainstreaming of ESE. In addition, LY was able to identify the community practice that would implement the change project as composed of the students that she taught, colleagues in ESE, other lecturers, agricultural extension officer and the village chief.

Adult learning: LY was able to recognise abilities of the student group that she was working with and decided that they would be able to be involved in the change project through the teaching and learning methods component. She recognised them as "First year students: their role is to learn new methods that are going to be adapted from the book *Methods and Processes* and use them for peer teaching as a practice to prepare for teaching practice the following year." LY therefore viewed her student teachers as adult learners who were learning for a purpose (SADC REEP, 2009).

Learning theory and methods: LY showed appreciation of the role played by learning theories in guiding practice, particularly how the notion of participation influenced the choice and use of teaching and learning methods. She noted that "learning interactions happen when engaging methods like learning by doing, experiential learning and problem solving[11]. These methods are supported well by theories of situated learning which involves a process of engagement in a community of practice." By considering the level of her students and the usefulness for them of peer teaching, she found it possible to engage them with methods that promote experiential learning, collaborative thinking and decision-making as well as taking informed collective social action.

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[10] These components of a community of practice were introduced in the on-course phase and were in the orientating course texts. The texts included discussions on strengths, weaknesses and potential pitfalls of working in CoPs.

[11] These teaching methods were introduced in the on-course phase of the course and were in the course materials as well as the handbook on teaching methods (*Methods and Processes: to support Change-oriented Learning*) that was given to course participants as part of the course materials.

6.5.2 Cultural emergent properties

Teaching and learning methods: LY demonstrated an ability to use a variety of teaching and learning methods: workshops, observations, meetings, discussions, experiential approaches, lecture, knowledge expert, learning through doing and problem solving. In addition, she demonstrated capacity for in-depth description and understanding of teaching methods with an emphasis on those that have the potential to promote change. LY was prepared to try a number of methods: "a series of workshops, classroom lessons, field trips and a seminar to share experiences and knowledge."

Teaching and learning resources (epistemological access): By using a variety of teaching and learning resources such as factsheets, use of knowledge experts and village elders such as the chief, LY showed her enhanced capacity to enable access to a range of knowledge sources, especially on sustainable practices related to soil conservation. The village chief would "...share his experiences about the policies and by-laws relevant to soil erosion." The chief therefore was considered as a repository of knowledge of the village.

Collaboration, democratic practice and participation: LY demonstrated capacity for promoting collaboration, democratic practice, and transformation by the choices she made regarding teaching and learning methods for the change project. Methods such as workshops, discussions, problem-solving and meetings brought learners together to deliberate and experience the learning conditions together. She indicated that "training and the use of mediating methods through active participation will also be of importance to support the community of practice." Her view was that the methods of engagement would also influence the modes of participation.

6.5.3 People emergent properties

Personal and valued choice: LY demonstrated an ability to choose a particular change project and an ability to remain focused on the aim of the project, which was to develop, promote and guide collaborative social action on reducing soil erosion through curriculum practice. She demonstrated her ability to make an informed choice by selecting particular teaching and learning methods that recognise complexity of socio-ecological issues and respond to the environmental issue at hand.

Structuring knowledge and practice: LY demonstrated an ability to structure implementation of the change project in the community of practice, using the constituents of the community of practice developed in the conceptual description.

Criticality: LY's criticality was demonstrated when she built her argument by foregrounding the purpose of teaching and learning methods and how they contribute to learning and practice in society: "learning interactions happen when engaging methods like learning by doing, experiential learning and problem solving." This enabled her to position the change project and the teaching and learning methods that she chose to use. In addition, LY demonstrated an in-depth critique of the notion of community of practice and highlighted its strengths and weaknesses. Before developing a list of potential pitfalls (some of which were suggested in the orientating course materials), LY indicated that "since a community of practice involves different categories of individuals there are anticipated problems that need to be avoided." Further criticality is demonstrated by her ability to recognise the importance of learning theory in guiding practice and her ability to discriminate between possible teaching and learning methods: "… these methods are supported by theories of learning…"

Reflexivity and agency: LY showed ability to reflect on the potential of her student group. She then decided to engage them in ESE through teaching and learning methods as she saw the potential for developing agency through peer teaching and learning experiences. Peer teaching was seen as an avenue for students to learn the relevance of the new teaching methods: "…to learn new methods that are going to be adapted from the methods handbook *Methods and Processes* and use them for peer teaching as a practice to prepare for teaching practice the following year." She further demonstrated reflexive ability by an ability to design the rationale, list the main tenets and structure an evaluation of the change project implementation process through processes of participatory evaluation, critical and participatory evaluation and reflexive evaluation.

6.6 Emergent properties from the Regional Knowledge Exchange group (ICT in EE group (see Section 4.1.2.5))

6.6.1 Structural emergent properties

Policy identification, analysis and use: LY was able to identify the roles that ICTs could play in supporting and enhancing change project implementation. To this end, she said ICTs were "helpful in developing skills needed to better network and to implement our change project."

6.6.2 Cultural emergent properties

Capacity development opportunities: LY demonstrated an ability to identify different computer applications such as zipping documents and using Google groups that were necessary for networking in communities of practice in the institution and across different institutions. Zipping was noted for "compressing large documents and files ... conserve disc space." She was also able to identify and discuss the different computer applications that would support teaching and learning interactions such as PowerPoint, "...a presentation software programme" and hyperlinks, "a simple approach to connect someone viewing content to another related page or document".

Networking: LY recognised the need for strengthening networking among colleagues in the institution, particularly teacher educators using ICTs. She expressed that "ICT is an important tool that is used to enhance learning and it allows easy access to information which can be easily shared through networking." Such shared information is based on concepts as well as skills for structuring and presenting lectures through such applications as zipping files and using PowerPoint.

6.6.3 People emergent properties

Deepened understanding: LY demonstrated an ability to deepen knowledge and enhance skills for working with particular aspects of ICT, for communication between members with similar interests and for presentation of information that developed from what members of her group valued and chose to learn. She indicated that the group mediator asked them what they wanted to learn: "...the facilitator set a meeting with the participants where we discussed what we wanted to learn in the field of ICT that will be helpful in developing skills needed to better network and to implement the change project." The choice of what

members of the group wanted to learn in ICT was also influenced by their individual interest to use the skills in their change projects.

6.7 Emergent properties identified via in-depth interview on change project implementation (LYI)

6.7.1 Structural emergent properties

Policy identification, analysis and relevance: LY was able to identify, analyse and locate the change project in her Agriculture Science classroom and particularly in the teaching methods module: "After that I had another change project where I continued with use of teaching andl learning methods that promote change especially in teaching of Agriculture Science." She had some notions of what had earlier been integrated into the college curriculum: "we had thing [a programme] of child-friendly schools where the college was advocating that we teach in the manner [that encourages] our students to be sensitive to their learners in the schools. And those gender issues are there…" LY was further able to locate some of the change project activities into the new Secondary School Science cohort's curriculum where ESD was already integrated alongside notions such as Gender, Child Friendly Schools and other contemporary issues. She recognised the inclusion of these in the curriculum, "…the new first year secondary curriculum for science … when we were developing [it] we included those issues of ESD, child friendly schools and other emerging issues."

Institutional leadership support: Institutional leadership was very supportive of efforts to mainstream ESE in institutional practices linked to, for example, commemoration of special environment days — the college commemorated Green Week[12]. The leadership also created a platform for reporting on ESD to the wider college lecturer group. The institutional leadership supported the ESSA institutional change project (see section 6.1) fully. LY noted that the Deputy Rector of Academic Affairs had learned about ESD from an ESD workshop. LY said "She was very excited when she came back from that workshop and that helped a lot because at least she has an idea of what is ESD, when we want to put forward something she would understand, but apart from that she is still a coordinator, at least she will ask

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[12] The college introduced a Green Week that foregrounded actions to raise awareness and taking social action on the environment among the college community.

what we are doing and will demand minutes of what we are doing, if she has minutes of what we were doing she would know." LY appreciated the enhanced support in mainstreaming new practices into the institutional culture from the leadership after they attended a capacity building workshop on ESD that was developed specifically for institutional leaders in teacher education institutions.

Roles of educator: LY was able to recognise that the roles of an educator can influence the extent to which one can mainstream ESD. So she chose to enhance her teaching methods to integrate ESD. She was also able to imagine her students influencing their own school curriculum through their teaching practices.

Institutional influence: LY demonstrated leadership and agency to influence her colleagues working on change projects — they established an ESD practitioners' core team that would lead efforts to mainstream ESD across some of the disciplines with special emphasis on Agriculture Science, Development Studies, Geography and Life Skills (the subjects of the core group members). Her earlier efforts to form a core team of ESD practitioners was consolidated by other efforts in the college, "...after I had put them together in a group called ESD Practitioners, ESSA programme called institutional leaders to a workshop so when the Deputy Rector Academic Affairs (DRAA) came back she found us already in a community where she could tell us the agenda of ESSA." The ESD Practitioners team, working with their institutional leadership, led institutional ESD mainstreaming efforts.

Mainstreaming creates conditions for mainstreaming: LY appreciated that one change project created opportunities for others. The five-day course on mainstreaming ESE in Teacher Education that she attended in 2010 and the change project she developed from that course (see Table 6.1) created an enabling platform for launching the change project on teaching and learning methods that facilitate change (see Table 6.1) which is the focus of this study. She remarked, "when I started my change project was when I came back from a teacher education course where I worked on methods that promote change while rehabilitating an eroded part of college grounds." With further courses she developed other change projects, "After that I had another change project where I continued with use of teaching and learning methods that promote change especially in teaching of Agriculture Science. And this was my second change project because I had attended an International EE

course in 2010." The second change project that emerged as a result of involvement with the RU/ SADC International Certificate in EE course was an expansion of the earlier five-day change project on rehabilitation of eroded parts of college grounds. Her change projects on teaching and learning methods and those of her colleagues created a firm basis for the ESSA institutional change project. In addition, all colleagues that were implementing change projects had formed an ESD Practitioners team from which future institutional change projects were launched. LY recognised that the same change project evolved every year, depending on learner group, resources available and reflexive innovations. This is evident in the way that she reflexively conducted the teaching and learning methods; "It is my same change project which I realise that each year it is changing depending on what I am teaching..." Every year has its own experiences, basing on the learnings from the previous years.

6.7.2   Cultural emergent properties

Problem-centred student assignments: LY set and gave assignments that pushed the students to go beyond mere content to answer the 'so what?' question, a question that challenged students to relate the content knowledge to their natural and social realities and encouraged them to think of more sustainable alternatives[13].

Technological innovation: After engaging with presentation applications in the Regional Knowledge Exchange Group, LY was more confident to integrate technology in her teaching methods in that "...so what I am assisting them is to use technology even better by including the ESD elements in that and their own teaching." She had enhanced technological skills and she now promoted the use of PowerPoint during microteaching activities.

Approach to inter-disciplinarity: While she developed the ability to collaborate with colleagues in the same discipline, LY also broke disciplinary boundaries and worked with colleagues in other departments that she would not normally have worked with, namely, Geography, Life Skills and Development Studies. She included four colleagues from four subjects, "...the five of us are not in the same departments or courses except for me and MNY (from Agriculture) but the three of them, MKY is in Development Studies, PSY, Life

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[13] More sustainable alternatives is a notion that was part of the discourse of the RU/SADC International certificate in EE course.

Skills and LKY, Geography." This transdisciplinary approach was aided by other positive social relations that existed between the lecturers who were able to see strengths in each other through social interactions and collaboration.

Teaching methods and mediation: LY demonstrated an appreciation of experiential and hands-on learning as she integrated these into her classroom interactions. She further engaged her learners in teaching and learning methods such as environmental auditing that promote self-reflection on unsustainable and more sustainable practices and have the potential to promote individual and social action.

Collaboration and democratic practice: LY was able to realise that personal effort alone does not always bring about the desired change so she chose to collaborate with colleagues and students. This is evident in her descriptions where she constantly refers to "we" rather than "I" in what she is engaged in, recognising the inputs of others. She noted two colleagues in particular for frequent collaboration in lesson planning. She was able to realise that capacity building initiatives in the institution are more successful when done in collaboration with colleagues, including student teachers. Despite the collaboration, the lecturers found strength in mainstreaming ESD in their specific disciplines (Agriculture Science, Development Studies, Life Skills and Geography) and specific aspects of their teacher education practice, such as the teaching methods module, or during teaching of content.

Recognising existing capacity development processes: LY observed that the institutional leadership created a platform for the ESD Team to report developments in ESD mainstreaming and the ESSA project. To this end the ESD Practitioners team took advantage of existing capacity development processes such as meetings, workshops and seminars to inform other lecturers on ESD. Commenting on opportunities offered to the team to showcase their activities, LY identified meetings as one platform to share with the rest of the college: "she gave us a slot that we talk about the change project in that particular forum."

Teaching and learning resources: LY demonstrated appreciation and use of teaching and learning resources that support learning for sustainability by using equipment including

computers and the ecosystem bottle [14]in a variety of teaching and learning methods, "this model where we planted the plant in the bottle, actually helped us, and we started there with a sustainable system." In so doing she aimed at enhancing understanding of concepts she taught while showing student teachers how to use some of these tools in order to promote epistemic access among the learners.

6.7.3   People emergent properties

Motivation and choice: LY showed a desire for capacity development in the field of ESD. She demonstrated that she valued enhancing her teaching methods, which she chose to work on in her change project from a wide range of possibilities. She sought capacity to improve generally in her teaching and particularly by enhancing her teaching repertoire using methods that contribute to making a difference in society: "...help them to see what is happening in real life situation, here we want to solve problems, societal problems that are there, not as when we do theory." LY showed continued motivation resulting from success in current actions and practices and the hope for enhanced practice for herself, her colleagues and her student teachers in the future. The desire to continually succeed was demonstrated by her continuing efforts in change projects: "what I realise with these changes projects is that they are changing, you need to give yourself a challenge every time, you move from what you were last time and move forward to something new." She claimed that if she wasn't involved in change projects she would probably have stopped teaching: "That is how it is helping me to cope with my work which I call boring these days. So if I wasn't into ESD I would have long started my fat cakes business."

Confidence and objectivity: LY demonstrated more confidence in using technology for teaching, particularly presentation applications such as PowerPoint that she had worked on in the Regional Knowledge Exchange Group. She was able to demonstrate confidence in teaching her students ways that promote understanding as well as individual and social action. She also showed her confidence in the ability to work with diverse teaching and learning methods despite the large classes that she taught.

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[14] This is a closed bottle with an enclosed mini-ecosystem developed by David Latimer that can be used to demonstrate the self-sustaining nature of natural ecosystems. This can be viewed at http://www.boredpanda.com/sealed-bottle-garden-david-latimer/

Enhanced reflexivity: LY showed an ability to reflect on her own teaching methods, a position which allowed her to appreciate a more practical and applied viewpoint: "It is my same change project which I realise that each year it is changing depending on what I am teaching and … we have to make sure the methods that we are using are moving from the traditional methods that we used to do, lecturing and the discussions sometimes do not benefit everybody in the class to a more individual kind of where everybody feels I have to say something." She also demonstrated self-awareness by being able to reflect on own motivation and vision during change project implementation which continued to steer the change project activities and motivated her to progress. She was able to continue to reflect on her experiences in the past change projects in order to inform the current teaching practices, demonstrating the evolving nature of the change project and teaching practice. LY was able to reflect on the speed of change and observed that the amount and speed of change was very low since other members of staff were not easily taking on ESD. She commented that it was difficult to get colleagues on board even though the change project was supposed to be collaborative: "…we have to do it together. But in order to get them on board it's a problem, I have to call, tell, chase and sometimes I just decide it is not worth it."

Enhanced self-reflexivity/ self-awareness: LY showed ability for enhanced reflexivity as she was able to reflect on current practices and experiences that enabled her to think of conditions of possibility that can be brought about by a good education on more sustainable alternatives. This was in particular reference to teaching and learning experiences on soil conservation in the community around the college. Her ability to use previous experiences of an ESD course to inform current practices on mainstreaming ESD was evidence of enhanced reflexivity. Her ability to be able to work alone and be a member of a team of lecturers mainstreaming ESD is part of her reflexivity. In her descriptions she constantly switched between "I" and "we", showing that she worked reflexively in a team and individually. She argued for capacity building of institutional leadership after observing that support from leadership was enhanced following a capacity building activity, a development that she appreciated.

Disciplinary specialisation: Despite her ability to switch between working alone and working in teams LY preferred to be based in her discipline and interact with others on issues that could be more generally applied.

Role of others – "I" and "we": LY showed that she can work alone but also depends on colleagues for some of teacher education practices.

Inter-disciplinarity: LY broke disciplinary boundaries to work with colleagues. She broke boundaries by first working more closely with a colleague in the same discipline. She eventually worked with colleagues from other disciplines starting with Development Studies, Life Skills and Geography. Interest developed on ESD among other subjects.

Teaching and learning resources: LY expressed her independence from the few prescribed books through her ability to use other sources of knowledge such as experts, use of experiential learning and her ability to create her own resources such as fact sheets.

Collaboration: LY pointed out she does lesson planning with some of her colleagues, "...although we do not team teach that much, we kind of plan together. That I have this class I want to teach and ask can this work or not." Lecturers shared resources and discussed their plans for inputs from colleagues. Discussions included reviews of lessons: "...even when we come from class we discuss what happened in class or sometimes when you see something going on very well I will call MK 'come to my class and see how that thing I was talking about is coming out'." She affirmed that ability to influence change was enhanced by having colleagues who have similar interests, aspirations and goals in mainstreaming ESD and enhancing quality and relevance of education. These colleagues were mostly members of the ESD Practitioners team but there were also other colleagues with whom she had good social and professional relations. To this end LK appreciated working in a community of practice on ESD with colleagues in the college and in other institutions outside the college such as the National University of Lesotho, the Lesotho College of Agriculture, the National Curriculum Centre and the UNESCO National Commission Office.

Goal-orientedness: LY showed an ability to stay focused on her goal of improving teaching methods to enhance sustainability by only changing the plan every year with each new student group, using her experiences from the previous year.

Capacity development spirals outwards: LY showed that capacity development at one level opens opportunities by raising awareness of other courses and providing the language required to apply as with the five-day Teacher Education course that increased her

awareness of other courses that were advertised. In addition, she recognised that involvement in the course created more professional opportunities including other courses, new relations with institutional colleagues and colleagues in institutions outside the college such as the *Le hae la rhona* initiative. LY recognised that ability to influence ESD implementation and change was enhanced by further training, as with the enhanced knowledge that she developed with the attending further courses such as the Leadership Course and the Climate Change Education Course (see Table 6.1).

Change project implementation as showpiece of capacity: After participating in the change project LY was selected by SADC REEP to attend the RU/SADC International certificate in EE Leadership in mainstreaming ESD Course. In addition, due to her active involvement in change project implementation, she was selected to attend a Climate Change Education Course by UNESCO. She was further involved in the ESSA programme, a partnership project between SADC REEP and SWEDESD, as a member of the college team that was implementing an institutional change project.

Self-identity and enhanced ego: LY was able to show ego and self-identity in confidently doing activities in her classroom, with her students and feel that she was making a difference, individually and in community with others.

Leadership and agency: LY demonstrated ability for leadership and agency by her ability to influence her colleagues through establishment of an ESD Practitioners team which was focused on mainstreaming ESD.

Making a difference: LY showed her desire to make a difference by encouraging her students to make a difference to their schools and their societies through the way in which they taught content: "… here we want to solve problems, societal problems that are there, not as when we do theory".

6.8   Extended ESD activities emerging from implementing the change project

Participation in the Climate Change Education course: After participating in the Rhodes University/ SADC International Certificate in EE course, LY developed an interest in the Climate Change Education course offered by Rhodes University in partnership with UNESCO.

She found the application easy, having learned many concepts and the 'language' during earlier courses such as the Teacher Education Network course, the RU/SADC International Certificate in EE course and the RU/SADC International Certificate Leadership in Mainstreaming ESD course. She now wanted to know more about climate change education and how it relates to sustainable development so that she could continue to enhance her teaching and learning methods in view of this issue. With her previous experience she was confident that her application would be favourably received.

Mainstreaming ESD in teacher education: With her capacity in ESE LY was incorporated into an institutional team of teacher educators across the college disciplines who were implementing the ESSA programme in the institution. She continued trying out teaching and learning methods that both involved student teachers and promoted their agency to take individual and social action on socio-ecological issues.

ESD roles in the institution and beyond: LY's current work commitments include writing and reviewing curricula, preparing and marking exams, preparing course outlines, teaching and research. She is working with colleagues to mainstream ESD into the respective disciplines of the members of the ESD Practitioners team. She is one of the college representatives in the Agriculture Subject Panel at the National Curriculum Centre. Members of the subject panel deliberate and contribute reviews to the curriculum. The NCC is rolling out new curricula in schools that are based on ESD.

6.9   An analytical landscape of emergent properties and mediation
(Emergent properties evident across the course phases)

Table 6.2 shows how emergent tendency, threads or trajectories of emergence, features or attributes of agency at the structural, cultural and people levels across the assignments and the interviews. The table highlights LY's developing capacity for mainstreaming ESE through engagement with the change project as well as her progress in mainstreaming ESE that is evidenced by emergent properties over time in relation to mediatory experiences and influences.

Table 6.2: Analytical landscape of emergent properties and mediation

	Pre-course assignment (LYPCA)	Assignment 1 (LYA1)	Assignment 2 (LYA2)	Assignment 3 (LYA3)	Regional Knowledge Exchange Group (LYRKE-ICTs)	Semi-structured Interview (LYI)
Significant mediation experiences and influences						
	In-context consultation with colleagues; previous course experiences	International policy history and overview in text; task to identify and work with national policy frameworks	EE policy history in relation to teaching and learning methods in the course	CoP theory and practice in the course	Group choice on what they want to learn in particular group	Engagement with practice in a CoP in context
Structural emergent properties						
Demonstrated policy identification, analysis and relevance (see Sections 6.2.1; 6.3.1; 6.4.1 and 6.7.1)	Ability to identify and relate national policy frameworks to capacity development for EE: Chapter 36 of Agenda 21 and the Lesotho EE Strategic Plan	Ability to identify more global, regional and national policies influencing ESE: the United Nations Conference on Environment and Development; the National Environmental Action Plan (NEAP); the national Paper on Environment; Development in Lesotho (1992); the National Action Plan to Implement Agenda 21; the national Environment Policy (1996); the draft Environment Bill (1997); the National Environmental Secretariat; guiding principles of the Ministry of Forestry and Land Reclamation; Lesotho Poverty Alleviation Strategy 2004-7; MDG 7; Chapter 36 of the National Constitution of Lesotho; the Lesotho National Environmental Policy of 199 and Vision 2020	Ability to identify and discuss policies that influence the choice and conducting of teaching and learning methods: Tbilisi Principles; NGO Forum and Guiding Principles; Gaborone Declaration of 2002	Ability to identify, describe and discuss global, regional and national policies that promote collaborative practice and working in communities of practice: Tbilisi principles; the Treaty of EE for Sustainable Societies and Global Responsibility; Lesotho EE Strategy	Ability to identify the roles that ICTs could play in supporting and enhancing change project implementation	Ongoing ability to locate the change project into the Agriculture Science classroom activities through Gender, Child Friendly Schools and other contemporary issues; the Green Week

Location of change project into specific course framework (see Sections 6.3.1; 6.5.1; 6.7.1)	Ability to identify own teaching practices as starting point and working with institutional colleagues with support from institutional leadership	Ability to locate the change project into the Agriculture Science course that she taught	Ability to locate change project activities in specific Agriculture Science lesson activities	Ability to locate the change project in the Agriculture Science classroom activities and in the community (Ha Thamae) in which the college is located	Ability to find relevance of ICTs in the change project in Agriculture Science classroom interactions	Ability to continue to find relevance of change project in Agriculture Science classroom activities and ability to relate change project activities to other institutional and CoP ESE mainstreaming activities
Mainstreaming creates further conditions for mainstreaming (see Sections 6.1; 6.2.1; 6.2.2; 6.2.3; 6.4.1 and 6.7.1)	Recognition of how prior teacher education course created a platform for the RU/SADC International certificate in EE change project	Outdoor based change project from earlier course transitioned into methods change project in the classroom	Use of policy to support T/L approaches and methods promoted for mainstreaming basing on learning from prior course interactions and outdoor based projects	Mainstreaming efforts in CoP expanded following learning experiences from prior change project	ICTs support relevant mainstreaming efforts as advancement from prior change project	The RU/SADC course change project created a platform for the ESD mainstreaming Leadership change project, the ESSA and ongoing involvement in capacity development while emerging from and building on a prior Teacher Education course
Cultural emergent properties						
Opportunities for professional training and capacity development of colleagues and students (see Sections 6.2.2; 6.3.2; 6.3.3; 6.5.2; 6.7.2; 6.10.2)	Consultation and audit as opportunities for capacity development	Identification of relevant policies supporting capacity development in ESE	Recognition of assignments, seminars, workshops and meetings as opportunities for capacity development	Recognition of assignments, and collaborative use of seminars, workshops and meetings as opportunities for capacity development	Use of ICTs in teaching methods, assignments and presentations	Existing assignments, seminars, workshops, meetings and institutional pronouncements as the Green Week as opportunities for capacity development

Importance of capacity building (see Sections 6.2.2; 6.3.2; 6.3.3; 6.5.2; 6.7.2; 6.10.2)	Ability to critique own practices in relation to context	Ability to critique own practices in relation to policy	Ability to critique own practices in relation to policy and teaching methods	Ability to critique own practice in relation to collaborative practice	Ability to critique own practice in relation to educational ICTs tools used	Enhanced ability to work collaboratively with students and in CoPs
Teaching and learning methods (see Sections 6.2.2; 6.3.2; 6.3.3; 6.5.2; LKPCA and LKI)	Observation of inadequacy of current teaching methods for transformation in social practice	Choice of teaching methods that promote change of practice in relation to policy	Choice of teaching methods that promote change of practice through teaching methods in relation to policy	Choice of teaching methods that promote change of practice in relation to policy and collaboration	Use of ICTs to enhance T/L methods that promote change	Choice of T/L methods that promote change of practice in a CoP
Teaching and learning resources (see Sections 6.4.3; 6.5.2;6.7.2 and 6.10.2)	Recognition of the shortage of relevant T/L resources	Production of factsheet and use of existing resources such as course notes and Methods Handbook	Production and use of resources for purpose of supporting T/L methods	Production and use of T/L resources in CoP	Use of ICTs, including the Internet as T/L resources	T/L resources developed to teach concepts; use of T/L resources introduced in the course such as ecosystem bottle enhanced
Valuing of collaborative and democratic practice (see Sections 6.3.2; 6.4.2; 6.5.2; 6.7.2 and 6.7.3)	Initial consultation with colleagues, CoP and institutional leadership	International and national policy on collaborative practice	International and national policy on collaborative practice in relation to T/L methods	International and national policy on collaborative practice in relation to T/L methods and CoP	Use of ICTs to enhance collaborative practice in class and communities	Collaborative practice evident in working in CoPs and classroom methods
Commitment to social justice (see Sections 6.3.3; 6.4.3; 6.5.2; 6.7.2; 6.7.3 and 6.10.2)	Recognition that land resource was unevenly distributed and not equally taken care of	International and national policy on capacity development and rehabilitation of land	International and national policy on environment including land care in relation to T/L methods	International and national policy on environment care in relation to collaborative T/L methods and CoPs	Use of ICTs to support deliberative and collaborative T/L methods	Use of T/L methods that facilitated deliberation, collaborative decision-making and action taking

Sustainable living and more sustainable alternatives on land (see Sections 6.3.2; 6.4.3; 6.4.2; 6.5.2; 6.7.2; 6.7.3 and 6.10.2)	Recognition of the few sustainable alternatives	Use of international and national policy to support learning on sustainable living and sustainable alternatives	Use of policy to support T/L methods that facilitate deliberation on sustainable living and more sustainable alternatives	Use of policy and T/L methods to facilitate deliberation on sustainable living and more sustainable alternatives in class and in CoPs	Use of ICT to support learning about sustainable alternatives	T/L methods to support ongoing efforts on sustainable living and more sustainable alternatives to reduce human impacts
People emergent properties						
Valuing (see Sections 6.1; 6.3.2; 6.4.2; 6.4.3; 6.5.2; 6.7.2; 6.7.3 and 6.10.2)	Valued producing teachers that were capable of responding to societal problems	Valued aspects of policy that supported capacity development for ESE	Valued and used policy that promoted T/L methods that facilitate change for socio-ecological sustainability	Valued T/L methods that facilitate change while working in collaboration through CoPs	Use of ICTs to support valued T/L methods that support change for socio-ecological sustainability	Ongoing valuing of conditions of socio-ecological sustainability
Criticality (see Sections 6.4.3; 6.5.3 and 6.10.3)	Ability to critique own practices and observe the need to change teaching approaches to include those that promote change	Ability to use national and international policies to guide thinking on concepts and practices	Ability to use national and international policies to guide thinking on concepts and practices in relation to T/L methods	Ability to use national and international policies to guide thinking on concepts and practices in relation to T/L methods in specific learning contexts and COPs	Ability to use ICTs to support thinking and learning on policies in relation to concepts and practices	Ability to relate teacher education practices to key concepts and policies
Reflexivity (see Sections 6.3.3; 6.5.3 and 6.7.3)	Reflections on own teacher education practices and experiences, especially the preparation of graduate teachers for their roles in society	Use of policy to support reflexive engagements with own practice	Use of policy and concepts to support engagement with own through T/L methods	Planning to engage with practice and with CoP through specific approaches (Indigenous knowledge and community problem solving)	Use of ICTs to support ongoing changing change projects	The ongoing desire to improve practice that is evident in the way she tried out T/L methods with different student cohorts

Deepened knowledge (see Section 6.10.3)	Knowledge of contextual environmental and sustainability as well as CoP conditions	Knowledge of the influence of international and national policy and of issues on practice and change project	Knowledge of the influence of international and national policy, on concepts and on more sustainable alternatives and T/L methods with depth and understanding	Knowledge of T/L methods in relation to collaborative practice and working in CoPs	Use of ICTs to support deepening of knowledge for collaborative practice and social change	Knowledge of notions used in the change project including the biophysical, social, economic and political aspects with critical depth and understanding
Agency (see Sections 6.4.3; 6.7.1; 6.7.3 and 6.10.3)	Ability to build on outdoor activities from prior course and bring activities into the classroom	Ability to use policy guidelines to support classroom activities and to find relevance of ESE change project in teacher education	Ability to use policy guidelines to support relevant T/L methods for the change project	Ability to use T/L methods that promote social change through collaborative practice in CoPs	Use of ICTs to support collaborative learning and practice for social change	Ability to use T/L methods that promote social change; leadership to form local CoP/ ESD Team
Ability to produce own resources, source own and to use own resources (see Sections 6.3.2; 6.5.2; 6.7.2; 6.7.3 and 6.10.2)	Ability to produce fact sheet	Ability to produce resources such as fact sheet in relation to T/L methods suggested by policy	Ability to produce resources such as PowerPoint in relation to T/L methods suggested by policy	Ability to use the Internet and texts received such as the Methods Handbook to produce teaching resources for the Agriculture Science classroom and for working in CoPs	Ability to use the Internet and other ICTs and existing resources to produce documents and files for mainstreaming ESE	Ability to use fact sheets produced, Teaching methods handbook, to make own PowerPoint presentations as well as MSWord documents and to design assignments that promote the use of these ICTs for better learning of Agriculture Science and sustainability concepts

6.10 Evident emerging attributes of competences

The next section illustrates the competences (see Section 2.6 and Section 3.15) that I identified as having emerged from LY's teacher education practice through the change project.

6.10.1 Emerging attributes of strategic competence

LY demonstrated an ability for strategic competence by identifying, describing and expanding on relevant policy framework that justified and guided her practice (see Section 6.2.1; 6.4.1; LYA1). In order to be able to locate the change project in her practice in the institution LY referred to roles of the college in producing knowledgeable teachers who can respond to societal problems in their teachers. She was further able to locate the change project in her own teaching of Agriculture (see Section 6.5.2)

The initial five-day teacher education course that LY stated in LKPCA enabled her to engage with the issue of soil erosion on the college grounds and led her to think reflexively about her curricula practices as well as how she and her students could contribute to responding to such issues through micro teaching and reaching out to teaching practices in schools through student teachers who would eventually teach in schools (see Sections 6.2.2; 6.3.2; 6.3.3; 6.5.2). My observation here is that the desire for changed practices influenced LY's interactions with the course and her structuring of the change project as evidence for Strategic Competence.

6.10.2 Emerging attributes of system thinking competence

By drawing on the nexus between policy and practice, LY showed capacity for systemic thinking. From LYPCA, she was able to show how policy provided both the framework and guidelines for practice. LY recounted and appreciated how enhanced knowledge on ESE by the Deputy Rector Academic Affairs (DRAA) made the rest of the organisation easy as her requests and those of her colleagues could be understood by the institutional administration. LY pointed out that mainstreaming of ESE was not possible if led by a small group of lecturers. It needed the whole college system to be knowledgeable of what the notion means so that the recommended practices could be implemented with minimum attrition.

By LYPCA she had already started noting the importance of working with different aspects of the college curriculum on the same issue when she noted "Collaborative teaching about soil erosion with development studies lecturer…", and "…technology department agreed to help with design of pavement…" (see Sections 6.2.2; 6.3.2; 6.3.3; 6.5.2). LY further extolled working in communities of practice that recognised contributions by the different members such as herself, student teachers, lecturers, village chief and the agricultural extension officer (see Section 6.3.2). By working with this CoP, LY recognised the need to link indigenous knowledge systems and particularly those related to agriculture and modern agro-ecological systems that bring new knowledge to communities. The desire to combine both forms of knowledge practices is evidence of systems thinking. Upon recognising the need to work as a collective, in LYI she noted that she had led the formation of a team of practitioners in ESD where individuals benefit from supporting each other, as evidence of systems thinking (see Sections 6.7.1; 7.6.2 and 6.7.3).

6.10.3 Emerging attributes of interpersonal competence

LY showed a tendency for collaboration (see Sections 6.2.2; 6.3.2; 6.3.3; 6.4.2; 6.5.2; 6.3.2; 6.7.2 and 6.7.3). She also claimed that colleagues promised to work with her, affirming her interpersonal competence.

The teaching and learning methods that LY chose for the change project involved collaborative work. In LYA2, she chose to engage students in indigenous knowledge systems, whereupon she would have to interact with elders in the society as repositories of knowledge, for them to bring their expertise to class. She noted that this knowledge "…could be gathered in social circles, informal societies and gatherings and from individuals," and this points to her ability to interact with people and to promote interactions between teachers and members of the community at various levels. In addition, by inviting elders of the community to teach her students, she was modelling how student teachers could also engage with people in their own teaching communities to enhance learning. She promoted action research and community problem solving (LYA2), an approach that requires collaborative decision-making and action-taking. She argued that this method involved working with others by being "…investigative, participatory and learning by doing…" (LYA2).

Interpersonal competence was further demonstrated by LY's ability to work with her students and colleagues. To this end, in LYI she constantly referred to "I" and "we" in her account of mainstreaming ESD. She talked about how she introduced some teaching methods but was also quick to recognise what she did in cooperation with others (LYI). She further said "...so what I am assisting them is to use technology even better..." Commitment to work in collaboration was also evident when she said "But for my change project we don't have to do it like this, we have to do it together", demonstrating a recognition that she needed to work with others on her change project if it were to succeed, which is the backbone for interpersonal competence.

In LYI, she also showed how working with her students helped her to understand and achieve what she wanted. In this account she said,

> We have tried doing arrows/concept maps, try to show which is linked to what. So that needs a lot of time as they need to convince and also they need to convince themselves. I think they are enjoying it because once they have free time they come to consult and I believe that we are in the direction where we might put into their minds that the 'so what' question is very important... (LYI)

 So in the end, it is both herself and the students who were keen to know more about and use the "so what" question.

LY added that her work together with that of her colleagues and students is futile "if other people are not on board..., we will have other subjects or courses missing..." In this she was advocating that as many lecturers from as many disciplines should be involved in collaboratively mainstreaming ESE for a higher level of success. LY's recognition of the influential role of collaborative practice in mainstreaming ESE is evidence of interpersonal competence.

6.10.4 Emerging attributes of normative competence

Recognising the role of the college in producing teachers who contribute to solving problems of society that was stipulated by such policy instruments as the Lesotho Environmental Education Strategic Plan, LY noted that college lecturers needed to do more (see Sections 6.2.1; 6.3.1; 6.4.1; 6.5.1; 6.7.1). She advocated that "... we need to change our way of teaching and encourage methods that promote change" (LYPCA), and change

entailed an "education about the world around us empowers individuals to think positively about how to protect, manage and reclaim resources that are available to them" (LYPCA).

Embarking on the soil was evidence of her commitment to social justice and empathy with villagers and farmers in the country by working to restore a resource, especially in an area "...where majority of people still practise subsistence crop farming in their home gardens and keeping livestock." LY observed that the livelihoods of the people depended mainly on tillage of the soil and rehabilitating the available land was her contribution to equity on soil productivity among members of the community (see Sections 6.3.3; 6.4.3; 6.10.2). In addition, this approach would give her students capacity to be able to function according to expectations of the society; this included being able to contribute more positively to development of the society, which is an aspect of normative competence.

6.10.5 Emerging attributes of anticipatory competence

LY started the change project course with the commitment to advocate for change in the future when she called for a different teaching approach, she said "...we as educators have to change our way of teaching and encourage methods that promote change." (LYPCA) (see Sections 6.2.2; 6.3.2; 6.3.3; 6.5.2; 6.3.2; 6.4.2; 6.5.2; 6.7.2 and 6.7.3). A further call to think about the future, in LKA1 she argued that "...society has an obligation to protect soil, conserve it, or even enhance its quality for future generations." Through LYA2, she was able to express that she chose these particular teaching and learning methods because of their ability to mediate for emergence of "new meaning and practices..." which is a pointer towards the change in the future that she desired. In LYA3 she used the community of practice notion to illustrate her desired future, where student teachers, lecturers, people living in villages and experts such as the agricultural extension officer would work collaboratively to respond to environmental issues. Her ability to anticipate a better future and better activities for the change project kept her motivated to do her work: "...these change projects is that they are changing, you need to give yourself a challenge every time, you move from what you were last time and move forward to something new. To me it's challenging to start something new and see how it works out and something like that." The changing nature of change projects created desire and expectations for continued change which constitutes evidence for anticipatory competence.

6.11 Emergent capabilities

The following sections present capabilities that LY demonstrated from the time she started interactions with the change project course.

6.11.1 Personal achievements (beings)

Personal achievements were discerned from the emergent properties. I observed that some were emergent features of LY's social interactions but some were also features that were unique to individuals, to their sense of being and becoming. The achievements were evidence of her being able to:

6.11.1.1 *Feel confidence and self-reliance about one's ESE work*

LY demonstrated an ability to build confidence in her work by engaging her colleagues at the beginning of the course: "… been meeting with some of my colleagues this year to discuss mainstreaming of EE/ESD…" (LYI). She further demonstrated an ability to consult and build confidence that she was doing the right thing in the statement, "From the discussions we had with my colleagues, it came out clearly that collaborative teaching could help a lot to interrelate environment activities across different disciplines." (LYPCA) (see Sections 6.2.2; 6.3.2; 6.3.3; 6.4.2; 6.5.2; 6.7.2 and 6.7.3). The indication here is that when LY engaged with the activities, she had adequate confidence as these were supported and valued by the other members of lecturing staff. In so doing she was able to integrate ESE principles and activities and still fulfil expectations of her work of teaching Agriculture Science, which is what ESD is all about.

LY was confident enough to try out a number of teaching and learning methods during her interactions with student teachers. She showed confidence to go beyond her own subject to try out new teaching and learning methods (see Sections 6.2.2; 6.3.2; 6.3.3; 6.5.2).

6.11.1.2 *Visualise the future*

LY's recognition that the college needed to "integrate EE/ESD in the curriculum so as to build capacity of people to address environmental and developmental issues" (LKPCA) was visionary because it shows how she saw a future where education was used to respond to such issues. It is this vision of transformation both at the college level as well as the societal level that she embarked on a change project that helped her to take the lead to "…change our way of teaching and encourage methods that promote change." (LYPCA) (see Sections

6.2.2; 6.3.2; 6.3.3 and 6.5.2). All this was in order to contribute to society which, according to her, "...has an obligation to protect soil, conserve it, or even enhance its quality for future generations" (LYA1) (see Sections 6.3.3; 6.4.3 and 6.10.2).

In LYA2, she expressed that the teaching and learning methods she was to use would help students teachers to build a historical account that would be used to make decisions on the way forward for the future.   In LYA3, she envisaged the community of practice as contributing to participation, collaborative problem solving on environment and development issues (see Sections 6.3.2; 6.4.2; 6.5.2; 6.7.2 and 6.7.3).

6.11.1.3   *Continue to develop abilities and show desire for continuous improvement*

In LYPCA she explained that the change project used in this study was not her first 'take-home' assignment (see Section 6.1). She had an earlier one which she said "I have been engaged in a change project that was brought about by the (teacher) educators' course that I attended in July 2009... In this case an audit was conducted to identify eroded areas ..." (LYPCA). LK then decided to use her teaching experiences in the new classroom-based change project which was to "... concentrate on the use of methods that will allow students to explore and look at the course and effects of trampling and decide on the appropriate approaches to alleviate the problem." (LYPCA).

The trend to build on previous experience is also evident in her ability to keep trying new methods every year and with each student teacher group that she interacts with (see Sections 6.2.2; 6.3.2; 6.3.3; 6.5.2). In LYI she indicated her continued interest in improving her practice: "I tried different methods where I tried to do outdoor learning activities, one of which is where we tried to conserve soil by promoting vegetative cover..." (LYI). She further indicated that she made a few further trials as "...in one of the classes last semester, I tried again the same scheme of making students presenting. In order to solve the problem of time, I engaged them in a group presentation. It was in an animal health task. They worked in pairs... But what was a challenge then was that the people who were seated did not get a chance to tell each other what they were doing. That was the loophole. The weakness was recognised by the learners themselves." (LYI). LY kept trying out these methods in different sessions: "I also did that kind of grouping again this year with a large group where I have 150 students, space was a limiting factor" (LYI). Interestingly, at every

next activity, she tried to strengthen the weaknesses that had emerged from the previous activity.

6.11.1.4 *Transform available resources and commodities into valuable functionings for teacher education and ESE*

During the on-course session, LY produced a fact sheet that she used in her lessons, "A fact sheet was used as a knowledge resource that will be used by used teachers during their lesson." (LYA2) (see Sections 6.7.3 and 6.10.3). LY was able to develop her understanding of the notion of community of practice that she used to structure the change project implementation process (LYA3). In LYI, she demonstrated how her ability to use ICTs and Computer Applications became a useful tool for her student teachers' micro-teaching activities (see Sections 6.6.2 and 6.10.3). She described how she used ICTs in teaching and learning: "… what we are supposed to be doing is talk about technology and how it can assist when teaching in the classroom especially when approaching the agriculture issue…" (LYI). Having known the usefulness of the application during the RKE activities, she could assist student teachers to use ICTs for presentation purposes. "We are just going to attach the technology issue … so what I am assisting them is to use technology even better by including the ESD elements in that and their own teaching…" (LYI). She further used concept mapping, which she had learned not from the course activities but from interaction with colleagues with whom she shared the ESE discourse: "We have tried doing arrows/concept maps, try to show which is linked to what."

6.11.1.5 *Be skilled, educated and to use and produce knowledge.*

LY realised that outdoor activities had covered the necessary awareness but needed to get into her classroom practice when she noted that "That place serves as a place where you can talk to people about what happened and what was the idea behind doing so …" (LYI). Further to her experiences with this initial outdoor and rehabilitation based change project, she used her learning on the RU/SADC International Certificate in EE course to design another change project that was based in the classroom, focussing on "…talking about the changing of the methodologies that we use in the classroom." (LYI) (see Sections 6.2.2; 6.3.2; 6.3.3 and 6.5.2). In addition, LY learnt how to use computer applications during teaching and learning as part of the RKE group experiences which she used to teach Agriculture Science concepts to student teachers, to teach her student teachers on how to

use the applications, and furthermore encouraged the student teachers to use the computer applications such as PowerPoint and Microsoft Word to present their assignments (see Sections 6.10.3).

6.11.2 Professional achievements (doings) are defined in terms of the subject being able to:

6.11.2.1   Acquire knowledge required for mainstreaming ESE

LY was able to demonstrate that she gained new knowledge and competences from courses. She showed that she had the knowledge and desire for engaging in a learning and change process by the way she responded to the pre-course assignment (LKPCA), on-course tasks (LYA1; LYA2 and LYA3) and the change projects that she implemented in her practice (LYI).

6.11.2.2   Be recognised, respected and treated with dignity by own students, colleagues and communities of practice.

LY demonstrated that her students were becoming more competent and were developing more confidence in her teaching approaches. To this she said, "I think it is going to work out well because they are starting to realise more than what is in the particular topic that they selected." (LYI). In addition, LY is respected more by colleagues in terms of her contribution to teacher education practice and ESE as they plan lessons and classroom activities together. She reported that "… we kind of plan together." LY developed closer relationships with colleagues who shared the same interests in mainstreaming ESE with whom she also shared any capacity developed (see Sections 6.4.2; 6.5.2; 6.7.2 and 6.7.3). LY seemed to enjoy the relationship with one particular colleague who "previously would go to a course and come back, I would not even know where she went and what she went to do. But now we are together ESD has made us closer, we are trying to make our work nicer, better." This means that colleagues developed more confidence and respect in LY after she attended courses and gained capacity for mainstreaming ESE. LY gained regional recognition of her efforts of mainstreaming ESE as she was involved in adapting a regional resource on mainstreaming ESD for SADC REEP. Due to her earlier participation and experiences in implementing change projects, she was involved in ongoing SADC level courses (see Section 6.1).

6.11.2.3 Be part of social and professional networks and communities of practice as well as give and receive social support

During the data generation process, I visited the National Curriculum Centre where it was confirmed that LY is a member of the subject panel for Agriculture Science. Lesotho has introduced a new ESD-based curriculum, starting with their primary school syllabi. LY led the formation of a local community of practice; the ESD Practitioners team when she returned from the Leadership Course that was offered by Rhodes University and SADC REEP (LYI) (see Sections 6.7.1 and 6.7.3). This was a core team of teacher educators who had gained capacity for mainstreaming ESE and incorporated interested teacher educators who had not received formal capacity building in ESE. In her account, she mentioned that "I had a change project when I attended a leadership course where my change project was to make sure teachers who have something to do with ESD must come together… a group of people who have been to ESD courses so that we have the same or common goal within the college because before that we were individuals, everybody working on individual change projects" (LYI).

6.11.2.4 Being able to participate in, negotiate and have a fair share of influence on political decision-making

Attending courses on ESE empowered LY to realise the potential she had to help with streamlining and coordination of existing efforts in the college. She then used the RU/ SADC International certificate in Leadership for Mainstreaming ESD course through the Rhodes University and SADC partnership whose change project was to coordinate the EE/ESD mainstreaming efforts in the college to bring the core group of educators with capacity for mainstreaming ESE together and called them the ESD Practitioners (see Sections 6.7.1 and 6.7.3). Any further developments in ESD mainstreaming such as the ESSA programme found a coordinated group in place (see LYI).

In other interviews made during the data generation process, LY was confirmed to be a member of *Le hae la rhona*, a local initiative of practitioners from various sectors in Lesotho who met regularly to share their experiences on mainstreaming ESE in their practice (see Sections 6.1 and 6.7.3).

6.12 Conclusion

Chapter Six presented structural emergent features (SEPs), cultural emergent properties (CEPs) and people emergent properties (PEPs) arising from LY's interactions with the different phases of the change project course, the RU/ SADC International Certificate in EE course.

This chapter recognised the key mediatory activities, tools and experiences on the course, with a focus on the assignments of the change project course. Emergent properties that were evident in the course tools and activities and were considered useful for mainstreaming ESE in teacher education practice, were presented. LY's interaction with the course was discerned through emergent properties discerned from the Pre-course assignment (LYPCA, see Section 6.2), Assignment One (LYA1, see Section 6.3), Assignment Two (LYA2, see Section 6.4), Assignment Three (LYA3, see Section 6.5). Emergent properties arising from LY's change project implementation process (see Section 6.7) at Institution Y were discerned from the interviews (see Sections 5.15 and 5.16).

I worked with Wiek et al. (2011)'s competences for sustainability (see Sections 2.7 on competences and 5.2 on how the emergent properties were analysed for competences) in LY's teacher education practice (see Section 6.10). Section 6.11 presented how the competences (see Section 6.10) contributed to LY's valued beings and doings, her capabilities (see Section 2.7).

Chapter Seven that follows presents another case of emergence in a teacher education context.

Chapter 7:   The emergent story of emergence: CX

7.0   Introduction

This chapter continues from previous chapters presenting the second of the cases of emergent properties associated with the Rhodes University/ SADC International Certificate in EE course. Emergent properties were discerned to establish how mediation on an academic professional development (APD) course and by the change project course influenced teacher education practices (see Section 1.13 on the Problem).

7.1   A brief history of CX and the change projects

CX holds a Certificate in Education in Geography and Building, a Bachelor of Education degree in Geography and a Master's degree in Population Studies. He taught at secondary school level and worked as a research manager at the local schools examinations regulator institution from where he subsequently joined the university as a lecturer at Institution X. He is a seasoned researcher and has been involved in commissioned as well as collaborative research through many organisations in the country. At the time of the research CX was pursuing PhD studies in environment and sustainability education (ESE).

Based on his interest and experience in teaching, particularly in Environmental Geography, CX became a member of the Environmental Education Association of Southern Africa (EEASA) in 2002 and attended some of the annual conferences. These conferences introduced him to some of the concepts of environmental education that were introduced during the RU/SADC International Certificate in EE course in 2010 when he was participant. He took home a change project in which he used a video and still camera to facilitate a rural community and his student teachers to learn about climate change. He recorded videos and took photographs while facilitating community discussions on climate change and climate change adaptation. He took these videos and photographs to his class of student teachers in Geography at Institution X and used them to discuss the notion of climate change and climate change adaptation.

Due to this involvement in the change project, CX was chosen to represent Institution X as a researcher on a SADC REEP research programme. His research was on climate change

adaptation in a rural setting and he studied the change project that he had started on the RU/SADC International certificate in EE course. In 2012 he decided to study social learning processes that were happening in the change project and how they prepared the members of the community for climate change mitigation and adaptation. In 2014 CX was chosen to be a member of an institutional team on the international ESSA programme (see Section 6.1). Even though CX had only one change project that he led individually, his capacity for mainstreaming ESE was influenced by involvement in the stated activities and programmes. While CX was implementing his change project, he collaborated with two other colleagues to conduct capacity building workshops for the faculty staff in Institution X. Table 7.1 below shows a summary of CX's involvement with mainstreaming ESE.

Table 7.1. Overview of CX's involvement in mainstreaming ESE and associated change projects

Date	Prior years since 2002	August-October 2010	2011	2012	2014 and onwards
Name of activity	EEASA Conferences	RU/ SADC IC EE course	Collaborative capacity building of faculty staff	PhD studies	ESSA mainstreaming ESD courses and workshops
Length of course	5 days	8 weeks	5 days	Ongoing	5 days at a time
Change project/ outcome	No change project but ideas on what constitutes EE and how it could be mainstreamed	Using and promoting teaching and learning methods that facilitate change	Faculty staff introduced to ESE and start to review curricula to integrate ESD	Understanding social learning processes for climate change adaptation in a rural setting	Team led and institutional change project to develop educative art out of waste

The following sections present aspects of the course from which emergent characteristics were discerned. These aspects were used to build the case stories of emergence in CX's teacher education practice.

7.2 Emergent properties from the pre-course assignment (CXPCA)

7.2.1 Structural emergent properties

Policy analysis and relevance: The pre-course assignment enabled CX to look into and trace the development of policies that influenced land-based practices. Such policies date back to the Land Apportionment Act of 1931 and policies including the Land Husbandry Act of 1951, and the recent Land Acquisition and Redistribution Acts of 1985 and 1992, which CX noted "could be traced back to the 1930 Land Apportionment Act up to the various other Land Acts up to the year 2010." To CX, government at times makes policies but does not think through these in order to accommodate sustainability alternatives for the people affected by the policies. These policies caused human settlements where land use practices such as overgrazing and depopulation of livestock invariably led to land degradation. The pre-course assignment provided CX with an opportunity to reflect on the roles of the institution that are "to teach, research and do community service". He realised that the change project would enable him to contribute to the role of the educational institution, that of valorising societal knowledge and at the same time to contribute to sharing the knowledge across knowledge divides. Through the pre-course assignment, CX found his intended change project worked towards the Vision and Mission statements of his institution that sought to make meaningful contributions to sustainable development of the nation by providing education, training and advisory services of high quality. In addition, CX managed to locate the change project into the new Masters in Environmental Science and Mathematics Education programme where it would support the current courses that already contained sustainability issues. The structure and content of the Master's course was built around ESD through the contributing disciplines: "it was then agreed that all members within their subject areas need to infuse ESD issues"

This change project would contribute to the institution's ability to respond to global policies such as the Millennium Development Goals (MDGs) with particular reference to MDG Number 7 to which the country responded by "put[ting] in place several policies that are pro-environment." He was also able to locate his intended change project into legislation by the national environmental body, the Environmental Management Authority (EMA) that promoted environmental conservation. According to CX, "the land policies that were

effected after the year 1999 could not help the environmental situation any better until the government through EMA in 2010, is now lobbying for woodlots...", thereby recognising the role of trees in influencing sustainable arable agriculture. Recognition that there were earlier efforts to mainstream other concepts such as HIV/AIDS in the institution, CX thought that experiences of mainstreaming these earlier concepts could be used to benefit mainstreaming of ESD; he noted "...infusion of contemporary issues in the Geography curriculum has to some extent worked well. Infusion of HIV/AIDS in the general education curriculum has to some extent worked also...".

7.2.2 Cultural emergent properties

Teaching and learning methods: According to CX, "the lack of knowledge on methods to mediate learning in adult learners has been the major limitation"; also "lack of methods suitable for communal areas was a major challenge" and limited ability of people to solve environmental problems in particular societal conditions. Despite there being experts from the forestry department to teach members of the community about planting and caring of trees, the practical engagement by the communities and schools remained limited. The pre-course assignment enabled CX to realise that the reforestation programme led by the forestry department separated seedling producing from tree growing. His change project sought to help bridge the two groups ("those who produce seedlings and the farmers") by encouraging them to develop and work in a community of practice on such issues as climate change adaption and mitigation. In his words, there were gaps in community development: "improvement is needed in coordinating so that farmers can just buy the seedlings that are available and not waste time in seedling production."

Locating the change project in the university and community practices: CX planned that "the chosen activity works on an ongoing project on the introduction of organic gardens and reforestation in the context of the rural poor, Muchena village of eastern Highlands of Zimbabwe." The change project aimed at improving teaching and learning methods and hence interactions concerned with organic farming and how this organic farming could be a response to climate change for communal farmers. According to CX the change project would contribute to "the long term proposed educational activities [that] include workshops on ESD and climate change issues to the community as they go about their organic

gardening." The hope was that the teaching would discourage community members from using inorganic chemicals to treat the soil and crops by encouraging use of organic fertility sources such as compost and humus.

It emerged that back in the institution, there were programmed departmental seminars which could be used as a platform for capacity development for other faculty staff by occasional reports of developments on the change project. For CX, "at institutional level the seminars on new methods to solve such contemporary issue are envisaged to help. Seminars are already penciled in from the 16th of September 2010 as agreed by our [institution] faculty board held on the 20th of July." Capacity building workshops according to CX were activities to engage other lecturers on ESD mainstreaming using community experiences during seminars. CX observed that "at national level the issues of sustainable environmental management can still be infused across existing educational curriculum through teaching and assessment." However, he had a concern that "a lot remains at workshop level with very little on the ground" since workshopping lecturers did not always result in transformed practice as some of the lecturers tended to continue working in the ways that they were used to.

7.2.3   People emergent properties

Motivation and individual agency: It emerged that the CX's motivation and interest to participate in the course was to contribute to societal responses to environment and sustainability issues and especially that "… my change project that is to improve on community education on organic farming as an attempt to address land degradation through organic farming in Muchena village of the Eastern Zimbabwe…" CX was also motivated by the desire to work with "others" (pointing to his colleagues) to mainstream mitigatory and adaptive measures to climate change into the curriculum. In order to reduce the distance between seedling production and farmers, CX helped rural farmers to develop "sustainability practices … [that were used for] reforestation in the production of gum seedlings as well as introducing organic agriculture to the community".

7.3 Emergent properties from Assignment One (CXA1)

7.3.1 Structural emergent properties

Policy analysis and relevance: CX was able to identify and describe policies and policy frameworks that influenced land use as well as agricultural practices among the communal farmers in the designated rural community. The policies identified in the pre-course assignment (see CXPCA above) were considered here. CX further illustrated ability to relate the development view of the policies to show how they support each other to cause the current state of the environment and sustainability concerns. CX noted:

> Shocks came through the introduction of the land laws such as the Land Apportionment Act of 1930 which pushed these people to the much hilly terrain... The Land Husbandry Act of 1951 which emphasised destocking solved the problem of overgrazing but created a new problem where the rural farmers instead of using cow dung as manure, resorted to artificial fertilisers. The Native Land Husbandry Act of 1951 reduced the number of livestock per household as a measure against land pressure and environmental degradation. This deprived the large population of cattle that provided manure for soil fertility enhancement forcing these rural poor to rely on the use of artificial fertilisers thereby degrading the lands due to this unsustainable farming practice. The Communal Land Act of 1981 shifted land authority from traditional leaders to Local Authority...

This critique included some policies such as the Land Distribution Acts that were more of social justice responses to historical unequal land distribution across the country as he argued that "the Land Policies that were effected after the year 1999 could not help the environmental and political situation any better." The ability to relate such responses to environment and sustainability issues, including re-afforestation and sustainable farming, to guidelines such as Millennium Development Goals, Tbilisi Principles, UN Conference on Environment and Development (UNCED), UN Convention on Combating Desertification (UNCCD) and the Gaborone Declaration emerged as a response to Assignment One. He recognised that certain policies ("In line with the MDG Goal 7: Ensure Environmental Sustainability. The Zimbabwe Government is a signatory to various international protocols on the Environment"; "The United Nations Conference on Environment and Development (UNCED), which was held in Rio de Janeiro in 1992 of which Zimbabwe is a signatory"), were steering policies in his environmental education work. In addition, CX showed ability to locate the change project into existing frameworks in the institution where it would be used for "sharing communal experiences with the DSME Masters students at the University of

Zimbabwe" as well as being as part of an existing organic farming project that involved a rural community.

7.3.2 Cultural emergent properties

Consumerism: Through engaging with Assignment One, CX demonstrated the ability to recognise that technology influenced the culture and behaviour of people in the rural community as they tended to use their money on marketed chemical agricultural inputs; they "had the capacity to buy and use artificial fertilisers and the capacity to infuse urban technology and lifestyles thereby influencing the culture and behaviour of the local society" but this had a negative effect on the land.

Inter-connectedness of resources: CX argued that "a shift from conventional farming to organic or bio-farming can be a good alternative." This statement is an affirmation of the emergence that the use of sustainable materials coupled to good land use practices resulted in sustainable production and conservation of land.

Teaching and learning methods: CX was able to identify "workshops with the community on how they react to such shocks" as one of the methods that would be used to facilitate interactions among members of the community as well as among lecturers at the teacher education institution. It emerged that "use of posters and billboards such as those found in forest areas (*Forest area – Do not cause fires*), are still relevant today as they were in yester years" together with "a resource or fact sheet would be used to disseminate land degradation issues and the mitigation measures" for disseminating information on any developments in the community.

Resource exploitation: According to CX, the community required more than mere laws to change their practices since "enforcement of bye-laws such as those dealing with uncontrolled bush fires became difficult to enforce at grass roots level, leading to further land degradation"

Through interacting with this assignment CX was able to recognize that introduction of sustainable farming methods such as crop rotation, organic farming, organic farming and use of traditional knowledge contributed to "behavioural change within the context of the community studied, reforestation and change towards sustainable farming practices,

organic farming" and would lead to more sustainable use of resources and reduced land degradation.

Innovating practice and collaboration: CX thought sharing information and experiences among community members and with the university as communities of practice, could also be achieved through videos and pictures. This was an innovation to the traditional methods pervasive in the community and university at that time as he argued for "community learning modules where the practical knowledge the community has is sent back to them in a document or video creating a symbiotic relationship."

Change agents: Through the assignment, CX recognised community members' potential change agents, who, if provided with views of how other communities were using their land producing crops, could emulate some of the practices and change their own practices. It was hoped that workshops were to help the community "on how they react to such shocks", which is their agency that would be shown through what they could do.

Institutional reflexivity: The realisation that knowledge can be exchanged between an educational institution and society that emerged from the assertion that "society has a lot of knowledge to offer" was key. CX understood the institution as having the ability for "dissemination of community work and its social responsibility to contemporary issues like Climate Change and HIV/AIDS across the university education curriculum as well as workshops with the community on how they react to such shocks." The teacher education institution therefore sought to continuously engage the rural community, used the knowledge generated in the community amongst community members and at the same time valorised and took the community developed knowledge back to the teacher education space.

7.3.3   People emergent properties

Deepened understanding of issue: The ability to show deepened knowledge and understanding of the political and conceptual landscapes starting with traditional knowledge systems where "Dos and Don'ts were used to protect the environment from degradation and these included the water bodies, the trees and all that lived with them, … were protected from over exploitation through the traditional knowledge systems (TKS)".

Teaching and learning methods: Through Assignment One, CX was able to identify appropriate teaching and learning methods, including "workshops with the community on how they react to such shocks."

Social justice: CX showed ability to relate policies such as the "the 1979 Lancaster House Constitution provided for addressing the land issue through resettlement..." and "the Land Acquisition Act of (1985) tried to further address the land pressure through resettlement..." respectively, which were enacted as a social justice response to historical unequal distribution of land and associated exploitation of resources.

7.4   Emergent properties from Assignment Two (CXA2)

7.4.1   Structural emergent properties

Policy analysis and relevance: The assignment enabled CX to show his ability to identify and describe global ESE (Tbilisi Principles as well as Ahmadabad and Bonn Declarations) and SADC level (Gaborone Declaration) policies guiding EE and ESD practice in relation to the change project; CX asserted that "in the Zimbabwean context, issues of environmental education are taken seriously from lower levels up to university and community levels." He further recognised that "the Bonn declaration ... called for action to set a new direction for education and learning for all, promoting quality education and it being inclusive of all people based on values, principles and practices necessary to respond effectively to current and future challenges," and the change project was meant to set a new direction for learning interactions and practices.

In addition, he recognised that ESE policies contribute to framing the change project; he noted "a lot can be learnt by including people of different ages and experience in the project as advocated in the Tbilisi principles ... environmental education should help the learners to discover the symptoms and real causes of environmental problems ... Principles have actually guided the methodology of mediation in my change project and by so doing my people would be engaged in critical thinking and problem solving at the same time." According to CX, policies also provided a guide to the teaching approach, teaching and learning activities as well as material resources that could be used on the ESE change project. CX foregrounded the use of traditional knowledge systems "Thus in my education mediation process, the use of Traditional Knowledge Systems (TKS) is of paramount importance especially in the

experimental and discovery approach used in organic framing" and he added that "this change project is likely going to give me the good opportunity to test the different methods as well as to apply the different policies, the Bonn Declaration included." The Gaborone Declaration influenced choice of teaching and learning methods as well as the materials for teaching and learning, as CX noted "Guided by recommendation number 1 under learning support materials, my change project advocated for the use of photos and videos to mediate learning as these seem to be flexible with learners of different ages."

7.4.2   Cultural emergent properties

Deepened understanding of teaching and learning methods: CX demonstrated the ability to identify relevant learning theories and appropriate teaching and learning methods that could be used to facilitate collaborative engagement and carefully linked these methods to community learning (expert-led demonstrations, workshops, field trips and observations, discussions, experimentation, videos and photography). Commenting on one of the learning theories he found relevant for the change project, CX said they "concentrate on socio-cultural and historical context of learning ... advocate that learning is not something limited to a classroom or training programme, but is part of our everyday lives. This has shaped all activities in our organic project."

CX recognized that "the community is going to identify the field trip with what they already know and with how they have been doing things. Even when a video on organic agriculture from any other country is shown, the members of Muchena community are likely not to get lost as there are a lot of generic issues to be found in the video as they are found in their context. Knowledge of the learning theories which in this case is situated learning helps the mediator to pitch at a certain level based on what the community already know." Through this recognition CX showed that people can develop agency for change out of interpersonal experiences with people physically present or through reviewing what was shown on videos and photographs.

7.4.3   People emergent properties

Processing and deepening knowledge: CX demonstrated the ability to identify relevant learning theories, particularly situated theories, that guided his thinking on and identification of appropriate teaching methods and was able to justify his use of these on

the change project since they were "generally recommended by the three policies studied, the Tbilisi principles, the Bonn Declaration and the Gaborone Declaration."

The deepened knowledge was used to produce his own resources for use on the change project as part of the assignment and in teacher education practice. The knowledge resource was to be used with student teachers in his classroom practice for the purpose of "evaluating the use of photos (cameras) and case studies to mediate in community learning through sustainable agricultural practices in Muchena village of Eastern Zimbabwe."

Structuring knowledge: By building a sound argument from situated learning theory and the teaching and learning methods that he used (demonstration, experimental, case studies as well as indigenous ways of knowing) and highlighting their strengths and weaknesses, CX structured his argument in ways that enabled him to argue for engaging methods that promote change for more sustainable land use practices. He mediated learning through use of "field trips, excursions and exchange visits" and he argued "there is exchange of knowledge in mitigating risk and observation on better methods on risk engagement and practical approaches to enhancing coping strategies and positive change."

Commitment to social justice and ethics: Through recognising the roles played by teaching and learning methods in enabling rural farmers to improve their performance, CX showed commitment to social justice issues on knowledge and re-thinking of farming practices. Emerging from this assignment write-up is also his commitment to valorising and integrating indigenous and contemporary ways (traditional knowledge systems) of doing things as well as human experiences into the community engagement processes and teacher education practices because the "the use of an agricultural expert bolstered the gap in contemporary knowledge on organic farming whilst the incorporating of the elders brought in the TKS."

Conceptualisation of change project: CX's participation in the on-course session and the assignments that he embarked on helped him to clarify his ideas on the work that he was already doing as part of his community engagement in relation to ESE. He revealed that:

> I had problems to clarify on what really was my change project. The work with the organic gardens looked very ordinary hence was difficult to distinguish what learning processes were taking place. Thanks to the course as now I am clear there has been indeed some learning in the project which I failed to recognise before.

7.5 Emergent properties from Assignment Three (CXA3)

7.5.1 Structural emergent properties

Policy identification, analysis and relevance: The institutional Vision and Mission statements which in CX's view "provides quality technical, learning, research and service to the community also contributes to building towards achieving the MDGs", emerged to be key institutional policies guiding his teacher education practices and thinking on formulation and framing of the change project. Regional policy such as the Gaborone Declaration, global policies such as Ahmadabad and Bonn Declarations as well as the Tbilisi Principles and Millennium Development Goals were key policy documents steering teacher education practice for ESD since "all the 6 institutions to be involved in my CoP are guided by the millennium development goals (MDGs) 1 and 7, eradicate extreme poverty and hunger and ensure environmental sustainability respectively."

Ability to locate change project into existing frameworks: CX showed an ability to locate the change project into a pre-existing community engagement programme on organic farming. The change project was in CX's view to contribute to "the move ... towards Open Distance and e-Learning (ODeL) system ... as videos and cases from this CoP could find their way to be adopted as work in progress towards 'odelifying' learning" since it would involve students learning using aspects of technology.

Willing stakeholders and adult learning: In addition to identifying relevant policies promoting mainstreaming of ESD, CX showed an ability to use his conceptual view of the notion of Community of Practice (CoP) to structure and organise change project activities. His observation was

> The community of practice (CoP) in my change project is derived from loose networks that already exist in the area of environmental sustainability and organic farming... What lacked before was the knowledge on how to pull these loose networks together into a coordinated strong group of learner-educators. Therefore the main aim of this CoP is to improve on mediation methods in ESD through sharing knowledge based on field-work and case studies with pictures (still and mobile) as the major tools.

Through this assignment, the change project would involve members of the community who were mostly willing stakeholders as well as adult learners and that influenced the thinking

on the change project framing and activities so that there would be more open approaches to learning.

7.5.2 Cultural emergent properties

Teaching and learning methods: Through the assignment, CX noted that "The main problem … has been the lack of problem solving and practical approaches to EE issues in colleges. The lecture and textbook approaches have been the main mediation behind EE issues. This … resulted in a teacher who fails to share practical and problem solving skills with her or his pupil's way after training in EE." CX recognised that using such textbook approaches as the lecture method did not always acknowledge knowledge and experiences of adult learners and "… also did not promote solving of contemporary environment and sustainability issues in the society." CX demonstrated ability to identify and to apply such pedagogical methods as meetings, group discussions, videos, photographs together with extension approaches (participatory extension approaches, participatory learning approaches, participatory rural appraisals, rapid rural appraisals, participatory technology development, farmer field schools, innovative farmer workshops, and look-and-learn tours, farmer-first, farmer-back-to-farmer, farmer-to-farmer extension and facilitation - extension agents and the 'visit farmers only when required) to mediate practice. For him teaching and learning methods should have enabled access to a "shared repertoire of resources that is experiences, stories, tools, ways of addressing recurring problems."

Collaboration, democratic practice and participation: Emerging from CX's interest in participatory methods is his quest for collaborative learning and practice that would promote the shared practice of "learning together using field work, case studies and pictures." In his view, the teaching and learning methods applied in the project should have influenced collaborative decision making and taking action as student teachers sought to "experiment and deliberate on these new methods" and at the same time "to foster democracy in education and society."

7.5.3 People emergent properties

Personal choice and motivation: Motivated by the desire to contribute to transformed land use practices CX carefully chose the CoP approach from a variety of possibilities. He

remarked that "The community of practice (CoP) in my change project is derived from loose networks that already exist in the area of environmental sustainability and organic farming as a sustainable alternative in my community. Today the need for better learning and sharing of knowledge has brought about the need to pull together these loose networks into a CoP." In this CoP approach, he found videos and pictures to be relevant tools for capacity building in both the community and the university where "the use of pictures and videos as mediation tools in ESD using a community based project on organic gardening" was pivotal.

Criticality: CX demonstrated an ability for criticality by being able to critique the social interactions among community members, recognising the importance of particular approaches to learning interactions. He suggested that "Today the need for better learning and sharing of knowledge has brought about the need to pull together these loose networks into a CoP." In such thinking ahead, he prepared the interactions for such issues as self-interests, dominance of voices and personalities safeguarded against any negative behavior to the project interactions by "sharing knowledge based on field-work and case studies with pictures (still and mobile) as the major tools."

Structuring of knowledge and intervention: Through the assignment, CX demonstrated the ability to structure knowledge on CoPs, knowledge that he then used to describe roles played by the different members of the CoP during the intervention. The CoP was constituted of a practice, people and organic farming knowledge where the "shared repertoire" was organic farming: "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" and knowledge on soil degradation that included "soil degradation as caused by unsustainable farming practices and deforestation by communal people and small scale farmers." This knowledge was used to frame the interventions which were composed of the introduction; facilitation of interactions among the CoP through (interaction and discussions) using field work approaches, case studies, pictures and videos during the second field visit, concluding with field visits to check on implementation of learning.

7.6 Emergent properties from the Regional Knowledge Exchange group (CXRKE) (Using the video and still camera to record proceedings (see Section 4.1.2.5))

7.6.1 Cultural emergent properties

Capacity development opportunities: CX demonstrated having developed capacity for use of video and still cameras, skills learnt while working in a team collectively by group members themselves. The RKE group followed steps of operating the devices and used them to produce a course portfolio of "every aspect of the course: the presentations, individual interviews, the excursions and the general course venue and visits on video and all that was covered by the video were also covered by digital camera.

7.6.2 People emergent properties

Deepened understanding: CX demonstrated an ability to deepen knowledge and understanding on use of the video as well as still camera by detailing the correct steps to be followed and the precautions to be taken when operating the devices. He claimed "every video camera remains unique but it comes with a detailed manual which one has to study carefully and follow the detailed instructions in order to start using it." What is worth noting here was that he learnt to refer to the manual in order to proficiently operate the cameras.

7.7 Emergent properties from interview over change project implementation (CXI)

7.7.1 Structural emergent properties

Policy identification, analysis and relevance: CX demonstrated his recognition of the importance of policy guidelines in structuring and justifying knowledge and practices during teaching and learning, "Normally during teaching and course development, we refer to guidelines such as the Gaborone Declaration, Bonn Declaration, Ahmedabad Declaration, even if it is not written in the curriculum, students are using these policy documents." In his view, the use of policy enhanced his teaching, "When introducing environmental studies, I talk about the policies before developing the knowledge and that has improved my teaching."

Locating into existing frameworks: The change project fitted as part of the institution's teacher education and community engagement business so support was easy to ask for as "the Dean supported me to work with the community but just recently I was asked by the Dean to report to the university." Outside the university, CX was able to locate the change project into an existing CoP on organic farming and land use practices where "the Forest Commission, both Harare and Mutare are very much interested in what I am doing and they provide the support."

Networking: CX recognised that a larger spectrum of members would enhance the CoP so there was a need to integrate them into the change project whereupon he "tried to expand the network whereby apart from the original communities I have been working with I am now working with other players. I have Friends of the Environment network, The EMA network, and the different farmer organisations that contract farmers." And in addition some of these members and institutions were "already networking with FAO who have an interest in organic farming aspect which I have been working with the communities and FAO seeks to improve that practice … a donor organisation from Italy with interest to … introduce solar power into the communities that I work with." CX's observation was that the Google Group [15]for the course group for which he was a member in 2010 was still active in 2013 with course participants checking on each other's social and professional status: "social interaction through the Google group … we are still meeting with the colleagues and we continue to communicate through the network and we email each other individually and these networks have created much wider networks that we are benefitting from."

Institutional leadership support: Institutional leadership was "very supportive … she also comes up with change project using an inter-disciplinary approach to look at the challenge of a river that is drying up … that she invited me and our department to the study." Institutional support was mostly non-monetary but in the form of time to work of the change project, moral support and space to operate in at the university. For example, "[Institution X] does not support directly with funding into my PhD studies but allows me to go for months for my studies … or go to collect data for weeks into the field of study while I am on duty. Even during the teaching time, I am allowed to attend to my studies and my

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[15] The course participants for that year were enrolled onto a Google Group where they exchanged social and professional experiences and continued to do so four years after they left the on-course phase.

research." It emerged that even though reporting rules are not written down, there were opportunities to share any knowledge and skills gained from programmed institutional capacity development seminars and workshops to larger departmental or faculty groups during these sessions because "whenever one comes from a workshop or course one takes the materials to the Dean and reports back … to the Chair after that … If Dean feels the report will benefit the Faculty, she will organise a formal presentation to the faculty and that I have done on two occasions."

University curriculum influence: Through the change project, CX demonstrated his ability to influence the faculty-wide curriculum by promoting mainstreaming of ESD particularly through capacity building of colleagues through formal faculty activities presented earlier and informal interactions with colleagues.

7.7.2 Cultural emergent properties

Problem-centred student assignments and assessments: CX ascribed his improved ability to set assignments that are based on contextual environment and sustainability issues affecting the students to on-course phase activities because "the assignments were quite practical, from the assignment I learnt to set my own assignments and improved my setting of assignments with my own students here…, instead of just giving a mere knowledge-based assignment." CX found it possible to use qualitative assessment methods as well as the quantitative approaches that he used in the past, "Now in addition to quantitative assessment I also assess qualitatively." The assignments that CX gave to student teachers after the on-course task were more longitudinal and were presented in a wider variety that included portfolios. He noted that "the portfolio assessment improved my methods of assessment. Learners come up with a small project which they come up with a small portfolio and I assess it."

Technological innovation: By indicating that "I took photos and videos in the communities that I used in the university curriculum (to talk about climate change and adaptation within rural communities of Zimbabwe)", CX showed technological innovation in both teaching and learning methods and engaging communities on mitigation and adaptation for climate change.

Approaches to inter-disciplinarity: Through engaging with the change project CX found it necessary to share knowledge with colleagues at both the departmental and faculty levels. Some of the seminars were sanctioned by the Dean as part of the institutional academic development through programmes activities. Interdisciplinary practice continued into other relations in the institution, whereupon CX was invited to contribute to a change project-based research task by institutional leadership: "change project using an inter-disciplinary approach to look at the challenge of a river that is drying up."

Teaching methods and mediation: CX demonstrated appreciation of role enhanced teaching and learning methods in improving disciplinary learning and individual reflexivity as evidenced when he and his colleagues took up some of the teaching and assessment tools used on the course such as "Within our course outline, we have embraced the idea of portfolios, small projects (change projects) and field trips." Practical activities that were part of the on-course phase such as fieldwork experiences were recognised to have positive influence on learning and changed practices. To this end CX particularly ascribed his ability to his course experiences, "Rhodes [University] /SADC course actually introduced the change project approach, field trips, case studies to us, then we introduced all that in our own teaching curriculum."

Collaboration and collaborative practice: CX perceived collaborative decision making as necessary for social action and agency, so he used pictures and videos to facilitate members of the CoP to relate to their own contexts. He pointed out that he "used the camera in order to talk about issues of climate change education within a community and the university." By teaming up with colleagues in the department to conduct capacity building for faculty colleagues, CX demonstrated ability for collective agency.

Recognising existing capacity development processes: At times the discretion of the institutional leadership resulted in the capacity being shared through programmed seminars and workshops since "If Dean feels the report will benefit the Faculty she will organise a formal presentation to the faculty and that I have done on two occasions." Working both individually and in a team, CX took advantage of existing capacity development processes including board meetings and programmed faculty wide seminars and workshops to bring in mainstreaming of ESD where "we had a faculty workshop for mainstreaming ESD in the

curriculum, so [Institution X] is working with ESD and we are still pursuing another workshop to see how far we have gone in greening our curriculum."

Research activities: CX claims to have developed enhanced research capacity, emerging from better understanding of ESE from the RU/ SADC International Certificate in EE course and implementing the change project. In this research, "...my PhD study is based on the initial change project. My initial change project was working with a community, my PhD study is now, 'exploring social learning and capabilities within communities in the face of climate change risks and vulnerabilities'." The PhD study was enabling him to look more closely at what the Community of Practice he was working with were able to do in climate change mitigation and adaptation, how they were doing it and why they were doing it that way using a social learning lens.

Teaching and learning resources: CX "made use of the videos that we took as SADC REEP students, went back to my community, they also learnt from what was happening at Isidore farm" thereby demonstrating ability to use and to teach members of the CoP on the use of cameras and use of the pictures and videos to generate reflections on own practice. He further "used the camera in order to talk about issues of climate change education within a community and the university."

7.7.3 People emergent properties

Motivation and choice: In CX's view, "as a teacher educator I was very much interested in improving the way I was handling my courses ...and the way I was teaching. That motivated me to join the SADC REEP course as a matter of looking for better ways of doing things." CX's key interest on the course was to generally enhance his teaching enterprise in Geography Education and he sought capacity development particularly in the field of environmental education. Such interest was partly generated by earlier involvement in the EEASA conferences. He valued one of the course activities in particular, a visit to an organic farm, "The organic farm project was very much in line with the work which I was doing with farmers in Zimbabwe." He also recognised that together with colleagues he had the ability to influence part of the curriculum that he was responsible for and he integrated ESD through selected aspects such as portfolios, change projects and field trips into his course outlines.

Confidence, objectivity, self-identity and enhanced ego: CX attested to having gained more confidence in his abilities and knowledge in ESD work because the course taught him to "cease to become a teacher and become a facilitator of learning and not a knower of everything, to learn from others and to tolerate pupils when teaching … I improved a lot in resource material use, I used the Methods book. When introducing environmental studies, I talk about the policies before developing the knowledge … I also picked up … the communities of practice concept, which is a base for my teaching and my present and future studies."

His confidence in his work and the CoP work was further shown by his ability to conceptualize and start a PhD study from the community engagement interactions.

Enhanced reflexivity: CX reflected on the speed of change, whereupon he found issues of institutional structure and human diversity to be contributory to the nature and speed of change. For him:

> From my experience, I haven't seen institutional change projects lasting, since 2005. Some projects had to be abolished before their end of life due to different interests in that same change project … In this department three or four change projects have been talked about but none is in existence. In 2007 we had the … partnership but immediately after the team … left, people in the department were pulling in all directions and the project died a natural death before it took off.

Evidence of his ability to be reflexive emerged from the realisation that in order to get activities happening, the channels for introducing innovations defined by protocol do not always work as expected. He pointed out one approach to protocol, "The first is the formal route which entails to sit down with colleagues in the university; Dean, faculty and the faculty planning committee. These will give the go ahead." Following this observation, he chose to take an unconventional route: "In this instance I did not take that route. I went to the community, I identified a problem and looked for people who wanted to help out in that community, then I came back to the university to inform them of what I was doing." This is evidence of enhanced reflexivity where he realised at times one has to be innovative when relating practice with protocol.

Enhanced self-reflexivity/ self-awareness: CX showed an ability to realise that individual effort alone does not bring about the desired change and especially if it is to do with the

curriculum. There was collaborative effort with constant change in ownership of the change project and ESD mainstreaming activities between "I" and "we". For example, recognising individual effort he said "I have tried to expand the network whereby apart from the original communities I have been working with I am now working with other players." In some parts of the discussions, particularly where he had to work with members of the CoP, student teachers or colleagues, CX would for express himself collaboratively, "we have worked well as a big team", "we are already networking with FAO" and "we for example went to the ESSA workshop."

Disciplinary specialisation: When CX indicated that "…it benefitted the students that I teach because I still use some of those videos on topics of climate change issues and adaptation," CX showed that he was interested in supporting student teachers to understand notions of social learning as well as adaptation to effects of climate change, a specific notion in the Geography curriculum and community engagement role of the institution.

Roles of educator and teaching methods: Through implementing the change project, CX demonstrated that in his role as a teacher educator, certain teaching and learning methods used on the course were relevant for strengthening his own practice. For example, "the assignments were quite practical, from the assignment I learnt to set my own assignments and improved my setting of assignments with my own students here, instead of just giving a mere knowledge-based assignment."

Inter-disciplinarity: CX showed capacity for working across disciplinary boundaries by interacting more closely with colleagues in the department and across departments, at faculty level on issues of education for sustainable development. This capacity was enhanced by his ability to mobilise people in ESE that was shown by sharing information of the notion more widely; he had "a colleague who is using the portfolio approach. Students do a small project in the field, more of a change project that they come and report back" and ability to share information teaching and learning methods, particularly on the use of pictures and use of portfolios.

Teaching and learning resources: Through engaging with the assignments, CX recognised how teacher educators can influence teaching methods and "made use of the videos" and

"used the camera in order to talk about issues" to generate discussions on teaching methods and climate change.

Goal-orientedness: CX showed an ability to stay focused using videos and photographs to support community learning on organic farming and climate change adaptation and mitigation as well as mainstreaming of climate change in the courses he taught to student teachers.

Change project implementation as showpiece of capacity: After the RU/SADC International Certificate in EE course, CX continued to be involved in the projects of some members of the CoP such as "Friends of the Environment network, the EMA network, the different farmer organisations that contract farmers..." as well as the Forestry Commission and FAO. Through recognition of the change project work and its impacts, including capacity of the faculty staff in ESE in their institution, CX was selected to be part of the team that "went to the ESSA workshop and came up with a change project that the faculty supported" as an institutional change project for the SWEDESD/ SADC REEP partnership on the ESSA programme.

Leadership, agency and commitment to social change: Leadership to lead faculty to mainstream ESD across the curriculum was shown by CX's presentation of ESD in seminars, which were "formal feedback to the department. Once I reported to the department that this is what I am doing and this is the format I am trying to follow. The rest have been implementing that in their different subjects but not necessarily coming back to me." He teamed up with colleagues to offer capacity development opportunities to the faculty staff. Using agential powers CX twisted the protocol and worked backwards by reporting back to institutional leadership on what he had done to establish a working relationship with the community of practice on organic farming.

7.8 Extended ESD activities emerging from implementing the change project

Further studies: CX used his change project to launch his PhD studies in ESE: "my PhD study is based on the initial change project ... is now, 'exploring social learning and capabilities within communities in the face of climate change risks and vulnerabilities'."

Mainstreaming ESD in teacher education: With the capacity developed, CX became a member of the team implementing "ESSA - Education for Strong Sustainability and Agency". He "also participated in Rhodes research workshops … climate change workshops" after the RU/SADC International Certificate in EE course.

Research and publications: CX has since the course established himself as a facilitator for capacity development as well as a researcher in ESD and Climate Change Education, especially Mitigation and Adaptation – at the time of this research he had undertaken "several collaborative researches with different people and institutions in the field of education including environmental education, the social sciences and water and sanitation." He also contributed chapters to various books on ESD and social learning.

7.9   ESD roles in the institution and beyond

CX's current work commitments included writing and reviewing curricula, preparing and marking exams, preparing course outlines, teaching, community engagement and research. CX was focussing on understanding social learning in a rural community setting for his PhD research. He continued to work with colleagues to mainstream ESD into teacher education programmes at various levels including course outlines and teacher education practices. He was working with colleagues on the ESSA project that was supporting capacity building for mainstreaming ESD in teacher education institutions across southern Africa. CX was the coordinator and link person for the institution within the organic farmers CoP (CXI).

7.10   An analytical landscape of emergent properties (Emergent properties evident across the course phases)

The following sections trace some of the evident attributes of agency that are shown across all phases of the change project; from the assignments and interviews on implementation.

Table 7.2. Analytical landscape of emergent properties and mediation

	Pre-course assignment (CXPCA)	Assignment 1 (CXA1)	Assignment 2 (CXA2)	Assignment 3 (CXA3)	Regional Knowledge Exchange Group (CXRKE – photographs and videos)	Semi-structured Interview (CXI)
	Significant mediation experiences and influences					
	In-context consultation with colleagues; previous course experiences	International policy history and overview in text; Task to identify and work with national policy frameworks	EE policy history in relation to teaching and learning methods in the course;	CoP theory and practice in the course	Group choice on what they want to learn in particular group	Engagement with practice in a CoP in context
	Structural emergent properties					
Demonstrated policy identification, analysis and relevance (see Sections 7.2.1; 7.3.1; 7.4.1; 7.5.1 and 7.7.1)	Ability to identify and relate national policy frameworks to capacity development for EE: institutional mission and vision; National Land distribution and management policies; Millennium Development Goals (MDGs)	Ability to identify more global, regional and national policies influencing ESE: national land distribution and land care policies; Millennium Development Goals, Tbilisi Principles, UNCED (1972, 1992 and 2002), UNCCD declarations and Gaborone Declaration	Ability to identify and discuss policies that influence the choice and conducting of teaching and learning methods: Tbilisi Principles as well as Ahmadabad and Bonn Declarations and SADC level (Gaborone Declaration) policies; national EE policy	Ability to identify, describe and discuss global, regional and national policies that promote collaborative practice and working in communities of practice: Gaborone Declaration, global policies such as Ahmadabad and Bonn declarations; the Tbilisi Principles and Millennium Development Goals	Ability to identify the roles that videos and photographs could play in supporting and enhancing change project implementation	Ability to locate the change project into the Agriculture Science classroom activities: institutional mission and vision statements, Gaborone Declaration, Bonn Declaration, Ahmedabad Declaration

Location of change project into specific course framework (see Sections 7.2.2; 7.3.1; 7.4.1; 7.5.1; 7.7.1)	Ability to identify institutional colleagues to work with: Masters in Environmental Science and Mathematics course and community engagement work	Ability to locate the change project into the Masters in Environmental Science and Mathematics course and community engagement work	Ability to locate change project activities Masters in Environmental Science and Mathematics course lesson activities and community engagement work	Ability to locate the change project and collaborative engagements in the Masters in Environmental Science and Mathematics course and community engagement work	Ability to find relevance of videos and photographs in the change project	Ongoing ability to continue to find relevance of change project in Geography classroom course activities, and community engagement and ability to relate change project activities to other institutional and CoP ESE mainstreaming activities
Mainstreaming creates further conditions for mainstreaming (see Sections 7.1; 7.2.1; 7.2.2 and 7.7.1)	Recognition of influence of prior experiences with ESE notion from the EEASA conferences on choice of capacity building through the RU/SADC International certificate in EE change project	Use of policy to support mainstreaming efforts to enhance achievement of requirements of institutional policy such as Mission and Vision	Use of policy to support conditions and approaches promoted for mainstreaming: the initial change project used to develop other activities and to support new programmes such as ESSA	Mainstreaming efforts in CoP: enlargement of the CoP with increased efforts in mainstreaming ESE in classroom and in community engagement	Videos and photographs support relevant mainstreaming efforts such as assignments, class discussions and presentations	The RU/SADC International certificate in EE course change project created a platform for the ESD mainstreaming, the ESSA programme, ongoing involvement in capacity development, and PhD studies in ESE
			Cultural emergent properties			
Opportunities for professional training and capacity development of colleagues and students (see Sections 7.2.2; 7.4.3; 7.5.2; 7.7.1)	Consultation with colleagues and institutional leadership and audit as opportunities for initial capacity development	Identification of relevant spaces for supporting capacity development in ESE, innovating practice and institutional reflexivity	Recognition of assignments, seminars, workshops and meetings in consultation with institutional leadership as opportunities for capacity development of colleagues	Recognition of assignments, and collaborative use of seminars, workshops and meetings as opportunities for capacity development	Use of videos and photographs in teaching methods, assignments and presentations	Existing assignments, seminars, workshops, meetings, collaborative research and institutional change projects as opportunities for capacity development

Importance of capacity building (see Sections 7.2.2; 7.3.2; 7.5.2; 7.7.2)	Ability to critique own practices particularly teaching and learning methods in relation to context	Ability to critique own practices in teaching and learning methods in relation to policy, context and concepts	Ability to critique own practices in teaching and learning methods in relation to policy, context and concepts	Ability to critique own practices in teaching and learning methods in relation to policy, context and concepts	Ability to critique own practice in relation to production and use of educational videos and photographs	Enhanced ability to work collaboratively with colleagues, students and in CoPs on concepts in context
Teaching and learning methods (see Sections 7.2.2; 7.3.2; 7.3.3; 7.5.2 and 7.7.3)	Observation of own current T/L methods as inadequate or ineffective and found it relevant to improve on	Choice of T/L methods that promote development in relation to policy: Tbilisi; Ahmedabad and Gaborone Declarations	Choice of T/L methods that promote development in relation to policy: Tbilisi; Ahmedabad and Gaborone Declarations	Choice of T/L methods that promote development in relation to policy and collaboration: CoPs and collaboration through reference to Tbilisi; Ahmedabad and Gaborone Declarations	Use of videos and photographs to enhance collaborative T/L methods with a view to promote sustainable practices	Choice of T/L methods that promote sustainable land care practices in CoPs
Teaching and learning resources (see Sections 7.1; 7.3.2; 7.5.2; 7.6.1; 7.7.2; 7.7.3)	Recognition of the inadequacy of teaching methods in fostering criticality and transformation for sustainability	Production of factsheet and use of existing resources such as course notes and Teaching Methods Handbook	Production of videos and photographs and use of resources such as the Methods Handbook to support T/L methods	Use and production videos and photographs their use as to promote collaborative learning and T/L resources in CoP	Making and use of videos and photographs as T/L resources	Ongoing production and use of videos as T/L resources; promotion of videos and photographs as an assessment tool
Valuing of collaborative and democratic practice (see Sections 7.2.2; 7.2.3; 7.4.2; 7.5.2 and 7.7.2)	Initial consultation with colleagues, CoP and institutional leadership	International and national policy on collaborative practice	International and national policy on collaborative practice in relation to T/L methods	International and national policy on collaborative practice in relation to T/L methods and CoP	Use of videos and photographs to enhance collaborative practice in class and communities	Collaborative practice evident in working in CoPs and classroom methods

Commitment to social justice (see Sections 7.2.3; 7.3.2; 7.3.3; 7.4.3 and 7.7.3)	Recognition that land resource was unevenly distributed and not equally taken care of; student teachers didn't have adequate skills to teach well	International and national policy on capacity development for better teaching and for rehabilitation of land	Use of international and national policy on environment including land care in relation to T/L methods	International and national policy on environment care in relation to collaborative T/L methods and CoPs	Use of videos and photographs to support deliberative and collaborative T/L methods	Use of T/L methods that facilitated deliberation, collaborative decision-making and action taking
Sustainable living and more sustainable alternatives on land (see Sections 7.2.1; 7.3.2; 7.4.3; 7.5.2; 7.7.2 and 7.7.3)	Sustainable alternatives seen within development concerns and organic farming foregrounded as sustainable alternative	Use of international and national policy to support learning about sustainable land care and land use	Use of policy to support T/L methods that facilitate deliberation on sustainable land care and land use	Use of policy and T/L methods to facilitate deliberation on sustainable land care and land use in the classroom and in CoPs	Use of videos and photographs to support learning about sustainable and care and land use	T/L methods to support ongoing capacity development efforts in sustainable land care and land use
People emergent properties						
Valuing (see Sections 7.1; 7.3.2; 7.3.3; 7.5.2 and 7.7.2)	Valued teaching approaches and methods that facilitate deliberation and collective decision making on sustainability issues and practices	Valued institutional and global policy that supported collaborative land care and capacity building for ESE	Valued and used policy that promoted collaborative T/L methods including photographs and videos that facilitate land care and capacity building for ESE	Valued T/L methods that facilitate collaborative land care and capacity building for ESE while working in collaboration through CoPs	Use of videos and photographs to support valued T/L methods that support collaborative land care and capacity building for ESE	Ongoing valuing of collaborative methods including use of videos and photographs to support development of conditions of socio-ecological sustainability

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Criticality (see Sections 7.2.3; 7.4.3; 7.5.3 and 7.7.3)	Ability to critique own teaching practices	Ability to relate national and international policies on land distribution to land care in relation to concepts and practices	Ability to use national and international policies to guide thinking on concepts and practices on land care and climate change in relation to T/L methods	Ability to use national and international policies to guide thinking on concepts and practices on land care and climate change in relation to T/L methods in specific learning contexts and COPs	Ability to use videos and photographs to support thinking and learning on policies in relation to concepts and practices	Ability to relate teacher education practices to guiding environment and sustainability policies and key concepts including land care and climate change
Reflexivity (see Sections 7.1; 7.2.2; 7.3.2; 7.3.3; 7.4.3; 7.5.1; 7.5.3; 7.7.3 and 7.7.3)	Reflections on own teacher education practices and experiences, especially effectiveness of own teaching methods	Use of land distribution policy to influence reflexive engagements with thinking on land care practices	Use of policy and concepts to support engagement with own through T/L methods to influence both land care and climate change adaptation	Application of Traditional Knowledge Systems to promote collaborative land care practices	Use of videos and photographs to support ongoing learning on land care and climate change adaption and mitigation	Demonstration of ongoing trial and retrial of the use of pictures of photographs and videos in the community and in the classroom
Deepened knowledge (see Sections 7.7.3; 7.4.2; 7.4.3; 7.5.3; 7.7.3)	Knowledge of contextual environmental and sustainability concerns in community and classroom	Knowledge of the influence of international national and institutional policy of land care and land use in relation to the change project	Knowledge of the influence of international national and institutional policy, on land care concepts, on more sustainable alternatives and T/L methods with depth and understanding	Knowledge of T/L methods in relation to collaborative practice, collaborative action and working in CoPs	Use of videos and photographs to support deepening of knowledge for collaborative practice and social change	Knowledge of notions used in the change project including the CoP, climate change mitigation and adaptation with depth and understanding
Agency (see Sections 7.1; 7.2.2; 7.2.3; 7.4.3; 7.5.3 and 7.7.3)	Recognition of inadequacy of current T/L methods; Ability to seek capacity development opportunities	Ability to relate land distribution policy guidelines to support classroom activities and to find relevance of ESE change project in teacher education	Ability to use policy guidelines to support relevant T/L methods in a change project supporting land care and land rehabilitation	Ability to use T/L methods that promote land care and land rehabilitation through collaborative practice by working in CoPs	Use of videos and photographs to support collaborative learning and practice for social change	Ability to use T/L methods that promote deliberation and collaborative decision making for improved land care, climate change adaptation and climate change education

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Ability to produce own resources, source own and to use own resources (see Sections 7.1; 7.3.2; 7.5.2; 7.6.1; 7.7.2; 7.7.3)	Ability to produce an audit of environment and sustainability issues in the institution	Ability to produce resources such as fact sheet in relation to T/L methods suggested by policy; ability to use T/L methods suggested in handbook on T/L methods in change project	Ability to produce videos and photographs in relation to collaborative T/L methods suggested by policy

Ability to work collaboratively with videos, photographs in relation to T/L methods suggested in book resources and those experienced on the course	Ability to produce documents and files using relevant videos and photographs to support collaborative practice on videos and photographs	Ability to use fact sheets produced, Teaching methods handbook, to make own videos and photographs; ability to use available resources to design assignments that promote deliberation and collective decision making on land care and on climate change adaptation and climate change education

7.11   Evident emerging attributes of competence

The next section illustrates the competences (see Section 2.6 and Section 3.15) that I observed to have emerged from CX's teacher education practice through the change project.

7.11.1 Emerging attributes of strategic competence

Ability to identify policy and define its relevance: CX demonstrated strategic competence by his ability to identify and critique policies that influenced the issue in the change project, land use practices (see Sections 7.2.1; 7.3.1; 7.3.2; 7.4.1; 7.5.1; 7.7.1 and 7.10.1; CXPCA; CXA1).

CX further demonstrated strategic competence by being able to locate the change project and mainstreaming of ESD into the recently approved Master of Environmental Science and Mathematics programme, one of the existing frameworks. Strategic competence was also demonstrated when CX was able to identify policies guiding mainstreaming of ESE and used them to justify the particular teaching methods that he decided to use in the change project (see Sections 7.2.1; 7.3.1; 7.4.1; 7.5.1 and 7.7.1 and 7.10.1 and CXA2; CXA3). Evidence of strategic competence can be seen in his use of videos and still pictures and his choice of Traditional Knowledge Systems and social learning strategies that were rooted in the environmental education and education for sustainable development discourse.

The way CX used the notion of community of practice, to transform a group of interested members to recognise each other's roles and become one community of different individuals and groups who share the same interests and who work towards the same goal was evidence of strategic competence (CXA2; CXA3; CXI). Strategic competence was further demonstrated when CX realised that university ethical approval processes for introducing innovations such as his engagement with the CoP were time consuming. He therefore engaged with the change project with the CoP and then reported the developments and learning processes that he was involved in to Institution X (see Section 7.7.3; CXI).

7.11.2 Emerging attributes of system thinking competence

CX demonstrated ability for systemic thinking by foregrounding the important role land distribution policies played in influencing land use practices from the colonial to the democratic governments (see Sections 7.2.1; 7.3.1; 7.4.1 and 7.5.1; CXPCA; CXA1; CXA2; CXI).

CX found that environmental education and education for sustainable development policy played important roles in promoting critical thinking and agency on issues of land distribution, land care and land rehabilitation. He foregrounded stipulations of ESE policies in justifying the use of experiential methods and such tools as videos and photographs in facilitating learning and development of agency as evidence of systems thinking (see Sections 7.4.1; CX A1; CX A2; CX A3 and CXI).

CX further showed an ability for systemic thinking by finding relevance for the change project in the institutional Vision and Mission statements and situating the change project within the Master of Environmental Science and Mathematics and into the core business of the institution as well as his own teacher education practice (see Sections 7.2.1; 7.5.1; 7.11.1; CXPCA; CXA1; CXA2; CXA3; CXI). Through deepening knowledge on community of practice, CX was able to break the knowledge up to show what constitutes a community of practice (7.5.1; CXA2; CXA3); this is the structure which he then used to transform the organic farmers and related individuals and institutions into a community of practice on organic farming.

7.11.3 Emerging attributes of interpersonal competence

CX demonstrated interpersonal competence in his ability to learn in collaboration with other course participants, and especially being able to learn the skills of operating cameras together with others in the Regional Knowledge Exchange Group (CXRKE). Ability to appreciate the usefulness of collaboration through working in communities of practice (CX A2; CX A3; CXI) is evidence of interpersonal competence, "we had to agree on a theme..." He mobilised the already existing community members into a community of practice (see Sections 7.5.1; 7.5.3; 7.10.3).

Further evidence for interpersonal competence was shown by CX's ability to use experiential teaching and learning methods, such activities as field visits, videos and photographs, where the learners interacted with each other and with the practice. Members of the CoP were able to learn from other individuals and groups (see Section 7.10.2 on Teaching and Learning methods as well as on Collaboration). They were also provided with a platform to collaboratively critique their land use practices as well as suggest alternative and more sustainable land use practices that they collaboratively embarked on (CXA2; CXA3).

CX further illustrated ability for interpersonal competence during change project implementation when he realised that despite his knowledge, he could not influence the curriculum alone. He realised that he had to work with like-minded colleagues in the department and faculty to promote and to build capacity among faculty staff for mainstreaming ESE into the teacher education curriculum. To this end, during interviews, CX constantly switched between individual and collaborative effort. He used "I" and "we" in describing what he was involved in (see Sections 7.7.2; 7.10.2), showing that his individual efforts in mainstreaming ESE were inseparable from the team effort (CXI), where RX was one of the colleagues that he closely worked with in this regard.

7.11.4 Emerging attributes of normative competence

CX showed normative competence in his ability to draw a relationship between land distribution, land care policies, land use practices and land degradation among different land users in the country (see Sections 7.2.1; 7.3.1; 7.4.1, 7.7.1 and 7.10.1).

By engaging individual and institutional members interested in organic farming into the community of practice notion with a view to enabling them to work collaboratively to care for and use their land more sustainably, CX showed normative competence (see Section 7.5.1). CX viewed collaboration as enabling collective deliberation and decision making resulting in even distribution of tasks and responsibilities as well as beneficence among the members (CXPCA; CXA1; CXA2; CXA3; CXI).

His recognition of prevalently used pedagogic methods and tools as failing to provide learning with adequate tools to engage with change is evidence of normative competence

(CXPCA), to which end CX introduced field visits, videos and photographs as a platform to critically engage the members of the CoP as well as his student teachers with factors that affect their land use practices (see Section 7.4.2).

7.11.5 Emerging attributes of anticipatory competence

CX was able to see the change project fitting into the roles of the university as it already responded to the Vision and Mission statements. In relation to this view, he was also able to see the change project as contributing to the teaching and learning of environment and sustainability on the Masters in Environmental Science and Mathematics programme (see Sections 7.2.1 and 7.3.1; CXPCA).

CX's ability to envision the future of the community involved in organic farming as a community of practice where members collaborate and adapt to climate change while his students gained knowledge to facilitate teaching and learning on climate change adaptation (see CXA2; CXA3; CXI) is evidence of his anticipatory competence. Anticipatory competence was also demonstrated by his view that enhanced land use practices would lead to reduced land degradation and enhanced land reclamation as well as consequent improvement in livelihoods of rural people through production of organic food (CXA2; CXA3; CXI). He also demonstrated anticipatory competence when he introduced experiential methods in pedagogy, including the use of videos and photographs to generate collaborative deliberations that would critique current practices and promote individual and collaborative agency (see Section 7.3.2 and 7.4.2; CXPCA; CXA1; CXA2; CXI).

Through working with colleagues to promote ESE and to build capacity among colleagues for mainstreaming ESE across the faculty (CXI), CX showed capacity for envisioning a teacher education curriculum including teacher education practices that were reviewed to mainstream ESE.

7.12   Emergent capabilities

The following Sections present capabilities that CX demonstrated from the time he interacted with the change project course.

7.12.1 Personal achievements (beings)

The achievements (see Section 2.6 and Section 3.16) were evidence of the subject being able to:

7.12.1.2 Feel confidence and self-reliance about one's EE/ESD work

CX expressed that he was both happy and confident with the experiential teaching and learning methods that he introduced to the CoP (see Section 7.4.2; CXA2; CXA3; CXI). He was also confident to use videos and photographs with his student teachers, the same pedagogic tools he encouraged them to use during their own teaching in schools through a written assignment (see Sections 7.4.2 and 7.4.3).

His choice of the change project and his ability to define his roles of facilitating learning processes in that change project is evidence of the confidence that he had developed in himself and the capacity that he had in mainstreaming ESE (7.4.3; CXA1; CXA2; CXA3; CXI). Further to this, his choice of the participants of the change project, both the CoP (CXPCA; CXA1) and his student teachers, indicates that he carefully thought about their involvement, his role and was confident the pedagogic innovation that he brought would be relevant.

CX was confident to implement the change project in his practice, which meant that he was confident to try out the approaches himself (see Section 7.5.1). With this confidence, he encouraged his student teachers to use experiential methods as well as videos and photographs as representatives of experiences (see Section 7.7.2; CXI). In addition, by making the change project part of his work, it meant that he had confidence in the methods and tools that he used and in his ability to mainstream critical thought for the development of agency, while at the same time developing the curricular content. CX demonstrated confidence in his knowledge and his ability to contribute to ESD mainstreaming in the institution by teaming up with colleagues to mainstream ESD into the curriculum and to building capacity of faculty staff on mainstreaming of ESD in the curriculum (see Sections 7.7.3; 7.7.3; CXI).

7.12.1.3 Visualise the future

CX demonstrated capability to visualise a future where curriculum practice contributes to changed practices in contexts of learning. He approached learning using different teaching methods, methods that would go beyond making people in the CoP and his students know

but also reflect on their practices (see Section 7.2.2; CXPCA; vA2; vA3; CXI). He was able to visualise his students teaching more effectively by using such tools as videos and photographs. For people to respond to the issues affecting them, CX visualised conditions where they had to participate in discussing issues that affected them and consequently participate in taking appropriate action (see Sections 7.4.2; 7.5.3; CXPCA; CXA2; CXI). CX was therefore able to visualise his change project as contributing to the institutional Vision and Mission statements (see Section 7.11.1; CXPCA; CXA2; CXA3; CXI).

CX was able to visualise a sustainable condition of the land with habitants engaging in sustainable land care and land use practices, including improved productivity of arable land and regeneration of indigenous plant species (see Section 7.10.2; CXPCA).

7.12.1.4   *Continue to develop abilities and show desire for continuous improvement*
CX's capabilities for continued improvement were evident when he realised that the learning experiences that he was exposing his learners to were not providing enough to enable learners to take action in their lived context (see Sections 7.2.2; 7.7.2; CXPCA). CX participated in the RU /SADC International Certificate in Environmental Education course, with the desire to gain skills to transform and continue to improve his practice of teaching (CXPCA). In relation to this, CX brought his cameras to the course and gained skills to operate them proficiently (CXI).

To demonstrate his interests in continued learning, CX went with a group of colleagues for further training on how to mainstream ESE through the ESSA programme (see Section 7. 7.3; CXI). In order to understand better the processes that he was working with together with the Community of Practice, CX took up PhD studies. His study seeks to understand social learning processes that CoP participants engage in and how the learning prepares them for adaptation to as well as mitigation of climate change and its effects on their lives and livelihoods (see Sections 7.1; 7.7.2; 7.8; CXI).

7.12.1.5   *Transform available commodities into valuable functionings for teacher education and ESE*
CX was able to use his knowledge of the notion of 'community of practice' to support the relationship between partners in organic farming to transform into a community of practice working on sustainable land use practices (see Sections 7.5.1; 7.5.3; CXA2; CXI). He was also

able to correctly use cameras to produce resources; videos and photographs that he shared during learning interactions as a member of the CoP were used in the classroom with his student teachers, as teaching tools for pedagogy lessons and the notion of climate change adaptation (see Section 7.7.2; CXA1; CXA2; CXA3; CXI).

7.12.1.6 *Be skilled, educated and to use and produce knowledge.*

CX demonstrated that he was skilled and able to produce knowledge by using the notion of a CoP to help a group of partners to realise that they had contributions to make towards the same goal of organic farming, land use and land care (see Section 7.7.2; CXA2; CXI). CX demonstrated an ability to expand his knowledge on the concepts that he used during the change project, proficiency in using cameras and editing videos, the notion of sustainable alternatives in relation to land use practices, the notion of community of practice, the teaching methods currently used and the teaching methods that he brought into his practice (see Sections 7.6.1; 7.6.2; 7.7.2; CXA1; CXA2; CXA3).

7.12.2 Professional achievements (doings) are defined in terms of the subject being able to:

7.12.2.1 *Acquire knowledge required for mainstreaming ESE*

CX demonstrated an ability to acquire knowledge for mainstreaming ESE by his ability to deepen knowledge, including the more sustainable alternatives on the key issue that influenced the change project (see Sections 7.2.3; 7.10.2; CXA2). He also showed an ability to acquire knowledge by deepening his knowledge on the teaching and learning methods that he was working with on the change project (CXA2; CXA3).

7.12.2.2 *Be recognised, respected and treated with dignity by own students, colleagues and communities of practice.*

CX noted the considerable respect he now received from the members of the community of practice who included him in all activities and offered him transport (see Section 7.7.1; CXI). Some colleagues have encouraged their student teachers to use videos and photographs in teaching, pointing to the respect they have for CX's work (see Section 7.7.1; CXI).

7.12.2.3 *Be part of social and professional networks and communities of practice as well as to give and receive social support*

CX demonstrated an ability to work in a team as he continued to be part of the CoP that was involved in the change project and whose focus was organic farming and establishment of eucalyptus tree nurseries and woodlots (see Sections 7.5.1; 7.5.3; CXA2; CXA3; CXI). He further demonstrated an ability to work in a team when he collaborated with departmental colleagues to promote mainstreaming of ESD among colleagues in the wider Faculty of Education through an institutional change project that was conducted through the ESSA programme (see Sections 7.7.3; 7.8; CXI). Ability to be a team member was also shown by CX's collaboration with departmental colleagues to conduct capacity building workshops on ESD to faculty colleagues (see Sections 7.2.2; 7.7.1; CXI).

7.12.2.4 *Being able to participate in, negotiate and have a fair share of influence on political decision-making*

CX demonstrated an ability to influence decision-making when he introduced his participation on the course to the Dean who represented institutional leadership before he joined the on-course phase. The Dean gave permission for him to participate on the course and for the change project to be implemented in the institution (see Sections 7.7.1 and 7.7.3). Through working with colleagues to conduct capacity building for mainstreaming ESD, CX was able to influence thinking and decisions on curricula and curricular review of the different disciplines in the faculty (see Sections 7.2.2; 7.7.1; CXI).

7.13 Conclusion

Chapter Seven presented structural emergent features (SEPs), cultural emergent properties (CEPs) and people emergent properties (PEPs) arising from CX's interactions with the different phases of the change project course, the Rhodes University/ SADC International Certificate in EE course.

Contributions of the key mediatory activities and tools, with a focus on the assignments and interactions at the workplace, on the change project to emergent properties that were useful for mainstreaming ESE in teacher education practice, were presented by exploring emergent properties in the Pre-course assignment (CXPCA, see Section 7.2), Assignment One (CXA1, see Section 7.3), Assignment Two (CXA2, see Section 7.4), Assignment Three

(CXA3, see Section 7.5) and the change project implementation process (see Section 7.7) in Institution X that was discerned from the interviews (see Sections 5.15 and 5.16).

I used Wiek et al.'s (2011) competences for sustainability (see Section 2.7 on competences and Section 5.2 on how the emergent properties were analysed for competences) to explore CX's teacher education practice (see Section 7.11). Section 7.12 presented how the competences in Section 7.11 contributed to CX's beings and doings and his capabilities (see Section 2.7).

Chapter Eight presents another case of emergence in a teacher education context.

Chapter 8: The emergent story of emergence: RX

8.0 Introduction

This chapter continues from previous chapters: Chapter Five discussed research methods and analysis and Chapters Six and Seven presented the first and second case stories of emergence. This chapter presents the third case of emergent properties associated with the Rhodes University/ SADC International Certificate in EE course. Emergent properties were discerned to establish how mediation in an academic professional development course influenced teacher education practices (see Section 1.13 on the Problem).

8.1 A brief history of RX and her change projects

RX was a lecturer for Physics Education in the Department of Science and Mathematics Education, in the Faculty of Education at Institution X. She taught students studying a Bachelor of Education in Science Education but majoring in Physics Education as well as those doing Master of Education in Physics Education. RX also contributed to the development of the Master of Environmental Science and Mathematics Education course for which she was a lecturer. At the time of the research, she had ten years teaching experience in an institution that was already working towards mainstreaming ESE: "For a number of years the...[*Institution's name*] has handled EE in both the structured and unstructured way through its various faculties, departments and institutes." In addition to teaching B.Ed. students RX was responsible for the Physics section of the department of science education. She was also working with some communities of practice that were mainstreaming ESE into their practice. She was instrumental in applying for the Harare RCE with the United Nations University (UNU).

RX was first involved in environmental education research with a senior lecturer; together they researched environmental knowledge and environmental practices in a rural school. This research exposed RX to some of the concepts of environmental education but she wanted to know more. In 2008 RX participated in the Rhodes University/ SADC International Certificate in EE course that expanded her knowledge of EE. RX joined a Regional Knowledge Exchange Group that was assessing opportunities of universities in southern Africa to mainstream ESD. From this course she took home a change project where she intended to

mainstream power cuts into the Physics component of the Master of Science in Environmental Science and Mathematics course. Her change project was a response to massive power cuts that were experienced in the country at that time. The change project was intended to educate the community through student teachers on ways to cope and adapt to lack of power. Environmentally, the change project sought to provide ideas on how "to teach about electricity, power, power generation, power consumption, power saving, and alternative energy in a way that will influence change." This change project never developed further because as soon as she arrived home, the Masters course was suspended due to lack of adequate staffing. She did however find the ideas from the change project useful in her Bachelor of Education lessons.

In 2009 RX was chosen to participate in the International Training Programme (ITP)[16], a course that was conducted as a partnership between SADC REEP and the Swedish International Development Agency (Sida), through Ramboll Natura[17]. RX's change project from the ITP was to conduct capacity building activities of faculty colleagues. This ongoing change project coincided with her colleagues' interest to build capacity among faculty staff. RX collaborated with two of her colleagues, including CX, to conduct capacity building for faculty staff. The capacity was used to review faculty curricula to mainstream ESD. At the time of the research, RX had started on her PhD studies and she wanted to study the relationship between power generation and use and climate change and climate change education. In 2014, RX was selected to be part of the institutional team of educators that led the ESSA programme (see Sections 6.1 and 7.1) activities in the institution. In addition to an institutional change project to produce artefacts for teaching using waste materials, the change project required the team to conduct capacity building of institutional colleagues.

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[16] The International Training Programme focused on capacity building for mainstreaming education for sustainable development. In southern Africa, participants for this course were chosen from among others, those who had participated well on the Rhodes University/ SADC international certificate in EE course. Part of the course entailed spending four weeks in Sweden during which time each member designed a change project. After this period, participants spent another 4 weeks back in their institution, reporting back and testing out their change project ideas. The final two weeks were spent at SADC REEP, where participants, together with a co-participant each, wrote up a resource that would be used to support change project implementation.

[17] Ramboll Natura is a Swedish NGO that was hired by Sida to conduct capacity development for ESD mainstreaming.

Table 8.1. Overview of RX's involvement in mainstreaming ESE and associated change projects (represented by the arrows)

Date	2007-	August-October 2008	2009	2010	2014 and onwards
Name of course	SADC REEP Research on the nature of EE happening in a school	RU/ SADC IC in EE course	International Training Programme for mainstreaming ESD	SADC REEP Research SADC Research Network in ESD	ESSA mainstreaming ESD courses and workshops
Length of course	Ongoing	8 weeks	9 weeks	Ongoing	5 days at a time
Change project	Investigation of Environmental Education notion and practices in a rural primary school	Mainstreaming power cuts into the Physics Education curriculum	Conducting capacity development activities for colleagues; Capacity building activities for faculty colleagues; Capacity building of CoPs	Researched the meaning of quality and relevance education and the role that ESD could take to enhance quality and relevance if education	Team led and institutional change project to develop capacity of institutional colleagues and to produce artefacts for teaching ESE from waste generated in the institution through normative institutional practices; Capacity building activities for faculty colleagues; capacity building of CoPs

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The following sections present aspects of the course from which emergent characteristics were discerned. These aspects were used to build the case stories of emergence in RX's teacher education practice.

8.2   Emergent properties from the pre-course assignment (RXPCA)

8.2.1   Structural emergent properties

Policy analysis and relevance: Through engaging with the pre-course assignment RX was able to identify policies that were relevant for the change project in the teacher education context as well as analyse and relate these policies to teacher education practice. These were policies that justified the need to embark on the change project and at the same time guided the structuring of the change project. RX's practice was influenced by institutional policy statements such as the Mission that sought "to make meaningful contributions to sustainable development in Zimbabwe. To this end we provide high quality education, training, and advisory services on a needs oriented basis … maintaining excellence in Teaching, Learning, Research and Service to the Community", and the Vision for "a leading university working for prosperity, peace, and dignity in Zimbabwe and beyond". Beyond the institution, teacher education practice relevant to ESD is influenced by commitments that institutions enter with regional, continental or international bodies such as SADC REEP, UNEP-Mainstreaming Environment and Sustainability in African Universities[18] (MESA) and the DelPHE-Ed Qual[19] project.

Locating the change project in the institution: The pre-course assignment enabled RX to recognise that there were other notions and initiatives that the institution was responding to such as gender, HIV/AIDS, orphaned and vulnerable children (OVCs) and resources management as "the content of our courses addresses quite a range of environmental issues including HIV/AIDS, gender parity, waste management, environmental management, cleaner and renewable sources of energy, organic farming." She argued that ESD should not

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[18] The MESA programme was for building capacity for mainstreaming ESD in African universities. It was sponsored by the United Nations Environment programme and supported change project courses.

[19] The DelPHE-Ed Qual programme sought to establish the nature and forms of educational quality in poor countries. Institution X was one of the southern African institutions that was conducting this research that fed into global understanding of quality, especially viewing issues of quality as going beyond figures. Part of this EDQual project was implemented by the SADC REEP Research Network which was coordinated by Rhodes University – RX and other institutional colleagues were part of this network.

be treated in isolation from these but should be one of the initiatives that the institution should embrace.

8.2.2 People emergent properties

RX was personally motivated to apply for the course by the intrinsic desire to learn about ESE "to improve my practice as an EE practitioner" in a condition where "our teaching methodologies are largely theoretical dominated by the lecture approach" and sought to contribute to an education better than one "that emphasises theories instead of values, concepts rather human beings, abstraction rather than consciousness, answers instead of questions, ideology and efficiency rather than conscience." She sought capacity "to re-orient our teaching methodologies so that they become more interactive, participatory in nature and promote reflective thinking."

8.3 Emergent properties from Assignment One (RXA1)

8.3.1 Structural Emergent Properties

Policy analysis and relevance: RX found numerous examples of mainstreaming ESE in the policies and identified policies that influence teacher education practice and mainstreaming of education for sustainable development. The wide array of policies included: "national, regional and international policies, treaties, conventions including the Millennium Development Goals (MDGs), the Earth Summit, the United Nations Decade of Education for Sustainable Development (UN DESD), Development Partnerships for Africa's Development (NEPAD) Environmental Action Plan, Southern Africa Development Community Regional Indicative Strategic Development Plan, (SADC RISDP), Zimbabwe National Environmental Education Policy (ZNEEP) and also our mission and vision as an institution". She was able to establish relevance of the change project and the institutional role in mainstreaming ESE at institutional, national, SADC wide, Africa wide and global levels. Policies and guidelines identified included the Zimbabwe National Environmental Education Policy, UNEP-MESA commitments, Earth Summit where "Chapter 36 of Agenda 21 emphasised that education is critical for promoting sustainable development and improving capacity of the people to address environment and development issue" and the UN Decade of Education for Sustainable Development (UNDESD).

Locating change project in institution frameworks and programmes: Through this assignment RX was able to reflect on current opportunities in the institution and found a contextual guiding framework, a home for the change project where it contributed "to mainstream environment and sustainability education into a new Masters of Science and Mathematics degree in Environmental Science Education. However for the purposes of this assignment, only one course (Issues in Environmental Science) from the entire programme will be looked into. One particular area (Energy) will be considered…".

8.3.2   Cultural emergent properties

Consumerism: RX demonstrated the ability to recognise that people tend to want to show that they are getting more affluent by using more resources; there is an element of desiring consumerism in "using air conditioning equipment, keeping the geyser running, using big electric gadgets are generally associated with affluence." This creates greater demand in some areas of the country and resources such as electricity suffer the burden of this group of users. This consumption is also a social justice issue where generated electricity was a preserve of the urban; alternatives such as "solar power for instance has largely been associated with the rural poor."

Interconnectedness of resources: It was notable that lack of electricity had "implications on service delivery since such services like the supply of drinking water for the city population depends on the availability of power", recognition that provision of resources particularly in such urban settlements as Harare, are closely related to each other.

Resource exploitation: It was recognised that "chief among the effects of power cuts is the fast rate at which forests are disappearing around the city centres" because communities exploit resources from the environment in response to lack of electrical power. They just look for immediate alternatives and at times they find business opportunities without considering whether there are more sustainable options or not such as when "…the sale of fuel wood has been a lucrative business for most people especially along all the major highways", creating competing interest with more sustainable alternatives.

Knowledge: RX demonstrated an ability to relate knowledge to change in behaviour and recognised that it takes more than mere knowledge for anyone to change their practices.

She argued that "people might have the knowledge but lack the motivation to do what is right." It was further recognised that knowledge, particularly of technologies and would-be alternatives is still locked up in particular institutions, in such research centres as "the Scientific and Industrial Research and Development Centre, SIRDC) and implementation has largely been confined to particular rural areas." Tied to knowledge about more sustainable alternatives is the observation that the more sustainable options tend to be more expensive than the less sustainable options, for example, "...energy saving lights on the market cost five to ten times the cost of an incandescent light bulb."

Innovating practice, change agents and collaboration: By recognising that "the learners can be used as change agents at their work places", RX showed capacity to innovate practice where she suggested the 'snowball approach' for capacity development of teachers in schools. In so doing RX hoped to break the norm in that "this entire project will make knowledge previously locked up in university libraries, research institutes, individuals, the internet and communities more accessible to a greater number of people and shared for the benefit of the nation." In addition, she showed appreciation for collaboration by working in communities of practice in teacher education for implementing the change project and other ESD mainstreaming activities in the institution and outside the institution when she suggested that a CoP "provides us with an opportunity to be innovative and improve our practice as EE practitioners by operating within various communities of practice of teaching and social learning."

Institutional reflexivity: RX recognised that other institutions are important as a mirror for one's own institutional activities; she made efforts to use knowledge on "how other universities or nations addressed issues of power cuts through education, of their communities..." which is evidence of an ability to be reflexive and promote institutional reflexivity.

8.3.3   People emergent properties

Deepened understanding of issue: Depth of understanding in this assignment depended on how one chose to look into the issue. RX demonstrated an ability to identify an environment and sustainability issue, "...the inadequacy of electrical power, which emanates from frequent and prolonged power cuts", justify it as worth responding to and showed

deepened understanding of the issue in the context of the institution and in teacher education practice. The ability to link the issue to other environment and sustainability issues such as "strong economic growth in some places, economic collapse in others, war, poor planning, population booms, high oil prices and drought have combined to leave both industry and residents short of power when many need it most" and as "a response to a number of national, regional and international policies, treaties, conventions including the Millennium Development Goals (MDGs), the Earth Summit, the United Nations Decade of Education for Sustainable Development (UN DESD), Development Partnerships for Africa's Development (NEPAD) Environmental Action Plan, Southern Africa Development Community Regional Indicative Strategic Development Plan, (SADC RISDP), Zimbabwe National Environmental Education Policy (ZNEEP) and also our mission and vision as an institution".

Teaching and learning methods: The ability to identify appropriate tools, teaching and learning methods for the change project "...PowerPoint presentation that will be used during a series of lectures ... handouts, assignments and reading lists will also be given to augment the presentation ... other teaching methods such as individual/group presentations and mini research papers and projects will also be used" can be regarded as an individually based attribute.

Reflections on change: Reflections on factors influencing change in the institution at the individual level were evident as RX looked into individual and institutional factors that could affect mainstreaming of education for sustainable development. She recognised that change was partly a moral issue: "different people perceive and respond to environmental issues differently, depending on their social values, cultural norms and beliefs." Therefore, change involves ethical and social values of individuals and the institution as a whole, cultural norms have an influence on what actions could be taken or not, and beliefs and habit affect thoughts and actions about change.

8.4   Emergent properties from Assignment Two (RXA2)

8.4.1   Structural emergent properties

Policy analysis and relevance: Through this assignment, RX was able to demonstrate an ability to identify and discuss in depth, policies that are relevant for supporting

environmental education and education for sustainable development at institutional, national, regional (SADC), continental and global levels. Policies identified included "international agreements on higher education and environmental education … the University Charter on Sustainable Development, the Tailloires Declaration, the Kyoto Declaration, the Halifax Declaration, the Thessaloniki Declaration, and the Luneburg Declaration on Higher Education" as well as the institutional vision and mission statements, UNEP-MESA, MDGs, Earth Summit and Agenda 21, UNDESD, NEPAD, SADC RISDP, ZNEEP, Tbilisi Declaration and WEHAB. RX also showed an ability to describe and give in-depth analysis of these policies and relate their relevance to the change project in teacher education.

8.4.2   Cultural emergent properties

Deepened understanding of teaching and learning methods: The ability to work more deeply with teaching and learning methods was demonstrated in RX's ability to identify and discuss methods that promote voluntary change in relation to the expected outcomes of the change project. The methods included student teachers having to "carry out a mini research project on possible ways that could be used to mitigate the impacts of power cuts … be involved in discussions and deliberations that engage them in critical thinking and reflection … include lecturing, group discussions, debates, and research and individual seminar presentations." Choice of these methods is a recognition that in RX's view, people can develop agency for change out of interpersonal experiences.

8.4.3   People emergent properties

Processing and deepening knowledge: RX demonstrated the ability to develop knowledge around power, especially considering that electrical power in Zimbabwe is

> … a complex challenge and is often a contested issue … is linked with development, it is the engine for growth and poverty alleviation but if not checked may lead to unsustainable harvesting of natural resources (e.g. coal) as well as increased air pollution, leading to global warming and climate change.

Structuring knowledge: RX's presentation of the policy responses showed how the wider global policies influenced national and local policies and how the notions of quality and relevance of education, environmental education and education for sustainable

development developed over the years and filtered through the different policy levels to the institutional level that directly has an effect on individual and social practice.

Commitment to social justice and ethics: Evidence of commitment to social justice and ethics is illustrated in the discussions on availability and use of resources. She argued that

> ... the poor have less access to power as compared to the rich. Added to that the poor have fewer alternatives as compared to their rich counterparts. In Zimbabwe for instance, the affluent residential areas are cut off the grid less than the townships. More so, the affluent normally resort to diesel powered generators in the event of a power cut.

The argument was that the few who have, tend to want and acquire more, they tend to use more resources because they have means to exploit them and yet the many who do not have means to exploit resources, continue to suffer.

8.5   Emergent properties from Assignment Three (RXA3)

8.5.1   Structural emergent properties

Policy identification, analysis and relevance: RX's preparedness to appreciate institutionally relevant structural conditions and guiding commitments that influence change project implementation were demonstrated by her description of her roles in the institution which were "teaching, research and community engagement". This ability is supported by the ability to locate the change into and as part of an existing and specific course framework. The Physics Education component of the Master of Environmental Science course was recognised as a vehicle for implementation of the change project.

Commitment to adult learning: Identification of the cohort of students as adult learners who would benefit from teaching and learning methods and experiences that recognise adult learning styles, was a feature that influenced the greater thinking of the tapestry of teaching and learning during the change project implementation. RX recognised that "sometimes adults do not like the idea of being lectured to especially if they are knowledgeable in a particular area."

8.5.2   Cultural emergent properties

Teaching and learning methods: RX's capacity to use a mix or a wide variety of teaching methods that included "information transfer approaches, including talks and presentations,

experiments and demonstrations, field trips, excursions and exchange visits" to enhance learning interactions in the change project was illustrated in this assignment. In addition, RX showed capacity for in-depth understanding and critique of each of the methods used by considering for each method, assumptions of reality or ontology; assumptions about knowledge; assumptions about the learner; the learner's knowledge and learner's experience; role of the learner; role of the educator; and finally her own educational experiences at school and as a member of society.

Collaboration, democratic practice and participation: Recognition of the essence of democratic practice is evident in RX's choice of teaching and learning methods that promote collaborative learning and practice. Teaching methods such as "investigative methods e.g. fieldwork and collaborative researches … to develop critical thinking and reflection with potential to transform people and animate them for action" were then understood to create conditions for students to appreciate collaborative practice, the notion of participation, individual and collaborative reflexive deliberations with their own practice and lifestyle choices, voluntary change and envisaged transformation.

8.5.3 People emergent properties

Personal choice: For RX, arriving at a choice depended on individual preferences that arose from individual values, depending on understanding of the issue at hand and the perceived approaches to educating about it. Suggesting that "to transform people we also use experiential approaches e.g. values clarification", RX pointed that people's experiences were central in designing educational experiences. She showed an ability to make choices from an array of teaching and learning methods to a few that were valued because the methods would expose learners "to a situation, e.g. a littered street, a movie, pictures or newspaper cuttings and then asked questions that have a direct bearing on what they value most with the possibility of creating opportunities for them to question their values and possibly change for the better." Teaching methods were valued due to their ability to provide conditions for learners to respond to the complexity of the contextual environment and sustainability issues.

Criticality: By foregrounding the purpose of teaching and learning in contributing to the society, RX showed an ability to critically construct an argument. Criticality is also demonstrated by capacity to provide in-depth critique as illustrated by the critique of teaching and learning methods "so that I could improve my teaching as well" (RXI) recognising that her current methods were inadequate. The criticality included her own experiences in social life. She, for example, said

> The presenter ... talked about social inequalities and how some people throwaway food while other people elsewhere will be starving ... I was really challenged because I used to put on my plate more than what I can finish and then throw away the rest ... an opportunity for me to challenge my eating habits and I was transformed in a positive sense.

RX further showed an ability to reflect on her own practice and methods used in the change project by making inferences in relation to application of the theory and method learnt.

One notable emergent feature was the ability to link teaching and learning methods with theories of learning. RX recognised that "the teachers' role is to guide and facilitate learning (what Vygotsky refers to as scaffolding) so that the new ideas fit in well in the pre-existing ideas. Social constructivism extends constructivism into social settings and stresses the need for collaboration among learners and with practitioners in the society." Scaffolding that was put forward by Bruner and popularised by Vygotsky, as well as 'Learning in Communities of Practice' developed by Lave and Wenger, were used to relate theory and practice.

8.6   Emergent properties from the Regional Knowledge Exchange group (RXRKE): (Higher Education group: Opportunities for Higher Education in southern Africa to participate in the UNDESD (see Section 4.1.2.5))

8.6.1   Structural emergent properties

Policy identification, analysis and use: RX demonstrated an ability to recognise the steering role of the university's triple mission of teaching, research and community engagement. She further demonstrated an ability to identify relevant policies such as "the period 2005 - 2014 the Decade on Education for Sustainable Development" for "integrating sustainable development into education systems at all levels". She recognised institutional commitments to such movements as MESA and used their objectives to guide mainstreaming of ESE at individual and institutional levels and these included:

- To enhance the quality and policy relevance of university education in Africa in the context of Sustainable Development (SD) and the achievement of the Millennium Development Goals (MDGs).
- To increase knowledge on ESD so that the future business managers, scientists and political leaders of the continent will incorporate values of SD in their decision making.
- To raise awareness and spread a new way of thinking about environment, development and society, beyond the university boundaries inside the many other social circles in which students, teachers and managers live.
- To offer opportunities for collaborative projects between universities/civic society/communities and the private sector.

8.6.2 Cultural emergent properties

Capacity development opportunities: RX showed an ability to recognise existing academic professional development activities – seminars, workshops and board meetings – as opportunities to build capacity of lecturers in institutions such as universities.

Networking: It emerged that networking of higher education institutions in ESE was possible through existing networks such as MESA, EEASA and SADC REEP while sharing was possible through platforms such as being "presented at a number of regional and international conferences publications and conferences" and "shared through publications such as the EEASA Bulletin".

8.6.3   People emergent properties

Criticality: RX showed high levels of analytical abilities and an ability to critique in the way she analysed higher education in southern Africa where "the majority of universities in southern Africa were established during colonial periods, hence their curricula tended to be westernised and of little relevance to the African context" and then argued for "a shift, to a more practical and relevant education that addresses the needs of African people within an African context".

Deepened understanding: Ability to deepen knowledge and understanding was shown with the identification and in-depth description of networking opportunities for higher education involvement in ESD including the MESA Partnership Forum, SADC REEP Research Network, Regional Centres of Expertise and the Environmental Education Association of Southern Africa.

8.7 Emergent properties from interview over change project implementation (RXI)

8.7.1 Structural emergent properties

Policy identification, analysis and relevance: RX demonstrated ability to identify, analyse and locate change project into institutional Vision and Mission statements:

"I always argued around our mission and vision statement. That was my biggest opportunity. The mission and vision talk about sustainable development and developing students who could be useful to develop this country. So as individuals and faculty we need to be making a contribution to our mission and vision."

Conducting a change project would therefore be part of fulfilling business interests of the institution. Through this ability, she found a course through which the change project would be implemented: "I was looking at different approaches to mainstream this into our new Environmental Education degree, the Masters in Environmental Science" course. Through this exercise, the change project was recognised as an integral part of institutional practice, so did not need whole new institutional arrangements and protocols.

Mainstreaming through research: To RX, ESD could be mainstreamed into the curriculum and institutional practice through research-based activities. She said "I include it in the course outline and also in the assignments that I give them. Part of the assignment will be some practical. Also as I supervise my students' research I encourage them to do research with a practical value." This was in recognition of research being one of the three pillars of university function, so in addition to mainstreaming ESD through teaching, she saw opportunities of mainstreaming through research. One of the emergent activities was an interest in issues related to the course and ongoing processes in education "through the SADC REEP research process where we are working with a school to mainstreaming HIV/ AIDS."

Institutional leadership support: To RX, the institutional leadership was supportive of ESD mainstreaming processes, especially her immediate superior: "we have a very supportive Dean." Institutional leadership foresaw the mainstreaming of ESD into institutional policies. The leadership elsewhere in the institution also prioritised and supported mainstreaming new practices such as engaging students in cleaning their own environment into the

institutional culture. She indicated that "the Dean of students has been working on a student charter which touches on respect for one's self, the environment and it introduces the Blue Hour where students clean their hostels and their surroundings, so that they appreciate living in a clean environment."

Roles of educator: Through implementing the change project, RX observed that one's understanding of the roles of educator influences the extent to which one can mainstream ESD, "...of late I have learnt that Physics is life really and everything we do we will be applying physics concepts. So I have also learnt to teach my subject from a very practical point of view, handling the physics in the classroom to the physics in real life."

University curriculum influence: Through the change project, RX showed an ability to influence the faculty-wide curriculum by promoting mainstreaming of ESD. She managed "to influence change at the faculty level. I worked with other colleagues to push EE ESD forward. One of the things we did was we held a workshop for faculty staff on mainstreaming EE and ESD in the curriculum. We managed to influence curriculum change in the curriculum." The faculty accepted the idea and started reviewing all courses to mainstream ESD.

Mainstreaming activities as springboard for further mainstreaming: It emerged to RX during the change project implementation process that the change project created favourable conditions or a fertile ground for other ESD initiatives such as recognition of other opportunities as in "my participation on the Rhodes course led me to participate in the ITP and due to my participation in the ITP, I worked with other colleagues to push ESD forward." The change project made institutional leadership and colleagues aware of the notion of ESD so they could easily take part. However, this idea was also noticed in relation to the other ESD related activities. The ESSA programme facilitated by SWEDESD and SADC REEP found conditions to bring ESD favourable because of such earlier activities as the change project:

> In March I presented a paper on Climate change Education for UNESCO ... working with UNISA on a research and publication on how the Zimbabwean schools' curriculum is responding to climate change education. I have also been identified by SWEDESD to be part of a team implemented an ESD programme. I was invited by UNESCO who are working on a workbook on mainstreaming ESD in Teacher Education curricula.

8.7.2 Cultural emergent properties

Problem-centred Student Assignments: The changes RX made in her practice included making use of "the change project approach in my teaching as I give my students assignments, that whatever assignment they do it solves some problem in the context that they live and of their work." Through these assignments, RX showed an ability to promote contextuality, relevance of learning and development of agency by ensuring that the assignments facilitated students to engage with some societal problem in the context of their workplace.

Technological innovation: Through implementing the change project, RX showed the capacity to promote technological innovation and contextualisation of learning by engaging with the Rs of waste management (referring to Refuse, Reduce, Reuse, Repurpose and Recycle), where "one Masters researched on the possibility of improvising teaching and learning equipment from waste … focused on developing switches and alarm systems by breaking up old equipment and building up electronic components." This ability was supported by the ability to link up concepts, the notion of waste management, the notion of technology in teaching and the idea of innovation and contextualisation. Usable parts of waste equipment were extracted and used to improvise science equipment by student teachers who "improvised a Gold leaf electroscope, a calorimeter and a voltage divider."

Approach to inter-disciplinarity: During implementation of the change project, RX showed capacity to transcend disciplinary boundaries by interacting more closely with colleagues in the department and across departments, at faculty level on issues of education for sustainable development: "One thing I have managed to do is influence other colleagues to participate and so far we have three people from this faculty,[name of a colleague in a different discipline], CX [who is participant in this study] and [name of a colleague in another discipline] who have also participated in the Rhodes course, I encouraged them so that more and more people are involved. The other thing I managed to do is to influence change at the faculty level." The faculty is made of a variety of disciplines.

Teaching methods and mediation: By changing her teaching approach "to teach my subject from a very practical point of view, handling the physics in the classroom to the physics in

real life", RX demonstrated commitment to experiential and hands-on learning in capacity building.

Collaboration and collaborative practice: Recognition of the importance of mediation and mediators in capacity building emerged as a key aspect, especially when RX was "advised by the course tutors to narrow it into a single topic which could be manageable for a small change project." The change project was narrowed down into a topic in the Physics Section of the Master's course by the end of the on-course phase. That one needs to work in collaboration with others to mainstream environmental education became clear to RX during the change project implementation period as she recounted "we held a workshop for faculty staff on mainstreaming ESD in the curriculum. We managed to influence curriculum change in the curriculum." She was no longer working alone. She then mobilised colleagues, introduced them to courses that would enable them to understand and appreciate ESD so that their collective capabilities could raise the voice and impetus of the discourse of ESD in the institution.

Recognising existing capacity development processes: RX stated that they "we hold monthly departmental board meetings, every Friday of the month and if someone has gone for a workshop, they report depending on the nature of the report. We hold seminars and request to do a seminar presentation … [name of colleague] and … [CX, another colleague] made seminar presentations" by taking advantage of existing professional development opportunities in the institution, including faculty workshops and monthly seminars and departmental board meeting presentations.

Research activities: RX acknowledges having become a better researcher since she started research on ESD, "The Rhodes SADC course was my launch pad to get interested in ESD. It was an eye opener because I learnt a number of things, in terms of teaching, teaching methodology, research, collaborative teaching." Most of the research was not part of the change project but was on environmental education and education for sustainable development. By researching in collaboration, teacher educators mediated each other's understanding of ESD and of research practice. Of note is the collaborative research on HIV/AIDS mainstreaming in a primary school (see earlier Section 8.7.1).

Teaching and learning resources: RX appreciated teaching and learning resources as supporting tools that should be considered and used with all teaching methods during capacity development processes and that they do not necessarily need to be expensive or commercially produced. Of note were the resources used to mediate learning when "studying the river and river systems ... those activities were mainly Biology activities which didn't even require money ... There were no chemicals or sophisticated equipment used except for little booklets that we used as manuals ... we don't need money or sophisticated equipment to give to our students a practical or hands on approach to learning."

8.7.3 People emergent properties

Motivation, agency and choice: By indicating that "I wanted to develop myself in the area of EE so that I could improve my teaching as well", RK showed that desire for capacity development in an area or discipline such as ESE motivates teacher educators to seek for relevant opportunities.

The course and implementation of the change project enabled her to show that she valued and selected (a capabilities centred feature) the change project approach when she pointed out that she tried to use "the change project approach in my teaching as I give my students assignments." She used this approach in her teaching, as the backbone of her assignments.

Confidence and objectivity: While embarking on the change project, RX showed and attested to having developed confidence on set goals, vision and aspirations. She started off with a vision "to teach about electricity, power, power generation, power consumption, power saving, and alternative energy in a way that will influence change." However her plans were disrupted when "the Masters in Environmental Science Education degree programme was suspended due to staff shortages." But she continued with the vision of promoting sustainable energy where "instead of infusing it in the curriculum I am now focussing on climate change as my PhD research area."

Enhanced reflexivity: RX showed an ability to reflect on opportunities and constraints for change processes that are related to interactions of institutional structures, especially institutional leadership. "We have a very supportive Dean, who supports with leadership. But one challenge is there always are people who you can never influence ... change has not happened as quickly as anticipated." By expressing that "there wasn't much involvement of

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the institutional leadership that at some point you also need to get leadership involved. This is opposed to the ITP where at some point you should involve the institutional leadership, this could help". She recognised that while some conditions such as policies may be enabling, institutional leadership has to be supportive of the developments in order to allow and support innovations brought into the institutions by individuals. An example is the RU/SADC International Certificate in EE course that did not get as much support as a sister course, the ITP, which involved leadership at the beginning. She was also able to note that university curriculum review process is very slow as it passes through a long and at times bureaucratic process when she raised that "one of the things is structural reasons. For example in this university the process of curriculum review is cumbersome and slow, that's how universities are organised."

She showed an ability to reflect on her own set goals and vision as these continued to steer the change project, and desire to mainstream education for sustainable development, even when the course she used as a vehicle was suspended (see earlier section on confidence and objectivity).

That "change has not happened as quickly as anticipated" is a realisation that developed due to the ability to reflect on her own practice and observations. The ability to reflect resulted in the realisation that the speed of change is influenced by both structural and human-centred reasons. She noted that "one of the things is structural reasons ... in the university the process of curriculum review is cumbersome and slow, that's how universities are organised ... in universities people specialise and do not care what other people are doing. People are also masters of their areas so wouldn't go across subjects or disciplines to ask or enquire. In the university people are rewarded for researching and publishing but not on what your research does to the community." This points to human diversity and diversity of human thinking as some of the causes of slow change in the institution.

Through this enhanced ability to reflect on her own practices, RX was able to identify and describe aspects of educational quality in teacher education that she could contribute to when she noted "Quality is related to application, is it useful for me. Can I use it to change certain things? When education makes people to reflect and opens their minds to make sound decisions."

Enhanced reflexivity was illustrated by RX's ability to shift from mainstreaming energy sources in the currently suspended Masters in Environmental Science to "focussing on climate change as my PhD research area"and mainstreaming climate change in B.Ed. courses.

Through the change project experiences, it emerged to RX that institutional readiness and receptiveness in such areas as leadership are not confined to the change project and ESD mainstreaming. In terms of institutional support, she believed that "in terms of moral support it is adequate but financially is not. At times we need financial support but it is not easy. Sometimes there are opportunities out there for training but because of bureaucracy, sometimes it is not easy to get a signature. As much as we are getting support there are constraints too." They were pervasive features for new ideas or initiatives in the institution.

Enhanced self-reflexivity/ self-awareness: The ability to reflect on individual roles as teacher educator is reflected in how she "learnt to teach my subject from a very practical point of view, handling the physics in the classroom to the physics in real life … that whatever assignment they do it solves some problem in the context that they live and of their work." In addition, she promoted such teaching approaches among her students.

By implementing the change project, RX showed the capacity to use some activities such as the eco-meal as a springboard to reflect on her own practices, lifestyle choices and development of agential action. She described how in her shopping prior to the course she would "focus on the price but not what it entails on waste disposal … Now I buy tomatoes and other things into one plastic bag." Her shopping behaviour has since changed to exclude what she doesn't need and will not use again. This learning went beyond shopping into other aspects of life such as realising "that each one of us is a problem and that each one of us is the solution. I never looked at myself as a source of shortage of water and electricity but I am due to my behaviour."

Disciplinary specialisation: By revealing that "the other thing is that in universities people specialise and do not care what other people are doing. People are also masters of their areas so wouldn't go across subjects or disciplines to ask or enquire", it emerged to RX that despite the desire to work in collaboration, individual teacher educators tended to focus their mainstreaming efforts on particular themes according to their specialisation and

interests. Such interests were related to their practice because "the university people are rewarded for researching and publishing but not on what your research does to the community." RX however realised that mainstreaming ESE required one to go beyond her discipline and include others, so she made an effort to "influence other colleagues to participate and so far we have three people from this faculty, (names of colleagues including CX, across three respective disciplines) who have also participated in the SADC REEP courses, I encouraged them so that more and more people are involved."

Roles of educator and teaching methods: RX realised that it is change in her teaching methods that will influence other changes elsewhere in her practice. This view motivated her to seek capacity building verbalised as "I wanted to develop myself in the area of EE so that I could improve my teaching as well."

Sense of community, collaborative and democratic practice: RX showed that she engaged with the course in community with others as democratic practice such as when "we walked to the river and observed the quality of water." She also demonstrated her realisation that individual effort alone does not bring about the desired change and especially if it is to do with the institutional curriculum as with "One of the things we did was we held a workshop for faculty staff on mainstreaming EE and ESD in the curriculum. We managed to influence curriculum change in the curriculum ..." Collaborative effort was extolled with the constant change in ownership of the change project and ESD mainstreaming activities between "I" to "we" during the discussions.

Inter-disciplinarity: RX showed capacity for working across disciplinary boundaries by interacting more closely with colleagues: "I managed to influence other colleagues to participate and so far we have three people from this faculty..." in the department and at faculty level where she "managed to influence change at the faculty level..." on issues of education for sustainable development. For her the "course was an eye opener which helped me to break the disciplinary boundaries as I now collaborate with colleagues to improve the teaching/learning of my courses."

Teaching and learning resources: RX asserted "I learnt to develop my own resources for teaching and learning and to diversify my sources on information. Previously I relied almost solely on textbooks as the ultimate source of reference." In this capabilities-centred feature,

RX expressed independence from the few prescribed text books through the enhanced ability to search for resources from other sources and the ability to create her own resources.

Capacity development is spiral: Emerging from RX's reflections is the appreciation that capacity development is spiral, that capacity development at one level opens opportunities for capacity development at other levels and across related fields/ concepts. She noted that "my participation on the Rhodes course led me to participate in the ITP and due to my participation in the ITP..."

She also recognised that involvement in one course created more professional development opportunities including when she "was invited to Zambia to participate in a workshop on mainstreaming ESD in teacher education. The Rhodes SADC course was my launch pad to get interested in ESD." She has presented at UNESCO workshops, she was involved in writing book chapters on ESD with UNESCO Teacher Education and is involved in ESD research projects.

Change project implementation as showpiece of capacity: RX recognised the change project as a showpiece of capacity in ESE. It was through the implementation process that she was recognised by UNESCO (see section on capacity development as spiral above) and invited to present at their workshops, meetings and seminars on ESD and climate change education such as:

> I presented a paper on Climate change Education for UNESCO, I am working with UNISA on a research and publication on how the Zimbabwean schools' curriculum is responding to climate change education ... identified by SWEDESD to be part of a team implementing an ESD programme ... invited by UNESCO who are working on a workbook on mainstreaming ESD in Teacher Education curricula.

Self-identity, enhanced ego and goal orientedness: By saying "I have also managed to make a name for myself in this EE/ ESD field" RK demonstrated an improved self-identity, a feature emergent from her involvement in ESE (also see change project implementation as showcase of capacity above). RX showed an ability to stay focused on her desire to mainstream ESE despite changing conditions affecting her initial plans on the change project where "instead of infusing it in the curriculum I am now focusing on climate change as my PhD research area" (see also section on Enhanced Reflexivity above)

Leadership, agency and desire to make a difference: RX demonstrated leadership and agency by informing colleagues on the notion of ESE, informing colleagues on opportunities for training in ESE and taking leadership for educating the faculty on ESE (see sections on disciplinary specialisation, inter-disciplinarity and collaborative practice above, respectively).

Her commitment to social change is shown by her personal desire to "improve my teaching" which translated to using "the change project approach in my teaching as I give my students assignments, that whatever assignment they do it solves some problem in the context that they live and of their work."

8.8 Extended ESD activities emerging from implementing the change project

Participation in the ITP: Through participating in the Rhodes University/ SADC International Certificate in EE course and implementing the change project, RK was selected to enrol for the International Training Programme for mainstreaming education for sustainable development in Formal Education where she gained more knowledge on how to mainstream ESD (see Section 8.7.3).

Mainstreaming ESD in teacher education: RX was recognised to have capacity to share about ESD so was invited by UNESCO, Harare Office to present at their workshops on mainstreaming ESD. With the capacity on ESE RX was incorporated into a team of teacher educators across the faculty who are implementing Education for Strong Sustainability and Agency (ESSA), a SWEDESD/ SADC REEP partnership programme mainstreaming ESD in teacher education across the SADC region (see Section 8.7.3).

Mainstreaming climate change and climate change education in higher education: Building on these experiences and capacity, RX showed her ability by presenting a paper on Climate Change Education to a UNESCO, Harare Office workshop and is exploring the issue climate change into her PhD study (see Section 8.7.3).

Publications: In a separate development, RX was invited to participate in a UNESCO Teacher Education initiative that was developing a workbook to support mainstreaming ESD in Teacher Education curricula in sub-Saharan Africa and stated that she "presented a paper on

Climate Change Education for UNESCO, I am working with UNISA on a research and publication on how the Zimbabwean schools' curriculum is responding to climate change education."

8.9   ESD roles in the institution and beyond

RK's current work commitments include "working with a school to mainstream HIV AIDS…" writing and reviewing curricula, preparing and marking exams, preparing course outlines, teaching and research. She was working with colleagues to mainstream ESD into the course outlines "We have been trying to put into the course outlines…" and she believed that ESD was already present in most of their course outlines.

8.10   An analytical landscape of emergent properties (Emergent properties evident across the course phases: RXPCA, RXA1, RXA2, RXA3, RXI and RXRKE)

The purpose of the Rhodes University/ SADC International Certificate in EE course was to enhance development of agency for mainstreaming EE/ESD/ESE. Attributes of agency in this research were understood as emergent properties that are evident across the course, from the pre-course assignment to the interview on implementation of the change project. Looking across the assignments and the interviews there was emergence of tendencies, threads or trajectories of emergence, features or attributes of agency at the structural, cultural and people levels. This research sought to establish the role of the Rhodes University/ SADC International Certificate in Environmental Education course in providing opportunities for these attributes to emerge. The following sections trace some of the attributes of agency that were evident across the assignments and interviews on implementation.

Table 8.2. Analytical landscape of emergent properties and mediation shown by RX across the change project course

	Pre-course assignment (RXPCA)	Assignment 1 (RXA1)	Assignment 2 (RXA3)	Assignment 3 (RXA3)	Regional Knowledge Exchange Group-Opportunities for mainstreaming (RXRKE)	Semi-structured Interviews (RXI)
			Significant mediation experiences and influences			
	In-context consultation with colleagues; previous course experiences	International policy history and overview in text; Task to identify and work with national policy frameworks	EE policy history in relation to teaching and learning methods in the course	CoP theory and practice in the course	Group choice on what they want to learn in particular group	Engagement with practice in a CoP in context
			Structural emergent properties			
Demonstrated policy identification, analysis and relevance (see Sections 8.2.1; 8.3.1; 8.4.1; 8.5.1; 8.6.1 and 8.7.1)	Ability to identify and relate national policy frameworks to capacity development for EE: institutional Mission and Vision; Mission; Vision; commitments to institutions such as SADC REEP, UNEP-Mainstreaming Environment and Sustainability in African Universities (MESA) and the DelPHE-Ed Qual project	Ability to identify more global, regional and national policies influencing ESE: Millennium Development Goals (MDGs); the Earth Summit; the United Nations Decade of Education for Sustainable Development (UN DESD); New Partnerships for Africa's Development (NEPAD) Environmental Action Plan; Southern Africa Development Community Regional Indicative Strategic Development Plan, (SADC RISDP); Zimbabwe National Environmental Education Policy (ZNEEP;	Ability to identify and discuss policies that influence the choice and conducting of teaching and learning methods: the University Charter on Sustainable Development, the Tailloires Declaration, the Kyoto Declaration, the Halifax Declaration, the Thessaloniki Declaration, and the Luneburg Declaration on Higher Education" as well as the institutional vision and mission statements, UNEP-MESA, MDGs, Earth Summit and Agenda 21, UNDESD, NEPAD, SADC RISDP, ZNEEP, Tbilisi Declaration and WEHAB	Ability to identify, describe and discuss global, regional and national policies that promote collaborative practice and working in communities of practice: the importance of the three pillars of university learning ("...teaching, research and community engagement" were the compass)	Ability to identify the opportunities universities had for mainstreaming ESD with a view to establishing opportunities for the change project activities and enhancing change project implementation	Ability to locate the change project into the Masters in Environmental Science and mathematics course classroom activities: institutional Vision and Mission statements influenced practice

Location of change project into specific course framework (see Sections 8.2.1; 8.3.1; 8.5.1; 8.7.1)	Ability to identify institutional colleagues to work with: Masters in Environmental Science and Mathematics course in relation to earlier notions such as gender, HIV/AIDS, orphaned and vulnerable children (OVCs) and resources management	Ability to locate the change project into the Masters in Environmental Science and Mathematics course	Ability to locate change project Physics Education activities, Masters in Environmental Science and Mathematics course lesson activities	Ability to locate the change project and collaborative engagements in the Physics Education on Masters in Environmental Science and Mathematics course	Ability to find the change project as contributing to the opportunities of mainstreaming ESE	Ongoing ability to continue to find relevance of change project in Physics Education classroom course activities at any level, and ability to relate change project activities to colleagues' work and to other institutional and CoP ESE mainstreaming activities
Mainstreaming creates further conditions for mainstreaming (see Sections 8.1; 8.5.1; 8.6.1 and 8.7.1)	Influence of prior experiences with researching EE in a rural school showed in interest to pursue capacity development in ESE	Use of policy to support mainstreaming efforts to enhance achievement of requirements of institutional policy such as Mission and Vision	Use of policy to support conditions and approaches promoted for mainstreaming: the initial change project used to develop other activities and to support new programmes such as institutional capacity development of colleagues, ESSA; Capacity built through the RU/SADC International certificate in EE change project process used to apply for the ITP	Mainstreaming efforts in CoP: student teachers worked on change projects in collaboration with colleagues and their learners	RKE knowledge relevant to open up opportunities for change project activities. Support relevant mainstreaming efforts such as production of videos and photographs and presentation	The RU/SADC International Certificate in EE course change project created a platform for the ESD mainstreaming climate change into Physics curriculum, the ESSA programme, ongoing involvement in capacity development, national and international interactions and PhD studies in ESE

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Cultural emergent properties						
Opportunities for professional training and capacity development of colleagues and students (see Sections 8.3.2; 8.4.3; 8.7.1 and 8.7.2)	Involvement in research indicated possibility for building capacity on ESE; Consultation with colleagues and institutional leadership and audit as opportunities for initial capacity development	Identification of relevant spaces for supporting capacity development in ESE such as workshops and seminars; innovating practice and institutional reflexivity as opportunities	Recognition of assignments, seminars, workshops and meetings in consultation with institutional leadership and in collaboration with colleagues as opportunities for capacity development of colleagues	Recognition of assignments, and collaborative use of seminars, workshops and meetings as opportunities for capacity development	Use of existing opportunities in own teaching methods, assignments and presentations as well institutional capacity development opportunities	Existing student assignments, seminars, workshops, meetings, collaborative research and institutional change projects as opportunities for capacity development
Importance of capacity building (see Sections 8.1; 8.3.2; 8.5.2; 8.7.2; 8.7.3)	Ability to critique own practices particularly teaching and learning methods in relation to context	Ability to critique own practices in teaching and learning methods in relation to policy, context and concepts	Ability to critique own practices in teaching and learning methods in relation to policy, context and concepts	Ability to critique own practices in teaching and learning methods in relation to policy, context and concepts	Ability to critique own practice and recognise own weaknesses as opportunities for mainstreaming ESE	Enhanced ability to work collaboratively with colleagues at institutional, national and international levels, students and working in CoPs on concepts in context
Teaching and learning methods (see Sections 8.1; 8.3.2; 8.3.3; 8.4.2; 8.5.1; 8.5.2; 8.7.1; 8.7.2 and 8.7.3)	Observation of own current teaching methods as inadequate to promote values, consciousness and inquisitiveness	Choice of teaching methods that promote students to take action in relation to policy: Millennium Development Goals (MDGs), the Earth Summit, the United Nations Decade of Education for Sustainable Development (UN DESD), Development Partnerships for Africa's Development (NEPAD) Environmental Action Plan, Southern Africa Development	Choice of teaching methods that promote students to take action for environment and development in relation to policy: University Charter on Sustainable Development, Tailloires Declaration, Kyoto Declaration, Halifax Declaration, Thessaloniki Declaration, and Luneburg Declaration on Higher Education" as well as the institutional vision and	Choice of teaching methods that promote taking action in relation to policy and collaboration: institution which were teaching, research and community engagement, in addition to policies identified in RXA2	Use of opportunities identified to enhance teaching methods that promote sustainable practices	Choice of teaching approaches and methods that promote sustainable practices such as waste management and climate change

		Community Regional Indicative Strategic Development Plan, (SADC RISDP), Zimbabwe National Environmental Education Policy (ZNEEP) and also our mission and vision as an institution; UNEP-MESA commitments	mission statements, UNEP-MESA, MDGs, Earth Summit and Agenda 21, UNDESD, NEPAD, SADC RISDP, ZNEEP, Tbilisi Declaration and WEHAB			
Teaching and learning resources (see Sections 8.1; 8.3.3; 8.7.2; 8.7.3)	Recognition of the inadequacy of teaching delivery methods	Production of factsheet and use of existing resources such as course notes	Use of activities such as the eco-meal to foster thinking about sustainable living and sustainable living practices	Use and production and use of artefacts to promote thinking about waste, climate change and sustainable living	Identification of shortage of T/L resources as opportunity to write and use own resources with student teachers	Ongoing production and use of artefacts from old and disused equipment as T/L resources Use of research opportunities to explore possibility of using produced equipment in the school classroom
Valuing of collaborative and democratic practice (see Sections 8.1; 8.2.3; 8.5.2 and 8.7.2)	Initial consultation with colleagues, CoP and institutional leadership prior to on-course session	International and national policy on collaborative practice	International and national policy on collaborative practice in relation to T/L methods	International and national policy on collaborative practice in relation to T/L methods	Use of opportunities for mainstreaming to enhance collaborative practice in class	Collaborative practice evident in working in CoPs and classroom methods
Commitment to social justice (see Sections 8.2.2; 8.3.2; 8.5.3 and 8.7.2)	Recognition that resources such as power are unevenly distributed	International and national policy on sustainable development in relation to consumption and consumerism (see policy identification and relevance above)	Use of international and national policy focusing on equity issues in access and utilisation of such resources as electrical in relation to T/L methods that promote changed practice	Promotion of collaborative T/L methods and CoPs to facilitate criticality and social action	Use of opportunities of mainstreaming to promote, collaboration, criticality and social action	Use of T/L methods that facilitated deliberation, criticality, reflexivity, collaborative decision-making and action taking

Sustainable living and more sustainable alternatives on land (see Sections 8.1; 8.3.2; 8.5.3 and 8.7.3)	Sustainable alternatives seen in relation to power outages which were the contemporary issue	Use of international and national policy to support learning and deliberation on electricity generation, distribution and sustainable use	Use of policy to support T/L methods that facilitate deliberation and learning on generation, distribution, and sustainable use of electrical power	Use of policy and T/L methods to facilitate deliberation and learning on generation, distribution, and sustainable use of electrical power in the classroom and in CoPs	Use of opportunities for mainstreaming in the curriculum and institution to support learning about generation, distribution and sustainable use of electrical energy	T/L methods to support ongoing capacity development efforts on learning and deliberation on generation, distribution, and sustainable use of electrical power in relation to climate change
People emergent properties						
Valuing (see Sections 8.1; 8.3.2; 8.4.3; 8.5.2 and 8.7.2)	Valued teaching approaches and methods that were more practical and tended to respond to contemporary issues	Valued institutional and global policy that supported learning, individual and collaborative decision on sustainable use of resources especially electrical energy	Valued and used policy that promoted collaborative T/L methods that supported learning, individual and collaborative decision on sustainable use of resources especially electrical energy (see section on Policy relevance above)	Valued T/L methods that supported learning, individual and collaborative decision on sustainable use of resources especially electrical energy while working in collaboration through CoPs	Use of opportunities for mainstreaming in own and institutional practice to support valued T/L methods that support individual and collaborative choices on sustainable use of power	Ongoing valuing of teaching and learning methods including use of change projects, portfolios and research to support development of conditions of socio-ecological sustainability through Physics related concepts; use of capacity to teach about and further explore knowledge on climate change

Criticality (see Sections 8.1; 8.3.2; 8.4.2; 8.5.3; 8.7.2 and 8.7.3)	Ability to critique own teaching practices and realising inadequacy in teaching methods	Ability to relate national and international policies on sustainable development to resource use in relation to concepts and practices around climate change	Ability to use national and international policies to guide thinking on concepts and practices sustainable development and climate change in relation to T/L methods	Ability to use national and international policies to guide thinking on concepts and practices on sustainable development and climate change in relation to T/L methods in relation to T/L methods and in COPs	Ability to use opportunities for mainstreaming to support thinking and learning on policies in relation to concepts and practices of sustainable development and climate change	Ability to relate teacher education practices to guiding, institutional, environment and sustainability policies and key concepts in Physics education including energy and climate change
Reflexivity (see Sections 8.1; 8.2.2; 8.3.2; 8.3.3; 8.5.3; 8.7.3 and 8.7.3)	Reflections on own teacher education practices and experiences, especially effectiveness of own teaching methods	Use of sustainable development policy to influence reflexive engagements with thinking on individual and societal practices on energy use	Use of policy and concepts to support engagement with own through T/L methods to influence individual and societal practices on energy use and climate change adaptation and mitigation	Use of change project approach and research to promote individual and societal reflexive practices on energy use and climate change adaptation and mitigation	Use of opportunities for mainstreaming to support individual and societal reflexivity on energy use and climate change adaptation and mitigation	Demonstrated by ability to mainstream electrical energy generation and sustainable use in BEd programmes when the Masters was suspended
Deepened knowledge (see Sections 8.2.3; 8.3.3; 8.4.2; 8.6.3; 8.7.3)	Knowledge and experience of power cuts and of the Physics Education curriculum	Knowledge of the influence of international national and institutional policy on sustainable development in relation to the change project	Knowledge of the influence of international national and institutional policy, on sustainable development, on more sustainable alternatives and T/L methods with depth and understanding	Knowledge of T/L methods to facilitate individual and collaborative sustainable practices, collaborative action and working in CoPs	Use of opportunities for mainstreaming to support individual and societal reflexivity on energy use and climate change adaptation and mitigation	Knowledge of the process electricity generation, distribution and use, sustainability notions used in the change project in relation to climate change mitigation and adaptation

Agency (see Sections 8.1; 8.3.28.5.2; 8.7.1 and 8.7.3)	Recognition of inadequacy of current own T/L methods; ability to seek capacity development opportunities	Ability to relate sustainable development policy guidelines to own practices and to find relevance of ESE change project in teacher education practice	Ability to use policy guidelines to support relevant T/L methods in a change project individual and societal reflexivity on energy use and climate change adaptation and mitigation	Ability to use T/L methods that promote individual and societal reflexivity on energy use and climate change adaptation and mitigation through collaborative practice by working in CoPs	Agency to find and use opportunities for mainstreaming to support individual and societal reflexivity on energy use and climate change adaptation and mitigation	Ability to use T/L methods that promote deliberation and collaborative decision making to facilitate individual and societal reflexivity on energy use and climate change adaptation and mitigation in the Physics Education curriculum and in CoPs
Ability to produce own resources, source own and to use own resources (see Sections 8.1; 8.3.3; 8.4.3; 8.7.2; 8.7.3)	Ability to produce an audit of resources supporting environment and sustainability learning in the institution	Ability to produce resources such as fact sheet guided by context dependent and context independent knowledge in relation to T/L methods that develop critical thinking as well as individual and societal change as suggested by policy; ability to use T/L methods suggested in handbook on T/L methods in change project	Ability to source, discuss and use relevant resources that promoted collaborative T/L methods suggested by policy such as research projects, group discussions and seminar presentations with depth and understanding. Use of the Internet	Ability to work collaboratively with others to source and use resources in relation to T/L methods suggested in policy. Use of the Internet, the handbook on teaching methods received on the course	Ability to find and use opportunities, including selecting appropriate resources for mainstreaming to support individual and societal reflexivity on energy use and climate change adaptation and mitigation through use of resources	Ability to use fact sheets produced, Teaching Methods handbook, and the Internet to make own teaching and learning resources through use of available resources to gain independence from prescribed texts. Resources used to support learning that promoted deliberation and collective decision making on energy use and on climate change adaptation and climate change mitigation

8.11 Evident emerging attributes of competences

The next section describes the competences (see Section 2.6 and Section 3.15) that emerged from RX's teacher education practice through the change project.

8.11.1 Emerging attributes of strategic competence

Strategic competence was shown by RX's ability to identify policies related to environment and sustainability issues of concern to her and to her practice as well as the ability to justify the process of mainstreaming ESE into teacher education practice (see Sections 8.1; 8.2.1; 8.3.1; 8.4.1; 8.5.1 and 8.7.1). Policies from the global, continental, regional (SADC), national and institutional levels were analysed for their appropriateness and relevance as responses to the issue and particularly to the role of education as a response to environment and sustainability issues (RXPCA; RXA1; RXA2, RXA3; RXI). Such policies include MDGs, the DESD (2005-2014), NEPAD, SADC RISDP, ZNEEP and the institutional Mission and Vision statements (see Sections 8.2.1; 8.3.1; 8.4.1; 8.5.1 and 8.7.1). RX was able to use the Mission and Vision statements to situate, justify and steer the process of mainstreaming ESE into institutional teacher education practice (see Sections 8.2.1; 8.7.1; RXI).

In order to make the change project easy to institutionalise, RX showed ability to find a home for the process of mainstreaming ESE in her practice through the Masters in Environmental Science and Mathematics course and later into BEd courses and PhD studies (see Sections 8.2.1; 8.3.1; 8.4.1; 8.5.1 and 8.7.1). This would ensure that the mainstreamed practices became part of her practice in the process of teaching the course, instead of bringing another course on ESE into the institution. Bringing another course could have taken too long as she noted that university curriculum approval processes can be bureaucratic and could have taken a long time (see Section 8.7.1 and 8.7.3; RXI). RX's role has persisted even after the Masters in Environmental Science and Mathematics was suspended; she continued to find possibilities for mainstreaming climate change and climate change adaptation into existing activities such as B.Ed. courses, workshops, seminars and studies (RXI), avoiding the need to create new courses on mainstreaming climate change education (see Section 8.7.3) as evidence of strategic competence.

Upon reflecting on two concurrent courses, the Rhodes University/ SADC International Certificate in EE course and the ITP in Formal Education, RX observed how difference in

engagement of institutional leadership influenced change project implementation and hence institutionalisation of the assignment (RXI). The Rhodes University/ SADC International Certificate in EE course did not bring institutional leaders to the initial phases of the course as did the ITP in Formal Education. Involvement of leadership tended to draw more support as well as recognition of capacity. RX recommended engagement of institutional leadership from the very onset of the course in order to ensure support of the change project implementation process (RXI) – this is evidence of her strategic competence.

RX showed an ability to work in collaboration or in a community of practice by noting that as a teacher educator, her immediate community of practice involves student teachers on her course as change agents (see Section 8.10.3; RXA1; RXI). In addition to this view was the ability to mobilise colleagues (RXA1, RXA2, RXA3, RXI) after noting that one cannot effectively cause change alone, but need to work in collaboration with others through working in communities of practices that even transgress disciplinary boundaries (see Sections 8.3.2; 8.4.2; RXA2; RXA3; RXI).

RX showed competence for thinking about approaches to reach out and multiply on the capacity for mainstreaming ESE in schools where "we start with one teacher and one school, the teacher will influence a number of children, there is a lot of ignorance around energy saving and alternative energy sources" (RXI). In this strategy, her assumption was that her student teachers constituted the core or critical mass from which their own learners developed capacity.

Ability to identify and analyse the potential of supportive networks and community of practice in mainstreaming including EEASA, SADC REEP, and MESA (RXRKE) is an attribute of strategic thinking (see Sections 8.2.1; 8.3.1; 8.4.1; 8.6.1; 8.7.1; 8.6.2 and 8.6.2). RX recognised the learning and supporting networks for mainstreaming ESD in higher education, without whom the goal of mainstreaming ESE was difficult.

8.11.2 Emerging attributes of system thinking competence

RX demonstrated capacity for systemic thinking by recognising that policy guides and steers practice in teacher education and efforts to mainstream education for sustainable development throughout the course (see Sections 8.2.1; 8.3.1; 8.4.1; 8.6.1 and 8.7.1; RXPCA, RXA1, RXA2, RXA3, RXRKE and RXI). Policy was regarded as the principal influence of

practice as it was discussed at various levels from the global that tended to give a broader scope to forms of practice. All forms of teacher education practice were promoted at the global, national and institutional policy levels (see Sections 8.2.1; 8.3.1; 8.4.1; 8.6.1; 8.7.1 and 8.11.1). RX also demonstrated an ability to find connections between ESE and the existing course frameworks such as the Masters in Environmental Science and Mathematics which she saw as a vehicle for supporting coordinated and collaborative departmental and inter-departmental work (see Section 8.7.1).

Ability to think about how other initiatives such as HIV/AIDS and sustainable agriculture (RXCA, RXA1) were integrated into the institution gave RX a vantage point to see how the institution relates with educator-led innovation, in order to think about own agency (see Section 8.2.1).

Connections between sustainability/ unsustainability, sustainable and unsustainable living practices, equity, social justice and ethics were evident. These connections emerged out of RK's ability to use different aspects of learning such as sustainable living, alternatives and more sustainable alternatives, ethics in ESE and knowledge about the issues in real life experiences (see Section 8.3.2).

8.11.3 Emerging attributes of interpersonal competence

The major attributes of interpersonal competence were shown in the tendency for collaborative engagement (see Sections 8.3.2; 8.4.2 and 8.7.2). In RXPCA and RXA1 RX expressed the desire to learn on a course with involving others. Ability to appreciate the productive contribution and collective capabilities coming out of working in communities of practice (RXA1, RXA3, RXI) and ability to mobilise as well as to become a member of the different communities of practice that emerged (RXI) are attributes of interpersonal competence (see Sections 8.3.2 and 8.10.2).

In Assignment Two (RXA2), emphasis was on production of a knowledge resource that would be used during teaching and learning (see Section 8.7.2). The resource was used as a tool to engage student teachers in discussions and reflections during capacity building. Approaches to teaching and learning that were guided by socio-cultural theories, scaffolding that was popularised by Vygotsky and learning in communities of practice that was put forward by Wenger (see Section 8.10.3; RXA3, RXI) were used to frame and inform teaching

and learning experiences for mediating learning across the course phases. These educational theories foreground interpersonal interactions.

Interpersonal competence was illustrated in the realisation that the desired change would not happen if RX worked to mainstream ESD in the institution alone (RKI). She needed to relate with others and sought support from like-minded colleagues. She sought collaborative support from colleagues in the same department but across different disciplines and went on to work with colleagues in different departments of the same faculty (see Section 8.7.3; RXI).

In establishing the necessary conditions for higher education institutions to be able to mainstream ESD, RX expressed the need for these institutions to work in networks and with networks (RXA1, RXRKE). Institutions were encouraged to learn from each other in order to build on what others have learned when implementing ESD activities and any other curricular innovations. Networks in which practitioners interact included EEASA, SADC REEP and MESA (see Sections 8.2.1; 8.3.1; 8.4.1; 8.5.1; 8.7.1 and; 8.11.1; RXRKE).

8.11.4 Emerging attributes of normative competence

The quest for a more sustainable future influenced thoughts and actions that were standard or what is considered to be normal on the course. The pre-course assignment enabled RX to demonstrate an ability to show how she thought and conducted herself regarding equity and justice issues in relation to lifestyles when she observed that the graduates from the institution had consumerist and exploitative tendencies linked to natural resources (see Sections 8.3.2; 8.4.3; 8.10.2; RXPCA). By Assignment One (RXA1) RX was able to recognise that people find and use resources from the environment, sustainably or unsustainably which was beginning to be the norm. She also recognised that in many cases these resources end up as a business and normalise profit making, a condition that tends to overlook concerns of conservation. However, she also observed that people generally tend towards affluence. Affluent people exploit and use more resources than poor people and feel like this is the norm. It follows that people tend to spend more resources to show that they are affluent (see Sections 8.3.2; 8.4.3; 8.10.2)

In Assignment Two (RXA2), RX showed a stronger ability to discern social justice and ethics issues from human actions. She indicated that the few who have, acquire and continue to

want more resources whereas the poor keep having less access to resources. By Assignment Three, she was arguing that the purpose of teaching and learning was to contribute to society (RXA3). During implementation of the change project, she recognised teaching methods such as 'auditing' as providing a platform for self-reflection as a response to the relationship between sustainable living and ethical and social justice issues, especially focusing on personal access and conscious use of resources (RXI). As part of the assignments she gave to her students, she encouraged them to approach issues in their context and try to resolve them as part of their assignments (RXI). This approach contributed to correcting the issues affecting society, for the good of the society (see Sections 8.7.1 and 8.7.2).

8.11.5 Emerging attributes of anticipatory competence

Evidence for anticipatory competence was shown when RX described her role in the institution and realised how her position as teacher educator could be a platform for mainstreaming ESE through implementing the change project and transformation of teaching methods (see Section 8.1; RXPCA). Student teachers were given assignments in the form of change projects that tended to encourage teachers to solve problems through social action in the context of their work (RXI) as a form of problem solving (see Sections 8.7.1 and 8.7.2).

Appreciation of teaching and learning methods that provided for self-reflection such as environmental auditing provided a platform for reflections and generating matters of concern that were the basis for individual and societal change in practice is evidence of RX's futuristic orientation to thinking. This capacity was envisioned to roll out to learners taught by the student teachers and other teachers in schools (see Section 8.4.3). Envisioning being able to engender people with knowledge on ESD was considered important as it enabled RX to emphasise epistemological access as one of the key tenets of the change project (see Section 8.5.1; RXA1, RXA2, RXA3, and RXI). Ultimately, the teachers and learners would make a difference to their schools and society in the future.

Before participating on the course RX "behaved like an island, and never shared information with colleagues in the department" (RXI). Anticipatory competence was shown when RX saw how environment and sustainability issues affecting the institution were normally treated in isolation from each other (RXPCA; RXI) as the people leading these did not collaborate with

others and her quest was to work towards unity of the responses because unity of purpose would have given better results.

These competences were developed by a conscious individual amongst other individuals, in response to prevailing teacher education contextual conditions. The following sections bring to the fore emergent features that were valued by the course participant, the valued beings and doings or capabilities as she participated on the change project course.

8.12 Emergent capabilities

The following sections present capabilities that RX demonstrated from the period that she interacted with the change project course.

8.12.1 Personal achievements (beings)

The achievements (see Section 2.6 and Section 3.16) were evidence of the subject being able to:

8.12.1.1 Feel confidence and self-reliance about one's ESE work

RX expressed that she had become very confident with anything she sets out to do in ESE (RKI), to which end she confidently embraced the change project approach and transformed assignments that she gave to her student teachers with the desire to contribute to the good of society (see Section 8.7.3). She expressed confidence in her choice of the change project approach over other approaches to teaching and learning on the BEd course. Achievement of self-reliance was also demonstrated by her ability to be free from the few prescribed textbooks and the ability to use various sources to search knowledge and reconstruct them for her own teaching and learning processes (see Section 8.10.3; RXI). RX expressed that she made a name for herself as evidence of her confidence in herself, especially in her appreciation of how other individuals and institutions recognised her capacity (RXI).

8.12.1.2 Visualise the future

Capability for visualising the future was illustrated in many ways across the course. By being able to locate the change project within the institutional frameworks, RX visualised a condition where the change project was an integral part of the institution's ESD practice, within a particular course, the Master of Science in Environmental Science and Mathematics (see Sections 8.2.1; 8.7.2 and 8.7.3). In this illustration, she viewed the change project

activities as her contribution to achieving expectations of the institutional Mission and Vision (see Sections 8.2.1, 8.3.1; 8.7.1; RXPCA, RXA1, RXA2, RXA3, and RXI).

Her recognition that the teaching methods were dominated by content delivery approaches point to her vision for a different scenario where content delivery was not dominant (see Sections 8.3.2; 8.5.2; 8.5.3; RXPCA). This was confirmed by valuing of social justice and equity issues upon which she had a vision of a society where resources were acquired and used equitably across different sectors of society. Noticing that the current trends of consumption that are driven by consumerist tendencies (including making business out of selling natural resources and production of consumerist driven graduates) are unsustainable practices, pointed to the ability to foresee the effects of overconsumption on the resources (see Section 8.11. 5; RXA1, RXA2). With this view of effects of unsustainable consumption, RX was able to visualise education as a potential solution, especially teaching and learning methods that promote change including those that use technology (see Section 8.11.1; RXPCA, RXA1, RXA3, and RXI). In addition, RX saw her students as change agents for mainstreaming education for sustainable development and believed that engaging BEd students in a change project based assignment that tended to respond to local issues would lead to change in practice of the student teacher and learners in schools (RXA3, RXI). During an eco-meal activity during the on-course phase, RX was able to see herself contributing to better waste management practices by selecting potential waste materials such as plastic wrapping during her own shopping (see Section 8.11.5).

8.12.1.3 *Continue to develop abilities and show desire for continuous improvement*

RX's desire for learning by being part of a course was a result of her goal to be able to improve her teaching (see Section 8.7.3; RXPCA; RXA1). By recognising that capacity development at one level opens up opportunities for capacity development at other levels, RX demonstrated how her involvement on the RU/ SADC International Certificate in EE course became a base on which she built knowledge-skills for mainstreaming ESD (see Section 8.7.3; RXI). After participating in the RU/SADC international certificate in EE course, RX was inspired to enrol on the ITP (see Section 8.1).

8.12.1.4 *Transform available commodities into valuable functionings for teacher education and ESE*

Recognising and taking advantage of existing and programmed institutional capacity development processes such as seminars, workshops and departmental board meetings to promote mainstreaming ESD is evidence of RX's ability to transform available commodities (see Section 8.7.2; 8.10.2; RXPCA, RXA1, RXA2, RXA3 and RXI). By being able to identify teaching and learning resources that were available for mainstreaming education for sustainable development, RX showed the ability to select appropriate resources from among many and demonstrated her achievement in using available resources (RXA1). Further ability to transform available commodities was demonstrated in her ability to promote innovation and improvisation of laboratory equipment by re-using waste, a feature which supported both learning and practices on waste management and conceptual development in physics (see Section 8.7.2; 8.7.2; 8.10.3; RXI).

8.12.1.5 *Be skilled, educated and to use and produce knowledge.*

The achievement to be skilled, to use and to produce knowledge was demonstrated by RX's enhanced criticality when working with knowledge of ESE, particularly by looking deeper into the meanings and implications of the notion as well as relating sustainability issues and knowledge about them to teaching methods (see Section 8.3.3; 8.4.2; RXI, RXRKE). Since the Masters in Environmental Science and Mathematics Education was suspended, RX was able to use the knowledge and skills gained on ESE to mainstream climate change education for sustainable development (see Section 8.7.3; RXI). The knowledge-skills from the course were used to present in capacity building workshops and seminars on ESD and climate change education in the faculty and outside the institution (see Section 8.7.3; RXI).

8.12.2 Professional achievements (doings) are defined in terms of the subject being able to:

8.12.2.1 *Acquire knowledge required for mainstreaming ESE*

RX knew how to look for knowledge that she needed during mainstreaming of ESD (see Section 8.7.3; RXA1, RXA2, RXA3 and RXI).

8.12.2.2   Be recognised, respected and treated with dignity by own students, colleagues and communities of practice

The first recognition was when RX was enrolled on the ITP soon after participating on the RU/SADC International Certificate in EE course. RX indicated that she had made a name for herself and that she was invited to facilitate capacity development activities by government and non-governmental institutions working to mainstream ESD and climate change (see Section 8.10.3; 8.12.1.1; RXI). The workshops were at institutional, national and international levels. In addition, she was invited to contribute to a UNSECO book on climate change.

8.12.2.3   Be part of social and professional networks and communities of practice as well as to give and receive social support

Through collaborative research activities and working on programmes and courses that were coordinated across different disciplines and departments, RX demonstrated ability to work with others (see Section 8.3.2; 8.7.2; RXPCA). She further worked to break disciplinary boundaries in order to enable mainstreaming of ESD across the faculty (see Sections 8.7.2 and 8.7.3; RXI). The learning theories used to guide teaching methods used and promoted such as learning in communities of practice and Vygotskian mediation encouraged collaboration and learning together and pointed to RX being an educator who had developed an ability to work and learn in community with others (RXA2). Realisation that individual effort alone cannot easily bring about desired changes led RX to work in collaboration with colleagues who had similar interests and aspirations in mainstreaming of ESD to conduct capacity building in the faculty (see Section 8.3.2; RXI). This collaboration persisted as RX worked with colleagues to mainstream ESD into course outlines. She developed an ability for networking by optimising networking opportunities in mainstreaming ESE for higher education through platforms such as MESA, SADC REEP, and EEASA (see Section 8.6.2; RXRKE).

8.12.2.4   Being able to participate in, negotiate and have a fair share of influence on political decision-making

RX was able to recognise and negotiate her way into institutional and curricular policy frameworks and existing courses that facilitated mainstreaming of ESD across the different phases of the course initially by involving institutional leadership and colleagues at the

beginning of the course (see Sections 8.7.1; 8.7.2; RXPCA, RXA1, RXA2, RXA3, RXI and RXRKE). Together with colleagues, she sensitised the institutional leadership on education for sustainable development and lobbied for mainstreaming of ESD into the faculty curriculum and faculty workshops were conducted (see Section 8.7.1 and 8.7.2).

8.13 Conclusion

Chapter Eight has presented structural emergent features (SEPs), cultural emergent properties (CEPs) and people emergent properties (PEPs) arising from RX's interactions with the different phases of the change project course, on the Rhodes University/ SADC International Certificate in EE course and her experiences of mainstreaming ESE into her practice.

Contributions of the different mediatory activities and tools, with a focus on the assignments and interactions in communities of practice for implementing the change project to emergent properties that were useful for mainstreaming ESE in teacher education practice, were presented. The assignments were the Pre-course assignment (RXPCA, see Section 8.2), Assignment One (RXA1, see Section 8.3), Assignment Two (RXA2, see Section 8.4), Assignment Three (RXA3, see Section 8.5) and the change project implementation process (see Section 8.7) in Institution X that was explored in interviews (see Section 5.15 and 5.16).

The influence of the course mediatory tools and activities on development of attributes of competence for sustainability (see Sections 2.7 and 5.2) in RX's teacher education practice was illustrated (see Section 8.11). Section 8.12 presented how the competences in Section 8.11 contributed to RX's valued beings and doings, her capabilities (see Section 2.7).

Chapter Nine synthesises the research, focusing on my reflections on what the study means by presenting findings of the study, recommendations and conclusions.

Chapter 9:   Humanising morphogenetic tendencies: Findings, Recommendations, Reflections and Conclusion

9.1   Introduction

Chapter 9 draws from and builds on the earlier chapters. It discusses the study as a whole by presenting the findings, organising these into a discussion, and making recommendations and conclusions. It seeks to consolidate the study by drawing on the research context, theory, methods and cases presented. It draws on social realist theory perspectives to explain social actions that emerged from mediation processes. Mediatory actions were understood to disrupt the normative habitus of teacher educators to facilitate a new habitus that accommodates mainstreaming of ESE (see Sections 1.13, 2.4 and Chapters 6, 7 and 8). This chapter illustrates how learning experiences of teacher educators in the process of building capacity for mainstreaming ESE through the change project, can contribute to understanding of capacity development processes and change in human agency and consequently, transformed practice.

9.2   Research summary

The course under study is the Rhodes University / SADC REEP International Certificate Course in Environmental Education (or ESE) course in which teacher educators were involved in various professional development activities organised around a central 'change project'. The aim was to transform teacher education practice by enabling conditions for reflexivity and reflexive teacher education practice (Archer, 1995; Bourdieu, 1998; Raven, 2005) in social-ecological contexts in which teacher education institutions were embedded. The reflexivity can potentially provide conditions for good education (see Section 2.12). UNESCO (2015b) recognises good education as a common good. In such a context, reflexivity can potentially improve quality of education for the purpose of educating for a better and more sustainable future. Reflexivity and reflexive practice can therefore potentially contribute to facilitating the common good of a good education and the wider common good of a sustainable future.

As indicated in Chapter 5, the study was conceptualised as an in-depth case study of teacher academic professional development mediation processes that were oriented towards interrogation of the concept of quality education as seen through the lens of reflexive mainstreaming of environment and sustainability education (ESE). According to Lotz-Sisitka (2013), quality education should not only entail a focus on learning for a sustainable future, but should foreground socio-cultural meaning making processes as these tend to deepen understandings of context, concepts and practices, and enhance inclusivity and epistemic access. Lotz-Sisitka (2013) further argued that teacher educators need to develop concepts of quality in and through their practices that are oriented towards the common good (UNESCO, 2015b). While much is said about what needs to be put in place for this transformation towards quality education, there is still inadequate knowledge of *how* such transformations are to take place (Mukute et al., 2012).

Hence, this study focused on the influence of mediation activities across three phases of a regional teacher education professional development course, with emphasis on ESD teacher education practices on the course and in teacher education workplaces. The interest of the enquiry was to understand *how* learning of a course participant was mediated through the change project course processes and into the teacher education institution. In essence, the research sought to understand whether and how the course processes (tools and artefacts, lectures, assignments, tasks and excursions) contributed to learning by course participants across all phases of the change project as envisaged in the course and after the change project period. The interest was in light of Vygotsky's (1978) view that one can only tell if the learner has mastered the knowledge in the form of signs and symbols if he/she can use these tools to mediate the learner's own actions. Therefore, according to Vygotsky, a learner who can show mastery of knowledge has higher mental functioning for that knowledge. This means that Vygotsky observed that mental activity is closely associated with action and it is because of such views that this study focussed on human actions. Accordingly, the research interrogated how mediation influenced structural, cultural and people emergent properties (Archer, 1995) whose powers influenced capacity of the participant (the agent) to mainstream ESD in teacher education practice through the change project (see Chapters 3, 4, 5, 6, 7 and 8).

A case study approach to understanding teacher education practice of three teacher educators and their work before, during and after the Rhodes University / SADC REEP International Certificate Course in Environmental Education (or ESE) course in two countries was used to illuminate teacher educators' experiences during development and implementing of a change project. These experiences were presented as stories of emergence in Chapters 6, 7 and 8 and analysis responded to the research question: *How do mediated actions in a regional professional development programme and the workplace influence ESD competencies, practice, learning and agency in Teacher Education for Sustainable Development (TESD) change projects?* Sub-questions arising from this question:

- *What mediated actions on the course influence ESD competences, practice, learning and agency on the professional development programme?*
- *How do these identified mediated actions influence ESD competences, practice, learning and on the professional development programme?*
- *What mediated actions in workplaces influence ESD competences, practice, learning and agency in the change Projects in teacher education institutions?*
- *How do these identified mediated actions in workplaces influence ESD competences, practices and mediated actions in the workplace?*

Abductive and retroductive modes of inference (Danermark et al., 2002) were used to make meaning of learning experiences developed through the change project (see Section 5.2.4). Practice was understood to manifest in mentally situated and technical forms, habitus (Bourdieu, 1998). Practice was also understood in terms of Kemmis's (2009a) perspective of *doings, sayings* and *relatings* (see Section 2.3). Archer's (1995; 2000a; 2004) assertion that social reality is constituted of structures, cultures and agency is related to the view of Kemmis et al. (2014) which argues that practice exists in and emerges out of practice architectures that show as practice arrangements; these reflect the SEPs, CEPs and PEPs outlined in this study. Schatzki (2012) argued that practice was made up of collections of different activities that happened at the same time and over a period of time. Practice as illustrated in detail in Chapters 6, 7 and 8 is located in a context, can be mediated and depends on the relationality of the different aspects of the context (Schatzki, 2012; Kemmis et al., 2014).

In this chapter I further discuss the findings of the study where influence of mediation was understood in relation to how emergent properties influenced perceived changed practices and the morphogenesis or morphostasis. I go on to suggest how more meaningful mediation processes could be conducted. My reflections on how mediation processes could be better understood concludes the chapter.

9.3 Key findings

9.3.1 Mediation in and as academic professional development activities for mainstreaming ESE using the change project approach enhanced capacity of teacher educators to mainstream ESE

As discussed in Section 4.11 and reported in Chapters 6, 7 and 8 and related to expected outcomes of the course, the research points to the teacher educators having gained capacity for ESE. Participants demonstrated expansion of their zones of proximal developments (ZPDs) by being able to: 1) identify relevant global, national and institutional policies that support ESE mainstreaming; 2) deepen knowledge on environment and sustainability issues or their matters of concern in ESE mainstreaming; 3) identify and deepen knowledge on sustainable and more sustainable alternatives on the identified issue, including education; 4) identify teaching and learning methods appropriate to context for mediating the educational response as well as deepen knowledge on the methods chosen; 5) engage their community of practice to identify and prioritise environment and sustainability issues as matters of concern for mainstreaming ESE; 6) find ways of mainstreaming ESE in their teacher education practice after the change project course. In the terms of Engeström and Sannino (2010) such an intervention as the change project was a "germ cell" through which all other processes and activities for building capacity for mainstreaming ESE materialised (see Section 4.8.3). Lotz-Sisitka and Hlengwa (2012; 2015) used the metaphor of the change project 'seeding' ESE mainstreaming in Higher Education contexts. It can be considered as 'seeding' because the initial change project transformed over time as it challenged and permeated the practice architectures (Kemmis et al, 2014); individual's practice, that of colleagues, the institution and communities of practice. Table 9.1 provides a summary of evidence of the learning that took place through participants' involvement with the change project in relation to course outcomes.

Table 9.1. Summary of learning emerging across the change project course and post-course processes

Features at the beginning of the course	Demonstrated enhanced ability during the change project on-course and during the post-course period	Learning outcome achieved
Participants indicated that their teacher education practice was guided mainly by institutional Mission and Vision, a few national policies and a few global/ international policies.	ESE mainstreaming and change project was influenced by more international policies and national policies that relate to their teacher education practice in addition to institutional guidelines. When policy guidelines were constraining implementation of the change project and mainstreaming ESE, participants chose alternate pathways that were at times not conventional.	1, 2
Participants were only able to identify and describe a few policies influencing ESE practice in teacher education.	Participants were able to critically engage with main policies guiding ESE practice, including how they influenced alternatives as well as teaching and learning methods.	1, 2
Participants were able to identify environment and sustainability issues affecting society.	Participants were able to find relationships between the identified environment and sustainability concerns with other aspects of life that are related to biophysical, social, economic and political dimensions.	2,4
Participants were able to identify an area that needed change and engage the focus of their change project with relevant CoP.	Participants were able to streamline their focus of the change project, usually by focusing it on their individual and institutional roles. At times they had to shift their ideas from one possibility to another till they settled on a more feasible choice.	1,2,3,4
Participants were able to locate the change project in the contexts of their work, such as specific courses or their community engagement work.	Participants were able to refine locating their change project in their practice more clearly into a module or into a specific topic in a module.	1,2
Participants were able to identify resources that were unsustainably used or harvested, were able to describe relationships between different resources and were able to relate this unsustainable use to equity and social justice concerns.	Participants were able to suggest sustainable and more sustainable alternatives and how education could help in transforming society towards sustainability and respond to inequity in accessing and using resources.	2,3,4,5

Participants' ideas were influenced mainly by their contextual experiences to describe notions that influenced their practice.	Participants were able to deepen and critically engage with knowledge and wider perspectives related to their chosen change project.	2,3,4,5,6
Participants used a variety of teaching and learning methods but mainly used delivery approaches for delivering knowledge on concepts.	Participants were able to think carefully, choose and use a wider range of teaching and learning methods with a purpose. Teaching methods chosen for the change project foregrounded context and experiences of the learner for the purposes of developing critical thinking and agency for sustainability. Participation, collaboration and democratic practice were key in choice of methods. Teaching and learning methods were chosen in relation to policy guidelines proposed for ESE.	2,4,5,6
Participants used conventional teaching and learning resources prior to the course.	In addition to using conventional resources, participants learnt to look for information from a variety of sources to make their own resources especially on concepts that are not in conventional sources. Participants diversified their teaching and learning resource materials to include technological innovation of ICTs applications such as PowerPoint as well as videos and photographs.	2,4,5,6
Participants demonstrated agency by seeking for opportunities to develop their capacity in ESE.	Agency manifested in the participants' ability to design and implement the ESE change project. During this implementation, participants had the agency for ongoing trying of new educational methods in their classroom practice. They also showed agency in influencing others to gain capacity in ESE and in working collaboratively to mainstream ESE in the communities of practice.	1,2,3,4,5,6
Participants demonstrated ability for reflexivity when they could that enabled them to be dissatisfied with their teaching practices and seek capacity development.	Participants showed enhanced reflexivity in many ways including when participants were able to reflect on the teaching and learning methods that they tried out and modified the same methods in the following year with a different learner cohort. During implementation of the change project, participants realised that they could not make change happen alone; they had to engage others and work collaboratively. Reflexivity was demonstrated when participants' plans for the change project could not proceed when the courses in which they had planned to implement the change project were either discontinued or deemed not appropriate. They instead continued to find relevance of ESE and mainstreamed it in other activities that they had not planned for, such as mainstreaming climate change education in other courses.	1,2,3,4,5,6

Participants expressed that they worked more individually in their institutional practice.	Participants demonstrated tendencies to work in collaboration with others in their disciplines, across disciplines and across institutions. The notion of community of practice guided their interactions with others. They also showed commitment to participation, collaboration and democratic practice through their tendency to choose and promote participatory, experiential and collaborative teaching and learning methods.	5, 6
Participants demonstrated criticality by recognising that the conceptual content they taught and content delivery methods that they used were not adequate for their student teachers' experiences in their schools.	Enhanced criticality was shown by the participants' ability to relate global, national and institutional policies to curriculum content and to sustainability concerns. Criticality was closely tied to reflexivity as participants thought more carefully about their teacher education practices and how they contributed developing more critical and reflexive student teachers.	1,2,3,4,5,6
Alertness to capacity building was dependent on colleagues and networks alone	Participants focused more on ESE when searching for capacity building opportunities. Alertness to other capacity development opportunities arising from being a member of an international community of practice in mainstreaming ESE facilitated actively searching for opportunities. Participants gained recognition by capacity building institutions for more specific ESE related notions such as climate change education.	4,5,6
Networking was limited to teacher education, national, local and institutional networks.	Networking was expanded by the notion of communities of practice, which as teacher educators, they potentially belonged to many. Participants became more involved in networks that were making efforts to mainstream ESE such as EEASA, MESA and Regional Centres of Expertise because they claimed to have understood more the notion of ESE better.	4,5,6

Table 9.1 shows expansion of learning and agency, involving enhanced reflexivity. It also shows how the course outcomes were engaged and realized via a variety of reflexive, expansive processes. Realising course outcomes as shown in Table 9.1 above is not a linear process, but is integrally associated into interrelated processes of reflexivity and change, in situ.

9.3.2 Mediation in and as academic professional development activities for mainstreaming ESE enhances competences of sustainability for teacher educators in their teacher education practice

As reported in Section 9.3.1, participants demonstrated capacity for *strategic competence* by identifying, describing and expanding on guiding policies while critically engaging with relevant policy frameworks that justified and guided ESE mainstreaming in their teacher education practice across the change project course and beyond. Participants showed an enhanced engagement with policy as they demonstrated ability to locate relevant policies at each level of their course.

System thinking competence was shown when participants realised that they needed to engage their institutional leadership for support and their colleagues for collaboration and scaling of the mainstreaming process. The recognition that participants could start with a change project in the context of their individual practice perhaps was also paradoxically a recognition of the difficulty of engaging the whole institution in the change project.

Interpersonal competence was illustrated by participants' engagement with and involvement of institutional leadership, colleagues and members of the community of practice on the change project and related ESE activities. Participants demonstrated commitment to interpersonal competence by the more interactive, collaborative and experiential teaching and learning methods that they chose for the change project and promoted these among their own students.

By being committed to equity, ecological sustainability and social justice issues, participants demonstrated *normative competence.* This commitment was shown in the way they saw unequal distribution, unequal exploitation of resources and at times the unequal distribution of risk that emerges from the earlier two. Consequently, the participants chose teaching and learning methods that promoted collaboration and democratic practice,

choosing also to address environment and sustainability concerns in their communities including food security, pollution and energy.

Anticipatory competence was shown by participants' ability to envision a transformed future. In all cases, the change projects were guided by aspirations for some changed practices and transformed environment and sustainability conditions.

Strategic and practical competence was shown by participants' ability to locate the change project in particular aspects of their teacher education practice, focusing on what they as individuals had potential power and influence over. Strategic competence was further demonstrated when participants continued mainstreaming ESE in alternative pathways when their initial plans did not work out, as when the course or module in which they hoped to base a change project was discontinued (see Section 8.1). Evidence of strategic competence was also shown when participants realised that following conventional channels to introduce the change project in the institution was not appropriate and they took alternative pathways (see Section 7.7.3).

9.3.3   Mediation in and as academic professional development activities for mainstreaming of ESE enhances capabilities of teacher educators in their teacher education practice

As reported in Sections 2.6.3, 5.12.6, 6.11, 7.12, 8.12 and 9.1, participants demonstrated enhanced capabilities that were for analytical purposes divided into two groups but in reality these are intertwined and interdependent. This section only highlights a few examples of capabilities that were shown by course participants. The first were 'beings' – those capabilities related to emergent properties that I understood to be emergent features of social interactions of the participant but which were also features that are unique to individuals, to their sense of becoming and how the individuals feel about themselves. Participants for example, demonstrated that they *felt confident and self-reliant about ESE work* by confidently using collaborative, experiential and interactive teaching and learning methods that they had not used before the course. They also were more confident to find teaching and learning resources beyond the confines of prescribed conventional materials. At times participants had the ability to make their own teaching and learning resources.

The whole change project was made possible through participants' ability to *visualise a more sustainable future*. They also imagined the role of their change projects in transforming teaching methods and assessment practices in their classrooms and were able to anticipate the possible effect of that teaching on actions of the society through the learners. Participants were able to foresee a condition where society was aware of consumerist tendencies in order to reduce these. Current inequities were a platform for participants to visualise a condition when resources were used more equitably across society. The RU/SADC International Certificate in EE course alerted participants to other such capacity development activities such as courses and workshops outside the institution. All participants in this research took up at least a short course or were involved in workshops on climate change education after the change project work. Some participants took up further studies in ESE at PhD level. This is evidence of their being able to *continue to develop abilities and show desire for continuous improvement and transformation.*

When participants deepened their knowledge of identified environmental issues, sustainable and more sustainable alternatives as well as methods for these issues, they demonstrated ability to *transform available commodities into valuable functionings.* Participants worked with material things such as videos and photographs, real objects in outdoor lessons and improvising teaching and learning resources by using parts of old technology devices. Technology applications such as PowerPoint were used for teaching during and after the change project. By using the deepened knowledge for teaching and learning and making knowledge resources with this, as well as using material and technological resources and working in collaboration using the notion of communities of practice with others, participants also illustrated their ability to be *skilled, educated, and to use and produce knowledge.*

Secondly, participants showed ability for 'doings' – those capabilities related to what and how individuals were able to perform certain teacher education activities in the delivery of their duties and in relation to other environment and sustainability education transformation aspirations. During the processes of deepening knowledge in the on-course phase, attending workshops after the course and taking up studies in the field of ESE, participants showed their ability to *acquire knowledge required for mainstreaming.* Participants were invited to workshops, to make presentations, attend other ESE courses

such as the ITP and SADC Leadership in ESE mainstreaming course and be part of the SADC REEP ESE Research Team. This showed their *being recognised, respected and treated with dignity by their own students, colleagues and community of practice.* After the on-course phase, participants became *part of social and professional networks and communities of practice* such as MESA, the Environmental Education Association of Southern Africa (EEASA) and the SADC REEP Network. They became members of national networks such as '*Le hae la rona'* in Lesotho. They also became members of local communities of practice such as Regional Centres of Expertise (RCEs) in Harare and Lesotho, the SWEDESD/SADC REEP ESSA team and led the formation of institutional communities of practice such as the ESD team in Lesotho. All participants introduced their change projects and ESE mainstreaming to their institutional leadership. All institutional leaders supported mainstreaming ESE and supported that participants share their knowledge in departmental or faculty wide capacity development seminars and workshops.

9.3.4 Mediation in and as academic professional development activities in ESE catalyses development of morphogenetic properties in teacher education practice

As reported in Sections 3.9, 5.2.4, 9.1 and Chapters 6, 7 and 8, there is evidence that the change project course provided momentum for potentially morphogenetic changes in teacher education practice (Archer, 1995). The course expanded zones of proximal development (ZPDs) for those characteristics of learning that showed as emergent properties in the participants' work. Course participants who were already dissatisfied with their teacher education practice within a structural and cultural context sought academic professional development in T1 of the cycle (see Sections 3.9 and 3.11). The pre-course assignment was the first tool to mediate their dissatisfactions or inconsistencies in praxis (Bhaskar, 1979), engage the community of practice and prioritise participants' 'ultimate concerns' (Archer, 1995) or 'matters of concern' (Latour, 2004), thereby catalysing the disruption of the culture of working individually and increasing the potential for collaboration. Inconsistencies and inadequacies in praxis here constituted generative mechanisms whose powers stimulated emergent properties and powers in the practices of teacher educators.

The pre-course assignment initiated the phase T2-T3 (see Section 3.9) that was constituted of processes for disrupting the habitus of teacher educators that was mainly influenced by prevailing structural and cultural conditions as reported in Sections 6.2, 7.2 and 8.2. The on-course phase had activities such as assignments, lectures, discussions, practical tasks and excursions, shown by the small circles on the larger circular arrow in Figure 9.1 below. These activities were based on their own mediatory tools that further contributed to disruption of the teacher education habitus (Bourdieu, 1998) to increase potential for an elaborated habitus that accommodates mainstreaming of ESE in T2-T3 in individual and institutional teacher education practice, and in a communities of practice. Social interactions at T2-T3 provided conditions for disruption of normalised (Ketlhoilwe, 2007) teacher education actions to produce a new form of practice architectures that exist relationally to each other. Disruption was necessary because Kemmis (2009b) recognised practice architectures as 'exoskeletons' in that they are fairly rigid, not easily changeable.

Mediation activities showed that mainstreaming of ESE tended to be influenced by casual powers of emergent properties (Archer, 1995). During the morphogenetic phase T2-T3 and T4, structural emergent properties (SEPs), cultural emergent properties (CEPs) and people's emergent properties (PEPs) interacted to enable reflexive change processes to emerge. Participants recognised that policies at global, national and institutional levels (SEPs) had powers influencing what they could choose to do and how they could perform regarding those choices when mainstreaming ESE. In choosing what they could do in relation to the promulgations of policy and their teacher education context, participants were reflexively engaging their PEPs. The teaching and learning methods that they embarked on to change practice were the CEPs.

Archer (1995) suggested that social action be explained analytically in terms of people and 'parts' (structure-agency and culture-agency). These three components were shown to be interactive and interdependent in this study. For example, participants identified global policies (their SEPs) that promoted mainstreaming of ESD such as the UN Decade of ESD Implementation Scheme. They related these to their national policies especially EE Policy or ESD policy frameworks. Of the many possible ways of implementing ESE suggested in the policies, participants used their PEPs to choose as a means of enhancing capacity for particular teaching and learning methods (their CEPs). Teaching and learning methods were

participants' 'ultimate concerns' (their CEPs) as teacher educators. Suggested teaching and learning methods were written up in course outlines that were used by participants. Although the course outline was not a formal institutional policy, it was a record that was used by teacher educators to guide the course or module. In this way, the course outlines become a form of policy document because of their powers to guide practice at the individual, or collective teacher educator level.

As a result, powers of ESE policies (SEPs) influence and shape the choice and conduct (PEPs) of teacher education practices in the form of teaching and learning methods (CEPs) that in turn influence and shape the structures (SEPs) in the morphogenetic phase T1-T4. The combination of SEPs, CEPs and PEPs arising from this interaction is the elaborated habitus in teacher education practice at T4. This elaborated habitus at T4 is a precondition for the next morphogenetic cycle at T1.

Figure 9.1 shows superimposed diagrams of the morphogenetic framework by Archer (1995) and the expansive learning cycle by Engeström (1996). The social conditions at T1 including generative mechanisms such as policy changes, global changes in culture embracing consumerism, the plethora of environment and sustainability issues, calls for education quality, perceived irrelevance of education to society and individual agency influence practice and the initial habitus of the teacher educator. This initial habitus is expressed through the emergent properties before the teacher educator participates on the course. The course provides social elaborating opportunities, T2-T3, through the different levels of tools and processes of the change project that are represented by the small circular arrows. The processes of social elaboration expand the habitus of teacher educators to new levels at T4.

Change Project Cycle

Generative mechanisms
- global and national policy narratives
- global movements and discourses (EE, ESD, EFA)
- desire to achieve competence
- prevalent environment and sustainability concerns
- historical circumstances (e.g. hierarchical structures of HEI's)

SEPs: Global and national policies on mainstreaming EE/ESD; policies on quality and relevant education; institutional mission and vision

CEPs: Participatory and collaborative T/L methods; seminars; workshops; ICTs; discussions

PEPs: dissatisfaction with current T/L methods; commitment to social justice; consumerism; environment and sustainability issues; criticality; ability to source and deepen knowledge; ability to write resources; ability to continue to want to learn; collaborative practice; commitment to democratic practice; ethical stance on matters relating to environment and sustainability

Generative mechanisms
- Policy changes
- global changes in culture embracing consumerism
- plethora of environment and sustainability issues
- calls for education quality
- irrelevance of education to society
- individual agency
- historical circumstances (e.g. hierarchical structures of HEI's)

SEPs: Global and national policies on mainstreaming EE/ESD; policies on quality and relevant education; institutional mission and vision

CEPs: lectures/ content delivery methods; content-based assignments

PEPs: dissatisfaction with current T/L methods; commitment to social justice; consumerism; environment and sustainability issues

elaborated habitus

initial habitus

T1   T2   T3   T4

Each of the smaller cycles could represent the different activities used, including individual reading, lectures, group tasks, plenary feedback sessions, and video presentation sessions

Each of these cycles could be a module or any one set of actions such as a lecture, seminar, workshop, assignment, excursion, practical activity or regional knowledge exchange group activities

Figure 9.1: The morphogenetic cycle (Adapted from Archer, 1995 and Engeström, 1996)

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This new or elaborated habitus is expressed through enhanced practices which show elements of structural elaboration and tendencies for morphogenesis or morphostasis. But the elaborated habitus or expanded practices at T4 are not an end in themselves; they in turn become the initial habitus for another cycle of expansive learning activities, such as another change project, which implies another morphogenetic and expansive learning cycle at T1 in the future. This **elaborated habitus** is influenced by ongoing generative mechanisms that result in dissatisfaction with the elaborated habitus, that in turn influence SEPs, CEPs and PEPs and consequent agency of teacher educators in that habitus. This new level of agency influences how the teacher educator works with the SEPs, CEPs and PEPs to generate another cycle of social elaboration and expansive learning.

This study shows that it is possible to proactively set up a morphogenetic framework to develop capacity for reflexive engagement with practice through a course. In this study the change project course fell into the period (T2-T3) and beyond the course period was T4 as illustrated in Figure 9.2 below.
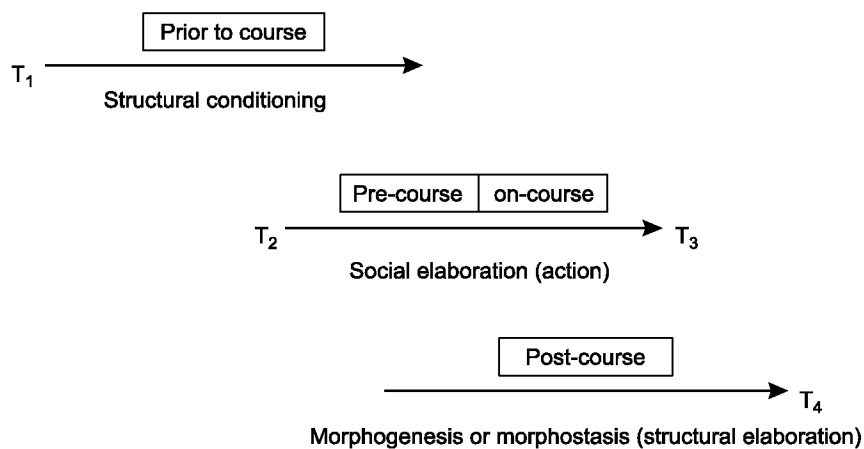
Figure 9.2: The morphogenetic cycle with the change project mediation phases (Archer, 1995, p. 157)

The course can be consciously set up to disrupt habitus at T1 in ways that potentially facilitate social elaboration along T2-T3 and structural elaboration along T4 by incorporating mediation tools and artefacts.

9.3.5 Mediation in and as academic professional development activities in ESE catalyses agency (double morphogenesis) of teacher educators in their teacher education practice

Archer (1995; 2004) asserted that interaction of emergent properties and powers of people (agency) and parts (structure and culture) resulted in system transformation (morphogenesis) or reproduction (morphostasis). While agency can, through its emergent properties and powers, result in structural and cultural elaboration or reproduction, it is in turn transformed during the process. This transformation of agency is 'double morphogenesis.' According to Archer, elaboration of agency results in a more social agent. Emergent properties should illustrate tendencies of the agent to be working with others or promoting social interactions (see Figure 9.3 below).

As shown in Figure 9.3 below, prior existing structure and culture at T1 conditions habitus and agency. Underlying generative mechanisms influencing habitus and agency include policy changes, global changes in culture and changes in consumerist tendencies, calls for different forms of education quality and individual tendencies of agency. These create inadequacies and dissatisfactions in the habitus. The dissatisfactions become the ultimate concerns that the agents intend to respond to. Their agential properties, which tend to disrupt the conditions of habitus that constitute ultimate concerns, emerge out of interaction of SEPs, CEPS and PEPs in relation to the habitus. A disruption of habitus in response to properties and powers of generative powers, which in this study include ultimate concerns of teacher educators, happens in the phase T2-T3. Socio-cultural interactions brought in by the change project facilitated elaboration of agency during the period T2-T3. The elaborated agency at the T4 phase constitutes the pre-condition of the next cycle of morphogenesis represented by T1 but at a slightly different level to the initial starting point. Figures 9.1 and 9.3 happen simultaneously, as the agent works to transform the system while being transformed by the same system – what Archer (1995) termed 'double morphogenesis'.

Participants demonstrated enhanced reflexivity in their teacher education and individual sustainability practices when they could reflect on their teacher education methods and how these were playing out in classrooms across student teacher cohorts and over the years. Teaching and learning methods were the conditions in which participants could relate

with their student teachers. Participants reviewed the teaching and learning methods they used each time to facilitate more meaningful interactions with student teachers. During and after the change project course, participants tended to use more experiential as well as collaborative methods, illustrating their elaborated social orientation to teaching and learning processes.

Individual agency was at times interlinked with collective agency when participants collaborated with colleagues to work on on-course assignments. Collaborative tendencies were also shown during change project implementation where participants sought support and found it useful to work with colleagues in their different communities of practice. Such CoPs included colleagues in the same discipline, across disciplines and at the faculty level. The change project therefore contributed to scaling in disciplines, across disciplines and across the faculty. Participants found it necessary to team up and engage in capacity building of the faculty, whereupon they brought their individual capacities into the collective for the good of capacity for mainstreaming ESE in the faculty. Figure 9.3 shows the change (elaboration) in agency during the course and how it is dependent on system change represented by Figure 9.1.

Generative mechanisms
- Global and national policy narratives
- global movements and discourses (EE, ESD, EFA); desire to achieve competence
- prevalent environment and sustainability concerns
- historical circumstances (e.g. hierarchical structures of HEI's)

Generative mechanisms
- Policy changes
- global changes in culture embracing consumerism
- Plethora of environment and sustainability issues
- Calls for education quality
- Irrelevance of education to society
- Individual agency
- historical circumstances (e.g. hierarchical structures of HEI's)

Change Project Cycle

Social/ elaborated agency

initial/ social agency

SEPs: Global and national policies on mainstreaming EE/ESD; policies on quality and relevant education; institutional mission and vision

SEPs: Global and national policies on mainstreaming ESD; policies on quality and relevant education; institutional mission and vision

T_1

CEPs: Participatory and collaborative T/L methods; seminars; workshops; ICTs; discussions

CEPs: Lectures/ content delivery methods; content-based assignments; collaborative on-course activities

PEPs: Enhanced reflexive practice; commitment to social justice; ethical stance on consumerism; ethical stance on wider ranger and relationships between environment and sustainability issues; enhanced criticality; enhanced ability to source and deepen knowledge; enhanced ability to write own resources; ability to continue to want to learn; enhanced collaborative practice foregrounding CoPs and tendency for working as a member of a collective; enhanced commitment to democratic practice; giving assignments that foreground change; expanding capacity of colleagues; looking for more capacity development opportunities; furthering education in the field; enhanced research and writing potential

T_2

T_3

PEPs: dissatisfaction with current T/L methods; commitment to social justice; consumerism; ethical stance environment and sustainability issues; inadequacy of working in isolation

T_4

Elaborated social agency: enhanced reflexive practice; commitment to social justice; ethical stance on consumerism; ethical stance on environment and sustainability issues; enhanced criticality; enhanced ability to source and deepen knowledge; enhanced ability to write own resources; ability to continue to want to learn; enhanced collaborative practice foregrounding CoPs and tendency for working as a member of a collective; enhanced commitment to democratic practice; giving assignments that foreground change; expanding capacity of colleagues; looking for more capacity development opportunities; furthering education in the field; enhanced research and writing potential
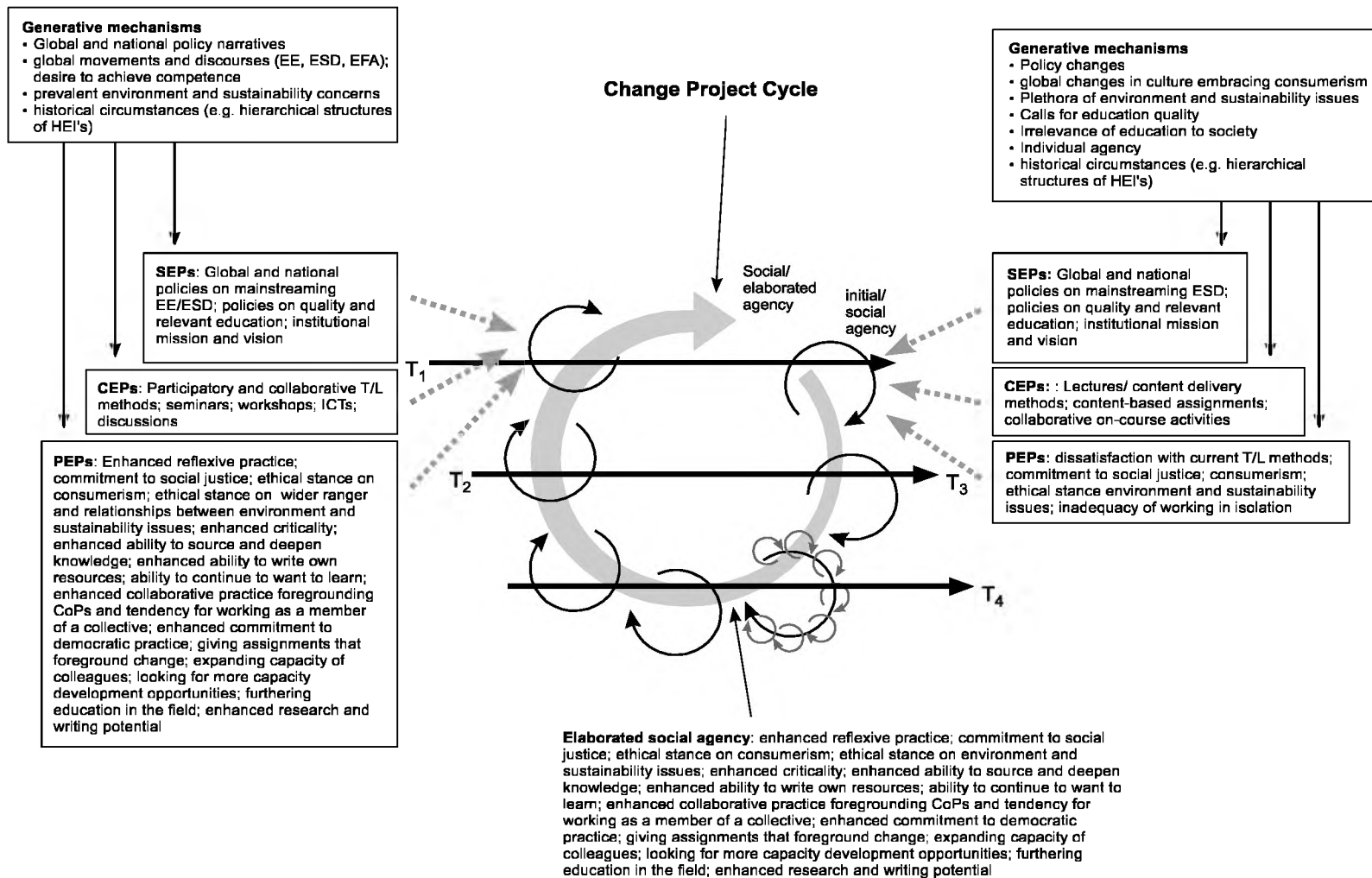
Figure 9.3: Double morphogenesis (change in agency) (Adapted from Archer, 1995 and Engeström, 1996)

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Participants showed ability to source and deepen knowledge on selected issues while critically engaging with it. This knowledge was used to select relevance of existing resources and for developing own resources for teaching, learning and assessment in the classroom. Enhanced knowledge as well as teaching and learning resources were used to facilitate learning interactions in particular ways. Participants challenged their student teachers to relate classroom knowledge to its relevance in their daily lives. Examples include when in one case a teacher educator asked students "so what?" questions in relation to content knowledge. In another case student teachers innovated teaching and learning equipment using other disused or obsolete equipment. Participants carefully thought about the teaching and learning methods they used in relation to the purpose of learning the concepts, such that teaching and learning methods were chosen for a purpose. Participants continued to use their networking abilities to actively look for and engage in other capacity development activities in the field, including further study.

Development of agency was retroductively mapped against the morphogenetic cycle to illustrate the influence of the course on teacher education practice as shown in Figure 9.4 below. Generative mechanisms that include policies and institutional culture of practice influenced teacher education practice during the period prior to course interactions. Individual effort, content delivery teaching and learning methods as well as objective assignments dominated teacher education practice. The pre- and on-course phases mediated participants' reflexive engagement with their practice. This reflexivity included being critical of their own practices and being critical of the knowledge and usefulness of knowledge that teacher educators were imparting to learners. Reflexivity enabled participants to question the adequacy of available resources and develop their own resources that supported learning of conceptual content together with environment and sustainability education. The course supported participants to work in collaboration and promoted democratic practices, features they demonstrated when they got back to their institutions. Participants developed interest in and used ICTs to enhance learning. ICT use included encouraging students to compile information searched on the Internet, use of such computer applications Word to make documents and PowerPoint to make presentations, as well as the use of videos to support learning of concepts (see Chapters 6, 7 and 9). Assessments during the on-course phase were qualitative and authentic.

T_1 ──────────────────────▶ | Prior to course |

Socio-cultural conditioning
(structure) of me in group

Emergent properties	Emergent features
SEPs	Institutional policies and curriculum influenced teacher education practice Normative teacher education work
CEPs	Focus on conceptual/ disciplinary work Content delivery teaching and learning methods dominated Objective assignments Little reference to learners' life experiences
PEPs	Individual effort dominated Little reference to learners' life experience

T_2 ──────────────────────▶ T_3 | Pre-course | on-course |

Group interactions with both
personal and social identity

Emergent properties	Emergent features
SEPs	Emergent leadership properties
CEPs	Tendency for collaborative practice Critical engagement with teaching and learning methods Networking and working in communities of practice Engagement with environment and sustainability issues during teaching of content Making resource materials from a variety of sources Using ICTs to facilitate learning Engagement with a variety of authentic assessment techniques
PEPs	Reflexive engagement with own practice Tendency for collaborative practice Emergent leadership properties Critical and reflexive practice Deepened and critical approach to knowledge on matters of concern Emerging networking and working in communities of practice Engagement with environment and sustainability issues during teaching of content Building capacity of colleagues, faculty and learners

──────────────────────▶ T_4 | Post-course |

The interactive "we" in
an elaborated group

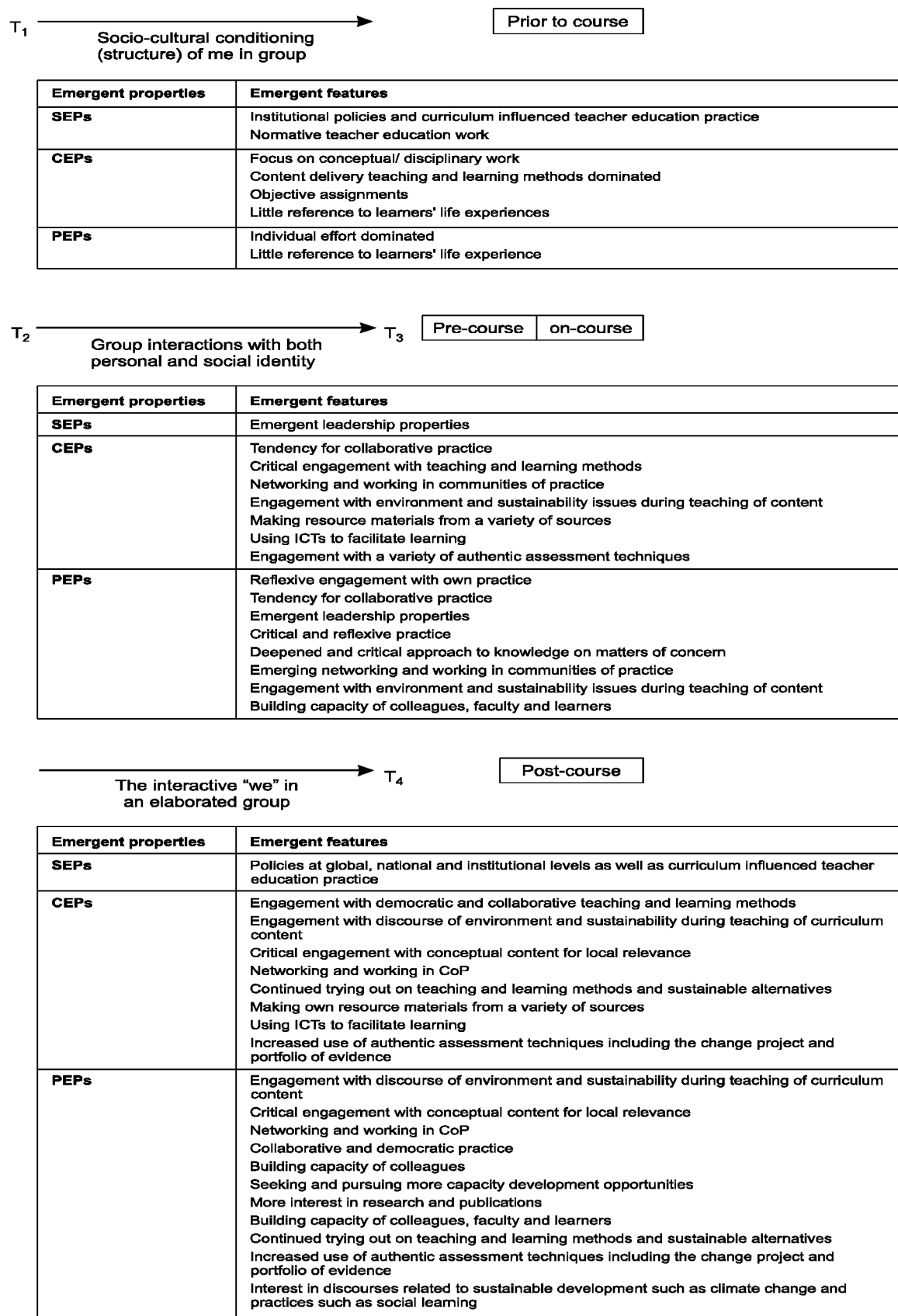| Emergent properties	Emergent features
SEPs	Policies at global, national and institutional levels as well as curriculum influenced teacher education practice
CEPs	Engagement with democratic and collaborative teaching and learning methods Engagement with discourse of environment and sustainability during teaching of curriculum content Critical engagement with conceptual content for local relevance Networking and working in CoP Continued trying out on teaching and learning methods and sustainable alternatives Making own resource materials from a variety of sources Using ICTs to facilitate learning Increased use of authentic assessment techniques including the change project and portfolio of evidence
PEPs	Engagement with discourse of environment and sustainability during teaching of curriculum content Critical engagement with conceptual content for local relevance Networking and working in CoP Collaborative and democratic practice Building capacity of colleagues Seeking and pursuing more capacity development opportunities More interest in research and publications Building capacity of colleagues, faculty and learners Continued trying out on teaching and learning methods and sustainable alternatives Increased use of authentic assessment techniques including the change project and portfolio of evidence Interest in discourses related to sustainable development such as climate change and practices such as social learning

Figure 9.4: Morphogenesis of agency and identity on the RU/SADC International Certificate in EE course

During the post-course phase participants demonstrated features that emerged during the on-course phase. In addition to features emergent in the on-course phase, participants demonstrated increased tendency for collaboration as they seemed to find it necessary to engage in social action in community with others. Participants tended to support departmental and faculty colleagues to build capacity for mainstreaming ESE by leading workshops and seminars that foregrounded ESE. Participants attested to increased use of and promotion of collaborative and democratic methods. Participants also showed increased use of authentic assessment techniques that allowed students' assignment write-ups to be different in response to students' different contexts. This was a shift from normative use of objective assessment techniques alone.

Participants showed tendencies for both corporate agency and collective agency (see Sections 2.5.1, 3.83, 3.12, 6.10, 7.10 and 8.10). They showed that as their agency changed from primary to social or corporate, their identity also changed from personal to collective. They recognised themselves as members of communities of practice that were mainstreaming ESE. To illustrate this tendency, participants referred to their individual efforts in description of their experiences of mainstreaming ESE but more so on those aspects of the course that they led and could do successfully as individuals. Most of their experiences of mainstreaming ESE in their institution were conducted in community with colleagues and they used "we" to describe their interactions, implying they recognised efforts of others in their mainstreaming efforts.

9.3.6 Mediation in and as academic professional development activities increased the potential for expansion of the zone of proximal development (ZPD) of teacher educators for mainstreaming ESE.

As illustrated in Section 4.11.1, the zone of proximal development is an ever expanding zone with potential for learning. The zone of proximal development exists mentally and also in practices that constitute social action (Vygotsky, 1978; Haenen, 2001; Lektorsky, 2009; Engeström and Sannino, 2010). As such, expansion of the ZPD is denoted by what participants are now capable of doing, which is the starting point for the next learning and mediatory actions whose potential is to further expand the learning that participants have already achieved. The construction of this ZPD assumed that teacher educators' learning had potential to expand from normative teacher education practice which influenced their

habitus prior to attending the RU/SADC International Certificate in EE course. Retroduction and abduction were used to establish changes in learning in the zone of proximal development. Figure 9.5 below shows how emergent features from participants' interaction with the course were mapped as expansion of the mind, learning and actions.
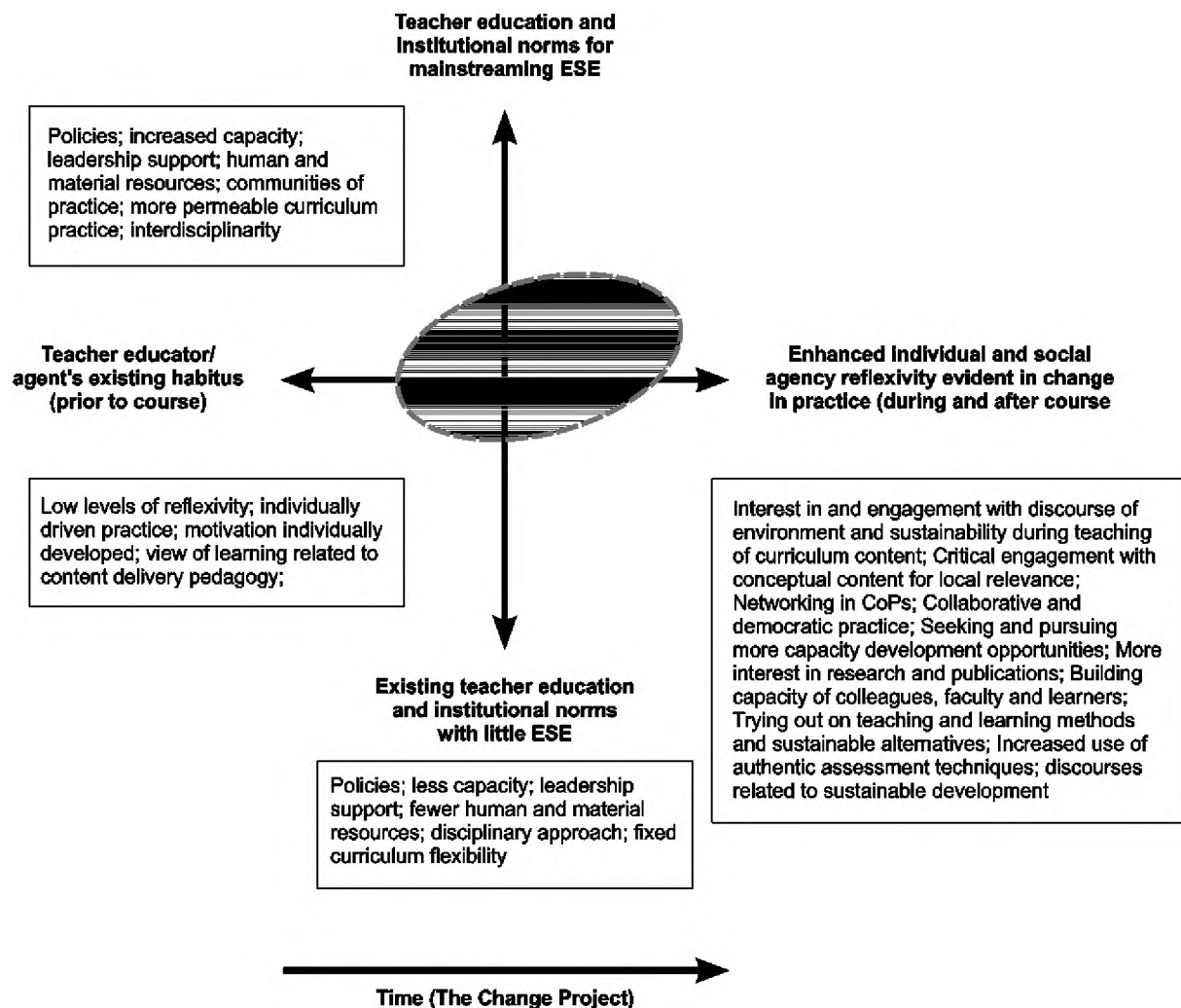

Figure 9.5: Factors and tendencies framing the Zone of Proximal Development of course participants

Figure 9.4 shows that during the pre-, on- and post-course phases (T2-T4) of the change project, participants demonstrated enhanced reflexivity that was a springboard for mainstreaming ESE. Enhanced reflexivity seemed to be dominated by PEPs, suggesting that human agency is key to change in practice that are evident in Figure 9.5. The zone of proximal development acknowledges that teacher educators had emergent features that constituted part of their initial habitus (T1) but also shows a shift of teacher education curriculum practice in the quadrant that shows increased individual and social agency against teacher education and institutional norms for mainstreaming ESE. The ellipse

represents prevalence of emergent features that are more influenced by reflexivity of individual and social agency.

9.4   Other findings

9.4.1   Mediation in and as academic professional development activities in ESE provided a platform for teacher educators to show tendencies for engaging humanising pedagogical methods

The change project course conducted through the RU/ SADC International Certificate in EE course showed humanising tendencies (see Chapters 6, 7 and 8). For example, the pre-course assignment facilitated participants to reflexively engage with their individual and institutional teacher education practice. Through this process they worked with their community of practice to identify and prioritise issues that prevented them in their institutions from mainstreaming ESE. They also collectively suggested responses to the issues identified. All assignments on the course were intended to develop the participants' abilities to engage with their context and experience in relation to content and experiences on the change project course. Foregrounding reflexivity (see Sections 6.10.3; 7.10.3 and 8.10.3) is a humanising tendency because reflexivity recognises the located nature of individuals and groups, practice and praxis (Motsa, 2004; Raven, 2005; Lindley, 2014). As a result of this experience, participants gave to their own student teachers assignments that were based on context and tended to develop responses to local environmental and sustainability issues. Some students, for example, researched the possibility of constructing laboratory equipment through reusing parts of old technological equipment.

The RU/SADC International Certificate in EE course contributed to teacher educators using more participatory and collaborative teaching and learning methods. Individuals can have agency but these individuals do not live in isolation, but in relation to other individuals, communities and institutions. The collaborative methods recognise that agency can be both individually and collectively developed. Since the interest in ESE is building capacity for social action, the change project course seems to have provided a platform for participants to engage in contextually framed reflexive collaborative social action on environment and sustainability issues that were contextually located. The change project was humanising in

its role of enabling participants to have tendencies to promote collaborative deliberations, decision-making and social actions for the good of community and society.

9.4.2 Capacity development in ESE makes teacher educators more confident to explore and make use of teaching and learning resources

Teacher educators expressed that the resources they were using were inadequate for the changing contexts in which they were teaching. The change project enabled them to consider other resources such as the Internet for current and more relevant information to the ESE issues they taught in relation to conceptual content. Teacher educators indicated that they produced their own resources for teaching since the resources with conceptual content did not have the ESE link that teacher educators needed for relevance and social action (see Sections 6.10.2; 6.10.3; 7. 10.2; 7.10.3; 8.10.2 and 8. 10.3). Teacher educators felt confident to give their student teachers assignments on using ICTs as they were more knowledgeable themselves on how to use them. Teacher educators were also more confident to use institutional contexts and conditions for learning. The contexts included increased use of outdoor activities and exploration of concerns related to conceptual content around the institution. There was increased reference to concerns in society such as waste, pollution, land degradation, food production, collaborative and democratic practice in relation to conceptual content (see Sections 6.10.3; 7.10.3 and 8. 10.3).

9.5 Contribution to new knowledge

My study spans across two fields, environment and sustainability education which appears in many different ways including environmental education and education for sustainable development; and teacher education.

This study revealed that the change project approach has potential to facilitate capacity development in ESE. Through this approach, individuals who had their capacity enhanced by interacting directly with the course contributed to capacity enhancement of senior leadership and colleagues in the institution. The ESE practices that individuals implemented in their respective curricula were experienced by their student teachers, some of whom it was hoped would take them into their teacher practices in schools. Despite Critical Realism denying a direct causative relationship as envisaged in the view that student teachers can take up practices, teacher education was structured in a way which assumes that learning in

the college can be translated into learning in the school classroom. The change project appears to be a useful tool for scaling in the Global Action Programmme for Education for Sustainable Development (UNESCO, 2015a; UNESCO, 2015b) and the Global Citizenship movement UNESCO (2014c; 2014d) in line with the Global Sustainable Development Goal 4 (United Nations, 2015) that calls the world to "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all".

Mediation on capacity development initiatives that foreground reflexivity promote individual and collective agency particularly because it involves matters of concern/ ultimate concerns of individuals and institutions in which they function. Teacher educator individual agency was at times interlinked with collective agency when participants collaborated with colleagues during the on-course phase to engage with on-course assignments. Collaborative tendencies were also shown during change project implementation where participants sought support and found it useful to work with colleagues in their different communities of practice (Urenje, 2012). Such CoPs included colleagues in the same discipline, across disciplines and at the faculty level. The change project therefore contributed to scaling capacity for mainstreaming ESE in disciplines, across disciplines and across the faculty. Participants found it necessary to team up and engage in capacity building of the faculty, whereupon they brought their individual capacities into the collective for the good of capacity for mainstreaming ESD in the faculty.

The study showed that matters of concern around environment and sustainability are similar across different countries and across different types of teacher education institutions (in this study, a university and a teacher training college). The implication is that should a course such as the RU/SADC International Certificate in EE course be framed for teacher education in southern Africa, the course is likely to be relevant for most of the countries and teacher education institutions as long as it foregrounds reflexivity in the context of practice. Emerging from the study were concerns that ADP or CPD courses such the RU/SADC International Certificate in EE course can be more beneficial if they involve course participants more adapting and producing appropriate teaching and learning resources. Participants also felt that they were adult learners who in turn were in most cases working with adult students. They therefore would have benefitted more if the course had greater emphasis on theories and practices of adult teaching and learning.

This study has explored how mediation of practice, using a course that had mediatory tools and artefacts, influenced teacher education practice for mainstreaming ESE. In order to illuminate this relationship, Chapter 4 was dedicated to describing and explaining concepts of mediation proposed by Vygotsky (1978) and neo-Vygotskian proponents, particularly the work of Engeström and Sannino (2010), using illustrations from the RU/SADC International Certificate in EE course.

In addition, the study contributes methodologically to research that seeks to trace transformation of practice following an intervention. This study illustrates how change in practice in relation to mediation was tracked retroductively using the theory of morphogenesis (Archer, 1995; 2004; Lindley, 2014; Ferdinand, 2015; Rivers, 2015). The study therefore contributes to more contextual interrogation of the notion of mediatory practices and theories that can explain social action as in the role of mediation in the T2-T3 phase of the morphogenetic cycle. Emerging from this contribution is that the study showed that it is possible to proactively set up a morphogenetic framework to develop capacity for reflexive engagement with practice through a course. In this study the change project course fell into the period (T2–T3) and beyond the course period was T4. The course can be consciously set up to disrupt habitus at T1 in ways that potentially facilitate social elaboration along T2–T3 and structural elaboration along T4 by incorporating mediation tools and artefacts.

9.6   Reflections

9.6.1   Reflexivity during the research process

Since I was researching the change project that I had been influential in conceptualising and developing (see Section 5.10.7), there were times when I felt like I was researching my own practice (Lindley, 2014; Ferdinand, 2015; Belay, 2012). A sense of co-ownership of the change project with participants always loomed. This position was deepened during the data generation period when some participants asked for advice on their ESE work. Many times during the data generation period, I had a heartwarming feeling that I had, through my position at SADC REEP (see Section 1.2), contributed to mainstreaming ESE in teacher education. I was also enlightened by what participants reported as not having helped much. Participants, for example, were grateful for the knowledge on developing teaching and

learning resources but they felt the course would have been more helpful if it had put more time on developing a wide range of teaching and learning resources, not just the fact sheet. It was also mentioned that the course could have prepared participants more to start engaging with their institutional practice. They thought the pre-course assignment didn't provide an adequate engagement platform because at times they found it difficult to start engaging with colleagues who were not knowledgeable of environment and sustainability education. Reflexivity in research helped me to constantly detach my professional development interests from the research project which sought to understand the same professional development process. I concur with Ferdinand (2015) who noted that self-reflexivity is a vehicle that enables one to overcome subjectivities and personal involvement when researching one's own practice. Self-reflexivity enabled me to focus on the research project while at the same time contributing advice to ongoing, continuing and transforming change projects.

9.6.2   Including student teachers of the research participants

As I proceeded with data generation process, research participants constantly referred to what they had done with earlier cohorts of student teachers as part of their evolving change projects. I was left with an interest in understanding the ESE practices that the student teachers could have valued and taken up into their own practices as teachers in schools. The scope of this study limited me to teacher education contexts but I was interested in what and how graduate teachers that were involved in the change projects were teaching. In relation to this view, I wondered how the research design would have influenced the outcome if the study were longitudinal through a phenomenological process –following research participants throughout the course, during implementation of the change project and into the schools of the graduate teachers.

9.7   Recommendations

Recommendations stated in this section arise from the findings of this study. The recommendations have potential to support building capacity on ESE initiatives including the potential of implications of the emerging insights on scaling of ESE capacity within and across institutions, as well as implications for research on capacity and capacity development.

9.7.1 Mediation as a precondition to influence practice

This study has shown that mediation has the potential to enhance capacity of teacher educators for mainstreaming ESE. This study showed that interactions in the phase T2-T3 on change project course were influenced by the course interactions. This study recommends that capacity development be proactively set up through courses that mediate a morphogenetic framework that facilitates capacity development for reflexive engagement with practice. This can be achieved by carefully thinking about mediation processes and activities that constitute socio-cultural activities in the period (T2–T3). Mediatory processes and activities should take into account contextual arrangements of course participants and should seek to develop competences and capabilities that are requisite for mobilising individual and collective agency in a discourse.

9.7.2 The change project has mediatory potential for capacity development

Following the findings of this study, it is recommended that the change project be used as a tool for transformative reflexive engagement for framing learning-led change with practice in academic professional development activities. The study has shown that participants were able to undergo reflexive praxis (see Chapters 6, 7 and 8) that enabled change-oriented learning on the change project and facilitated them to continue to learn through reflexive engagement with other aspects of their teacher education practice (Bourdieu, 1977; 1998; Motsa, 2004; Raven, 2005; Lotz-Sisitka, 2009). The change project course enabled participants to relate to different aspects of their practice including policies and practices in ways they may not have done before. The course enabled participants to develop competencies and capabilities that supported their agency for mainstreaming ESE into their teacher education practices. In so doing, the course enhanced the participants' agency that has potential to provide them with ability to keep interrogating and pushing the bounds of their teacher education habitus.

9.7.3 The change project as a potential tool for developing capacity for humanising tendencies

The study has shown that during development of the change project, participants were able to reflect on experiences that constitute their practice. This reflexivity using ESE as a sensitising notion tends to develop humanising pedagogies. By emphasising learning from

context, ESE is also a humanising concept as it takes account of people's views, cultures and ways of being (Kapoor, 2009; Neocosmos, 2012; Lotz-Sisitka et al., 2015). It also prepares learners to learn to live justly, equitably and sustainably in the world; this is not learning for the sake of human capital development to serve the market.

In most cases, various structural conditions prevent people from flourishing because of their dehumanising, constraining, subversive, oppressive or discriminatory nature. Thus, following Bhaskar's (1993) logic of seeking out 'the pulses of freedom', it is possible to suggest that engagements that enable people in de-humanising conditions to realise that while barriers exist, they still have agency and potential to challenge and remove the barriers; the engagements become humanising forms of learning and pedagogy. Epistemologies that provide conditions for learners to reflect on their conditions, visualise a better future, weigh out options and set up conditions that address negative factors, factors that hinder attainment of their visualised future are humanising. These conditions that tend to challenge boundaries and frames of habitus facilitate transgressive learning (Lotz-Sisitka et al., 2015) for individual, community and societal freedom. Such learning involves learners reflecting on conditions and contradictions influencing their lives and lived experiences in order to disrupt those factors and create conditions for a better future (Neoscomos, 2012; Kapoor, 2009; Mukute, 2010a; Mukute, 2010b; Wa Thiongo, 1981; Mamdani, 1996; Mbembe, 2001).

9.7.4. Capacity development for teacher education should integrate more resource material development

Research participants expressed appreciation for their involvement in the introduction to adaptation and production of teaching and learning resources which was part of the course. They however also pointed out that they would have benefitted more if the course had enabled them to spend more time on adaptation and development of a wider variety of teaching and learning resources. To this end, I recommend that any professional development activity needs to consider adaptation and development of a wider range of teaching and learning resources. These resources have to be developed as part of the teacher educator's reflexive engagement with own practice.

9.7.5 Further research

This study has shown that it is possible to explain social actions and trace them using realist social theory. Future research could explore mediation of ESE classroom practices and social actions of graduate teachers coming out of learning interactions with the teacher educators who participated in this study. Besides following up on classroom based ESE practices, the change project approach needs to be interrogated for its applicability in the schools' curriculum, where it can be used as a tool for troubling mediation of the relationship between concept-led curriculum practices, engaged social action and agency as in the work of Silo (2011). Researching applicability of the change project as a mediatory and transformative learning tool in different aspects of societal enterprise could contribute knowledge on transformative tools as well as the different forms of transformation in different contextual settings.

9.8   Conclusion

ESE tends to provide a sensitising focus for initiating and sustaining institutional change (O'Donoghue, 1986). The change project course demonstrated that it is a useful tool for developing transformative capacity for reflexive praxis and agency that can potentially be used to educate for a sustainable future. Capacity for reflexive praxis and agency is relevant for mainstreaming ESD in teacher education contexts particularly for scaling up, scaling out, scaling across and scaling innovatively during the UNESCO 2030 Agenda period, and within the Global Action Programme for mainstreaming ESD and Global Citizenship Education (UNESCO, 2014c; 2015a) and the "rethinking education focus" (UNESCO, 2015b).

By conducting the change project, participants showed commitment to learning from context while using and promoting teaching and learning methods that are critical, collaborative and experiential while foregrounding values. The teaching and learning methods they promoted tend to be humanising and constitute the new form of education quality suggested by the World Conference on Education in Incheon Declaration (UNESCO, 2015b) that could potentially transform individuals and groups from inside and from outside to mobilise appropriate agency for environment and sustainability at individual and collective levels.

By stimulating people's capacity to transgress current ways of learning, the change project seems to be a useful tool for building capacity for quality education which is a common good for the good of humans and the future of planet earth. The change project therefore seems to provide a useful reflexive tool for facilitating an education that changes in response to the world which is in constant flux. This approach to educational practice has potential to contribute the new forms of education that can facilitate development of competencies which foster humanising tendencies by bringing together social, economic and environmental dimensions of sustainable development, in context. This is an education which is expected to enable learning for more social justice, social equity, global solidarity and other approaches to sustainable development in the future as suggested by UNESCO (UNESCO, 2015a; 2015b).

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Appendices

Appendix 1: Pre-course assignment

Rhodes/SADC International Certificate Course

in Environmental Education

2009

Change oriented learning and sustainability alternatives: A focus of the RU/SADC International Certificate Course

The Rhodes University / SADC International Certificate in Environmental Education course is focused on supporting change oriented learning and sustainability alternatives in southern Africa. It is also a workplace-based course and it is designed to support you to improve your practice as an environmental educator in your institution, and in southern Africa. On the course you will complete one long assignment – **An Environmental Education Change Project** that is relevant to your work and that will improve your practice as an environmental educator. The Change Project must be an **environmental education project / activity / programme** that you wish to improve or change.

Some examples of what previous course participants have done as change projects are:

- Improving a forestry extension programme by improving the methods of working with communities to address the unsustainable harvesting of trees.
- Improving school food gardens projects through involving learners in educational activities in the gardens to plant more nutritious food plants to address unsustainable poor nutrition practices.
- Developing curriculum materials for teachers to improve learning about waste issues and solutions to waste issues in school-communities to address unsustainable environmental health issues in the community.
- Developing a parks-and-community education programme to strengthen sustainable use of natural resources and conservation.
- Developing of a fieldwork module for university students to investigate environmental health issues associated with unsustainable mining practices.

The **Change Project** will be developed in 5 parts, each of which will be an assignment on the course, starting with this Pre-Course Assignment. The activities on the course will be designed so that you can continuously improve on your change project.

- Part 1: Pre-Course Assignment (to be done before coming on the course, and presented in Week 1 of the course at Rhodes University): *Identify a relevant change project in your workplace (20% of the course)*
- Part 2: Assignment 1 (done at Rhodes University in Week 2 and 3 of the course): *Clarify the unsustainable practices, more sustainable alternatives and mediating educational activities relevant to your change project. (20% of the course)*

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- Part 3: Assignment 2 (done at Rhodes University in Week 4 and 5 of the course): *Deepen understanding of content and methods for mediation of better learning and more sustainable alternatives in your change project. (20% of the course)*
- Part 4: Assignment 3 (done at Umgeni Valley in Week 6 & 7 of the course): *Identify tensions, opportunities and plan for strengthening and resourcing the implementation of your change project and how you will evaluate it. (20% of the course)*
- Part 5: Assignment 4 (done back at your workplace after the course): *Run a workshop on your change project back at work, get feedback from colleagues and report on the progress of your change project to managers and to the SADC REEP Network Representative in your country. Submit a reflection report to Rhodes University and the SADC REEP. (20% of the course)*

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Pre-Course Assignment

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The pre-course assignment is structured to help you get started with your change project.

For the pre-course assignment, you will have to do the following:

- **Identify and briefly describe an environmental education change project in your workplace, and justify why you plan to work on this project during and after the course.**
- **Provide evidence of consulting with others in your workplace about the relevance of the change project, and to find out which colleagues can support you with your change project and how they can do this.**
- **Bring examples of materials or programme activities that you are already using, and show how you might want to improve on these.**
- **Show how this change project is relevant to your institutional mandate and other relevant policies or reports on the state of the environment in your local context or country.**
- **Prepare a professional presentation with a 2 page written text to share with other course participants and course tutors when you arrive at the course.**

Further guidelines are provided below.

RATIONALE FOR THIS ASSIGNMENT

This first part of the course enables you to start up an environmental education change project relevant to your own professional growth, and to the organisation that you work in. The assignment is particularly important since this is a professional development course designed to benefit the individual participant by enhancing environmental education knowledge and skills as well as the institution from which the participant comes. The enhanced knowledge and skills are meant to enable the participant to work much better with others in their work place on environmental education programmes that contribute to sustainability in SADC communities and organisations. Through this approach of working with **individuals in institutions,** the institutions benefit from individual participants' engagement with the course.

It is suggested that you start the assignment as soon as possible so as to prepare thoroughly for the course. The following steps will guide you to work on your first assignment,

DECIDE ON A RELEVANT CHANGE PROJECT WITH YOUR COLLEAGUES

- Identify a more experienced colleague as a workplace mentor (this could be a manager/ superior or somebody who has been in the organisation for a long time) in your workplace *and* other colleagues who could support you to work on this change project over the next six – eight months (pre-course, during and after the course). They should be willing to give you advice and give you feedback on what you are doing so that the project is supported in the organisation.
- Organise a meeting/s with your manager (s) and the other staff members that will be able to support you with the change project. Explain to them that you need advice and input on your ideas for the change project. Work with them to complete the REVIEW SHEET attached, so that they can help you identify a suitable change project to work on.
- Using the questions on the REVIEW SHEET, discuss the following aspects of the proposed change project with them:
    - The unsustainable practices that the project aims to respond to (e.g. unsustainable harvesting of trees, poor nutrition, poor waste management or whatever the issues are that you are trying to address in your work).
    - The policy and institutional relevance of the proposed change project – how will it contribute to the mission and vision of the organisation and to local and national policy implementation?
    - The alternatives (e.g. better management or harvesting practices; using new technologies; sharing benefits with communities etc.); that can be implemented to address the unsustainable practices and what educational activities are needed to help implement or develop these alternatives.
    - The educational activities and materials that you are already using and how these could be improved.
  - Write a short report on this meeting/s showing how you colleagues have helped you to think about the change project more carefully. What advice and feedback did they give you? The report of the meeting should be no longer than 1 page.
  - Prepare a name and contact list of the colleagues that will support you with the change project, since we would like to communicate with them and show our appreciation for them supporting you and keep them updated on your progress during the course. Include the name of your manager.
  - Ask your manager to sign the attached form indicating that his/her support for your change project. The form also informs your manager that this project is a project of importance in the SADC region, and that you will be working on this change project over the next few months as part of your participation on the course.
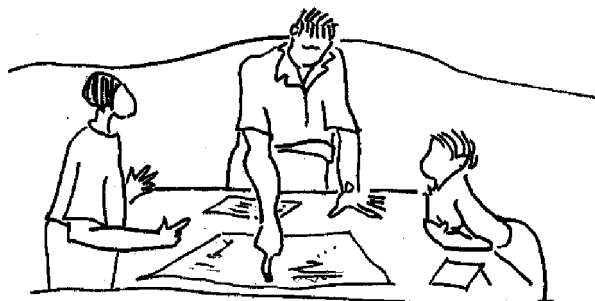
DESCRIBE THE CHANGE PROJECT YOU PLAN TO WORK ON IN MORE DETAIL

After completing the review sheet, and the consultations in your workplace, DESCRIBE the change project you wish to work on. The following questions should help you structure a 2 page description of the change project:

- What are the **unsustainable practices** that you are trying to address in your workplace, and in your educational work specifically? (e.g. over-harvesting of resources; pollution and poor waste management; poor land use planning etc.). As shown by these examples, an **unsustainable practice** is one that is leading to socio-ecological damage and degradation. Describe the *causes* and *effects* of these unsustainable practices.
- What **sustainability practices** (**solutions / alternatives**) are you trying to implement or develop in your workplace, and in your educational work specifically? (e.g. better environmental management; replanting of deforested areas; co-management; water quality auditing; solid waste management (e.g. recycling, sorting, re-using etc.); sustainable health and nutrition programmes; sustainable agriculture etc.). As shown by these examples, a **sustainability practice** is a possible solution or alternative to the problem. Describe how the sustainability practice is working, and the tensions or difficulties you are experiencing with the implementation of the sustainability practice.
- What **educational mediating activities** are you using to address the problems and strengthen the solutions / alternatives? (e.g. community-based learning and action projects; permaculture training; radio programmes; development of learning support materials; mobilising indigenous knowledge to integrate it into the curriculum; value addition and sustainable use training etc.). As shown by these examples, these educational mediation activities can be diverse, and depend on *who (e.g. communities, school children, adult farmers etc.)* you are working with, and in what context you are working *(e.g. schools, colleges, conservation organisations, urban communities, rural areas etc.)*. Be sure to provide a detailed description of what you are currently doing.
- Drawing on the discussions with your colleagues, and your own reflections, explain how you would like to **improve your environmental education activities.**

This should be no longer than 2 pages.

BRING MATERIALS AND DOCUMENTS RELEVANT TO YOUR CHANGE PROJECT TO THE COURSE

- Bring any materials that you are using or can use for the change project to the course.
- Also collect at least 1 policy document from your institution/province/country that is relevant to your change project focus (e.g. a National Environmental Management Act or an Environmental Education Policy etc.). Bring this to the course.
- If your institution has a vision and mission statement, please bring this to the course.
- If your country / local district / province has a State of Environment Report please bring this to the course (even if it is a bit old).

JUSTIFY THE RELEVANCE OF YOUR CHANGE PROJECT

- Be prepared to answer questions on *why* your change project is relevant to your institution, local and national context, and in a southern African context more widely.

PREPARE YOUR PRESENTATION

- Prepare a 10 minute presentation using a poster or powerpoint format on your proposed **environmental education change project**. In the presentation make sure that the unsustainable practices that you are responding to are clear. Also show what sustainability practices you are trying to implement, and show how you are using educational mediating activities to respond to the problems and implement solutions.
- Also show how you plan to improve the project, based on feedback from your colleagues.

Be prepared for 20 minutes for questions after your presentation.

SUBMISSION OF THE ASSIGNMENT

This assignment MUST be completed before you come to Rhodes University.

When you arrive you should submit the following:

- The review sheet
- A 1 page report on the consultations in your workplace
- A 2 page description of your change project
- Selected materials and policies that are relevant to your change project
- The presentation (in poster or powerpoint format)

SUPPORT FOR DEVELOPMENT OF YOUR ASSIGNMENT

The SADC REEP will provide you with ongoing support for the development of this assignment. If you have any questions or if you need any further clarification or guidance, please contact:

Caleb Mandikonza

SADC REEP Training Manager

By post: Box 394, Howick, 3290, SOUTH AFRICA

By e-mail: caleb@wessa.co.za

By telephone: +27-33-3303931 / +27-83-2374193 (SMS if you would like us to call you)

Also draw on the support of your manager and colleagues in your organisation, as decided on in your consultations with them.

ASSESSMENT OF THE ASSIGNMENT

The course is assessed through 5 assignments, which together form the Portfolio of Evidence required for the award of the Rhodes University International Certificate in Environmental Education.

This assignment counts 20% of the course certificate. It will therefore form the first part of the Portfolio of Evidence.

REVIEW SHEET

to help you identify an environmental education change project

Read through the entire assignment before completing the review sheet. Try to complete the review sheet with colleagues.

Answer these questions:

QUESTION	YOUR RESPONSE:
What <u>unsustainable practices</u> are visible in your local area that are relevant to the work that you do?	
Which of these are you focussing on in your environmental education work?	
Are there other pressing <u>unsustainable practices</u> that you could respond to through educational activities?	*If yes, state which ones ...*
What <u>sustainability practices</u> (solutions / alternatives) is your institution promoting?	
Are the sustainability practices working well? What makes them work well? If the <u>sustainability practices</u> are not working well, what can be done to improve them?	*Give detail of what can be improved ...*
How can <u>educational activities</u> help to improve the success of the sustainability practices (alternatives / solutions)?	
What has worked well in your educational activities so far?	*Try to build on your strengths when you think about the change project ...*
What has not worked so well, and what can be improved?	*Give detail of what can be improved ...*
After completing all of these review questions, decide on what change project you can work on. The change project can be small (i.e. you might want to improve your educational methods in an existing programme, or you might want to develop new materials, or it could be bigger i.e. you might want to develop a bigger programme or curriculum). Don't be too ambitious, but challenge yourself!	

REQUEST FOR INSTITUTIONAL SUPPORT FOR ENVIRONMENTAL EDUCATION CHANGE PROJECT

The SADC Regional Environmental Education Programme has a commitment to ensure that its professional development programmes are relevant to environmental education issues and institutions in southern African countries. To ensure that the outputs of the RU/SADC International Certificate Course are both useful and relevant to participants and their institutions, the SADC REEP requires participants that have been selected to the international certificate course to obtain institutional support for the environmental education change projects that they will work on during the course. Throughout the course the participants will work on an **environmental education change project (consisting of 5 parts) which is the main outcome of the course.** This change project will be assessed, and all parts of the course need to be completed to obtain a Certificate of Competence. The course is designed to be workplace relevant, and course activities support participants to improve their environmental education practice for enhanced relevance and efficacy in institutions in SADC.

The SADC Regional Environmental Education Programme therefore requests managers of course participants to

- understand that course participants will work on a **environmental education change project** before, during and after the 2 month International Certificate Course in order to obtain their Certificate in Environmental Education, and
- help to ensure that this environmental education change project is <u>relevant</u> to the institution and context in which the course participant works; and
- to <u>support</u> the participant to undertake such a change project.

NB: *The change project can be small (i.e. improving existing methods), or can be bigger, (e.g. developing a new programme). The scale of the change project will depend on the institution's priorities, existing practices, and available resources for the change project in the home institution.* The change project should also build on the existing experience of the course participant. The SADC REEP therefore also requests that managers and others in the workplace help course participants to identify a suitable environmental education change project that they can work on before, during and after the course.

To indicate that the course participant has such support, and that managers and institutions are aware of the nature of the course and its outputs, the SADC REEP requests course participant's managers to complete the details of the form on the back. This should be sent through to the SADC REEP *BEFORE* the course commences on 17 August 2009.

The SADC REEP, working with course participants, will communicate with programme managers on the progress being made on change projects during the course, and course participants will be required to report on their change projects to their managers and colleagues, and to the SADC National Network Representatives in each country once they return home. This is to strengthen institutional relevance, communication, and regional networking, and to make the benefits of individual professional development more visible and useful at institutional and regional levels.

STATEMENT OF SUPPORT FOR ENVIRONMENTAL EDUCATION CHANGE PROJECT

I, _____, appointed manager of

_____(course participant's name) agree to support the

following environmental education change project

_____

_____

_____ (title of

environmental education change project) that will be developed prior to, during and after the
RU/SADC International Certificate in Environmental Education Course, offered and supported by the
SADC REEP from 17 August 2009 - 10 October 2009.

Course participants are also required to complete a **Pre-course Assignment,** which includes getting
collegial and institutional support for their environmental education change project (hence this form).

The final part of the Environmental Education Change Project Assignment (which provides evidence
that the course participant has reported back to the workplace on the change project, and to the SADC
National Network Representative in each country) is due on 15 December 2009, after which the
Certificate of Competence will be awarded.

Signed: _____

Date: _____

Name of Institution: _____

Postal Contact Details: _____

_____

Telephone Contact Details: _____

E-mail: _____

Name of Course Participant: _____

SEND OR FAX THIS FORM TO:

Caleb Mandikonza
SADC REEP Training Manager
PO Box 394, Howick, 3290, SOUTH AFRICA
E-mail: caleb@wessa.co.za
Tel: +27-33-3303931 / +27-83-2374193
Fax: +27-33-3304576

*Please feel free to contact Caleb Mandikonza at the SADC REEP if there are any queries
related to this statement of commitment.*

Appendix 2: Assignment 1

Rhodes/SADC International Certificate Course in Environmental Education 2009

Assignment 1:

Change oriented learning and sustainability alternatives:
Analysing issues, risks, unsustainable practices and policy responses in order to develop a knowledge resource

As already indicated in the pre-course assignment and the introductory part of the course, the Rhodes University / SADC International Certificate in Environmental Education course is focused on supporting change oriented learning in southern Africa. It responds to environmental issues through education, and helps to implement more sustainable alternatives. It is designed to support you to improve your practice as an environmental educator in your institution by addressing issues that are relevant to your institution and to southern Africa.

In your pre-course assignment you were asked to identify and outline unsustainable practices, and the associated environmental risks and issues that your institution is responding to. In this assignment, you will take this analysis further.

YOUR TASK IS TO DEVELOP A KNOWLEDGE RESOURCE FOR USE IN YOUR CHANGE PROJECT:

- **Choose one key environmental issue or risk relevant to your work context.**
- **Define *why* it is an issue, and what risks are associated with the issue.**
- **Describe the nature of the issue or risk from a biophysical, social, economic and political perspective.**
- **Describe and analyse the unsustainable practices that have caused the issue or risk.**
- **Identify if there are relevant policy responses to the issue or risk in your (national or sectoral) context, in Southern Africa and internationally. Show how these are responding to the issue**
- **Describe what alternative, more sustainable practices are possible.**

To do this, you will need to access *high quality information* on the issue or risk, and you will have to review various policies, and you will have to find information on relevant alternatives. However, not all knowledge on the issue will be available in books or on the internet. Sometimes knowledge of issues also exists in the local context. In dealing with risk, it is also not always possible to know the full scope or extent of the risk. As an educator it is important to try to establish what is not yet known, so as to 'keep finding out'.

- **Describe how you will use this knowledge resource in your context, especially with reference to a) combining it with local knowledge that exists amongst people (not always in books); and b) the fact that not everything about the issue or risk is known yet. Develop an activity showing how you plan to use this knowledge resource in your Change Project.**

Rhodes/SADC International Certificate Course in Environmental Education 2009

Assignment 2:

METHODS for MEDIATING LEARNING

In this assignment you will plan carefully for the use of two new educational <u>methods for mediating learning</u> in your change project.

To do this you need to:

- Describe the methods that you have already used in your educational work (2 pages)
- Identify <u>two new methods</u> that would be appropriate *in your context of practice*, and explain why they will be appropriate (i.e. justify them in relation to your context of practice, and the objectives of your Environmental Education Change Project). Here you should be able to show how the educational mediating methods will allow you to mediate between current unsustainable practices towards more sustainable alternatives. Describe what is known about these methods and HOW these methods are useful for mediating towards more sustainable alternatives (2-3 pages)
- Draw on at least three Environmental Education and Education for Sustainable Development Policy Documents to explain how your thinking about environmental education methods is being guided by these international recommendations for good environment and sustainability education. (Select from the Tbilisi Principles; the Gaberone Declaration; the Ahmedabad Conference Recommendations; the Bonn Declaration). (1-2 pages)
- Explain how the educational methods are influenced by learning theory (draw on the information in the Core Text, and the readings on learning theory in Reading Activity Pack 8)- (2-3 pages)
- Describe what learning support materials will you need to use the methods in your Environmental Education Change Project (including but not limited to your knowledge resource produced in Assignment 1), and explain how will you go about working with the educational methods (i.e. what learning interactions will you plan for). (1-2 pages)

Rhodes/SADC International Certificate Course in Environmental Education 2009

Assignment 3:

PLANNING FOR IMPLEMENTATION

In this assignment you will plan carefully for the implementation of your environmental education change project, with reference to <u>working in a community of practice</u>, and <u>evaluation of the learning processes</u> involved in the environmental education change project.

To do this you need to:

1) Describe the main **community of practice** that you will work with to implement the environmental education change project, with reference to:

   a) the community of practice *participants* (i.e who are they?);
   b) your *shared knowledge interest* in the environmental education change project (i.e. why they would be interested in the project and how policies help to create a shared knowledge interest),
   c) your *shared practices* (i.e. what you will do together),
   d) how you plan to facilitate *learning* through *learning interactions using methods and learning support materials* in the community of practice (i.e. how learning will be supported in the community of practice). (2-3 pages)

2) Describe how you will give attention to **building the internal strength of the community of practice** to implement the environmental education change project. This will require you to think about how you plan to:

   • provide *conceptual and practical support* for the environmental education change project implementation in the community of practice;
   • ensure that *basic resources* for the implementation of the environmental education change project are planned for and mobilised;
   • enable and encourage *participation* in the environmental education change project practices;

- ensure *ongoing participation* in the environmental education change project community of practice over a longer period of time.
- *Anticipate and avoid typical problems* that emerge in a community of practice (see core text for an overview of some of these). (2-3 pages)

3)Describe how you will *evaluate* the learning that emerges from the environmental education change project implementation in a community of practice. This should include a description of at least three methods that you will use to undertake the evaluation. These methods should be appropriate for *evaluating learning in a community of practice.* You should indicate *when* you will use these methods (i.e. before, during or after the environmental change project implementation), *who* will participate in the evaluation and *how* they will be supported to participate. Also include *how you will share and use the findings of the evaluation in the community of practice to enhance reflexivity (i.e. ability to change practice) and learning.* (2-3 pages)

Rhodes/SADC International Certificate Course in Environmental Education 2009

Assignment 4:

REPORTING ON IMPLEMENTATION

In this assignment you will report on the first phases of your implementation plans for the environmental education change project.
To do this you need to:

1) Run a workshop or a work-based reporting session in which you report to your institution on the plans for your environmental education change project and/or
2) Run at least one community of practice meeting with colleagues and/or community members that will be involved in the environmental education change project to start with implementation of the environmental education change project.

Report to the RU/SADC REEP on this early implementation work.

The report should reflect on:

Part A: Early implementation of the environmental education change project

1) Report any feedback on the environmental education change project from workplace colleagues, managers and community of practice participants. Where possible, make contact with the national network representative in your country, and invite him/her to attend your feedback meeting / workshop. Be specific in reporting on what others say about your environmental education change project and how you are planning to implement it.
2) Report on the feasibility of the environmental education change project plans (i.e. can you use the change project plans as anticipated or do you have to bring about any changes).
3) Report on the value of your knowledge resource to others in your workplace, and or to members of your community of practice.

4) Indicate if and how your plans are changing now that you have returned to the 'realities' of everyday work in your institution.

Part B: What you have learned in the RU/SADC course?

1) Reflect on the most important learning from the RU/SADC International Certificate Course. What, in your view, are some of the most useful insights and skills that you have developed through your participation in the course. How are these assisting you with implementation of your environmental education change project?
2) Reflect on how your environmental education change project is contributing to environment and education objectives in your country, and in southern Africa.

Your reflective report should be 3-4 pages long. Submit it to Caleb Mandikonza at caleb@wessa.co.za The report should be submitted **no later than** 10 December 2009.

Appendix 6: Regional Knowledge Exchange Group Tasks

Regional Knowledge Exchange Groups

The Regional Knowledge Exchange Groups will continue with their project for the full two months. The tasks are simple, but will require quite a lot of continued work over the two months. Each group will present the results of their work in the final week of the course.

Using ICT in Environment and Sustainability Education

Your task is to develop a 15-20 page booklet on **how to** use ICTs in Environment and Sustainability Education.

Your booklet should share:

- Useful internet sites
- Different strategies to use ICT in environment and sustainability education
- Useful ICT resources and where these can be found

To compile the booklet you should interview at least 4 people with good experience of using ICT in education.

Try out what you recommend to others to make sure that it is good advice that you will be giving to others.

Do research to find out how ICT is being used in education and decide if this is useful for environment and sustainability educators like yourselves.

Your support tutor: Tich Pesanayi, Ingrid Schudel & Janet Snow

Using Video in Environment and Sustainability Education

Your task is to produce a video on Environmental Education Methods that have been used during the two month course.

To do this, you should consult with your tutors to identify at least 6-8 different methods that will be used during the course. While you can take other footage, **be sure to take good footage** of the 8 different methods.

In writing the script for the video you should **explain the methods and narrate what was happening when the methods were used.**

You should work out a schedule for video work, and should include time for working with the final video editor to produce the video, using the video footage that you take during the course.

Your support tutor: Palloma Pachiti

Writing Newsletter articles for the EEASA Bulletin

Your task is to write and edit **four** short articles of 2-3 pages each for the EEASA Bulletin. The articles should reflect some of the activities that have happened on the course. Consult with your tutors which would be good opportunities for writing good articles, and target your efforts.

To do this task you should review four copies of past EEASA Bulletin's to analyse and identify what kinds of articles are published in the EEASA Bulletin.

After this, you should do research to find out what the key elements of a good article are, and what the technical aspects of writing good articles are.

You can also arrange to meet the EEASA Bulletin Editor (Lausanne Olvitt – l.olvitt@ru.ac.za) to discuss your plans for the articles, and to ask her advice on writing a good bulletin article.

You should also consult with the EEASA Bulletin Editor or with an experienced proofreader (Sally@wessa.co.za) to get assistance with proofreading and structuring of your articles.

Your support tutor/advisor: Tino Haingura & Lausanne Olvitt (EEASA Bulletin Editor)

Monitoring and Evaluation of the RU/SADC International Certificate Course

Your task is to evaluate the following aspects of the RU/SADC International Certificate Course that you are on:

- What people are learning from presentations
- What people are learning on field trips
- What people are learning from each other
- What people are learning in relation to their context and change project
- One or two other things that you think are significant to evaluate

To do this you will need to design at least **three different evaluation instruments** that focus on these aspects (e.g. questionnaires, interviews, participatory evaluation methods etc). Each week you will need to run a short evaluation session, and you should consult with the tutors to schedule this into the weekly programme (Friday's or Monday's are normally good times).

To plan your monitoring and evaluation strategies, you should make use of the planning framework provided in the Evaluation Toolkit.

Your support tutor: Caleb Mandikonza & Heila Sisitka

Regular Meetings

Each group should set **two meetings per week** (at least) in the time slots between 15h30-17h50.

Work should be **equally shared** amongst members of the group.

You will have a tutor who will support you when you need assistance, but tutors will not be spending all of their time with you, they are there to consult if necessary.

Appendix 7: Sample of daily timetable (broken down to weekly periods)

Rhodes University/SADC REEP International Certificate in Environmental Education
Week 1: 17 August 2009 – 21 August 2009

DATE and SESSION	TIME	CONTENT OF SESSION	TUTORS / LECTURERS
Monday **17th August** **Session 1**	08h30-10h30	Introduction to the course*An overview of the SADC REEP (Tichaona Pesanayi)An overview of Environmental Education at Rhodes University (Heila Sisitka)*Health and safety orientation to the course	Heila, Tich, Caleb
Session 2	11h00 – 12h15	Our Stories: Contributing to the design of the curriculum	Heila, Tich
Session 3	14h00-15h30	Our Stories: Contributing to the design of the curriculum	Heila, Tich, Caleb
Session 4	15h45-17h30	Campus Tour	Michael
Tuesday **18th August** **Session 1**	08h30-10h30	Morning reflections Curriculum deliberations continued Principles of the course curriculum Orientation to Change Projects and the Assignment Pathway	Heila, Tich, Caleb
Session 2	11h00 – 12h15	Orientation to key resources used on the SADC Course: The course file, reading activity packs, resource file	Heila & Caleb
Session 3	14h00-15h30	Participant input on policy and environmental issues, risks and unsustainability practices in their countries/ work contexts	Heila & Caleb
Session 4	15h45-17h30	**Introduction to Regional Knowledge Exchange Groups**	Heila & Caleb
Wednesday **19th August** **Session 1**	08h30-10h30	Morning reflections Change Project introductions	Caleb and Palloma
Session 2	11h00 – 12h15	Environmental and Educational Policy in SADC and implications for Environmental Education	Tich
Session 3	14h00-15h30	**Introduction to Peer Review Process** & Participant Presentation 1	Caleb & Tich
Session 4	15h45-17h30	RKE Working Groups and Assignment Work	Caleb & Tich
EVENING (18h30) – VC Distinguished Teaching Award Lectures (Eden Grove Lecture Theatre)		
Thursday **20th August** **Session 1**	08h30-10h30 **OPENING TEA**	Morning reflections **Introduction to**Theme 1 Issues, Risks and Unsustainable Practices **Introduction to Assignment 1**	Heila & Caleb
Session 2	11h00 – 12h15	*EE & ESD - The Global and the Local*	Heila
Session 3	14h00-15h30	*Orientation to computers*	
Session 4	15h45-17h30	RKE Working Groups and Assignment Work	
Friday **21st August**	8h15 -17h30h	EXCURSION: Issues, risks and Unsustainable Practices – What alternatives and educational mediating activities are happening? *Grahamstown Excursion*	*– Michelle van der Merwe & Gladys Tyatya and Henry Muloongo*
***SATURDAY & SUNDAY** (Free Time / Work on Assignments / RKE Working Group Activities etc.)*		

Appendix 8: Consent Form

Consent Form to Participate in Research

*You are asked to participate in a research study conducted by **Caleb Mandikonza** who is supervised by **Prof. Heila Sisitka** and **Prof. Rob O'Donoghue**, from the Environmental Learning and Research Centre, Department of Education at Rhodes University. The study is conducted as part of a PhD study. Your participation in this study is entirely voluntary. Please read the information below and ask questions about anything you do not understand, before deciding whether or not to participate. **The study seeks to understand change-oriented learning in teacher education professional development contexts by following up on selected institutional change projects and their contexts.***

Please tick the appropriate boxes	Yes	No
Taking Part		
I have clearly understood the purpose of the study.	☐	☐
I have been given the opportunity to ask questions about the study.	☐	☐
I agree to take part in the study. Taking part in the study will include being interviewed, recorded (audio or video), and taking of still photos.	☐	☐
I understand that my taking part is voluntary; I can withdraw from the study at any time and I do not have to give any reasons for why I no longer want to take part.	☐	☐
Use of the information I provide for this project only		
I understand my personal details such as phone number and address will not be revealed to people outside the study project.	☐	☐
I understand that my words may be quoted in publications, reports, web pages, and other research outputs.	☐	☐
*Please choose **one** of the following two options:*		
I would like my real name used in the above	☐	
I would **not** like my real name to be used in the above.	☐	
Use of the information I provide beyond this project		
I understand that the data that I provide will be archived in whatever form by Rhodes University and any other institutions that may be willing to use the study findings for purposes of learning and teacher education professional development.	☐	☐
I understand that other genuine researchers will have access to this data only if they agree to preserve the confidentiality of the information as requested in this form.	☐	☐
I understand that other genuine researchers may use my words in publications, reports, web pages, and other research outputs, only if they agree to preserve the confidentiality of the information as requested in this form.	☐	☐
So we can use the information you provide legally		
I agree to allow Caleb Mandikonza to use any materials I produced in this study.	☐	☐

_____ _____ _____

Name of participant   [printed]   Signature   Date

Contacts (Tel/Cell &
email):_____

_____ _____ _____

Researcher   [printed]   Signature   Date

Appendix 9: Semi-structured interview guideline

Questions for semi-structured Interviews: 2013

To course participant:
1. May you please share with me your history of teaching from when you started until now?
2. What are your qualifications and have you added more over the years that you taught?
3. Which courses and workshops did you participate in the past 5-10 years that you think made impact to the way you do your teaching in general and EE/ESD work? In what ways have they influenced the way you do and think about your work?
4. May you please identify some of the learning that you experienced and thought was new or helped you understand your work better or helped to motivate you to do certain things in your work?
5. Any learning that you think stood out from
    - assignments
    - lectures and any particular concepts of note?
    - Excursions
    - Social interactions with colleagues
6. What was (were) your change project (s) and what was your vision when you left the course? Has your vision been realised? Why do you say so?
7. How much of this vision has been realised?
8. Since you left the Rhodes/ SADC International Certificate in EE course, what changes in thinking and doing have happened in the way you do your work?
9. Which of these are led directly by you?
10. How (in what ways) have these activities and processes been influenced by your participation in the SADC REEP courses and?
11. What opportunities and challenges did you find/ experience when implementing your EE/ESD change project?
12. Have you experienced any changes in the way you work with colleagues or other members of your communities of practice since you returned from the Rhodes SADC International Certificate course and started implementing your change project (s)?
13. Have these changes that happened in the work you do in any way influenced the way other people/ colleagues do their work in the department?
14. What changes have they brought to the way the department works?
15. How do your superiors support you when you want to introduce anything new or want to do the same thing differently? Is this adequate? How else could they support you?
16. Are there any rules or guidelines for reporting back and carrying into the institution any ideas that were learnt or that developed in professional development activities? How do you report back?
17. Is there any change in the way you worked with colleagues and your students since you left the course?
18. Is there any evidence to support your views on the changes that were brought by the way you work?
19. Have your superiors been alerted to the way you work and how have they taken it?
20. Are your colleagues aware of the innovations that you are bringing to your work and how are they responding?

21. What are your students saying about the way you do your work?
22. Are there any individuals or institutions outside your own that are appreciating the way you work and how have they shown that appreciation?
23. Have you met any problems related to such issues as the institution's (college) guidelines (presence or absence thereof) , getting support from superiors, working with others, working with students, when implementing ideas that you got from courses?
24. What would you advise anyone intending to do a change project in your institution?
25. What do you understand by quality education? In what ways does your change project (s) contribute to quality education at the UZ, the community and the rest of the country?
26. How has your change project contributed to Education for sustainable development work?
27. Has the Rhodes SADC International certificate course and the change project influenced the way you express statements in guidelines in guiding documents such as the syllabus and any other work related documentation? Can you cite examples?

Questions to the superiors/ Dean
1. When *(participants)* went for courses and workshops, how did they report back? Do you have guidelines for reporting?
2. If lecturers and especially *(participants)* wants to pursue requirements of the course or workshop in the institution, how does the university support them?
3. Do you think this kind of support is adequate?
4. If there was more they needed, is it easy for them to make a request?
5. Are there any changes in the way *(course participants)* work in the Department of Science and Mathematics Education that you think can be ascribed to your lecturers having attended courses and workshops outside the university?
6. Are there any problems with university guidelines when lecturers come from a course and want to implement some change in the way they work and how have you treated them?

Interview with colleagues
1. In what ways has *(course participant)* changed the way they work and how have you taken it?
2. Why have you taken that position?

Appendix 10: Sample of semi-structured interview transcript and emergent properties

Mr. Caleb Mandikonza

After that interview, I revisited some of the statements that I said, and now I have a change of mind during this member-check exercise. You can see where I had to delete information and where I had to add information for clarity purposes (see trek changes from the transcribed interview). Concerning bureacracy issue, line [00:25:52.15] and line [00:29:19.26] I have to change that after a revisit of the statement as the Dean of my Faculty has been fully supporting the ESSA project and we have worked well as a big team and we are almost finishing the ESSA sculptures.

Education and Research background

I am not very sure about the question and I hope I have addressed it well, if I haven't please feel free to come back to me for clarity. I have a Certificate in education from Belvedere Teachers College 1987-1990 in Geography and Building. I taught at secondary school level from 1991 to 1999 in Zimbabwe schools. I have a Bachelor of Education Degree in Geography 1995-1996. I have a Master's degree in Population Studies, 1999-2000. All my degrees are from the [Name of Institution]. I worked as a research manager at the Zimbabwe School Examinations Council (ZIMSEC) 2000-2004, mainly working on assessment and evaluation in education. From 2005 to date I have been teaching Geography in the Department of Science and Mathematics Education at the [name of Institution]. I have done several collaborative researches with different people and institutions in the field of education including environmental education, the social sciences and water and sanitation. I have done researches with UNESCO, UNICEF, SNV, Africare, Edcon (Norway), Fondazione Basso (Italy) and several local organisations and colleagues. I am not very sure what exactly you are looking at in terms of the researches that I have done, may be my CV might help if that is the sort of thing you might be interested in. Currently I am working on my PhD research project with Rhodes University.

Interview with CX at Institution X

Question: May you please briefly describe your history and your teaching history. Your research history if not mentioned in the interview below would also be interesting.

[00:00:12.22] Interviewer: What motivated you to apply to attend the Rhodes SADC International certificate in EE course

[00:00:32.10] Interviewee: 2010, as a teacher educator I was very much interested in improving the way i was handling my courses at [Name of institution], Dept of Science and Maths Education and the way I was teaching. That motivated me to join the SADC REEP course as a matter of looking for better ways of doing things.

[00:01:05.23] Interviewer: in what ways has your attending the course influenced, what changes in thinking and doing can you identify in your work?

[00:01:24.25] Interviewee: there are quite plenty, firstly the SADC REEP course taught me to cease to become a teacher and become a facilitator of learning and not a knower of everything, to learn from others and to tolerate pupils when teaching. But in the long run, after the SADC REEP course I improved a lot in resource material use, I used the Methods book. When introducing environmental studies I talk about the policies before developing the knowledge and that has improved my teaching. I also picked up straight from the SADC course the communities of practice concept, which is a base for my teaching and my present and future studies.

[00:03:23.05] Interviewer: can you identify anything that you think stood out on the course (lectures, assignments, excursions, social interactions with colleagues....)?

[00:03:45.27] Interviewee: the assignments were quite practical, from the assignment I learnt to set my own assignments and improved my setting of assignments with my own students here (at UZ), instead of just giving a mere knowledge-based assignment. The portfolio assessment improved my methods of assessment. Now in addition to quantitative assessment I also assess qualitatively. Learners come up with a small project which they come up with a small portfolio and I assess it. All the excursions were great but I benefitted most from the visit to Isidore Farm in Durban. The organic farm project was very much in line with the work which I was doing with farmers in Zimbabwe. I made use of the videos that we took as SADC REEP students, went back to my community, they also learnt from what was happening at Isidore farm. So the field work did not just benefit me as an individual but benefitted the communities that I worked with, it benefitted the students that I teach because I still use some of those videos on topics of climate change issues and adaptation where organic farming is part of it.

On social interaction through the Google group we have been communicating. That network we created in 2010 is lifelong. Up to now we are still meeting with the colleagues and we continue to communicate through the network and we email each other individually and these networks have created much wider networks that we are benefitting from.

[00:06:54.00] Interviewer: are the portfolios of evidence written in the curriculum, have you contributed anything into the curriculum yet?

[00:07:15.25] Interviewee: in this institution the individual lecturer comes up with a course outline within the approved regulations, that is approved by the departmental board. Within our course outline, we have embraced the idea of portfolios, small projects (change projects) and field trips. That we have been doing and we have documented that.

[00:07:49.20] Interviewer: What was the role of the Rhodes SADC course in this?

[00:08:00.29] Interviewee: Rhodes SADC course actually introduced (the change project approach, filed trips, case studies)to us, then us (introduced all that in our own teaching) curriculum. Myself being a product of this the department of science and maths (DSME),

(this approach) wasn't there. I have been teaching here (UZ) since 2005. We were not doing that but after the Rhodes SADC course we tried to implement all that into our course outline

[00:08:37.00] Interviewer: What was your change product about?

[00:08:40.11] Interviewee: My change project unfortunately kept on changing but the focus was to look at how communities were coping with climate change issues, my change project ended up with making use of the camera as a tool for change. So I used the camera in order to talk about issues of climate change education within a community and the university. So I took photos and videos in the communities that I used in the university curriculum (to talk about climate change and adaptation within rural communities of Zimbabwe).

[00:09:29.12] Interviewer: what was your vision?

[00:09:33.01] Interviewee: my vision was long term. It was to explore how a community could learn within their setup, exploring social learning issues, within a particular community and the mechanisms a community can use in an informal way, to deliberate issues of climate change and I have done that since 2010.

[00:10:32.27] Interviewer: have you developed any new aspirations in the way you work?

[00:10:39.27] Interviewee: For sure, so far I have tried to expand the network whereby apart from the original communities I have been working with I am now working with other players. I have Friends of the Environment network, The EMA network, the different farmer organisations that contract farmers. All those are involved in environmental issues and that is my interest (to share knowledge on environmental issues with them).

[00:11:41.07] Interviewer: are your PhD studies related to your change project?

[00:11:52.25] Interviewee: for sure, my PhD study is based on the initial change project. My initial change project was working with a community, my PhD study is now, 'exploring social learning and capabilities within communities in the face of climate change risks and vulnerabilities'. But during RHODES/SADC-REEP course, the change project only looked at the practical aspect of organic farming as an adaptation to climate change. The only learning aspect was how the camera could be used to explore issues of climate change and adaptation. In my PhD I am now looking in detail the exploration of social learning within the same change project that I started in 2010 project.

[00:13:18.18] Interviewer: how do your superiors support you to bring anything new or do anything differently?

[00:13:25.19] Interviewer: normally, our Dean is very supportive. Currently she also comes up with change project using an inter-disciplinary approach to look at the challenge of a river that is drying up, in a place in Headlands-Manicaland province, that she invited me and our department to the study. The research is linked to my study as we explore possibilities

that might have caused the river to dry up, climate change being a possibility. The university of Zimbabwe does not support directly with funding into my PhD studies but allows me to go for months for my studies at Rhodes University or go to collect data for weeks into the field of study while I am on duty. Even during the teaching time, I am allowed to attend my studies and my research. That is the greatest support.

[00:15:36.14] Interviewer: how do you report back on workshops attended?

[00:15:50.02] Interviewee: there are no written reporting down guidelines but whenever one comes from a workshop or course one takes the materials to the Dean and reports back. One also goes to the Chair after that. But with the SADC REEP course I had to do a formal feedback to the department. If Dean feels the report will benefit the Faculty she will organise a formal presentation to the faculty and that I have done on two occasions.

[00:17:44.03] Interviewer: do you have any teaching guidelines and some of your exam papers that I can get?

[00:18:08.04] Interviewee: yes I will give you

[00:18:15.19] Interviewer: are your colleagues aware of the innovations that you are bringing into your work?

[00:18:18.05] Interviewee: I would say they are because I have a colleague who is using the portfolio approach. Students do a small project in the field, more of a change project that they come and report back. [Name of colleague] is doing that. Once I reported to the department that this is what I am doing and this is the format I am trying to follow. The rest have been implementing that in their different subjects but not necessarily coming back to me. I can also site another example, two of my former students now lecturers at the Great Zimbabwe University published an article in an international journal on traditional knowledge systems. When I came into the university in 2005 I tried to introduce IKS into the curriculum and am happy this is part of the evidence.

[00:20:12.21] Interviewer: are there any individuals outside the university who could be interested in the work that you are doing?

[00:20:36.24] Interviewee: yes, I can site the Forest Commission, both Harare and Mutare are very much interested in what i am doing and they provide the support. Forest Commission provides the technical expertise, free transport to the community that i work with. They also provide me with free transport. Apart from those the fact that they are inviting me to their meetings with other different stakeholders shows that they have interest in what I am doing with the communities. We are already networking with FAO who have an interest in organic farming aspect which I have been working with the communities and FAO seeks to improve that practice. There is a donor organisation from Italy with

interest to move further to introduce solar power into the communities that I work with, in 2014.

[00:23:03.27] Interviewer: have you met any problems in implementing your own ideas?

[00:23:26.15] Interviewee: the model which I have been following is a bit different from the university set up. In a university set up when you have a project you go to the Deanery and introduce it. In this instance I did not take that route. I went to the community, I identified a problem and looked for people who wanted to help out in that community, then I came back to the university to inform them of what I was doing. The Dean supported me to work with the community but just recently I was asked by the Dean to report to the university.

[00:25:33.19] Interviewer: what would you advise for the change project if it is to happen in the institution?

[00:25:52.15] Interviewer: my advice is two-fold. The first is the formal route which entails to sit down with colleagues in the university; Dean, faculty and the faculty planning committee. These will give the go ahead. Here in this institution that approach does not work. We for example went to the ESSA workshop and came up with a change project that the faculty supported. The change project is now almost done and all have cooperated including the Dean.

[00:29:02.04] Interviewer: are you suggesting bureaucracy as a problem?

[00:29:19.26] Interviewee: We have worked well as a big team, the Dean involved too in the ESSA change project. 00:30:22.29] Interviewer: what do you think of individually driven change projects and institutional change projects

[00:30:30.04] Interviewee: it is a bit tricky. Institutional change projects are ok as they are what the institution wants. From my experience, I haven't seen institutional change projects lasting, since 2005. Some projects had to be abolished before their end of life due to different interests in that same change project. But a departmentally driven change project, which is not directly driven by the institution, such a change project might last. In this department 3 or 4 change projects have been talked about but none is in existence. In 2007 we had the Japanese partnership but immediately after the team from Japan left, people in the department were pulling in all directions and the project died a natural death before it took off. So at times institutional projects are good but can be very tricky to implement due to varying interests and intolerance of other people's ideas and interests.

[00:33:13.03] Interviewer: what do you understand by quality education?

[00:33:20.15] Interviewee: quality is relative but my understanding of quality education

[00:38:10.10] Interviewer: in what ways does your change project contribute to quality education?

[00:38:11.08] Interviewee: because I was working with a community I believe my students will eventually work in the community, they will experience community problems and should be able to help solve them. Problem solving approach that uses cameras to generate evidence has been widely in assignment tasks in this department.

[00:39:31.22] Interviewer: has your participation on the Rhodes SADC course influence the way you express yourself in documents?

[00:40:02.04] Interviewee: Normally during teaching and course development, we refer to guidelines such as the Gaborone Declaration, Bonn Declaration, Ahmedabad Declaration, even if it is not written in the curriculum, students are using these policy documents.

[00:41:41.12] Interviewer: how does UZ work with sustainable development?

[00:41:58.08] Interviewee: we had a faculty workshop for mainstreaming ESD in the curriculum, so UZ is working with ESD and we are still pursuing another workshop to see how far we have gone in Greening our curriculum.

[00:42:41.00] Interviewer: are there any other courses that you have attended in the past five years

[00:42:28.26] Interviewee: I participated in ESSA- Education for Strong Sustainability and Agency; I also participated in Rhodes research workshops, writers' workshops, Climate change workshops, some workshops carried out by the Forestry Commission here in Zimbabwe and so on.

[00:43:57.12] Interviewer: how do you find the relationship between these courses?

[00:43:59.09] Interviewee: all these courses link. I have special interest in courses covering environmental issues and how best to teach them. The forestry commission one is how communities can learn better within their social settings. Research workshops mould my theoretical and conceptual frameworks. Climate change workshops help me understand better concepts of climate change that I need to work with the community. I will attend a one week workshop at the Met Station so that I understand the Zimbabwean Climate and Climate Change context.

[00:45:33.09] Interviewer: what would you advise someone who goes for a Rhodes SADC course which has a change project?

[00:45:37.13] Interviewee: To be successful you need to identify a project from deep down your heart. It is not a matter of coming out with a project that you are not even interested in. It must be something that must bring change in the community and it has to address sustainability issues. Something that will change the education system in the long run, rather than just fulfil course requirements.

Appendix 11: Change management workshop groups guide questions

Questions for Case Institutions mini workshop

1. Which curriculum innovations were introduced /happened in the past 10-15 years?
2. Who initiated them? From what point were they initiated; are they Ministry of Education (national project), institutional, Donor driven?
3. Who led them/ who is leading them?
4. What kind of person should lead change and institutional change?/ what are the characteristics of a change agent if he/she are to be successful in implementing/ leading change?
5. Who was supposed to be involved and how?/ How were/ are they being taken into the institution?
6. How successful were they/ are they?
7. What problems did they face/ are they facing?
8. What could have been done to ensure success?
9. Looking at the EE/ESD Change project, how is it being implemented? What has happened so far? What is working well, what is not working well, what needs to be done?
10. What does this envisaged change mean to you personally and for your work/ how do you relate with it?
11. Do you have adequate skills and knowledge to contribute to EE/ESD change project work? What would you need (skills and otherwise) in order to be part of and to contribute to the change project?
12. Is the institution adequately prepared for change processes? What needs to be done to prepare it for the change processes?
13. Which change processes (already happening or envisaged) in the institution would support the change project (s)?
14. Which aspects (rules, guidelines, practices) of your institution or department or subject allow/ enable/ permit change? Any examples?
15. Which aspects (rules, guidelines, practices) of your institution or department or subject constrain/ do not allow change? Any examples?
16. What are your recommendations to anyone who is thinking about innovating an idea/ a practice in the institution?

Appendix 12: Sample of posters from change management workshop
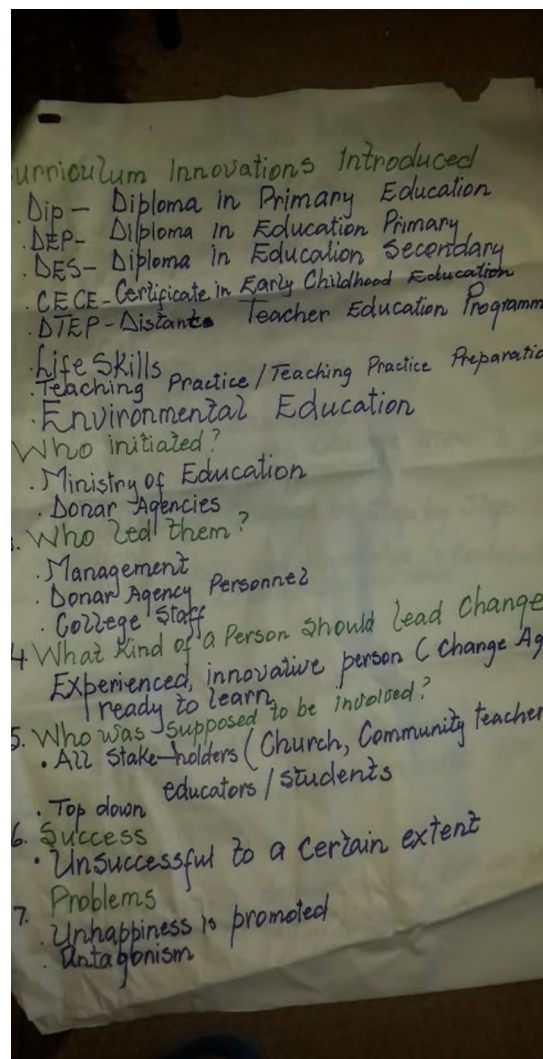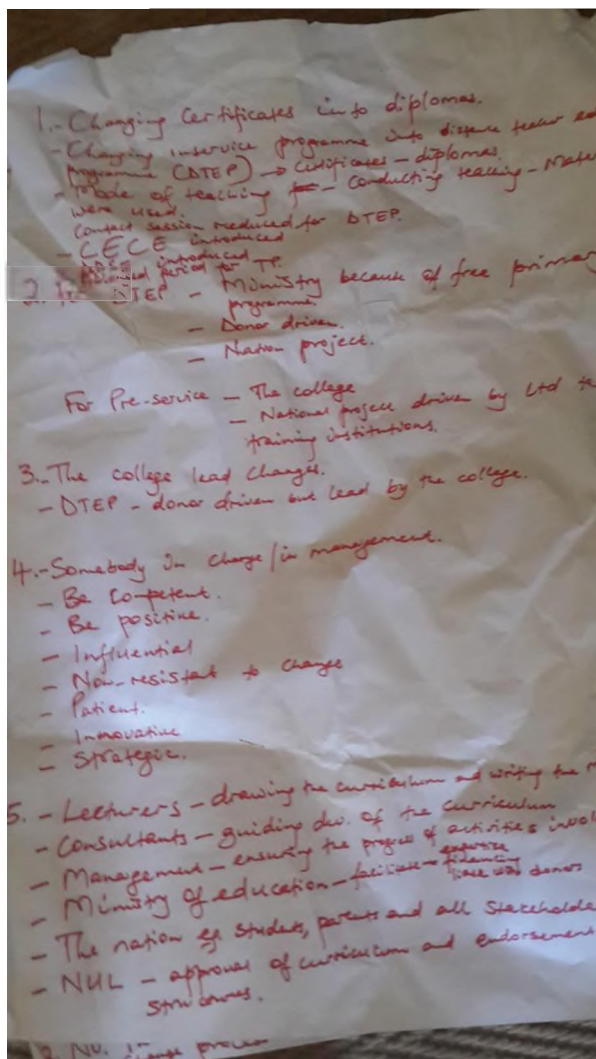
Appendix 13: Sample of Assignment Assessment Rubrics

ASSESSMENT FRAMEWORK FOR ASSIGNMENT 2

Criterion referenced assessment with the aim of strengthening reflexivity

	Assignment One Criteria	Borderline	Good	Excellent	
COURSE OUTCOMES	Assessment Criteria	There is evidence that the task has been understood	There is evidence of **clarity and depth of understanding** with regards to the content and substance of the task	There is evidence of **critical engagement** with the content and substance of the task	EXPLANATION
Outcome 1: Enhance the policy, institutional and contextual relevance of environmental education programmes and activities	**Policies relevant environmental education are critically reviewed to identify their influence on environmental education methods.**	Have you *identified* policy (e.g. Gaborone Declaration, Ahmedabad Recommendations etc.) that can provide guidance in the use of environmental education methods?	Have you identified policy and explained how it guides and influences environmental education methods *with clarity and depth*?	Have you identified policy and *critically analysed* how it guides and influences environmental education methods?	**Understanding the task** (borderline) shows a basic understanding of the task and that you are able to engage with the task
Outcome 2: Develop deeper understanding of unsustainable practices, and associated environmental issues and risks, and how to respond to them through educational mediating activities	**Environmental education methods have been identified that can help to mediate between unsustainable practices and more sustainable alternatives in a relevant context of practice.**	Have you identified environmental education methods that can help to mediate between unsustainable practices and more sustainable alternatives in your context of practice?	Have you identified and explained your choice of two new methods, showing how they will mediate between unsustainable practices and more sustainable alternatives in your context of practice, *with clarity and depth*?	Have you *critically analysed* and explained your choice of two new methods, showing how they will mediate between unsustainable practices and more sustainable alternatives in your context of practice?	**Clarity and depth of understanding** means that you have engaged more fully with the task, and that you are able to explain aspects that are relevant to your work context and why they are relevant
Outcome 3: Develop understanding of more sustainable alternatives and how to enhance them through educational mediating activities	**Explain environmental education methods relevant to your context of practice through drawing on learning theory.**	Have you identified how the environmental education methods you have selected are influenced by learning theory?	Have you identified and described *with clarity and depth* how the environmental education methods you have selected are influenced by learning theory?	Have you identified and *critically analysed* how the environmental education methods you have selected are influenced by learning theory?	**Critical engagement** means that you have engaged with the task through drawing on a range of sources, by thinking through what it means for your daily practice / workplace, while also being able to

Outcome 4: Improve the use of educational methods and materials for mediation of better learning and more sustainable alternatives	**The use of two environmental education methods in a context of practice is described, with reference to the process involved, as well as learning support materials needed.**	Have you described how you will use two environmental education methods in your context of practice, and have you identified the learning support materials that you will need?	Have you described *(with clarity and depth)* how you will use two environmental education methods in your context of practice, and what learning support materials you will need?	Have you critically analysed how you will use two environmental education methods in your context of practice, and what learning support materials you will need?	show possible areas for further development and change.

ASSESSMENT SHEET FOR ASSIGNMENT 2

Criterion referenced assessment with the aim of strengthening reflexivity

	Assignment One Criteria	Borderline	Good	Excellent	
COURSE OUTCOMES	Assessment Criteria	There is evidence that the task has been understood	There is evidence of **clarity and depth of understanding** with regards to the content and substance of the task	There is evidence of **critical engagement** with the content and substance of the task	GENERAL COMMENTS
Outcome 1: Enhance the policy, institutional and contextual relevance of environmental education programmes and activities	**Policies relevant environmental education are critically reviewed to identify their influence on environmental education methods.**				
Outcome 2: Develop deeper understanding of unsustainable practices, and associated environmental issues and risks, and how to respond to them through educational mediating activities	**Environmental education methods have been identified that can help to mediate between unsustainable practices and more sustainable alternatives in a relevant context of practice.**				
Outcome 3: Develop understanding of more sustainable alternatives and how to enhance them through educational mediating activities	**Explain environmental education methods relevant to your context of practice through drawing on learning theory.**				

Outcome 4: Improve the use of educational methods and materials for mediation of better learning and more sustainable alternatives	The use of two environmental education methods in a context of practice is described, with reference to the process involved, as well as learning support materials needed.				

Understanding the task (borderline) shows a basic understanding of the task and that you are able to engage with the task

Clarity and depth of understanding means that you have engaged more fully with the task, and that you are able to explain aspects that are relevant to your work context and why they are relevant

Critical engagement means that you have engaged with the task through drawing on a range of sources, by thinking through what it means for your daily practice / workplace, while also being able to show possible areas for further development and change.

To successfully complete this assignment you should achieve good or above in at least 3 outcomes.